ANGLIA RUSKIN UNIVERSITY

FACULTY OF ARTS, HUMANITIES AND SOCIAL SCIENCES

MUSIC THERAPY AND PARENT COUNSELLING TO ENHANCE RESILIENCE IN YOUNG CHILDREN WITH AUTISM SPECTRUM DISORDER: A MIXED METHODS STUDY.

LAURA BLAUTH

A thesis in partial fulfilment of the requirements of Anglia Ruskin University for the degree of Doctor of Philosophy

Submitted: March 2019

ACKNOWLEDGEMENTS

First, I would like to thank **the children and their families** who participated in this research project. It was a joy to work with you and to learn from you. Your enthusiasm for music therapy inspired me to conduct this study. I am grateful that the parents gave their consent for all music therapy and parent counselling sessions to be video recorded and for the material to be used for research purposes.

Amelia Oldfield Where to start… Thank you for encouraging me to realise this project. I am extremely grateful for your continuous support, your good humour, your friendship, and your readiness to think outside the box. I could not have imagined a better supervisor.

Helen Loth Thank you so much for your advice, your constructive feedback, your attention to detail, and all the enjoyable hours we spent together discussing work and life.

Anglia Ruskin University I would like to thank Anglia Ruskin University for funding my doctoral studies and for providing a stimulating and supportive research environment.

The TIME-A study team Thank you for developing and conducting TIME-A, a cutting-edge research study that enabled so many children to receive music therapy. Being part of TIME-A introduced me to inspiring clinicians and researchers and motivated me to carry out this doctoral project.

Johanna Finnemann You have accompanied me on my doctoral journey from the beginning. Thank you for your genuine interest in my project, for all the inspirational discussions, for your insights and ideas, and for being a friend.

Stefanie Heinicke Thank you for your help with finding the most suitable statistical model for my data and with making sense of the software R. I am deeply grateful for your calm guidance, your patience, your critical questions, and your interest in my study.

Roger Mundry Thank you for sharing with me your expert knowledge in statistics generally and in generalised linear mixed models particularly.

Michael Scuffil Thank you for your proofreading and your helpful feedback.

Finally, I would like to thank **my family**, especially my husband Florian for unconditionally supporting me throughout the project, for showing interest in the world of music therapy, and for being truly wonderful. Thank you to the rest of my family for believing in me and for encouraging me to embark on this exciting academic journey.

ANGLIA RUSKIN UNIVERSITY

ABSTRACT

FACULTY OF ARTS, HUMANITIES AND SOCIAL SCIENCES

DOCTOR OF PHILOSOPHY

MUSIC THERAPY AND PARENT COUNSELLING TO ENHANCE RESILIENCE IN YOUNG CHILDREN WITH AUTISM SPECTRUM DISORDER: A MIXED METHODS STUDY

LAURA BLAUTH

March 2019

This study investigates the effects of music therapy and parent counselling on resilience in young children with autism spectrum disorder (ASD). As many children with ASD and their families face adversity due to the condition, effective interventions are needed. Commonly, interventions are considered effective if they reduce ASD symptoms. However, it is controversial whether symptom reduction is an appropriate treatment aim. Rather, treatment effectiveness might be better measured against improved resilience. Resilience refers to positive adaptation in the context of significant adversity. The potential of music therapy and parent counselling to promote resilience has not been sufficiently explored yet.

A mixed methods design was used for this research. Thirteen children with ASD aged four to seven years received individual music therapy sessions over five months. In addition, all parents were offered three counselling sessions each. Video-recorded excerpts of music therapy sessions were analysed using a time-sampling method to detect occurrences of behaviours indicative of resilience. In addition, an assessment of the quality of the child-therapist relationship was carried out. Generalised linear mixed models were used for the statistical analysis. To extract relevant information from video-recorded counselling sessions, one session for each family was transcribed and analysed using thematic analysis. Quality of life of children in the treatment group and in a control group was measured with a parent-rated scale at different time points. The material analysed in this doctoral research was a subset of data which had been collected but not analysed in the international randomised controlled trial TIME-A.

The time-sampling video analysis of music therapy sessions revealed that several child behaviours indicative of resilience significantly increased over the course of the intervention, including self-expression, engagement, eye-contact, reciprocal smiles and initiating behaviours. The relationship between child and therapist significantly improved for all children receiving music therapy. According to the thematic analysis of counselling sessions, parents felt empowered by the simultaneous treatment approach. They reported improved child wellbeing and an improved ability to recognise and celebrate their children's strengths. The analysis of quality-of-life scales pre- and post-intervention indicated that mean changes in participants' quality of life were significantly more positive in the music therapy group than in the control group.

This study provides preliminary support for the use of music therapy and parent counselling to enhance resilience in young children with ASD. Implications for clinical practice and future research are discussed.

Keywords: music therapy, resilience, autism spectrum disorder, young children, families

TABLE OF CONTENTS

CHAPTER FIVE

CHAPTER SIX

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

ABA	Applied Behavioural Analysis
ACTR	Assessment of Child-Therapist Relationship
ADOS	Autism Diagnostic Observation Schedule
AQR	Assessment of the Quality of Relationship
ASD	Autism Spectrum Disorder
BERS	Behavioural and Emotional Rating Scale
CBT	Cognitive Behavioural Therapy
CYRM	Child and Youth Resilience Measure
DESSA	Devereux Student Strengths Assessment
DIR	Developmental, Individual-differences, & Relationship-based model
DMT	Dance/Movement Therapy
DSM	Diagnostic and Statistical Manual of Mental Disorders
DTT	Discrete Trial Training
ESDM	Early Start Denver Model
GFCF	Gluten-Free/Casein-Free
GLMM	Generalised Linear Mixed Models
ICD	International Classification of Diseases
IMT	Improvisational Music Therapy
M	Mean
MOPC	Music-Oriented Parent Counselling
MT-SAS	Music Therapy Session Assessment Scale
P_A, …, P_M	Parent of Arjun, …, Parent of Malik
PTSD	Post Traumatic Stress Disorder
PRT	Pivotal Response Training
RCT	Randomised Controlled Trial
SD	Standard Deviation
SRS	Social Responsiveness Scale
TA	Teaching Assistant
TIME-A	Trial of Improvisational Music therapy's Effectiveness for children with Autism
VIPP	Video-feedback Intervention to promote Positive Parenting
WHO	World Health Organization

COPYRIGHT DECLARATION

MUSIC THERAPY AND PARENT COUNSELLING TO ENHANCE RESILIENCE IN YOUNG CHILDREN WITH AUTISM SPECTRUM DISORDER:
A MIXED METHODS STUDY

LAURA BLAUTH

March 2019

CHAPTER ONE
INTRODUCTION

1.1 Motivation for this research

The neurodevelopmental disability autism spectrum disorder (ASD) affects approximately 1% of the population (Baron-Cohen et al., 2009; Brugha et al., 2012). Core symptoms are persistent deficits in social communication and social interaction as well as restricted, repetitive patterns of behaviour (American Psychiatric Association, 2013). Children with ASD[1] and their families often face challenging and adverse situations due to the characteristics of the condition. For most children with ASD, early intervention is desirable to reduce stress levels and to prevent the manifestation of secondary symptoms. There is a long tradition of music therapy with children with ASD and this area has been well-documented in the literature (e.g. Alvin, 1978; Bruscia, 2011; Oldfield, 2006). However, even though systematic reviews concluded that music therapy is one of the few promising treatment options for children with ASD (Rossignol, 2009; Wheeler, Williams, Seida, & Ospina, 2008), results of the international trial of improvisational music therapy's effectiveness for children with autism (TIME-A) do not support the use of music therapy for symptom reduction in this client group (Bieleninik, Geretsegger, et al., 2017). In TIME-A, the development of social communication skills, i.e. the development of core symptom severity, as measured by the Autism Diagnostic Observation Schedule (ADOS) was the primary outcome. The findings caused uncertainty and concern for music therapists and families receiving treatment who started wondering whether their previous belief in music therapy's effectiveness has become untenable.

However, it is highly controversial whether symptom reduction is an appropriate treatment aim in the first place (Silberman, 2015; Turry, 2018). Rather, treatment effectiveness might be better measured against improved resilience in children with ASD (Brooks & Goldstein, 2012; Szatmari, 2018; Williams, Siegel, Mazefsky, & ADDIRC, 2018). Resilience refers to 'positive adaptation within the context of significant adversity' (Luthar, Cicchetti, & Becker, 2000, p. 543). A resilient child achieves positive developmental outcomes and avoids maladaptive outcomes despite risk factors.

[1] In this thesis, the term 'children with ASD' is used to achieve consistency with the terminology in reference manuals, such as DSM-5 and ICD-11. This is why the term ASD (Autism Spectrum Disorder) rather than ASC (Autism Spectrum Condition) is used here. In addition, the author is aware of the constant debate regarding appropriate language for referring to people with ASD. The current convention is to use people-first language, such as 'child with ASD', to express that the condition is not the most important or defining characteristic of the person. Self-advocates, however, increasingly argue for using identity-first language, such as 'autistic child', to express that autism cannot be separated from their personality - a deficit that needs to be cured - but is part of a valued identity. For a more detailed review of the discussion, see section 2.1.2 of this thesis.

This doctoral research has been motivated and inspired by my involvement in TIME-A and by my belief that music therapy can make a significant difference in the lives of children with ASD and their families. In my clinical work with this client group, I have become aware of the positive effect music therapy has on their overall wellbeing. The children seem to gain an enhanced sense of self, to become more content and more able to cope with their condition: They seem to become more resilient. This effect was not considered as an important treatment outcome and, consequently, not captured by measurements used in TIME-A or in similar studies. I therefore felt that further research was necessary; research that looks beyond the previously applied assessments and that asks different, maybe more relevant, questions. My observations as well as positive feedback from parents[2] and teachers indicated that music therapy and parent counselling help children with ASD and their families to become more resilient, but this potential benefit has not been sufficiently explored hitherto.

1.2 Research questions and methods

The aim of my doctoral research is to gain a better understanding of the effects of music therapy and parent counselling on resilience in young children with ASD. A mixed methods design, combining quantitative and qualitative data, was chosen to enable a comprehensive understanding and thorough investigation of the complex phenomena involved. In my doctoral study, I investigated data retrospectively that had been collected but not analysed in TIME-A. These data include video recordings of both music therapy and parent counselling sessions. The main research question of my doctoral study is:

> Do music therapy and parent counselling sessions enhance resilience in young children with ASD?

To answer this composite question, the following subquestions were outlined:

1. What is the evidence to show that increasing resilience is a more appropriate treatment aim than symptom reduction for young children with ASD?
2. Do music therapy sessions increase behaviours indicative of resilience in young children with ASD?
3. Does different treatment intensity result in different increase or decrease of behaviours indicative of resilience?
4. Does verbal ability of children influence the increase or decrease of behaviours indicative of resilience?
5. What are the effects of parent counselling sessions offered to the families alongside music therapy sessions regarding resilience in children with ASD and their families?

[2] Throughout this thesis, the term ‘parents’ is used to refer to the primary caregivers of children and explicitly includes single parents, foster parents and adoptive parents.

6. How does quality of life of young children with ASD, as rated by their parents, develop in children receiving music therapy compared to children in a control group?

The first subquestion is addressed in the literature review, which considers relevant literature in the fields of autism, including interventions for children with ASD, and of resilience, including interventions to enhance resilience. The second, third and fourth subquestions led to an extensive time-sampling analysis of videos of music therapy sessions with 13 children, six of which received music therapy once a week and seven of which received music therapy three times a week. Seven children in the group were verbal while six children did not use verbal language. To answer the fifth subquestion, transcribed parent counselling sessions of 13 families were evaluated using thematic analysis. Quality-of-life scales for 25 children were analysed to approach subquestion six, these included children receiving music therapy and children in a control group. All the findings are considered and synthesised to answer the research question of whether music therapy and parent counselling enhance resilience in young children with ASD.

While some of my research methods are well established and have been applied successfully in several music therapy studies, other procedures are rather novel to music therapy research. These innovative methods include conducting statistical analyses in the computing environment R (R Core Team, 2018) and applying generalised linear mixed models (GLMM) to my statistical data. By these means, possibilities to organise and analyse the extensive data collected are extended and refined. In addition to answering the research questions and filling the knowledge gaps, this thesis aims to advance music therapy as a research discipline by introducing statistical cutting-edge methods that are already used advantageously in other disciplines.

1.3 Outline of the chapters

This thesis is structured into eight chapters. After this introductory chapter, a literature review, and a description of the applied clinical approach can be found in chapters two and three, respectively. Chapter four sets out the methodology and methods before the results of the quantitative and qualitative analyses are presented in chapter five. In two case studies, outlined in chapter six, the different data are brought together and reflected on. This is followed by a comprehensive discussion in chapter seven. Finally, the findings and their significance are summarised in the conclusion in chapter eight. The contents of each chapter are now described in some detail.

Chapter Two presents the literature pertinent to my study and research questions. The literature review is divided into two main sections, summarising and discussing theories and research related, firstly, to ASD and, secondly, to resilience. In the beginning, information about the neurodevelopmental condition ASD is given, including an overview of diagnostic criteria, causes, prevalence rates, and comorbidities. An introduction to autism advocacy and the neurodiversity movement is followed by a presentation of the impact of ASD on the parents and families of affected children. Frequently applied treatment programmes and interventions for children with ASD are described, with a special focus on different music therapy approaches and on music therapy research with this client group.

The second section of the literature review is concerned with debates and research on resilience. First, the historical development of resilience research is outlined, and relevant terms and concepts are defined before resilience applications are examined from a disability studies perspective. Different ways of measuring resilience, including the use of specific resilience scales as well as alternative methods of assessing resilience, are described, and their respective benefits and limitations are discussed. Literature focusing on resilience and children with ASD is presented. Finally, an overview is given of interventions aiming to enhance resilience, including creative arts therapy interventions and, more specifically, music therapy interventions.

Chapter Three delineates the clinical approach that I applied during this research study. First, the elements that characterise my approach for the music therapy sessions are presented. The description covers the setting and practical aspects of music therapy sessions, the TIME-A treatment guidelines and additional components of and influences on my approach, as well as the role of supervision. In the second section of this chapter, my approach for the parent counselling sessions is outlined. Characteristics of simultaneous treatment of children with ASD and their parents are mentioned, and the significance of specific counselling skills as well as the use of video feedback are considered.

Chapter Four describes the methodological approach of my study and situates the project within the field of music therapy research. My research uses a mixed methods design, combining quantitative and qualitative data. The chapter first clarifies the methodological background of this study, delineates the development of my study design, and discusses ethical considerations. This is followed by sections on selection of participants and their allocation to different treatment conditions, on data collection, data preparation, and data analysis. Data have been derived from various sources, such as video recordings of music therapy sessions, video recordings of parent counselling sessions, and a scale measuring the quality of life of participants at different time points.

Specific methods and procedures chosen for data handling at various stages of research are presented and justified. For music therapy sessions, processes of excerpt selection, time-sampling analysis, development and application of a bespoke assessment tool measuring the quality of the child-therapist relationship, and the statistical analysis using GLMM are described. Similarly, I outline how video recordings of parent counselling sessions were selected and transcribed before the data were analysed applying thematic analysis. The quantitative statistics used to analyse data gathered from the analogue visual scale measuring the quality of life of participants are explained in the subsequent section of this chapter.

Chapter Five presents the results of the analyses of quantitative and qualitative data. First, baseline characteristics of study participants are displayed and further illustrated using pie charts. After that, key findings related to the music therapy sessions are reported. This includes information on data generated from the excerpt-selection procedure, with a table and pie chart presenting music therapy activities occurring in selected video excerpts. The section on music therapy session results focuses on outcomes from the time-sampling analysis. Tables, scatter plots, bar charts and line graphs illustrate data distribution and diagnostics, model results, and exploratory analyses. Results of the child-therapist relationship rating are displayed, showing both individual developments as well as model results. Findings from the parent counselling sessions are reported in the following section. Data on attendance are presented before the eight identified themes and their subcategories are described and listed in a table. Hereupon, each theme is elaborated on and exemplified with quotes. Finally, results from the quality-of-life scales are given and visualised using diagrams and tables.

Chapter Six depicts two case studies that illustrate processes of therapeutic change and increased resilience factors. One child from each treatment subgroup, low-intensity music therapy and high-intensity music therapy, was chosen for a closer consideration of different types of data and information. Individual time-series graphs from the video analysis are presented for the two children, showing the development of certain behaviours over the course of the five-month intervention. The video-analysis results are related to quotes from the families' parent counselling sessions, their data of the quality-of-life scales, their results of measures gathered through TIME-A, comments from their teachers, and my session notes.

Chapter Seven provides a discussion, drawing together the results from various data sources, relating them back to the research questions and the relevant literature, and contextualising the study within the current research environment. An interpretation of findings is attempted and resulting implications for clinical practice and training are discussed. The chapter further addresses the limitations of this doctoral study and lists recommendations for future larger-scale research projects.

Chapter Eight summarises the findings and their relevance. The thesis concludes with a reflection on the knowledge gained.

CHAPTER TWO
LITERATURE REVIEW

This literature review summarises and discusses theoretical perspectives and research studies related, firstly, to ASD and, secondly, to resilience. Both sections follow a similar structure. In the beginning, relevant terms and concepts are defined before related issues, such as the impact of ASD on families or the challenge of measuring resilience, are considered. Finally, literature on interventions for children with ASD and literature on interventions to enhance resilience is reviewed, each with an emphasis on music therapy interventions. To fulfil the criteria for a quality literature review, it aims to be clearly delimited, comprehensive, coherent, synthesised, and well referenced (Abbott, 2016). The method for reviewing the literature involved using electronic databases, such as ProQuest, EBSCOhost, PubMed, PsycINFO, and Google Scholar, as well as consulting handbooks and standard works in the fields of music therapy, ASD and resilience research. Pertinent journals, such as *British Journal of Music Therapy*, *Journal of Music Therapy*, and *Nordic Journal of Music Therapy*, as well as *Autism*, *Journal of Autism and Developmental Disorders*, and *Pediatrics* were searched. Further literature was obtained from manually searching the reference lists from articles and book chapters. This literature review includes references up until September 2018.

2.1 Autism spectrum disorder

In this section, information about the neurodevelopmental condition ASD, its impact on affected children and their families, and about autism interventions is given. First, an overview of the diagnostic criteria, causes, prevalence rates, gender differences, and common comorbidities introduces the current state of research (2.1.1). The section on the neurodiversity movement and perspectives from self-advocates allows the reader an insight into some prevailing debates (2.1.2). This is followed by a presentation of the impact of ASD on the parents and families of children with the diagnosis (2.1.3). The remaining parts of this section focus on treatments and interventions for this client group (2.1.4). An introduction to the most common programmes that are specifically developed for children with ASD is provided in section 2.1.4.1. Against this background, the development and current occurrences of music therapy as an intervention for autism can be understood and situated (2.1.4.2). The overview of the different music therapy approaches commonly applied with this client group is followed by a discussion of relevant music therapy research studies (2.1.4.3).

2.1.1 Diagnostic criteria, prevalence, and comorbidities

Two systems are widely used to classify diseases and assist in the diagnosis: The International Classification of Diseases (ICD), which is the official world classification produced by the World Health Organization (WHO), and the Diagnostic and Statistical Manual of Mental Disorders (DSM), which is the standard classification in the USA by the American Psychiatric Association (Tyrer, 2014). While the ICD is a coding system for all diseases and disorders, the DSM focuses only on mental disorders. Despite some differences, the two manuals converge in many respects. For example, in their most recent editions, both the ICD-11 (World Health Organization, 2018) and the DSM-5 (American Psychiatric Association, 2013) merged the previously separated diagnoses of childhood autism, Asperger's syndrome and other non-specified developmental disorders into the single category of autism spectrum disorder (ASD). Both classification systems define ASD by its core symptoms, which are persistent deficits in social communication and interaction, as well as restricted, repetitive patterns of behaviour. The DSM-5 provides a more detailed description of the characteristics of ASD. For a comprehensive overview of ASD, I cite here the diagnostic criteria as they are listed in the DSM-5:

> 'A. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history … :
>
> 1. Deficits in social-emotional reciprocity …
> 2. Deficits in nonverbal communicative behaviors used for social interaction ...
> 3. Deficits in developing, maintaining, and understanding relationships …
>
> B. Restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following, currently or by history …
>
> 1. Stereotyped or repetitive motor movements, use of objects, or speech …
> 2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior …
> 3. Highly restricted, fixated interests that are abnormal in intensity or focus …
> 4. Hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment …
>
> C. Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, or may be masked by learned strategies in later life).
>
> D. Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.
>
> E. These disturbances are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay.'
>
> (American Psychiatric Association, 2013, pp. 50-51).

Many scientists endeavour to understand the causes of ASD. It is known that there is no single cause for the condition (The National Autistic Society, 2018). Rather, a number of risk factors seem to contribute to changes in brain structure and function which cause symptomatic behaviour and differences in sensory perception. Genetic factors, for example gene mutations, play an important role. Further, environmental factors, including sociological, toxicological or pharmacological exposure, possibly increase the risk of developing ASD. Evidence points to the fact that especially complex combinations of both genetic and environmental influences, also referred to as gene/environment interactions, cause the neurodevelopmental disability and result in more severe autism symptoms (Ackerman, Schoenbrun, Hudac, & Bernier, 2017; Kim et al., 2017).

In 2018, the Centers for Disease Control and Prevention released new data on the prevalence of ASD, reporting that 1 in 59 children in the USA has received a diagnosis by the age of eight years (Baio et al., 2018). This represents a 15% increase on the previous estimate of 1 in 68 children (Wingate et al., 2014). Studies in the UK indicate that approximately 1% of the population is affected (Baird et al., 2006; Baron-Cohen et al., 2009; Brugha et al., 2012). The direct and indirect economic effect of ASD on families and the society is very high. Lifetime support for an individual with ASD and intellectual disability costs around £1.5 million in the United Kingdom (Buescher, Cidav, Knapp, & Mandell, 2014). The condition occurs across all racial, ethnic, and socioeconomic groups; however, higher socioeconomic status is associated with higher prevalence rates (Durkin et al., 2010). ASD is more often diagnosed in boys than in girls. And even though the previously accepted male-to-female ratio of 4:1 has now been questioned (Loomes, Hull, & Mandy, 2017), ASD still seems more prevalent in boys and men. It has been hypothesised that ASD is ‘an extreme manifestation of the male brain’, a theory building on the gender stereotypes that ‘females on average have a stronger drive to empathize while males on average have a stronger drive to systemize’ (Baron-Cohen et al., 2011, p. 1). There is evidence that girls might benefit from a female protective effect in autism, meaning that more genetic mutations are necessary in girls before they translate into behaviour that warrants a clinical diagnosis (Palmer et al., 2017). In addition, ASD in girls might manifest itself through slightly different symptoms and behaviours. As most of the diagnostic assessment tools have been developed in studies with boys, they are more likely to detect ASD in males and to miss a less stereotypical presentation (Dworzynski, Ronald, Bolton, & Happé, 2012). Another possible explanation for the gender gap is that females are simply better at camouflaging their symptoms and pretending to be normal (Dean, Harwood, & Kasari, 2017). Analysing self-report measures and observational measures, Lai and colleagues (2017) found that there is higher discrepancy between feelings and behaviour in girls with ASD than in boys with ASD. This ability to disguise or compensate, however, can also be a disadvantage as it might impede or delay diagnosis and, thus, necessary interventions. It also seems to come at the cost of mental wellbeing. Compared to boys with ASD, girls with ASD are at a higher risk of developing psychiatric disorders, such as depression or anxiety (Hartley & Sikora, 2009; Solomon, Miller, Taylor, Hinshaw, & Carter, 2012).

Unfortunately, depression is a common comorbidity in children, adolescents and adults with ASD. A recent meta-analysis reported that approximately 14% of people with ASD suffer from a unipolar depressive disorder, which means that, 'compared to typically developing individuals, individuals with ASD are 4-times more likely to experience depression in their lifetime' (Hudson, Hall, & Harkness, 2018, p. 1). Depression has been linked to suicidal ideation and attempt. Alarmingly, according to their mothers, 18% of children with ASD aged six to 18 years have thought about or attempted suicide (Dickerson, Calhoun, Baweja, & Mahr, 2015). Depression, however, is only one of many psychiatric comorbid illnesses that affect people with ASD. Around 70% of children with ASD have at least one other diagnosed mental-health problem, including anxiety disorders, attention deficit hyperactivity disorder, obsessive compulsive disorder, and oppositional defiant disorder (Simonoff et al., 2008). The high prevalence of associated psychiatric disorders has also been acknowledged in the DSM-5. Many of these mood disorders increase the risk for externalising behaviour, such as aggression or self-injury, which is a major cause for hospitalisation. This might explain why 11% of young people with ASD have been admitted to a psychiatric hospital unit by the age of 21 (Siegel & Gabriels, 2014).

Another serious disorder that often co-occurs with ASD is epilepsy, affecting between 5% and 46% of diagnosed children and especially those with intellectual disability (Spence & Schneider, 2009). Widely varying numbers are also reported for comorbid gastrointestinal disturbances. Prevalence rates between 9% and 91% indicate that a high number of children with ASD suffer from diarrhoea, constipation, reflux, and abdominal pain (Coury et al., 2012). A recent study detected predictive patterns of co-occurring medical conditions and found that children with ASD who have gastrointestinal problems are twice as likely to experience difficulties with sleep, and vice versa (Aldinger, Lane, Veenstra-VanderWeele, & Levitt, 2015). The prevalence of insomnia in children with ASD has been estimated to be between 50% and 80%, which means that insomnia affects this group of children approximately three times more often than neurotypical children (Veatch et al., 2017). The study by Veatch and colleagues (2017) highlighted that there is an association between shorter sleep duration and increased severity of autism symptoms, low IQ, maladaptive behaviours and depression.

2.1.2 Autism advocacy and the neurodiversity movement

ASD is an umbrella term for a wide spectrum of conditions and symptoms. Accordingly, the autism community is very diverse and includes people who have a job, live independently, and navigate their way successfully through society as well as people who need lifelong substantial support. This has led to attempts to distinguish different subtypes of ASD (Foss-Feig, McPartland, Anticevic, & Wolf, 2016). One suggestion has been that behavioural symptoms or cognitive ability, for example, could determine different categories which could then lead to appropriate interventions for each category. The diversity among people with

ASD is also more and more reflected in published accounts by people who are themselves affected by the condition. Whereas most books by people on the spectrum are naturally written by adults who are cognitively and verbally very able (e.g. Brauns, 2004; Grandin, 1995; Williams, 1996), some inspiring narratives provide insight into the world and minds of people who have more severe ASD symptoms (e.g. Higashida, 2013; Kedar, 2012; Mukhopadhyay, 2003). These authors learned to write with the help of special equipment and technology, and they were thereby enabled to communicate despite not being able to speak.

The importance of listening to the perspectives and opinions of the diverse autism community has been recognised by Pellicano, Dinsmore, and Charman (2014), who aimed to identify the views of autistic adults, family members, practitioners, and researchers in the UK regarding current autism research and their priorities for future research. Results indicate a large discrepancy between what is funded and what is needed or wanted. All stakeholder groups were disappointed with the heavy emphasis on biomedical research and basic science. They suggested that research should be more 'about what actually helps' (p. 760), including better services and interventions. Results also echo issues that have been expressed by the neurodiversity movement which regards ASD as a valid variation within human diversity (Kapp, Gillespie-Lynch, Sherman, & Hutman, 2013). The participants in the study by Pellicano et al. (2014) opposed research efforts to cure ASD and change the core of people with the condition. Instead, they hoped for more awareness, acceptance and adaptation in society that would provide necessary support. In his bestselling book *NeuroTribes*, Silberman (2015) explained that the neurodiversity movement frames autism as a disability rather than as a disorder or disease. Treatment and research goals that are in line with this framework include improving functioning, quality of life, and the ability to cope, and do not include making a person less autistic. The psychiatrist Baron-Cohen (2017) has also advocated the neurodiversity paradigm as 'a more humane and accurate lens through which to view people with autism' (p. 744). He argued that applying this framework entails societal support and adjustment but not searching for a cure. As Grandin (2012) put it in the title of her book, it entails seeing people with ASD as 'different not less'.

The relevance of the neurodiversity movement has also been acknowledged by the music therapist Joseph Straus (2014) who criticised that in our society many facets of human variability, including ASD, are understood as pathological medical conditions in need of diagnosis, normalisation and cure. He argued that music therapists who adopt this medical model and try to use music to remedy alleged deficiencies of people with ASD not only ignore the intrinsic value of diversity but also will most likely fail in their attempt to cure. In his paper *Music therapy and autism: A view from disability studies*, Straus (2014) further claimed that a cure for ASD is not only unattainable but also undesirable. Nevertheless, according to Straus, music therapy can support people with ASD by focusing on valuable goals, such as shared pleasure through mutual music making as well as enhanced self-expression, self-exploration and self-realisation.

2.1.3 Impact on parents and family

ASD has been described as 'the most severe childhood behavioural disorder with the most complex developmental pattern' (Altiere & von Kluge, 2009, p. 142). The characteristic features of the condition often cause considerable challenges for parents or siblings, and ASD is thus likely to have an impact on the whole family and not only the child diagnosed (Greeff & van der Walt, 2010; Newsom & Hovanitz, 2006). Early worries about the child's development, followed by the struggles of obtaining a diagnosis, searching for appropriate treatments, attending frequent appointments, and dealing with the child's communication and behaviour difficulties are typical sources for parental stress. These may lead to disturbed family routines and strained family relationships. A relatively high prevalence of insecure and disorganised attachment relationships between young children with ASD and their parents has been described (Naber et al., 2007; Rutgers, Bakermans-Kranenburg, Van Ijzendoorn, & van Berckelaer-Onnes, 2004). Families affected by ASD often experience social isolation due to the child's need for sameness and routine, the child's oversensitivity to sensory stimuli, or the child's lack of adherence to social norms. Having a child with ASD requires some parents to become full-time carers, which leaves families to cope with the loss of one income while paying high costs for special ASD interventions. These financial hardships, parental fatigue and exhaustion, and difficulties in finding adequate child-minders may further impede social participation (Altiere & von Kluge, 2009; Greeff & van der Walt, 2010).

Parents of children with ASD report significantly elevated stress levels (Baker-Ericzén, Brookman-Frazee, & Stahmer, 2005; Montes & Halterman, 2007), have lower health-related quality-of-life scores (Khanna et al., 2011), and suffer more often with depression, anxiety, and somatic symptoms (Lee, 2013; Yirmiya & Shaked, 2005) than the general population. In addition to increased psychological stress, caregivers of children with ASD suffer from higher concentrations of proinflammatory biomarkers and from more episodes of physical ill health in comparison with parents of typically developing children (Lovell, Moss, & Wetherell, 2012a). They also experience markedly higher levels of stress and aggravation and lower levels of wellbeing than parents of children with Down syndrome (Abbeduto et al., 2004; Dabrowska & Pisula, 2010), fragile X syndrome (Abbeduto et al., 2004), special health-care needs (Schieve, Blumberg, Rice, Visser, & Boyle, 2007), or other developmental problems (Estes et al., 2009; Schieve et al., 2007).

For several decades, cold and distant parenting was considered one possible cause of autism (Feinstein, 2010). This hypothesis has been disproved and the scientific community unambiguously rejects it today. However, the damaging term ‘refrigerator mothers’, introduced by Bettelheim (1967), and the idea that parents are responsible for their child’s problems still seem to be present in society to some extent (Furnham & Buck, 2003; Gray, 1995). The associated stigma, resulting feelings of guilt as well as the fear of being judged can cause immense levels of stress in parents of children with ASD in addition to the stress caused by the characteristics of the condition and the burden of care. Grieving for the loss of the expected healthy child can also lead to self-blame and frustration. Caregivers often witness their children with ASD struggling and being distressed. As research has supported the saying that parents are ‘only as happy as the least happy child’ (Fingerman, Cheng, Birditt, & Zarit, 2011), the observed suffering of their diagnosed child might be another contribution to the high stress levels of parents.

More challenging child behaviour with conduct problems is a predictor of poorer psychological outcomes and higher stress levels in parents of children with ASD (Davis & Carter, 2008; Lecavalier, Leone, & Wiltz, 2006). However, a literature review by Boyd (2002) concluded that ‘the most powerful predictors of depression and anxiety in mothers’ of children with ASD were ‘low levels of social support’ (p. 209). This finding was replicated in more recent studies showing that better social support leads to improved psychological and physical health and functioning, and to reduced symptoms of anxiety and depression in caregivers of children with ASD (Gallagher & Whiteley, 2012; Lovell, Moss, & Wetherell, 2012b). Social acceptance and support have been determined to be ‘integral to the emotional well-being of these families’ (Altiere & von Kluge, 2009, p. 151). In a mixed methods study by Greeff and van der Walt (2010), social support was identified as one main aspect that contributed to family resilience. Further positive factors reported by parents were professional help and advice, treatment programmes, and knowledge of autism. These results indicate that interventions for the child diagnosed with ASD need to be complemented by support and psychological help for their parents and families.

2.1.4 Interventions for children with ASD

The diversity of ASD is reflected in the diversity of treatment options. Some educational programmes are offered specifically for children with ASD and claim to treat the core symptoms. These include, for example, Applied Behavioural Analysis (ABA), Pivotal Response Training (PRT), Early Start Denver Model (ESDM), or the Developmental, Individual-difference, Relationship-based (DIR/Floortime) intervention. Other therapies are applied with various client groups and might focus on core challenges or associated symptoms. Speech and language therapy, occupational therapy, creative arts therapies, animal assisted therapies, and medication are common examples of these interventions. In this section, I give an overview of the interventions children with ASD commonly receive in

Europe and the USA, including a brief description of the principles, content, and evidence base. This is followed by a section focusing specifically on music therapy interventions for children with ASD. Finally, current trends and advances in music therapy research with children with ASD and their families are presented.

2.1.4.1 Frequently applied treatment programmes for children with ASD

Two surveys collected data on interventions most frequently chosen by parents of children with ASD living in the USA (Becerra et al., 2017; Green et al., 2006). In the 2006 study, families used on average seven different treatments. The most common treatment was speech therapy (70%), followed by ABA, sensory integration, and visual schedules. The belief that children with ASD benefit from processing information visually has influenced the special education programme Training and Education of Autistic and Related Communication Handicapped Children (TEACCH), and the learning programme Picture Exchange Communication System (PECS), which are both used by a significant number of families and schools (Rao & Gagie, 2006; Ryan, Hughes, Katsivannis, McDaniel, & Sprinkle, 2011). Of the families responding to the survey by Green and colleagues (2006), 16% received music therapy. The 2017 study listed speech and occupational therapy as well as individualised education programmes, such as ABA, ESDM or DIR/Floortime among the services most often used. Music therapy or, more generally, creative arts therapies were not recorded as a separate intervention category. In both surveys, around 50% of parents reported that they were using medication to treat their child. Many families affected by ASD also try dietary or nutritional interventions, hoping that they will remove behavioural symptoms. In the more recent survey, 37% of the respondents used a special diet. Among those, the gluten-free/casein-free (GFCF) diet was the most prominent. However, almost half of the families using the GFCF diet perceived this intervention as non-effective (Becerra et al., 2017). This observation confirmed the results of the first large-scale double-blind trial on the effectiveness of this diet, which found no significant improvements in children with ASD following the GFCF diet (Hyman et al., 2015). The clinical guidelines on the management and support of children and young people with ASD, published by the National Institute for Health and Care Excellence (NICE, 2013), explicitly advise against the use of certain pharmacological interventions and against exclusion diets. An online survey about the interventions received by children with ASD, aged seven years or younger, across Europe (Salomone et al., 2015) found results similar to those of the American surveys regarding the frequency of speech and language therapy (64%) as well as behavioural, developmental and relationship-based interventions (55%). However, the authors also reported that, in a few countries, an alarming number of children do not receive any treatment. The UK and Ireland were the two countries with the highest proportion of families not using any intervention (25.2% and 29%, respectively).

Of the behavioural and educational interventions offered for autistic children, ABA is one of the oldest and best-known approaches. Based on the ideas of operant conditioning (Skinner, 1953), ABA programmes aim to teach children through reinforcing positive behaviours and discouraging unwanted behaviours. To motivate children to communicate and interact, ABA therapists employ a method that involves antecedents, behaviours, and consequences (Autism Speaks, 2010). An antecedent, for example a verbal request, is used to prompt a desired behaviour. The response or lack of response to the stimulus leads to a consequence, such as rewarding the desired behaviour with praise, a sticker or candy. There are various distinct approaches under the umbrella term ABA. Sometimes called the traditional ABA or the Lovaas model, Discrete Trial Training (DTT) is a very structured and deliberate form of ABA (Lovaas, 1987). In DTT, the therapist itemises the skills or behaviours that the child should acquire and teaches them step by step. Therapist and child usually sit at a table and work through many discrete trials, successively increasing the complexity of tasks. ABA programmes are typically applied for up to 40 hours per week and integrated into school settings as well as family homes.

ABA has been shown to effectively improve cognitive, adaptive, and language skills of some children with ASD (Dawson, 2008; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005). This treatment has achieved an ‘established’ rating by the National Autism Center (2009), a prominent society in the USA aiming to promote evidence-based practice in the treatment of ASD. However, while Lovaas (1987) claimed that 47% of children in the programme ‘achieved normal intellectual and educational functioning’ (p. 3), this finding could not be replicated in later studies and is thus dubious (Gresham & MacMillan, 1998; Shea, 2004). Strict ABA techniques, and especially DTT, have been criticised for being overly practitioner-led, and for teaching artificial skills that are not generalisable (Horner, Carr, Strain, Todd, & Reed, 2002; Steege, Mace, Perry, & Longenecker, 2007). It has been cautioned that pure behavioural therapies are ‘at risk of focusing on procedures and data collection at the expense of the child as a person’ (Anderson, 2012). The autistic author Ido Kedar (2012) reflected on the ABA treatment he received and described it as ‘drills’ and ‘frustrating experiences’ that caused him to feel ‘miserable’ (all on p. 55), ‘bored to tears’ (p. 54) and are even remembered as ‘torturous’ (p. 49). A recent study by Harris and colleagues (2015) challenged one of the underlying principles of ABA, as the research team found that excessive repetition results in over-specificity and even increases inflexibility of children with ASD.

PRT is an example of an intervention that employs the behavioural approach but in a more naturalistic and engaging environment (Koegel & Koegel, 2006). The PRT programme is based on the belief that some characteristics of ASD are fundamental or pivotal and affect many behaviours and overall functioning. Interventions that focus on these core pivotal areas are hoped to result in improved outcomes across several domains, such as communication, social behaviour, or play skills. Motivation, responsivity, initiation, and self-management are considered pivotal targets (Koegel, Koegel, & McNerney, 2001). PRT is a child-led intervention that incorporates varying tasks and activities. Desired behaviours of the child, as well as attempts, are rewarded as they occur in the natural play and learning environment. Because studies have shown that PRT can successfully improve adaptive behaviour (Baker-Ericzén, Stahmer, & Burns, 2007) and question-asking initiation (Koegel, Bradshaw, Ashbaugh, & Koegel, 2014), as well as decrease disruptive behaviours (Mohammadzaheri, Koegel, Rezaei, & Bakhshi, 2015), it has been rated an 'established' intervention by the National Autism Center (2009).

Another intervention that merges ABA techniques with a developmental approach, is ESDM, which can be applied with children as young as 12 months. The comprehensive intervention is child-led, and aims to improve social communication, motor skills, learning, and engagement through enjoyable, play-based interactions (Rogers & Dawson, 2010). A randomised controlled trial (RCT) showed that expressive and receptive language as well as adaptive behaviour could be improved with ESDM (Dawson et al., 2010). Further, normalised brain activity and increased social behaviour were reported (Dawson et al., 2012). The intervention has received the increasing attention of researchers, practitioners and parents after a 2-year-follow-up study demonstrated that positive outcomes could be maintained, and core symptom severity reduced (Estes et al., 2015). Early intensive behavioural intervention programmes, such as ABA or ESDM, have been criticised for their intervention targets, methods and attitudes (e.g. Baron-Cohen, 2017; Mottron, 2017; Silberman, 2015). The child psychiatrist Laurent Mottron (2017) criticised that these programmes had normative and normocentric aims, ignored objections raised by the autism community, and failed to promote happiness and personal accomplishments. He argued that intervention and education offered to autistic children should rather follow a strength-based approach.

Apart from behavioural interventions, relationship-based treatment approaches are commonly applied with children with ASD. One example is Floortime, which is a component of the DIR model, and therefore often referred to as DIR/Floortime. The idea behind this therapeutic approach is that, in order to help a child with ASD develop further, adults need to meet the child at his or her current developmental level (Wieder & Greenspan, 2003). In Floortime, the therapist or parent literally joins the child on the floor in the child's natural play activities, hoping that this will catch the child's interest and enable emotional connection and shared attention. Following this mutual engagement, more complex emotional and social relating as well as abstract thinking may emerge; the child is helped in 'climbing the symbolic ladder' of development (Wieder & Greenspan, 2003, p. 425). The emphasis is on the overall development of the child, and through a child-led and strength-building approach, development of speech, motor, sensory, or cognitive skills are addressed simultaneously (Greenspan & Wieder, 2007). Preliminary research suggests that DIR/Floortime is effective in increasing functional emotional development (Pajareya & Nopmaneejumruslers, 2011; Solomon, Necheles, Ferch, & Bruckman, 2007). However, as there is not enough evidence to determine that this treatment provides beneficial effects, the National Autism Center (2009) rated DIR/Floortime as an 'emerging' intervention.

In addition to the above-mentioned specific models, many programmes and therapy approaches that are offered to children with ASD include some behavioural, developmental and relationship-based elements. As the diagnosis ASD encompasses such a wide spectrum of challenges and abilities, it is evident that no one treatment is suitable for every child with ASD. However, what does seem indisputable is that early intervention is key for better outcomes (Koegel, Koegel, Ashbaugh, & Bradshaw, 2014; Zwaigenbaum et al., 2015). Early intervention not only holds promise of improved functioning, behaviour and wellbeing of children with ASD and their families. It has also been shown to be cost effective as it reduces the services needed in adolescence or adulthood (Cidav et al., 2017). The effectiveness of early intervention has been demonstrated by the long-term follow-up of a parent-mediated communication-focused treatment in children with ASD (Pickles et al., 2016). While no improvement in symptom severity could be found immediately post-treatment (Green et al., 2010), children scored significantly lower on autism symptom severity five years after the intervention had been delivered (Pickles et al., 2016). This longitudinal study points to the necessity that, in order to adequately examine treatment effectiveness, one needs to either follow children and families over several years or look for factors that predict later improvements. However, findings from a recent study involving 346 children with ASD question whether symptom reduction changes relevant long-term outcomes, and consequently, whether interventions should focus on that aim. Williams and colleagues (2018) found that it was the ability to cope and adapt and not communication skills that influenced problem behaviours of children with ASD (Williams et al., 2018).

2.1.4.2 Music therapy with children with ASD

There is a long tradition of music therapists working with children with ASD. Early pioneers of improvisational music therapy described their clinical work with this client group in the 1960s and 1970s (Alvin, 1978; Nordoff & Robbins, 1965, 1968), and theoretical texts, case studies and research investigations on music therapy with individuals with ASD were published during the first decades of emerging music therapy literature (e.g. Euper, 1968; Hollander & Juhrs, 1974; Mahlberg, 1973; Saperston, 1973; Stevens & Clark, 1969; Thaut, 1984). A detailed presentation of the early music therapy research and treatment for children with ASD has been provided by Reschke-Hernández (2011), although her historical review is limited to publications in English. Further information about the history of music therapy for individuals with ASD can be found, for example, in Bergmann (2016), Geretsegger et al. (2015), and Oldfield (2016).

From the early beginnings of music therapy and autism research, authors have pointed to the unusual interest and ability in music that can be observed in a high proportion of children with ASD (e.g. Euper, 1968; Romerhaus, 1968; Sherwin, 1953). Today, several music therapists still refer to the exceptional musical skills and the superior musical sensitivity of some individuals with ASD (e.g. Lim, 2012; Ockelford, 2013). And even though these remarkable abilities might only relate to a small subgroup, research results suggest that people with ASD do not differ from neurotypical individuals in their appreciation and understanding of music (Bhatara, Quintin, Fombonne, & Levitin, 2013; Heaton, 2005), and that 'music, as a form of non-verbal communication, constitutes a domain of preserved skills and interest' (Molnar-Szakacs & Heaton, 2012, p. 322). People who are themselves on the autism spectrum have also highlighted that they enjoy music and feel it has various beneficial effects, including calming, helping with learning, or connecting with others (Kedar, 2012; Toigo, 1992; Williams, 1996). One reason for this might be that music can easily fulfil the need for repetition and recognisable structures but, at the same time, allows individuals to venture out of restricting uniformity through introducing variations within a reassuring form (Wigram & Gold, 2006; Wigram & Elefant, 2009). Thus, music seems to be an important intrinsic motivator that can be used in therapeutic interventions to foster attention, engagement, and interaction. A recent study provided neurobiological evidence for the belief that music is a suitable medium in interventions for children with ASD (Sharda, Midha, Malik, Mukerji, & Singh, 2015). Using fMRI scans of children with and without ASD listening to spoken and sung words, brain mechanisms involved in speech and music processing were investigated. The researchers found that in children with ASD patterns of brain activity and connectivity were disrupted during spoken-word perception but preserved during sung-word perception. Sharda and colleagues (2015) concluded that music has the ability 'to overcome the structural deficit for speech across the autism spectrum' (p. 174).

Music, as an alternative and motivating form of expression and communication, seems to be a suitable medium to engage individuals with ASD who struggle with more conventional verbal and non-verbal means of expression and communication. In music therapy, interpersonal relating and communicative interactions can be tried and experienced in a playful, non-threatening and enjoyable way. It is known that interactions between individuals are essential for cognitive and emotional development and growth (Stern, 1985). As deficits in social interactions constitute a core symptom of children with ASD (American Psychiatric Association, 2013), it is especially important that alternative means and situations are offered for the child to practise and enjoy social interactions. The psychiatrist Daniel Stern not only emphasised the importance of reciprocal communication for development, he also highlighted that the early interactions between a baby and his or her caregiver are of a distinct musical quality (Stern, 1985). The intrinsic musicality of these early interactions makes music 'a fundamental part of our social experiences from an early age' (Pavlicevic, 2005, p. 114). The striking similarities between early parent-infant communication and musical interactions include the use of rhythm, melody, dynamics, intensity, structure, and timing as main elements of intersubjective exchange (Malloch, 1999; Papousek, 1996, Stern, 1985). Furthermore, both interactions are non-verbal, intuitive, spontaneous, and playful (Oldfield & Bunce, 2001). The mother or father attunes to the child's emotional state through, for example, synchronising the speech rhythm with the infant's movements or matching the pitch of his or her vocal sounds. Similarly, the music therapist attunes to the client through imitating, mirroring, holding, or complementing musical responses, and thereby helps the child to self-regulate and to experience a sense of self, a sense of the outer world, and the possibility to connect with another. It is possible for humans to share emotions and experience togetherness at this preverbal level because of their inborn 'communicative musicality' (Malloch & Trevarthen, 2009).

Two music therapy approaches that have been successfully employed with children with ASD are Free Improvisation Therapy, developed by Juliette Alvin (1978), and Creative Music Therapy, developed by Paul Nordoff and Clive Robbins (1977). Both consider live improvised music as the crucial factor in therapy to enable development and growth. The writing and teaching of Alvin as well as of Nordoff and Robbins have influenced and continue to inspire many music therapists. It is therefore not surprising that most music therapists working with autistic children use improvisational techniques (e.g. Aigen, 2005; Edgerton, 1994; Holck, 2004; Kim, Wigram, & Gold, 2008; Oldfield, 2006; Wigram & Elefant, 2009). These clinicians have used improvisation to assess and treat children's social communication skills and to build a trusting therapeutic relationship. Some music therapists have combined elements of improvisational music therapy with theoretical foundations and techniques from other treatment approaches when working with children with ASD. Berger (2002) has outlined a music therapy method from a multidimensional physiologic perspective that aims to address sensory regulation and sensory integration issues. Carpente (2009, 2011) has developed a programme that integrates Nordoff-Robbins music therapy within the DIR/Floortime model to improve interpersonal interaction and communication. In South America and other Latin countries, the music therapy model developed by Benenzon (1982) has become very influential (Wagner, 2007). The Benenzon model of music therapy is psychoanalytically informed and uses various musical and natural sounds to allow for sensory integration and a reorganisation of individual development. Other psychoanalytic and psychodynamic music therapy approaches for autistic people have been described by Lecourt (1991) or Levinge (2015). A developmental approach focusing on the quality of the therapist-client relationship and integrating findings of infant research has been outlined by Schumacher and Calvet-Kruppa (1999). Especially in German-speaking countries, it constitutes one of the main clinical approaches applied by music therapists working with children with ASD (Kowal-Summek, 2016).

All the above-mentioned authors include improvisational techniques in their clinical work and pursue a mostly child-led approach, addressing not only separate symptoms of the disorder but various developmental, behavioural and emotional needs of the whole person. A very different understanding of music therapy and its potential benefits for autistic children underpins the education-oriented and behavioural approaches that are especially popular in the USA (Kern, Rivera, Chandler, & Humpal, 2013). Under this umbrella, various mainly therapist-led music interventions aim to modify specific behaviours of children with ASD through modelling, repetition and reinforcement. Music has been used as a prompt and reward in ABA to teach desired behaviour (Martin, 2012), and as a stimulus to improve speech production (Lim & Draper, 2011). Further examples of behavioural approaches are the use of prescriptive songs to help with specific rituals or transitions (Kern, Wolery, & Aldridge, 2007), or the combination of music with social stories that teach socially expected behaviours (Brownell, 2002). These uses of music can be easily implemented and their effects can be, in the current research climate most importantly, easily quantified and measured. Therefore, their supporters claim that these behavioural approaches are evidence-based practice (Humpal & Kern, 2012). In some respect the measurable changes in behaviour satisfy the need of some people for these children to conform to societal norms. However, it remains questionable whether effects achieved in this way generalise to future situations, lead to holistic development and growth, or improve the wellbeing of the individual with ASD.

There is a wide variety of settings in which music therapy sessions with autistic children are conducted, including child development centres and outpatient clinics, nurseries and schools, as well as in family homes. The most common music therapy intervention format for this client group is individual therapy, i.e. one-to-one sessions. However, to enhance their social skills, children with ASD are also treated in music therapy groups consisting of several children with the same or similar diagnosis (e.g. Ikuno, 1999; Kern & Aldridge, 2006; LaGasse, 2014). In addition to providing opportunities for social interaction, play, and turn-taking, the group-based music therapy enables children with ASD to enjoy and engage in shared activities with their peers. Family-centred music therapy for this client group is receiving increasing attention and its specific values have been described by several authors (e.g. Bull, 2008; Oldfield, 2006, 2008; Pasiali, 2004; Thompson, 2017; Thompson, McFerran, & Gold, 2013). Music therapy treatment for the child with ASD together with a parent is often considered appropriate for young children who are emotionally very dependent on the caregiver. The therapy is usually concerned with the individual needs of both child and parent as well as with their relationship issues. Another very important rationale for including carers in the sessions is the positive feedback from parents themselves. They report feeling more attuned and bonded to their child because of family-centred music therapy (Thompson et al., 2013), being amazed by the progress of their child and by the child's strengths transpiring in sessions (Jones & Oldfield, 1999), and being delighted to see their child's enjoyment and to share positive moments together (Oldfield, 2011). Some approaches also include siblings or extended-family members, depending on the needs and preferences of the family. Music therapy groups are also offered to several children with ASD and their parents (e.g. Bull, 2008; Oldfield, 2006). The presence of other families who experience similar problems may help parents to feel more relaxed, to socialise, and to benefit from peer support. As the above-mentioned literature unanimously suggests that family-centred music therapy is highly beneficial, it seems indicated that parents of children with ASD should always be included in their child's treatment in some way. If the setting or the prioritised treatment aims require individual therapy, regular feedback sessions or parent counselling may be an alternative option to involve caregivers.

2.1.4.3 Music therapy research with children with ASD

When reflecting on the past and future of music therapy for persons with ASD, Oldfield (2016) stated that this is probably 'one of the clinical areas that has received the most attention in the music therapy literature' (p. 96). In the first decades of music therapy literature, anecdotal reports, case studies and detailed descriptions of applied methods prevailed. The wealth of case studies of music therapy with individuals with ASD has been assembled in the book *Case examples of music therapy for autism and Rett syndrome* (Bruscia, 2011). Over the last two decades, research studies have increasingly investigated the effects of this treatment on developmental and behavioural outcomes in children with ASD more systematically. Indeed, by now, so many research projects in this area have been conducted that several literature reviews (Accordino, Comer, & Heller, 2007; Simpson & Keen, 2011), systematic reviews (Whipple, 2004, 2012), and Cochrane reviews (Gold, Wigram, & Elefant, 2006; Geretsegger, Elefant, Mössler, & Gold, 2014) have analysed and summarised the findings and the current state of research. Even outside the discipline, scientists and clinicians have recognised the number of high-quality studies in music therapy with individuals with ASD: A systematic review of novel and emerging treatments for ASD concluded that music therapy is one of the few promising interventions which received the highest grade of recommendation (Rossignol, 2009). Similarly, an overview of Cochrane reviews identified music therapy as a promising treatment option for children with ASD (Wheeler et al., 2008).

Two narrative reviews of the literature on music interventions for children with ASD are available (Accordino et al., 2007; Simpson & Keen, 2011). Accordino and colleagues (2007) identified 20 music therapy and auditory-integration training studies conducted between 1973 and 2000. The reviewers observed that case study designs accounted for most of the published studies. As a result, useful information regarding music therapy techniques, methods and approaches could be gathered, providing, however, only limited empirical support of the effectiveness of the intervention. Simpson and Keen (2011) excluded case studies without experimental controls from their review. They identified 20 studies, published between 1993 and 2010, which mainly used composed songs and music improvisation as intervention techniques. The reviewers concluded that preliminary evidence supports the beneficial effect of music interventions on social, communicative and behavioural skills of young children with ASD.

Whipple (2004) provided the first systematic review on music interventions for young people with ASD. Nine quantitative studies with a total of 76 subjects were included in the meta-analysis. The effects of music and no-music treatment conditions on communication, social behaviour, and cognitive skills were compared. Results suggested that all music interventions, regardless of participants' ages, investigated outcome, and treatment implementation, are effective for this client group. However, the findings have to be interpreted with caution as the author did not limit the review to music therapy research studies but also included intervention studies that used any (not necessarily therapeutic) application of music implemented by professionals not trained as music therapists. This was different in a later systematic review by the same author (Whipple, 2012), which focused specifically on music therapy for children with ASD aged five years or younger. The meta-analysis included eight quantitative studies (Finnigan & Starr, 2010; Kern & Aldridge, 2006; Kern, Wakeford, & Aldridge, 2007; Kern, Wolery, & Aldridge, 2007; Kim et al., 2008; Lim, 2010; Lim & Draper, 2011; Wimpory, Chadwick, & Nash, 1995) with a total of 91 participants and concluded that 'music therapy may be considered an extremely effective treatment for young children with ASD for developing communication, interpersonal, personal responsibility, and play skills' (Whipple, 2012, p. 72). As three out of eight studies in the review had a sample of only one individual, and as the review excluded studies that reported qualitative results or effects on caregivers of children with ASD, findings do not necessarily represent current clinical practice of music therapy for this client group.

The first Cochrane review on music therapy for people with ASD was published by Gold and colleagues in 2006. Due to the selection criteria, only three studies with a total of 24 participants could be included. Furthermore, these studies were only 'of limited applicability to clinical practice' (Gold et al., 2006, p. 1). Nevertheless, the results indicated that music therapy has a positive short-term effect on verbal and gestural communicative skills of children with ASD. The updated version of this Cochrane review (Geretsegger et al., 2014), which is also the most recent systematic review of music therapy treatment for individuals with ASD, added seven newer studies to the meta-analysis, so that 165 participants from ten studies (Arezina, 2011; Brownell, 2002; Buday, 1995; Farmer, 2003; Gattino, Riesgo, Longo, Leite, & Faccini, 2011; Kim et al., 2008; Lim, 2010; Lim & Draper, 2011; Thomas & Hunter, 2003; Thompson, 2012) were included. However, the authors noted that the sample size was still relatively small, compromising the methodological strength (Geretsegger et al., 2014). The studies included were RCTs or controlled clinical trials investigating short-and medium-term effects of music therapy compared to ‘placebo’ therapy, no treatment, or standard care. Meta-analyses found significant improvements in the treatment group in social interaction, communicative skills, initiating behaviour, and social-emotional reciprocity. In addition, music therapy was superior to standard care in promoting social-adaptation skills and the quality of parent-child relationships. The authors highlighted that findings are promising but that more research with larger sample sizes and parallel designs, relevant and standardised outcome measures, as well as long-term or follow-up assessments is needed to strengthen the evidence. Furthermore, they recommended that future studies should be explicit about the type of applied music therapy, and that future trials should be pragmatic. A pragmatic study is ‘reflecting usual conditions’ (Thorpe et al., 2009, p. 466) and thus investigating the effectiveness of the treatment as opposed to the efficacy of the treatment which is assessed under experimental conditions (Geretsegger et al., 2014).

All these recommendations have been implemented by the international music therapy research study TIME-A, which has motivated this doctoral project. As outlined in the study protocol (Geretsegger, Holck, & Gold, 2012), TIME-A aimed to determine whether music therapy improves the social communicative skills of young children with ASD. Having enrolled 364 children in nine countries (Australia, Austria, Brazil, Israel, Italy, Korea, Norway, UK, USA), this single study included more participants than all the studies in the most recent systematic review combined, which makes it also ‘the largest randomised controlled trial on non-pharmacological therapy for autism so far’ (Uni Research, 2016). The large sample size allowed for a parallel rather than a cross-over design. Children had a diagnosis of ASD and were aged four to seven at the time of enrolment. After baseline assessments, children were randomly assigned to the low-intensity music therapy condition, the high-intensity music therapy condition, or the enhanced standard care condition. The allocation ratio was 1:1:2, resulting in half of the children receiving music therapy. The type of music therapy was clearly specified as improvisational music therapy and described in the detailed treatment guidelines (Geretsegger et al., 2015). As the primary outcome, symptom severity was measured with the Autism Diagnostic Observation Schedule (ADOS) social affect domain subscale pre- and post-intervention. The ADOS, which is mainly used for diagnostic purposes, was administered by blinded assessors. In addition, parents were asked to complete the Social Responsiveness Scale (SRS). Data from the standardised scales were collected at baseline (0 months), mid-intervention (2 months), post-intervention (5 months), and follow-up (12 months). Both the duration and frequency of treatment as well as the applied music therapy approach ensured that the trial was pragmatic, i.e. close to the standard clinical practice in most participating countries. The results were published in a high-impact journal (Bieleninik, Geretsegger et al., 2017) and received attention from music therapists as well as related research disciplines, the media and general public (Gold, 2017). Regarding the primary outcome, no significant difference in improvement could be found between the music therapy group and the enhanced standard care group. Furthermore, of the 20 exploratory secondary outcomes measured, only three (social motivation and autistic mannerism subscales of the SRS) showed a significant group difference. The study authors concluded that ‘these findings do not support the use of improvisational music therapy for symptom reduction in children with autism spectrum disorder’ (Bieleninik, Geretsegger et al., 2017, p. 534).

Not surprisingly, the results and this statement caused great concern for many music therapists as well as affected families who have benefited from and advocated music therapy. It was feared by some that instead of having a promoting effect, the study might have a detrimental effect on the reputation of music therapy as an intervention for children with ASD (Gold, 2017). As a response, the principal investigator (Gold, 2017), involved clinicians and researchers (Oldfield, Blauth, Finnemann, & Casey, 2019), as well as external music therapists (Bergmann, 2018; Turry, 2018) commented on the study results, highlighted the strengths and limitations of the trial, and reminded readers of positive quantitative and qualitative results that were not presented in the original report. For example, it was noted that the intervention protocol did not say anything about the quality and appropriateness of the musical material used, and that thus the quality of the therapy implementation might have been very diverse across the different sites, leading to inconsistent results (Bergmann, 2018; Oldfield et al., 2019; Turry, 2018). A critique voiced in all these responses to the trial was the choice of the ADOS as the primary outcome measure. As a diagnostic tool, it was not designed to measure small changes and effectiveness of treatment. This has also been acknowledged by the TIME-A study team (Bieleninik, Posserud et al., 2017; Gold, 2017). Maybe the most important comment on the study results relates to the choice of symptom-severity reduction as the primary outcome. Partly due to the increasing number of individuals with ASD who engage in the research discussion, it is now highly controversial whether symptom reduction can be considered an appropriate treatment aim (Silberman, 2015). Rather, ‘functional gains and quality of life’ (Turry, 2018), the opinion of and impact on parents (Blauth, 2017; Oldfield, 2006), and the resilience of children with ASD (Brooks & Goldstein, 2012; Szatmari, 2018) may be more relevant outcomes.

Nevertheless, this international RCT has clearly advanced music therapy research, built a strong basis on which to explore further, encouraged fruitful discussions about best clinical practice and research methods, as well as allowed for several related projects to emerge. For example, a TIME-A spin-off study (Mössler et al., 2017) analysed session videos of 48 children enrolled in TIME-A to determine whether changes in social skills, as measured by ADOS and SRS, were predicted by the quality of the therapeutic relationship, as rated by the Assessment of the Quality of Relationship (AQR). Linear mixed-effect models confirmed that there were significant interaction effects between the therapeutic relationship and the development of social, communication and language skills.

Other recent music therapy research studies investigated interdisciplinary or family-centred approaches to assess their effect on outcomes relevant for affected children, their families, and the professionals working with them. A mixed methods study with high clinical relevance and applicability has been carried out by Tomlinson (2016). She investigated whether the effect of music therapy sessions on the development of verbal skills in young children in a special-needs school could be enhanced by additional music sessions conducted by teaching assistants. Results suggested that the collaborative approach of music therapists and teaching assistants was effective and a promising procedure for helping children reach their best potential.

Several recent studies put an emphasis on parents' perception of music therapy with autistic children (e.g. Gottfried, 2017; Kaenampornpan, 2015; Schwartzberg & Silverman, 2017; Thompson, 2017; Thompson et al., 2013). Gottfried (2017) developed a music-oriented parent counselling model for parents of children with ASD. Participating parents reported feeling less stressed and more competent. A qualitative study by Kaenampornpan (2015) explored parents' experiences in music therapy sessions with their children with special needs. Improved social and communication skills of the children, positive experiences for the families, and enhanced interaction patterns of the parents with their children could be observed. Schwartzberg and Silverman (2017) analysed semi-structured interviews with parents and discovered recurrent themes, such as 'the collaborative approach benefits all aspects of treatment and promotes rapport and alliance', and 'parents independently implement techniques used in music therapy in other settings'. Thompson et al. (2013) concluded that family-centred music therapy strengthens the parent-child relationship. Parents perceived an improvement in the quality of their child's social interactions as well as in their own abilities to relate positively to the child. In a four-year follow-up qualitative study, Thompson (2017) investigated whether positive effects sustained. Mothers reported that, because of the family-centred music therapy sessions, they felt more confident and competent, observed improved child social communication and wellbeing, and cherished the music-elicited mutual enjoyment. These results indicate that family-centred music therapy might improve social relationships in the family as well as the quality of life of the child with ASD and other family members.

Another exciting project on the long-term effects of music therapy with children with ASD and their families was carried out by Amelia Oldfield and resulted in the production of a documentary film (Thompson & Thompson, 2017). The film combines excerpts of music therapy sessions in 2001 and 2002 with excerpts of interviews with the same families 15 years later. The film was directed by Maxim Thompson who himself received music therapy 23 years earlier when he was three years old and had a diagnosis of ASD. The parents interviewed in the film reflected on the experience of participating in music therapy sessions with their child and were all very positive about it. This unusual format captures the emotional responses of families which gives the viewer an insight into the immense impact of music therapy on children with ASD and their parents.

2.2 Resilience

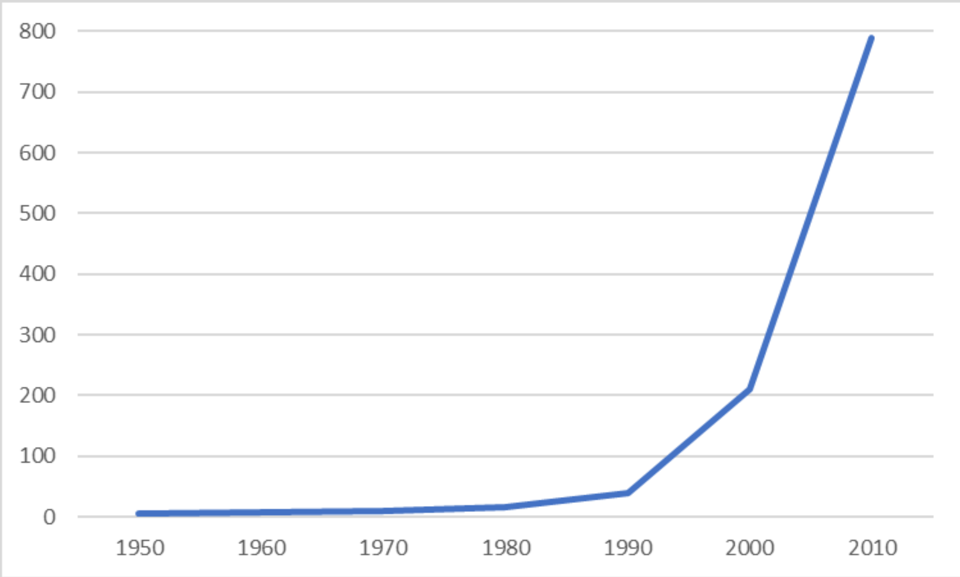
This section begins with an overview of the development of resilience research, and of current debates regarding definitions of the construct and related concepts (2.2.1). As this thesis is concerned with resilience in children with ASD, resilience definitions and applications are also looked at from a disability studies perspective (2.2.2). The subsequent part focuses on possibilities to measure resilience (2.2.3), considering both the use of specific resilience scales (2.2.3.1) as well as alternative methods of assessing resilience (2.2.3.2). The literature on resilience and children with ASD is presented (2.2.4), followed by a discussion on interventions to foster resilience (2.2.5). The vast number of studies is organised into three sections. I examine systematic reviews of resilience-building interventions for adults (2.2.5.1), systematic reviews of resilience-building interventions for children (2.2.5.2), and literature on creative arts therapy interventions, including music therapy, to foster resilience (2.2.5.3).

2.2.1 Defining resilience and related concepts

The word resilience originates from the Latin prefix 're-' which means 'back', and the Latin word 'salire', which means 'to jump'. Thus, the meaning of resilience can be connected to jumping or bouncing back. The term is not only used in psychology and social sciences, but also in disciplines such as architecture (e.g. Craig & Ozga-Lawn, 2013) and ecology (e.g. Holbrook, Schmitt, Adam, & Brooks, 2016). In social sciences, the resilience construct is applied to families (e.g. Patterson, 2002; Walsh, 2003), and systems (e.g. Masten, 2011), but it most commonly relates to individuals. Because of the topic and purpose of my study, I limit the attempts to define and conceptualise the resilience construct to psychological resilience in individuals and focus specifically on resilience in children and in people with disabilities.

The contemporary research on resilience derives from studies in the mid-twentieth century following Norman Garmezy's introduction of the concept (Rolf, 1999). Especially in the last two decades, the resilience construct has gained immense popularity among researchers in the social sciences. As an illustration, Figure 1 presents data that have been collected by Bonanno, Romero and Klein (2015). It depicts the frequency with which the term 'resilience' and its variants 'resiliency' and 'resilient' have appeared in titles of relevant journals from 1950 until 2010.

Figure 1: Appearance of the term 'resilience' in titles of social science publications



(adapted from Bonanno et al., 2015)

This dramatic increase in the use of the term also brought with it a divergence in definition and application. Masten and Obradović (2006) offer a definition that embraces the complexity of the construct: 'Resilience is a broad conceptual umbrella, covering many concepts related to positive patterns of adaptation in the context of adversity' (p. 14). Resilience research has developed and advanced in four major waves (Wright, Masten, & Narayan, 2013). Initially, studies focused on identifying the factors that allowed some individuals to achieve better-than-expected outcomes. Influential longitudinal studies provided insight into probable resilience predictors and trajectories (e.g. Fergusson & Horwood, 2003; Schoon, 2006; Werner & Smith, 1982). The second wave focused on the developmental processes and ecological systems involved in resilience. Researchers tried to understand not only what led to resilience but also how the adaptation process took place. In the third wave, efforts have concentrated on intervening to promote resilience, i.e. on designing and evaluating prevention and intervention programmes. The fourth wave is characterised by a multilevel approach to resilience which aims to understand neurobiological and epigenetic processes linking them to behaviour and emotions. The knowledge gained from all waves of resilience research continues to benefit and influence studies and programme implementation.

In the early phases of the discipline, resilience usually referred to a personality trait, such as optimism or hardiness (e.g. Block & Block, 1980; Connor, Davidson, & Lee, 2003). Respective definitions equate resilience with an ability or capacity of a person. This notion led to the description of people as vulnerable or invulnerable and even invincible (Anthony & Cohler, 1987; Werner & Smith, 1982), which put immense pressure on the individuals while also ignoring the fact that positive adaptation is much more common than maladaptive behaviour (Bonanno & Diminich, 2013). In a seminal paper, Masten (2001) has clarified that ‘resilience does not come from rare and special qualities, but from the everyday magic of ordinary, normative human resources in the minds, brains, and bodies of children, in their families, and in their communities’ (p. 235).

Today resilience is mostly conceptualised as an outcome or a process (Chmitorz et al., 2018). Rutter (2006) defines resilience as ‘an interactive concept that is concerned with the combination of serious risk experiences and a relatively positive psychological outcome despite those experiences’ (p. 2). Several researchers have supported this outcome-oriented approach to resilience (e.g. Kalisch, Müller, & Tüscher, 2015; Mancini & Bonanno, 2009). This understanding entails another necessary definition, namely what constitutes a positive outcome. It is usually the researchers who determine this. However, if the participants are not involved in the process of defining a positive outcome, a culturally and contextually inappropriate normative judgment may be the result (Kaplan, 2013; Ungar, 2015). It has been pointed out that this biased perspective often leads to narrow focuses on one aspect of functioning while other aspects that might be more important to the individual are ignored (Reyes, Elias, Parker, & Rosenblatt, 2013). Applying a constructionist approach to resilience is a possible response to this difficulty.

Some researchers equate a resilient outcome with the absence of mental disorder (e.g. Chmitorz et al., 2018; Kalisch et al., 2017). However, this has been criticised because ‘the absence of an undesirable state does not necessarily imply the presence of a desirable one. One may be asymptomatic without having fulfilled his or her potential for health’ (Kaplan, 2013, p. 41). The understanding of resilience as the absence of psychopathology despite adversity contextualises the concept within a deficit-based approach. However, resilience is more commonly situated within strength-based approaches and positive psychology (Goldstein & Brooks, 2013; Masten, 2001; Seligman, 1995). In line with a strength-based understanding, a positive outcome for children has been described as ‘the attainment of developmental milestones or competencies’ (Naglieri, LeBuffe, & Ross, 2013, p. 242). Brooks and Goldstein (2001) have listed various characteristics of a resilient child. These include having the capacities to deal effectively with stress and pressure, to cope with everyday challenges, to rebound from disappointments, mistakes, and trauma, to develop clear and realistic goals, to solve problems, to interact comfortably with others, and to treat oneself and others with respect and dignity.

If resilience is defined as an outcome, it is important to specify whether it is thought of as a general positive outcome or a context-specific outcome. It has been emphasised that ‘it would be more useful if discussions were presented in terms of specific domains of successful coping’ (Luthar, 1993, p. 442), so that a child might be described, for example, as resilient in the school context but not in the family environment. In a large-scale longitudinal study (Werner & Smith, 1982), the authors identified several individuals whose resilience shifted between contexts or time points. Some people, for example, did well in the work context but only after they had stopped contact with family members, or they did well in their youth and early adulthood but developed mental health problems when they were older. As outcomes and thus the label ‘being resilient’ vary across domains and throughout life, resilience has also been conceptualised as a process (Cohen, 2013; Luthar et al., 2000; Ungar, 2015; Windle, Bennett, & Noyes, 2011). The often-cited paper by Luthar and colleagues (2000) offers the following definition: ‘Resilience refers to a dynamic process encompassing positive adaptation within the context of significant adversity’ (p. 543).

The presence of significant adversity is a necessary condition for the resilience construct. ‘Individuals are not considered resilient if there has never been a significant threat to their development’ (Masten, 2001, p. 228). This threat can take many forms. Acute and chronic stressors, major traumatic life events, or daily concerns (so-called microstressors), can all constitute risk factors in a child’s life. Examples of adverse conditions that have been studied by resilience researchers include natural disasters, poverty, parental mental illness, child maltreatment, bereavement, chronic illness and disability. Risk factors that are predictors of poor outcomes can be moderated or mitigated by protective factors. Protective factors, also called resilience factors or promotive factors, are predictors of better-than-expected outcomes. They ‘change the cause-and-effect relationship between adversity and outcome’ (Shapiro, 2015, p. 8). Both risk and protective factors occur at multiple levels, the internal level, known as the within-child factors, and the external level, including family, community and societal characteristics. A stable and supportive home environment, good public health care, and values and resources directed at education are examples for protective family, community and societal factors (Wright et al., 2013). Most research has focused on identifying the intrapersonal factors that improve outcomes, maybe because they are more likely to respond to clinical interventions. Reivich and Shatte (2002) listed emotion regulation, impulse control, causal analysis, realistic optimism, self-efficacy, empathy, and reaching out as key factors. Good social-emotional skills, including self-awareness, social-awareness, self-management, goal-directed behaviour, relationship skills, personal responsibility, decision making, and optimistic thinking, have been named by others (Naglieri, LeBuffe, & Shapiro, 2013). Several studies have shown that having a positive relationship with a pro-social adult is the most critical protective factor for children at risk (Luthar, 2006; Masten, Best, & Garmezy, 1990).

2.2.2 Resilience and disability studies

When writing about resilience, especially in relation to children with ASD, it is imperative to consider the construct from a disability studies perspective. Over the past 30 years, disability studies have emerged as an interdisciplinary academic field which ‘challenges deep-rooted assumptions and beliefs about disability’ (Albanesi, 2017, p. 2). Disability studies examine social, political and cultural meanings of disability, and aim to empower people with disabilities and de-stigmatise illness and impairment (Society for Disability Studies, 2016). Unfortunately, rather than empowering ability-diverse people, 'traditional approaches to understanding resilience have often contributed to the discrimination and marginalisation that disabled people often face' (Runswick-Cole & Goodley, 2013, p. 67). This is partly due to normative judgments about good outcomes, adequate development, and adaptive behaviour or functioning. Even though the discourse on resilience has attended to the differences of assumptions and beliefs in different cultural contexts (Ungar, 2008; Ungar & Liebenberg, 2011), the dominance of ableism that determines and defines normality is rarely reflected on (Runswick-Cole & Goodley, 2013). Ableism is a term that describes discrimination against people on grounds of their disabilities. This shortfall might lead to definitions of resilience that ignore the voices and views of people not conforming to the social norm:

> 'It is possible that the socially defined desirable outcome may be subjectively defined as undesirable, while the socially defined undesirable outcome may be subjectively defined as desirable. From the subjective point of view, the individual may be manifesting resilience, while from the social point of view the individual may be manifesting vulnerability.' (Kaplan, 1999, pp. 31-32).

When the manifestation of resilience among disabled people is studied, the risk of this discrepancy between judgments is high. The presence of an impairment and the 'conflation of resilience with 'health'' (Hutcheon & Wolbring, 2013, p. 247) often deny ability-diverse people even the possibility to be considered resilient. Individuals might be categorised as lacking the strength or capacities to be resilient. In this way, the fact is disguised that necessary and enabling resources which would enhance resilience are not provided by society (Young, Green, & Rogers, 2008). Promoting resilience, however, should be viewed as a social rather than a personal responsibility (Shapiro, 2015). This social responsibility also implies the responsibility of a research community. It has been noted that many studies on resilience exclude disabled participants in more or less subtle ways, by, for example, conducting interventions that are inaccessible to people with physical disabilities, or by evaluating programme effectiveness using resilience scales that require high levels of cognitive functioning and reading skills and utilise inappropriate concepts (Hart et al., 2014). Hart and her colleagues attributed this to a general level of disability blindness and the absence of an inequalities imagination in the academic community.

To ensure ethical and inclusive research and practice, a constructionist approach to resilience seems adequate as it would enable ability-diverse people to engage in the process of defining resilience. This perspective on resilience allows varying concepts of what constitutes a positive outcome or successful adaptation, and thus questions normative judgments that are often belittling. It also 'has the potential to transform services for disabled people by focusing in a more holistic way on the development of resilience in people's lives' (Runswick-Cole & Goodley, 2013, p. 76). This more holistic way involves, for example, applying a strength-based rather than a deficit-based approach. It also implies that we need to focus on aspects of human life and wellbeing other than those solely expressed in terms of abilities, health and normality. An example of this was provided by Brooks and Goldstein (2015), who added the dimension of mindsets to what constitutes resilience. They suggest that resilient children believe that they make a positive difference in the lives of others, that they recognise, enjoy and use their strengths, and that they feel loved and accepted. Their understanding of resilience is of particular relevance to this project because it does not rely on children conforming to societal norms or being able to, for example, talk. This understanding of resilience is based on positive relationships, development, acceptance and wellbeing.

2.2.3 Measuring resilience

After the concept of resilience has been defined and operationalised, it becomes possible to assess resilience or related constructs in research and clinical practice. The necessity to develop and use appropriate measurement tools follows from the potential to further our understanding of resilient processes and, consequently, the effectiveness of resilience-enhancing interventions. Measuring resilience 'is only a first step toward the validation of interventions that focus on the promotion of wellbeing' (Ungar, 2015, p. 14), and thus an important procedure to develop and improve clinical practice and policies that prevent and help in the best possible ways. In addition, measuring resilience is also an important aspect of securing funding for non-medical and strength-based treatment options:

> 'While mental health systems tend to provide financial compensation for the treatment of disorders, changes in children's resilience should also be valued as a worthwhile use of the clinician's time.' (Ungar, 2015, p. 14).

To be able to claim that an intervention can foster changes in children's resilience, it is essential to provide evidence and data obtained from scientifically sound assessment instruments. However, 'up to now, there is no 'gold standard' for the assessment of resilience and no established outcome measure of resilience' (Chmitorz et al., 2018, p. 79). One reason for this lack of a 'gold standard' assessment tool is the above-mentioned difficulty to come to an agreement regarding the definition of resilience. Many coexisting conceptualisations of the term lead to many coexisting measures, some of them even contradicting each other. Researchers have argued that resilience must be assessed in an inferential way by considering risk and protective factors (Luthar & Zelazo, 2003), that resilience should be 'defined and studied based on outcomes in prospective studies' (Kalisch et al., 2017, p. 789), or that 'the assessment of resilience must necessarily become phenomenological' (Ungar, 2015, p. 9). Others have even questioned whether it is feasible to measure resilience at all, or whether it is more appropriate to measure the likelihood of resilience (Naglieri, LeBuffe, & Ross, 2013).

When developing or choosing a resilience assessment for research or clinical practice, several questions need to be answered: 1) What do I want to measure exactly? An outcome, a dynamic process, or predictive risk and resilience factors? 2) Who defines which outcome, process or factor is desirable and considered a sign of resilience? The researcher, the study participant, or the communities (e.g. family, school, neighbourhood, ethnic community, country) in which the participants live and interact? 3) In which domains or on which levels do I want to assess resilient functioning? On an individual, familial or societal level, assessing internal or external factors? 4) How do I want to assess the construct I am measuring? By participant self-report, by parent or professional rating, by measuring biological markers, or by observing behaviour? 5) How many measurement time points do I want to include? Am I interested in a snap-shot for screening or profiling purposes, or in a longitudinal study looking at change and progress pre-and post-intervention? 6) Whose voices should be heard and valued during this process?

The diversity in resilience-assessment tools does not mean that there are no valuable and sound tools available. However, the researcher needs to be mindful about the specific purpose of their study and choose or develop measures accordingly. The following section is divided into two parts. I first review established and widely-used resilience scales, and discuss issues regarding psychometric rigour, target populations, and variety in underlying conceptual definitions. I present a summary of my review in Table 1 before I describe three scales in more detail (2.2.3.1). In the second part of this section, I look into alternative methods of measuring resilience or resilience-related constructs that have been used in addition to or instead of scales (2.2.3.2). Benefits and limitations of the respective measures are discussed and the suitability of their use with children with ASD is examined.

2.2.3.1 Resilience scales

As the interest in researching resilience has increased over the last two decades, different resilience scales have also been developed for various purposes and target groups, based on diverse resilience definitions and constructs. Methodological reviews of existing scales aim to guide researchers in choosing the most appropriate and psychometrically sound assessment tool. An early review (Ahern, Kiehl, Sole, & Byers, 2006) focused on scales suitable to be used with adolescents. Out of six scales, only one, the Resilience Scale (Wagnild & Young, 1993), received the highest rating by the reviewers. A more comprehensive review of the psychometric rigour of resilience scales was undertaken by Windle, Bennett, and Noyes (2011). They included 15 measures that were developed or applied to general and clinical populations of all ages. Each scale was awarded an overall score ranging from 0 (low) to 18 (high), following a validated scoring system. The score 7 was given to three measures, including the Connor-Davidson Resilience Scale (Connor & Davidson, 2003), the Resilience Scale for Adults (Friborg, Hjemdal, Rosenvinge, & Martinussen, 2003), and the Brief Resilience Scale (Smith et al., 2008). Three further scales obtained a psychometric rating of 6, namely the Psychological Resilience (Windle, Markland, & Woods, 2008), the Resilience Scale (Wagnild & Young, 1993), and the ER 89 (Block & Kremen, 1996). All other evaluated questionnaires received even lower scores. The reviewers concluded that none of the assessment tools had a more than moderate psychometric quality, and that, accordingly, no 'gold standard' measure of resilience exists.

Using the review by Windle et al. (2011) as a starting point, I updated it to 2018, and added important resilience scales developed for use with children. Of the six scales identified as having higher psychometric properties than other available measurements, one scale, the ER 89, was excluded from my review because of an incongruent definition of resilience. The ER 89 measures ego-resiliency, a stable personality-trait and a concept independent of risk and adversity, which is, thus, not suitable as an indicator of resilience. The five remaining scales were all developed for use with adult populations. In addition to these measures, an extensive literature search has revealed six scales with adequate psychometric characteristics that were developed specifically for child populations. These assessment tools include the Behavioral and Emotional Rating Scale (Epstein, 2004), the California Healthy Kids Survey – Resilience Assessment Module (Constantine & Benard, 2001), the Child and Youth Resilience Measure (Ungar & Liebenberg, 2011), the Devereux Early Childhood Assessment (LeBuffe & Naglieri, 2012), the Devereux Student Strengths Assessment (LeBuffe, Shapiro, & Naglieri, 2009), and the Resiliency Scales for Children and Adolescents (Prince-Embury, 2007). I have summarised my findings in a table listing the names of the scales in alphabetical order, and presenting the authors, the target population, the mode of completion, the number of items, the purpose of the assessment as stated by the authors, and the resilience-related concepts measured. These concepts allow insight into the underlying understanding of resilience and the choice of measured variables that potentially influence resilience. Variables include internal factors, such as psychological, genetic and physical aspects, and external factors, including the family, school, community and society. The list of these variables is diverse, reflecting the many parallel existing definitions of the construct resilience, and the fact that the 'determination of which combination of variables best predicts resilience and the complex interactions of these variables is still evolving' (Naglieri, LeBuffe, & Ross, 2013, p. 258). Apart from the Brief Resilience Scale, all the presented scales assess the likelihood of resilience as opposed to measuring resilience directly. The following table aims to provide an overview of relevant resilience scales and may help music therapy clinicians and researchers interested in measuring resilience to choose the assessment tool most appropriate for their purposes and their client group.

Table 1: Resilience scales

	Name	Author(s)	Target population	Mode of completion	Number of items	Purpose of the measure	Concepts measured
1	Behavioral and Emotional Rating Scale, Second Edition (BERS-2)	Epstein (2004)	Children and adolescents: 5-19 years	Self-report, parent report, teacher report	52-57	A strength-based measure assessing individual, family and external support factors to inform referrals, intervention planning and outcome studies.	• Interpersonal strength • Family involvement • Intrapersonal strength • School function • Affective strength
2	Brief Resilience Scale (BRS)	Smith, Dalen, Wiggins, Tooley, Christopher, Bernard (2008)	Adults	Self-report	6	An outcome measure to assess individual's ability to recover from stress.	• Ability to bounce back from stress
3	California Healthy Kids Survey (CHKS) - Resilience Assessment Module	Constantine and Benard (2001)	Children and adolescents: 9-18 years	Self-report	36	To assess students' perception of available resilience factors (internal and external) to guide the development and evaluation of health prevention and intervention programmes.	• Family/school/ community connection • Autonomy experience • Pro-social peers • Communication • Self-efficacy • Empathy • Problem solving • Self-awareness • Goals and aspirations
4	Child and Youth Resilience Measure (CYRM)	Ungar and Liebenberg (2011)	Children, adolescents and young adults: 5-23 years	Self-report, report by a person who knows the child well	12-28	A screening tool to measure resilience-enhancing resources (individual, relational, communal and cultural) available to the young person.	• Personal/social skills • Peer support • Physical/psychological caregiving • Spiritual/cultural factors • Educational factors

	Name	Author(s)	Target population	Mode of completion	Number of items	Purpose of the measure	Concepts measured
5	Connor-Davidson Resilience Scale (CD-RISC)	Connor and Davidson (2003)	Adults	Self-report	25	To measure the individual's stress coping ability. Scale has been used with community and clinical samples for screening, intervention planning and monitoring purposes.	• Personal competence • Effects of stress • Acceptance of change • Control • Spiritual influences
6	Devereux Early Childhood Assessment Preschool Programme, Second Edition (DECA-P2)	LeBuffe and Naglieri (2012)	Children: 2-5 years	Parent report, professional report	37	To measure within-child protective factors to determine if child has developed age-appropriate emotional and social skills, to monitor progress, and to evaluate intervention programmes.	• Initiative • Self-regulation/self-control • Attachment/ relationships • Behavioural concerns
7	Devereux Student Strengths Assessment (DESSA)	LeBuffe, Shapiro, Naglieri (2009)	Children: 5-14 years	Parent report, teacher or other professional report	72	A strength-based measure to identify social-emotional competences of children and protective factors within a resilience framework to screen groups of children, plan for intervention and measure change.	• Self-awareness • Social-awareness • Self-management • Goal-directed behaviour • Relationship skills • Personal responsibility • Decision making • Optimistic thinking

	Name	Author(s)	Target population	Mode of completion	Number of items	Purpose of the measure	Concepts measured
8	Psychological Resilience	Windle, Markland, Woods (2008)	Older adults	Self-report	19	To assess individual level protective factors and measure change.	• Self-esteem • Personal competence • Interpersonal control
9	Resilience Scale (RS)	Wagnild and Young (1993)	Adolescents and adults	Self-report	25	To measure personal attributes associated with resilience. The scale has been used successfully in several research studies.	• Equanimity • Perseverance • Self-reliance • Meaningfulness • Existential aloneness
10	Resilience Scale for Adults (RSA)	Friborg, Hjemdal, Rosenvinge, Martinussen (2003)	Adults	Self-report	37	To assess intra- and inter-personal protective factors that are important to prevent or cope with psychological disorders and maintain or regain mental health.	• Personal competence • Structured style • Social competence • Family coherence • Social support
	Resilience Scale for Adolescents (READ)	Hjemdal, Friborg, Stiles, Marti-nussen, Rosen-vinge (2006)	Adolescents				
11	Resiliency Scales for Children and Adolescents (RSCA)	Prince-Embury (2007)	Children and adolescents: 9-18 years	Self-report	64	A screening tool to measure personal attributes related to resilience that can also be used to plan interventions or monitor progress. The scale evaluates students' strengths and vulnerabilities with a focus on behavioural concerns.	• Sense of mastery (optimism, self-efficacy, adaptability) • Sense of relatedness (trust, social support, comfort, tolerance) • Emotional reactivity (sensitivity, recovery, impairment)

Out of all the scales presented in the table, none encompasses the full age range of children participating in my doctoral research study (four to seven years). The target population of three scales seems reasonably appropriate for use with this study cohort. These measures are the Behavioural and Emotional Rating Scale (BERS-2; Epstein, 2004), the Child and Youth Resilience Measure (CYRM; Ungar & Liebenberg, 2011), and the Devereux Student Strengths Assessment (DESSA; LeBuffe et al., 2009). In the following, I present these resilience scales in more detail and discuss potential limitations for use with my study's client population.

The BERS-2 is a strength-based assessment. Even though the author does not directly refer to resilience, the underlying theoretical framework is closely related to resilience. The assessment is based on the belief that the emotional and behavioural strengths measured 'enhance one's ability to deal with adversity and stress' (Epstein & Sharma, 1998, p. 3), as well as foster a sense of personal accomplishment, satisfying relationships and healthy development. The BERS-2 generates an overall strength index, and strength indices for six subscales. These include scales for interpersonal strength, family involvement, intrapersonal strength, school functioning, affective strength, and career strength. The BERS-2 was developed for use with children and adolescents aged 5 to 19 years. A parent-rating scale, a teacher-rating scale and a youth self-report scale with 52-57 items each are available. Ratings are given on a four-point Likert-type scale (0 = not at all like the child, 1 = not much like the child, 2 = like the child, 3 = very much like the child). In addition, eight open-ended questions (e.g. 'The student's favourite hobbies or activities are…', 'The best thing about this student is…') provide further insight and can inform intervention planning and follow-up assessments. The BERS-2 has acceptable psychometric characteristics (Epstein, 2004). Items such as 'Reads at or above grade level', 'Uses appropriate language', or 'Discusses problems with others' suggest that, in order for the scale to be applied successfully, children need to have a certain level of verbal ability and cognitive functioning. This indicates that the measure might not be suitable for use with children with developmental disabilities or learning disabilities. No study has been conducted to validate BERS-2 with children with ASD.

The CYRM originates from an international resilience research project that was conducted in eleven countries (Ungar & Liebenberg, 2011). The aim was to develop a culturally sensitive and relevant resilience measure. Resilience is understood as a social-ecological construct. The initial CYRM was designed to be used with young people aged nine to 23 years. Since its validation, the scale has been modified into versions applicable in studies with younger children, aged five to nine years, and with adults. The data obtained from the child or the youth version of the scale can be complemented by information from a person who knows the child very well. This can be a parent, an older sibling, a teacher or another person who plays a significant role in the child's life. All versions of the scale are available in the full format with 26 to 28 items, and as a reduced assessment tool with 12 items. The questions intend to measure resilience-enhancing resources across four domains (individual, relational, community, and culture). Answers are recorded on a three-point Likert-type scale (No, Sometimes, Yes). The questions of the child version can be read to the child, who then provides answers by pointing on smileys or pictures that represent the three options. To ensure that the tool is contextually relevant, it contains a section with site-specific questions that should ideally be developed by a committee from the local community in conjunction with the research team. Adequate psychometric properties of the measure have been demonstrated (e.g. Liebenberg, Ungar, & Van de Vijver, 2012; Daigneault, Dion, Hébert, Mcduff, & Collin-Vézina, 2013; Sanders, Munford, Thimasarn-Anwar, & Liebenberg, 2017).

Even though the CYRM has been used with clinical populations (e.g. Liebenberg et al., 2012; Rainone et al., 2017), no applications with children with ASD or with other developmental disorders, with non-verbal children, or with children with learning disabilities have been reported, and the appropriateness for use with these groups remains questionable. Even though the children do not need to be able to read themselves, the required level of understanding verbal language is high. Items such as ‘Do you feel that your parent(s)/caregiver(s) know where you are and what you are doing all of the time?’ or ‘Do you talk to your family about how you feel (for example when you are hurt or feeling scared)?’ illustrate that the measure is not suitable for a sample of children with ASD with limited or no verbal language and with learning disabilities. The version for the person who knows the child very well could be an alternative option. However, according to the authors, it is not designed as a sole but only as an additional measure (Resilience Research Centre, 2016). A real strength of the CYRM is the option to add context-specific questions. In a study with verbal children with ASD, relevant aspects specific to children with ASD, their families and school environment could be included.

The DESSA is one of several scales developed by the Devereux Center for Resilient Children. Resilience is conceptualised within a risk-and-protective-factor framework (Naglieri, LeBuffe, & Shapiro, 2013). The DESSA, an entirely strength-based assessment, measures social-emotional skills and competencies that are understood to serve as protective factors. It is an appropriate assessment scale for children aged five to 14 years, which can be completed by parents, teachers or other professionals who know the child well. No self-report rating scale is available. An overall social-emotional composite score is derived from eight subscales, including self-awareness, social-awareness, self-management, goal-directed behaviour, relationship skills, personal responsibility, decision making, and optimistic thinking. All 72 items are presented in the following format: ‘During the past 4 weeks, how often did the child (item)?’. Answers are recorded on a five-point scale (never, rarely, occasionally, frequently, very frequently). The DESSA has been reported to have high psychometric qualities (LeBuffe et al., 2009). According to the authors, the DESSA is a suitable measurement for children in mainstream as well as in special education services (Naglieri, LeBuffe, & Shapiro, 2013). However, the possibility to apply the scale with children with learning disabilities has not been elaborated on or tested in studies. Only one form is provided for all ages so that no differentiation regarding developmental level or cognitive functioning is possible. As with the other two measures, some items imply that the child with whom the DESSA is administered is verbal. These items include, for example, 'During the past 4 weeks, how often did the child say good things about herself/himself?' and 'During the past 4 weeks, how often did the child speak about positive things?'. No use of the DESSA with children with ASD has been reported.

Recently, Pasiali, Schoolmeesters, and Engen (2018) conducted another review of resilience scales. They describe seven measures that overlap with the eleven scales I have identified, but neither the BERS-2 nor the DESSA is mentioned. Their review adds important recommendations regarding the use of scales in music therapy. The authors present the appropriate age of respective target groups and discuss whether the scale can provide relevant information for screening purposes, for profiling interventions, or for measuring change pre- and post-treatment. They also caution therapists not to use the scales without carefully reflecting on underlying definitions and conceptualisations. However, the authors do not discuss possible uses or limitations of uses with clinical populations frequently encountered in music therapy practice, such as non-verbal clients or people with disabilities.

To ensure validity, clinicians and researchers should use resilience measurement scales only 'within the boundaries specified by the authors' (Naglieri, LeBuffe, & Ross, 2013, p. 258), and therefore, non-matching target populations might be a serious limitation of their applicability. Of the three assessments I have discussed in more detail, namely BERS-2, CYRM, and DESSA, no scale seems to be appropriate for use with non-verbal children or even with children with a limited passive or active verbal ability. Even though authors suggest that the use with children in special education, children with learning disabilities or developmental delay might be possible, no successful use with these groups has been documented and feasibility seems questionable. While researchers highlight the importance of including strength-based and resilience assessments when working with children with ASD, they also point out that 'the instruments and procedures for obtaining this assessment information will not be the same' as for typically developing children (Cosden, Koegel, Koegel, Greenwall, & Klein, 2006, p. 137). Because of the characteristics of the disorder, many children with ASD have different areas of strengths, and 'it is not likely that strengths in children with autism will be adequately captured by the same items' (Cosden et al., 2006, p. 137). They thus need assessments more specific to their needs and assets.

2.2.3.2 Alternatives to resilience scales

Resilience scales are only one possible tool to measure resilience factors or resilient outcomes. They provide a limited examination of a person, and to constitute a meaningful assessment the obtained information ‘needs to be integrated into a larger picture’ (Naglieri, LeBuffe, & Ross, 2013, p. 258). Because of the multidimensionality and complexity of the resilience construct, it makes ‘little sense to take assessment instruments ‘off the shelf’ and use them without careful contextualisation’ (Wessells, 2015, p. 19). In the following paragraphs, I discuss measures that have been used as additions or alternatives to resilience scales.

Regardless of the chosen method, several authors have highlighted that determining the exposure to adversity and its impact on physical and mental health is important for an assessment of resilience (e.g. Bonanno et al., 2015; Chmitorz et al., 2018; Ungar, 2015). Information about adverse circumstances can be collected through structured interviews or through using specific scales. The Social Readjustment Rating Scale (Holmes & Rahe, 1967), the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983), the Daily Hassles Scale (Holm & Holroyd, 1992), and the Stress and Adversity Inventory (Slavich & Epel, 2010) are examples of widely used and well-established stress assessments. When assessing adversity, one has to be mindful of the different impact of, for example, chronic and acute stressors or major life events and minor annoyances. Not only the intensity and duration of experienced adversity but also the cultural context will have an influence on the effect of certain stressors on the individual. In response to this complexity, Ungar (2015) proposed to assess five domains of adversity, namely severity, chronicity, ecological complexity, attributions of causality, and the cultural and contextual relevance of the factors.

In addition to the traditional assessment of resilience through self-report or parent and professional rating measures, there is growing interest in researching the phenomenon from a multilevel perspective, including investigations into biological markers and genetic or neurobiological correlates (e.g. Carnevali, Koenig, Sgoifo, & Ottaviani, 2018; Cicchetti, 2010; Osório, Probert, Jones, Young, & Robbins, 2017). Understanding underlying mechanisms of resilient functioning and using this knowledge for measuring the construct adds value to the evolving multidisciplinary research discipline. There is evidence, for example, that stress hormones and immune mediators are functional biomarkers of stress-response and thus potential pathways for translational resilience research (Daskalakis et al., 2016). Similarly, microRNAs, molecules that regulate gene expression and several developmental processes, have been identified as important biomarkers of resilience (Chen et al., 2015). Further studies indicate that individual differences in heart-rate variability may predict different levels of resilience (Carnevali et al., 2018). Structural and functional neuroimaging research becomes increasingly relevant as assessment instruments become more advanced and indicate that neuroflexibility might be associated with resilient functioning (McEwen, 2016; Sinha, Lacadie, Constable, & Seo, 2016). The problem with these research methods is that they require expensive technology, are mostly constrained to laboratories, and are not all applicable in daily clinical practice. However, portable measurement tools are becoming more available, and an increasing number of research studies include saliva or hair samples that can be easily collected and provide information about cortisol levels (e.g. Ouellet-Morin et al., 2016).

Another evolving approach in resilience research focuses on measuring meanings of resilience that are relevant to the participants. This might be achieved through using ecological momentary assessments, a method applied in several resilience-related studies (e.g. Kashdan, Ferssizidis, Collins, & Muraven, 2010; Mehl, 2017; Trull & Ebner-Priemer, 2014). Participants report their feelings, thoughts or behaviour on a mobile device as they occur in daily life and in natural settings. It is a way of unobtrusively collecting authentic data repeatedly and in real time. A similar pathway is explored in research using diaries (e.g. Kleim, Wysokowsky, Schmid, Seifritz, & Rasch, 2016). Both methods, however, require participants to have enough language skills to be able to write or to respond to prompts on a mobile device. The methods might also not be feasible in certain potentially important situations (for example during a musical improvisation), and they might involuntarily elicit unwanted memories or behaviours (Field, 2015).

A multimodal approach to assessing resilience has been chosen by Liebenberg, Ungar, and Theron (2014) who aimed to understand obscured processes in the lives of resilient youth. They combined observational video recordings and reflective participant photo production with interviews. The researchers filmed the young person in their natural environment and edited the recording before watching it together with the adolescent. Similarly, the photos taken by the participants were looked at together and could be commented on. The focus of the interviews during which the film and photographs were reviewed was on how participants gave meaning to the material. In the process, participants' voices and context-related expressions were considered and valued. Using video recordings to analyse behaviour is also a widely used method in resilience research using animal models. Rodents or primates are exposed to a stressful or enriched environment and their behavioural responses are assessed to understand more about resilient processes (e.g. Lyons, Buckmaster, & Schatzberg, 2018; Parker, Buckmaster, Schatzberg, & Lyons, 2004). Video recordings are a valuable tool to code and measure behaviours and expressions as they occur in relevant, real-life situations. The method is unobtrusive and can be applied in clinical settings and with most participants, including non-verbal children with ASD and associated disabilities. Furthermore, video recordings offer the opportunity to share the research material with participants or their carers to discuss different experiences of reality and meaning in a reflective dialogue (Pink, 2013).

2.2.4 Resilience and children with ASD

Despite the variability in definitions and measures, research findings on factors and adaptive systems fundamental for resilient functioning and development are surprisingly consistent (Masten & Obradović, 2006). This list of adaptive systems includes learning systems of the human brain (e.g. information processing, problem solving), attachment systems, mastery-motivation system (e.g. self-efficacy processes), stress-response systems, self-regulation systems, the family system, the school system, the peer system, and cultural and societal systems. Masten and Obradović (2006) point out that the 'most devastating threats to children and child development occur when these systems are damaged, destroyed, or develop abnormally as a result of adversity' (p. 21). The normal development of all these systems is threatened by ASD, and the life-long neurodevelopmental disorder must thus be considered a significant and severe risk factor for the wellbeing and mental health of affected children. A high proportion of children with ASD face challenges in several domains on a daily basis. The various risk factors and potentially poor outcomes for children with ASD have been studied extensively. Protective factors and their potential to moderate and mitigate risk factors for this client population, on the other hand, have been almost neglected by the research community to date. This has now been recognised as a missed opportunity by an increasing number of scholars and practitioners, who are stating that much could be learned from 'putting a resiliency lens on research and clinical practice' with children with ASD (Szatmari, 2018, p. 225). This shift would not only further our understanding of the condition but also promote interventions with a lasting positive effect on children and their families. 'Symptom relief has simply not been found to be synonymous with changing long-term outcomes for the better for children with ASD' (Brooks & Goldstein, 2012, p. xi). Instead, interventions with a 'focus on strengthening protective factors may improve long-term outcome' (Szatmari, 2018, p. 225). This seems especially evident when remembering that we have little or no control over several risk factors, such as symptom severity or intellectual disability, but that we have many possibilities to strengthen protective factors of children with ASD, their families, and communities (Bekhet, Johnson, & Zauszniewski, 2012).

Up to now, however, available literature on resilience and children with ASD remains scarce and is mainly descriptive. Several studies have investigated the occurrence and characteristics of family resilience or the resilience of an adult caregiver in families with a child with ASD (e.g. Bayat, 2007; Greeff & Van der Walt, 2010; Plumb, 2011; Siman-Tov & Kaniel, 2011). Bekhet and colleagues (2012) provide a thorough review of the literature concerned with resilience in family members of persons with ASD. They summarise important findings and list self-efficacy, acceptance, sense of coherence, optimism, positive family-functioning, and enrichment as the identified indicators or predictors of resilience in family members of children with ASD. A very recent study examined child, caregiver and family factors in relation to caregiver stress, and concluded that adequate family resources, higher levels of perceived social support, and parenting efficacy are among potential protective factors (Lindsey & Barry, 2018). Another study focused on sleep problems as a specific risk factor impacting resilience in families with a child with ASD (Roberts, Hunter, & Cheng, 2017). There are far fewer intervention studies (e.g. Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Okuno et al., 2011). These, however, indicate that interventions targeting resilience of caregivers are beneficial for the wellbeing of both the parents and the children with ASD, and thus an area in need of further research and clinical application.

The book *Raising resilient children with autism spectrum disorders* (Brooks & Goldstein, 2012) is one the very few publications concerned with the resilience of the child with ASD as opposed to the resilience of their caregivers. The book is directed towards parents of children with ASD and aims to provide strategies for helping the children maximise their strengths, cope with adversity, and develop a social and resilient mindset. These strategies are structured into eight guideposts, namely:

‘1. Teaching and conveying empathy
2. Using empathic communication and listening actively
3. Accepting our children for who they are – conveying unconditional love and setting realistic expectations
4. Nurturing ‘islands of competence’
5. Helping children learn from rather than feel defeated by mistakes
6. Teaching children to solve problems and make sound decisions
7. Disciplining in ways that promote self-discipline and self-worth
8. Developing responsibility, compassion, and a social conscience’
(Brooks & Goldstein, 2012, p. 16).

The authors explain why these principles are sometimes difficult to apply to children with ASD, even though they might seem obvious and natural at first. A deficit-based approach is discarded, and the importance of promoting strengths, abilities and assets is highlighted throughout the book. Furthermore, the authors emphasise the relevance of a partnership between parents and professionals as children with ASD do best when adults ‘collaborate to create environments at home and school that nurture a social resilient mindset’ (p. 234). In a recent review by Kaboski, McDonnell, and Valentino (2017), the authors posit that applying the resilience framework to children with ASD is crucial to furthering our understanding of mechanisms behind multifinality (i.e. heterogeneous outcomes despite homogeneous starting points) and effective interventions. Consequently, they propose that ‘further exploration of likely mediating and moderating factors associated with resilient processes’ in children with ASD is the ‘most urgent next step’ (p. 186).

2.2.5 Interventions to enhance resilience

As the main 'rationale for the systematic study of naturally occurring resilience was to inform practice, prevention, and policy efforts directed towards *creating resilience*' (Wright et al., 2013, p. 27), it is not surprising that the number of published studies investigating the effects of interventions on resilience has been rising over the last decades. Generally, the therapeutic processes involved in resilience promoting interventions are informed by the 'two broad principles of risk reduction and protective enhancement' (Seymour, 2015, p. 32). In this section, resilience-building intervention studies are presented. First, recent systematic reviews evaluating the effects on adults are delineated before systematic reviews analysing the effects on children and adolescents are looked at. This is followed by an account of published resilience enhancing intervention studies in the creative arts therapies. Finally, I discuss studies that specifically examined the impact of music therapy on resilience.

2.2.5.1 Systematic reviews of resilience interventions for adults

Whereas some reviews focused on a very specific setting or target group, for example the effectiveness of resilience-training programmes at the workplace (Robertson, Cooper, Sarkar, & Curran, 2015; Vanhove, Herian, Perez, Harms, & Lester, 2015), three systematic reviews examined the reported effects of interventions on resilience in adults more generally (Joyce et al., 2018; Leppin et al., 2014; Macedo et al., 2014). Macedo and colleagues (2014) identified 13 studies aiming to strengthen resilience and the participants' ability to better cope with future stressors and adversities. The non-clinical adult samples included employees, managers, students, soldiers and physicians. Interventions were based on cognitive behavioural therapy (CBT), positive psychology techniques, mindfulness, interpersonal therapy, relaxation and breathing techniques. The review and meta-analysis by Leppin et al. (2014) aimed to determine the efficacy of resilience-promoting interventions targeting both non-clinical adults as well as adult patients with chronic conditions. The authors analysed 25 RCTs. The conceptualisation of resilience, applied intervention approaches, as well as the chosen method of evaluation varied immensely across trials. Both systematic reviews noted that the overall methodological quality of studies was low, risk of bias high, sample size too small, and reporting poor. Nevertheless, both reviews found some evidence that the examined programmes promote resilience and improve a number of mental-health outcomes, such as quality of life or depressive symptoms.

The most recent systematic review and meta-analysis on the efficacy of resilience interventions (Joyce et al., 2018) only included RCTs that used one of the three measurement scales identified by Windle et al. (2011) as the most valid and reliable scales (see 2.2.3.1 for a presentation of resilience scales, including a discussion of the paper by Windle and colleagues). A meta-analysis of eleven trials found a moderate positive effect of interventions on psychological resilience. All assessed programmes were CBT-based, mindfulness-based, or a mixture of both. Another systematic review of intervention studies for adults (Chmitorz et al., 2018), put a focus on methodological aspects of trials. The authors evaluated the design of 43 RCTs, outlining the resilience definition used, outcomes, and measurement instruments. One striking finding was that only 18 of the studies provided an explicit resilience definition. Applied measures varied, and included resilience scales and instruments assessing stress perception, mental health or specific resilience factors. Most of the interventions aimed to promote stress-management skills, coping strategies, or cognitive flexibility. As the concepts, methods and designs of the trials were rated to be only 'of limited use to properly assess the efficacy of interventions to foster resilience' (p. 86), Chmitorz and colleagues conclude their review with a proposal for a resilience framework and methodological standards for future intervention trials.

2.2.5.2 Systematic reviews of resilience interventions for children

The number of resilience intervention studies focusing on children and adolescents has also increased dramatically. Following this development, several systematic reviews have been published in recent years (Dray et al., 2017; Fenwick-Smith, Dahlberg, & Thompson, 2018; Hart et al., 2014; Purewal Boparai et al., 2018; VicHealth, 2015). Most of the reviews analysed a subset of resilience intervention papers, for example, only those evaluating universal, school-based programmes (Dray et al., 2017; Fenwick-Smith et al., 2018), only those reporting effects on biomarkers and physical-health outcomes (Purewal Boparai et al., 2018), or only papers describing interventions for children with disabilities (Hart et al., 2014). One literature review (VicHealth, 2015) looked at interventions to build resilience among young people in general. The authors of this review identified 32 studies describing a diverse range of programmes for children and young people aged 0 to 25 years. Findings from studies demonstrate that interventions had beneficial effects in promoting resilience and preventing mental-health problems, but the reviewers also detected a general low quality of studies. CBT-based interventions with or without other components, such as arts therapy, and skills-based psychoeducational interventions for children and their parents have been shown to enhance resilience. On the other hand, according to the authors, 'the impact of mindfulness, arts therapy and participation in performing arts, as stand-alone interventions to foster resilience requires further research' (p. 5).

Two systematic reviews analysed the effects of universal, school-based interventions targeting child resilience and mental health (Dray et al., 2017; Fenwick-Smith et al., 2018). Whereas one review looked at studies for children and adolescents aged five to 18 years (Dray et al., 2017), the other review focused on primary-school children younger than 12 years (Fenwick-Smith et al., 2018). Universal, school-based interventions address all children in a classroom or whole school setting as opposed to only children with specific needs or children facing high levels of stress and adversity. Universal resilience-enhancing programmes can thus be understood as prevention programmes aiming to equip children with skills that prepare them for future adversities. Dray and colleagues (2017) identified 57 RCTs with more than 40.000 participants in 16 different countries. Included intervention studies addressed three or more internal protective factors, such as cognitive competence, problem solving, communication, and coping skills, and reported at least one of the following mental-health outcome measures: anxiety symptoms, depressive symptoms, hyperactivity, conduct problems, internalizing problems, externalizing problems, and general psychological distress. Meta-analyses yielded promising results. Four out of these seven outcomes, namely depressive symptoms, internalizing problems, externalizing problems, and general psychological distress could be reduced by resilience-enhancing interventions. In addition, a subgroup analysis of interventions for younger children (five to ten years) showed significant effects for anxiety symptoms. More than half of the intervention programmes were based on CBT. Other applied approaches included, for example, positive psychology, social and emotional learning, or mindfulness. While emphasising that results are encouraging, the authors of the review also point out that the variability of interventions and outcomes, the only low-to-moderate quality of evidence, and the high risk of bias in included studies necessitate further research before specific conclusions about the effectiveness of universal resilience-enhancing interventions can be drawn.

In the review by Fenwick-Smith et al. (2018), only eleven studies reporting on seven different programmes met eligibility criteria. These programmes aimed to improve 'one or more protective factors, hypothesizing increased resilience as a result' (p. 4), and measured change in various outcomes, including resilience and coping, academic and learning motivation, emotion and behaviour self-regulation, relationships, psychological symptoms, and empathy. Interestingly, even though all the studies used some standardized and validated tools, none of them used one of the widely established scales that claim to specifically assess resilience. Overall, results reported by the studies were encouraging and point to the potential benefit of school-based programmes as a preventive strategy boosting coping skills and resilience of typically developing children. However, effects, if assessed in long-term follow ups, did not seem to be sustained. The reviewers criticised the fact that few of the studies included the students' own view or observational data in their programme evaluation, and thereby missed an important opportunity to assess lived experiences and used skills. The authors emphasised that collecting both quantitative and qualitative data allows more insight and that a mixed methods approach should be aimed for in future research on resilience-enhancing programmes and interventions for children.

One literature review specifically evaluated the effects of resilience-promoting interventions on biological markers and physical-health outcomes (Purewal Boparai et al., 2018). Only interventions addressing young people with adversities were included in the review. These adversities included poverty, child maltreatment, living in institutions or foster families, parental mental-health problems, and bereavement. Disability, such as ASD, however, was not mentioned as an adversity by any of the evaluated studies. The authors of the review identified 40 RCTs that applied 15 different programmes, of which most engaged both children and their caregivers. Programmes focused on parenting skills, attachment building, or improving problem-solving skills, self-efficacy and self-esteem of children. Cortisol levels, brain development, epigenetic regulation, and immune outcomes were assessed, and overall, intervention programmes were successful in improving or normalising these physical-health outcomes after they had been impacted by adversity. The reviewers highlight that early timing of intervention and parental involvement had a positive influence on intervention success.

Of the reviews on resilience interventions for children and adolescents, one specifically looked at interventions addressing young people with disabilities (Hart et al., 2014). However, due to the limited number of relevant studies and the poor reporting of study details, the authors refrained from assessing effectiveness and resorted to a more descriptive approach. To have a broader study base, they expanded their eligibility criteria and included studies that did not evaluate the intervention, that did not explicitly link their intervention to resilience theory, or that did not investigate clinical interventions as opposed to leisure activities. Despite this, the reviewers identified only 23 studies conducted in nine countries with a total of approximately 800 participants, aged 0 to 25 years. They state, 'that children and young people with complex needs are unjustly under-represented in study samples' and 'that resilience-focused interventions seem to exclude the very people who might need them the most' (p. 410). This becomes apparent when one of the only two studies with children with ASD (Alvord & Grados, 2005; Evans & Plumridge, 2007) excludes children with 'below average intellectual capability or severe aggression' (Alvord & Grados, 2005, p. 242). The widening of inclusion criteria resulted in immense heterogeneity of reviewed studies in terms of programme content, length and delivery mode, as well as in terms of participants and setting. However, a common feature that distinguishes these studies from interventions for typically developing children is the often-provided psychoeducation, including contextually relevant information and advice regarding the disability and how to cope with it. Most papers also described interventions that target family members or school staff in addition to the young person, and interventions that apply highly individualised rather than universal approaches. Overall, the reviewers criticise inconsistent measurement, insufficient definitions of theoretical concepts and interventions, and design flaws. Nevertheless, they conclude that the 'review has provided some evidence for the notion that resilience-based programmes hold promise' (Hart et al., 2014, p. 414).

Of the 255 studies included in the nine above-mentioned systematic reviews and meta-analyses of resilience-enhancing interventions for children or adults, only two trials included participants with ASD (Alvord & Grados, 2005; Evans & Plumridge, 2007). Reviewers did not identify a single intervention that specifically targeted children, adolescents or adults with ASD or any other neurodevelopmental disability. In total, only four programmes incorporated art or music activities, or included elements of art therapy (Coholic, Eys, & Lougheed, 2012; Macpherson, Hart, & Heaver, 2016; Roghanchi, Mohamad, Mey, Momeni, & Golmohamadian, 2013; Theron, 2006). No intervention in any of the reviews applied music therapy techniques and approaches or was conducted by trained music therapists.

2.2.5.3 Creative arts therapy interventions to enhance resilience

The presented systematic reviews only included a very limited number of studies evaluating interventions which apply components of arts therapies or approaches other than the more common CBT-based and mindfulness-based interventions. However, a thorough literature search identified additional studies and publications in the disciplines of play therapy, art therapy, dance/movement therapy, and music therapy.

2.2.5.3.1 Play therapy, art therapy and dance therapy to enhance resilience

The book *Play therapy interventions to enhance resilience* (Crenshaw, Brooks, & Goldstein, 2015) is dedicated to informing readers about play therapy approaches, and merges case studies, narrative accounts and theoretical considerations from some of the most experienced clinicians and researchers in the field. The current practice of individual play therapy, family play therapy, and group play therapy has been informed and influenced by the growing body of resilience research (e.g. May, 2006; Seymour, 2010; Watson, Rich, Sanchez, O'Brien, & Alvord, 2014). Through providing opportunities to practice alternative forms of expression, communicating, relating, and problem solving, play therapy sessions can strengthen a child's internal protective factors (Russ, 2004). The sessions constitute a safe and creative space in which 'the play becomes transformative in providing a new perspective on the self and/or the environment, which is at the heart of resilience as a therapeutic power of play' (Seymour, 2015, p. 35).

Malchiodi (2015) has pointed to the many overlaps of play therapy and art therapy as 'each is a creative, action-oriented form of therapy that demands participation and sensory self-expression' (p. 127). As in the first-mentioned discipline, books on art therapy approaches and resilience have been published in recent years (e.g. Aumann & Hart, 2009; Stepney, 2017). An article by Macpherson et al. (2016) reviews the existing literature on arts and resilience, and presents a case study of resilience-enhancing arts workshops for adolescents with complex mental-health needs and/or learning difficulties. The authors argue that both the literature review and the obtained qualitative data provide evidence that 'even short-term visual arts interventions can impact on young people's resilience' (p. 541). To further resilience-promoting practice among art therapists, the project team has also published an arts-for-resilience guide with instructions and activity examples.

Dance/movement therapy (DMT) is another creative arts therapy that aims to promote resilience. The first conference of the European Association of Dance and Movement Therapy, which took place in 2014, was themed *Resilience within a changing world*, acknowledging the importance of resilience research and its relevance for DMT practice (Zhou, 2015). An example of the emerging literature is the master's thesis by Taylor (2015) that describes the use of DMT and liturgical dance to support resilience of children with complex trauma. Shim and colleagues (2017) have conducted a mixed methods research study with the aim to develop a composite model of DMT for promoting resilience in people with chronic pain. They collected quantitative and qualitative data from 22 participants who participated in a ten-week group intervention. Outcomes were promising with statistically significant improvements in resilience, kinesiophobia, body awareness, and a lessening of pain intensity over time. Activating self-agency, connecting to self, connecting to others, enhancing emotional intelligence, and reframing were identified as key mechanisms. DMT can access and work through dynamic mind-body pathways and may thus be an effective resilience-enhancing treatment for chronic-pain management. The implications of resilience for the professional identity and practice of dance/movement therapists, and the relevance of the resilience construct for DMT has also been discussed by Wengrower (2015). She emphasises that widening the lens and putting the focus on resilience is important as it provides opportunities to understand DMT not only as an intervention but also as a prevention.

2.2.5.3.2 Music therapy to enhance resilience

The development of music therapy as a distinct profession was influenced by a variety of theories and ideas in music, psychotherapy, philosophy, health and education which naturally led to a vast plurality of understandings and approaches of music therapy. However, despite this diversity and complexity, the discipline seems to be unified by the aims of clinical practice outlined in different definitions. Through the professional use of music and within a therapeutic relationship, music therapy has 'the specific purpose of helping clients to promote health' (Bruscia, 2014, p. 269), and of engaging clients who 'seek to optimize their quality of life and improve their physical, social, communicative, emotional, intellectual, and spiritual health and wellbeing' (World Federation of Music Therapy, 2014). According to these definitions, and in line with my understanding, music therapy aims to support the whole person, and to improve functioning in various domains while being sensitive to different environments and cultural or social contexts. Music therapy is directed 'towards the patient as a whole' (Wigram, Pedersen, & Bonde, 2002, p. 82) rather than towards separate characteristics or symptoms, and it is thus a holistic intervention. Furthermore, music therapists often apply a strength-based and resource-oriented approach when they work in ways that 'clients' abilities are strengthened and transferred to other areas of their lives' (American Music Therapy Association, 2019). In this sense, music therapy fits well within a resilience framework, and it seems to be well-suited as a successful resilience-enhancing intervention. However, even an extensive search revealed only a very limited number of publications on music therapy and resilience.

Two studies report on the use of music therapy to increase resilience in cancer patients. Robb and colleagues (2014) conducted an RCT investigating the efficacy of a therapeutic music-video intervention on resilience in adolescents undergoing hematopoietic stem cell transplant. The 113 participants were randomised to the intervention delivered by a certified music therapist, or a low-dose control group listening to audiobooks. Young people in the therapeutic music-video group showed significant improvements in the protective factors courageous coping, social integration, and family environment, and the research team concluded that the music therapy intervention reduced the risk of adjustment problems and supported positive health outcomes during cancer treatment. Another recent study (Letwin & Silverman, 2017) analysed effects of resilience-focused music therapy on adult patients in an oncology unit. The intervention was applied on two days only. Quantitative results on mean scores of pain perception showed no significant differences between the music therapy group and the waitlist control group. However, thematic analysis of semi-structured interviews indicated that music therapy provides a positive distraction, and improves inner strength, mood and hope, and can thus help patients to cope with their situation and develop resilience.

Interviews were also employed in an exploratory study examining the role of music therapy with informal hospice caregivers during pre-bereavement (Potvin, Bradt, & Ghetti, 2018). Feedback from the informal caregivers led to the development of a theoretical model of resource-oriented music therapy fostering resilience as well as feelings of purposefulness and value. Furthermore, music therapy and resilience has been discussed with regard to posttraumatic stress disorder (PTSD) in adults (Landis-Shack, Heinz, & Bonn-Miller, 2017) and children (Felsenstein, 2013). A case study of short-term music therapy with pre-schoolers who experienced a forced evacuation from home due to armed conflicts suggests that music therapy promotes post-trauma resilience in young children (Felsenstein, 2013). The theoretical review by Landis-Shack and colleagues (2017) investigates whether music therapy relieves symptoms of PTSD in adults. They conclude that the intervention may engage hard-to-reach individuals, improve functioning, and foster resilience, but they also point to the lack of rigorous empirical research.

Promising results have been reported about community music-making interventions. A study by Fancourt et al. (2016) examined effects of a ten-week intervention of group drumming on depression, anxiety and social resilience of adult mental-health service users. Whereas no significant improvements were found in the waitlist control group, the drumming group showed significant decreases in depression and anxiety scores, and significant increases in social resilience and mental wellbeing post-treatment and at a three-month follow-up. Psychological benefits of the music intervention were complemented by improvements in inflammatory immune response, i.e. a more balanced immune system associated with decreased depressive symptoms. This research thus provides an example of a music therapy study that successfully includes a biomarker assessment supporting their results and demonstrating that the intervention enhances resilience.

Varvara Pasiali is one of the few music therapists who have written more extensively about resilience (Pasiali, 2010, 2012, 2017). In her doctoral thesis (2010), she investigates the effects of family-based music therapy on child resilience and on parental self-efficacy and competence. Participants were members of four families which shared the risk factor of self-reported history of maternal depression. Their children, all aged three to five years, had no diagnosis of illness or disability. Each family received eight weekly sessions that employed mainly improvisational music therapy techniques within an interactive framework. Pasiali incorporated musical instruments as well as non-musical toys and props to engage the family members. Her child-led but structured approach was inspired by the family-based music therapy described by, among others, Oldfield (2006), Drake (2008), and Loth (2008). Using the methodological approach of a collective case study, Pasiali analysed recorded music therapy sessions, parent interviews and parent journals, and concluded that music therapy could help families to share positive experiences, to rehearse mutual interactions, and to find ways of relating with each other. The author reflects on these results, understanding them as indicators for the potential of music therapy to influence child resilience, while also acknowledging that the short duration of the intervention will limit its influence, and that resilience depends on many more variables.

In her seminal theoretical paper on resilience, music therapy, and human adaptation, Pasiali (2012) explores how music therapy can promote resilience in young children and their families. She discusses behavioural, psychosocial, and neurobiological processes of resilience from a family-systems perspective and argues that music therapists need to understand these processes to be able to develop successful applications of music therapy as an asset-building, mediating, or risk-activated intervention, i.e. a resilience-enhancing intervention, for young children and their families. Pasiali criticises the fact that there is not enough literature and rigorous research on the effectiveness of music therapy as a treatment to strengthen protective factors and prevent negative outcomes. Having identified both the research gap and the potential of music therapy to contribute to support systems and services fostering resilience, it is not surprising that she urges researchers to ‘intertwine the construct of resilience and music therapy with a solid theoretical foundation’ (2012, p. 50), and to further explore the effects of music therapy on resilience. Brooks and Goldstein (2015) state that probably ‘most, if not all, child therapists would express as an important treatment goal their patients’ becoming increasingly resilient’ (p. 6). I presume that the same holds true for music therapists, and much of the recent music therapy literature is linked to the core concepts of resilience without using the exact term. Articulating this treatment aim more explicitly and researching the effects on resilience outcomes might be an important development of music therapy towards a more securely funded clinical profession and a leading scientific discipline.

2.3 Summary of the literature review

In this chapter I presented the literature pertinent to my research question. The first part was concerned with literature on ASD. The diagnostic criteria, the rising prevalence and the gender ratio of this complex neurodevelopmental condition were outlined, and the strikingly high occurrence of comorbidities was discussed. Reflecting on the discrepancy between research currently prioritised by funding and the research requested by self-advocates, family members and clinicians, highlighted the importance of listening to different stakeholders and affected people. Only by valuing and considering their opinion will clinical research be able to provide for the most urgent needs. Furthermore, the neurodiversity paradigm was introduced, stating that treatment success cannot be equated with symptom reduction but rather with improved social support, functioning and wellbeing. I summarised the impact of ASD on the parents and families of children with a diagnosis. Significantly elevated stress levels, and poorer psychological and physical health are partly consequences of the low levels of social support this group receives. I therefore argued that interventions for the child with ASD must be complemented by appropriate support for the caregivers and families.

The literature review on ASD went on to focus on interventions. I first described commonly applied treatment programmes, such as ABA, PRT, ESDM, or DIR/Floortime, and discussed underlying principles, methods and the evidence-base as well as limitations of these approaches. The overview of music therapy with children with ASD included a brief history of the intervention with this client group. I demonstrated the suitability of music as a motivating medium for individuals with ASD to engage in self-expression, communication and play. I looked at the benefits of using improvisational music therapy techniques within an interactive, strength-based, and child-led framework for addressing the developmental and emotional needs of the child in therapy. Family-based music therapy in the context of ASD was presented. Over the last decades, several music therapy research projects with children with ASD have been conducted. I summarised key findings and listed the literature reviews, systematic reviews and Cochrane reviews in this area. The recent international music therapy investigation TIME-A that inspired my doctoral study was described in more detail. The multi-centre RCT has implemented current recommendations for high-quality research projects and has thus advanced music therapy research in several aspects. Responses to and critiques of the trial were also presented. Finally, I highlighted that research studies increasingly examine family-centred approaches. Examples of recent projects demonstrate the new emphasis on parents' perception and opinion. My research has been influenced by this development as the contemporary literature and findings suggest that a family-centred treatment approach seems suitable to attend to the needs of children with ASD and their families in a respectful and effective way, and to enhance their quality of life and resilience.

The second part of the literature review was concerned with resilience. First, I outlined the development of resilience research and discussed common definitions of resilience and related terms. I conceptualised resilience as a dynamic process that is influenced by risk factors and protective factors on internal and external levels, and I situated my understanding of resilience within a strength-based approach. To ensure inclusive and ethical practice and research, I also approached resilience from a disability studies perspective which emphasises that resilience is a social responsibility, that the opinions of clients and study participants are crucial in determining desirable outcomes, and that the resilience definition cannot rely on having certain abilities but on experiencing appreciation and respect by self and others. For my doctoral study, determining a suitable way of measuring resilience is a central issue. I therefore described available methods of assessing resilience and considered their benefits and limitations. No resilience scale with sound psychometric characteristics could be identified that was developed for a target population with the age range needed for my study, or that was suitable for children with ASD. Thus, I also examined alternative assessment tools, such as measuring (neuro)physiological mechanisms or using video recordings for behaviour observations. The latter has been judged an adequate method of assessing resilience as it can be applied in pragmatic research settings with non-verbal children with ASD. I pointed to the gap in literature and research regarding resilience and children with ASD before I presented and discussed interventions to enhance resilience. An overview of systematic reviews of resilience interventions for adults and for children illustrated the need for more intervention research for individuals with disabilities generally and with ASD more specifically. The studies investigating creative arts therapy interventions, such as art therapy, DMT, and music therapy, indicate that these interventions have the potential to enhance resilience. Underlying principles of music therapy are in agreement with and seem to fit well within a strength-based resilience framework. I argued that the music therapy profession would benefit from research that further explores the effects of music therapy on resilience and from clearly articulating that fostering resilience is an important treatment aim.

CHAPTER THREE
MY CLINICAL APPROACH

In this chapter, the clinical approach that I applied in this research study is outlined. First, I present the elements that characterise my approach for the music therapy sessions (3.1). I discuss the practical aspects and the setting of the music therapy sessions (3.1.1), the treatment guidelines published by the TIME-A study team as well as additional components of my approach (3.1.2), and the value of a supervision group (3.1.3). This is followed by a description of my approach for the parent counselling sessions (3.2). The characteristics of the simultaneous treatment model (3.2.1), the importance of acquiring counselling skills (3.2.2), and the use of video feedback (3.2.3) are considered.

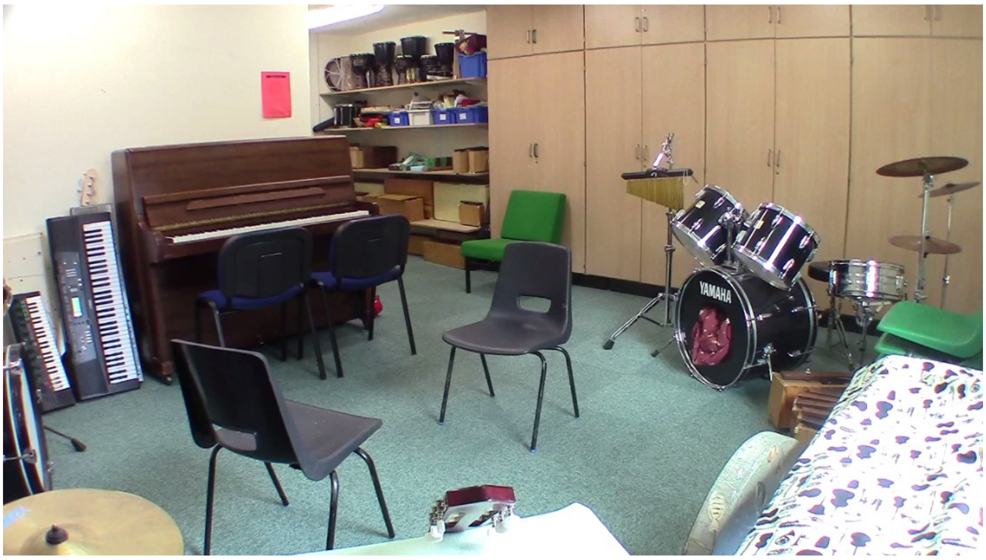
3.1 Music therapy sessions

The music therapy sessions described here have been conducted with a narrowly defined client group. All children had a diagnosis of ASD and were aged between four years and six years eleven months at the beginning of treatment. Individual sessions lasted approximately 30 minutes each and took place in the child's school during school hours. Despite the group being formally homogeneous, the developmental stages and emotional needs of the children varied immensely. To be able to respond appropriately to the individual needs, I employed an eclectic approach, drawing on different theories and frameworks. Previous work experience with a similar client group had prepared me for my role and had helped me to define an approach that seemed suitable and successful for young children with ASD. Moreover, treatment guidelines specified the techniques therapists should apply during the research study, and a supervision group, including five music therapists working for TIME-A, provided further guidance. Before I expand in more detail on my approach, I focus on the practical aspects of my sessions.

3.1.1 Setting and practical aspects of music therapy sessions

For this study, I saw children in three schools. The different school environments, their routines, pedagogical approaches, and their respective relationships with music impacted the way I was working in each school. School A was a special school for children with moderate to severe learning difficulties that also offered autism-specific education. The school had already employed a music therapist for many years when I started the project, which had several advantages. For example, I could use a purpose-built music therapy room that was spacious, light and equipped with plenty of instruments (see Figure 2). Furthermore, the teachers were already accustomed to music therapy, had established a working referral system, and valued the treatment provision. I benefited from the structure and trust that the regular music therapist had built up in the team. All these elements made it easy for me to work in this environment.

Figure 2: Music therapy room, school A

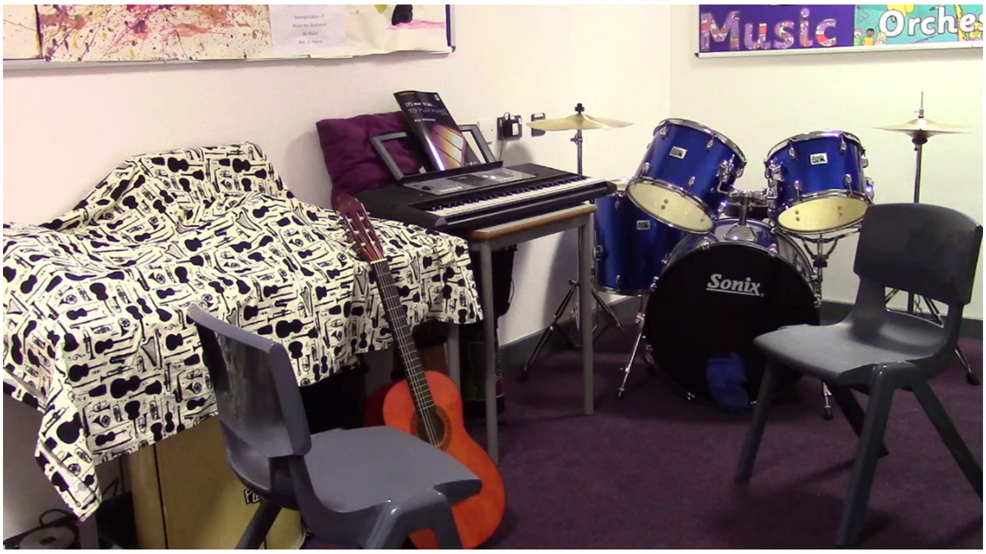


School B was a mainstream primary school which had not offered music therapy before the research project. The school was relatively small with no music room and almost no musical instruments. However, the head teacher was enthusiastic about music therapy and offered a meeting room as the therapy room (see Figure 3). This meant that I needed to spend approximately 20 minutes each day transforming the room in the morning into a suitable music therapy room, i.e. removing chairs and tables and setting up instruments, and another 20 minutes after the sessions re-arranging everything to its original position. The school provided a keyboard and few percussion instruments to which I added a variety of instruments that I brought with me. In this school, teaching assistants (TAs) were present in all music therapy sessions. This allowed us to build close partnerships, discuss ideas, and reflect on the children's progress in and outside sessions. As the TAs shared their experiences with the classroom teachers, the latter also developed an interest in music therapy, attended several sessions and supported my work.

Figure 3: Music therapy room, school B

School C, a special school for pupils with a diagnosis of ASD, had also no prior experience with music therapy. However, they offered regular music lessons, and were thus well equipped with instruments. These were stored in a very small room in which it was difficult to move around or dance during the sessions (see Figure 4). Even though I always tried to spend breaks together with other teachers in the staff room and to engage in conversations about the children, it was more difficult in this school to become a member of the team. Work satisfaction among staff seemed low, maybe because budget cuts resulted in a shortage of qualified teachers, and TAs were often expected to run whole classes on their own. The school also struggled with rooms and space, which sometimes seemed to cause feelings of rivalry and disturbances of the sessions by staff or pupils. As more and more children benefited from music therapy and started to show improvements outside sessions, staff and parents became more interested. At the end of the research project, many of them advocated a continuation of the treatment provision so that funding could be secured to employ a music therapist.

Figure 4: Music therapy room, school C



Even though the external preconditions differed between schools, I always made sure that a variety of appealing instruments was available in the sessions. As the piano is my principal instrument, I feel comfortable using it and it usually plays a prominent role in my sessions. The piano is very versatile, and it is relatively easy to produce 'proper' music, which is maybe why so many children seem to be drawn to it as well. I also use guitars and ukuleles very often as they allow me to be mobile while playing chords and they often motivate children to develop or improve fine motor skills. Different-sized drums and djembes, as well as hand-held percussion instruments including shakers, tambourines or jingle bells are almost always used in my sessions. Tuned percussion instruments, including xylophones, wind-chimes or resonator bells allow children to create melodies easily, and wind instruments, such as reed horns, kazoos or swannee whistles support the development of mouth muscles and breath control. My second instrument is the saxophone, and I brought my tenor saxophone to several sessions. Most children showed an interest in the big, shiny instrument that had a very different sound quality, reminding some of jazz or pop music. The sensory nature of the instrument, also described by Annesley, Crociani, Davidson, and Vaz (2015), seemed to be especially appealing to many of the autistic children. I used my voice almost constantly and thereby encouraged children to sing and vocalise as well. Most of the music played in sessions was live and improvised. Apart from free musical exchanges, recurring elements such as a hello and a goodbye song, familiar songs, musical games as well as movement and dance activities were also incorporated in the sessions.

In addition to the musical instruments, I also offered objects and toys to some children. These included, for instance, a blanket under which instruments or persons could be hidden and discovered, colourful pieces of material that could be placed on different body parts and shaken off during specific action songs, or a teddy bear that could motivate children to engage in pretend-play or role-play activities. As many children with ASD get easily overwhelmed when they are presented with too many visual stimuli, the layout of the therapy room was very important. I used a blanket to cover up some of the instruments and objects (see Figure 4) and thereby reduced the amount of distractions in the room, which helped many children to settle and focus. The blanket also enabled and supported structure, as we included the acts of uncovering the instruments, choosing them one at a time, starting and finishing an improvisation consciously, and returning things to their place afterwards as integral parts of the session. However, this structure was not fixed or rigid. On the contrary, presenting the structure in the first place allowed children to experiment with it and venture out of it when they were ready to engage in more spontaneous ways. For children who appeared too withdrawn and rigid, I chose a different layout of the room with attractive instruments being openly accessible at all times (see Figure 3). Apart from reducing distractions and providing structure, a carefully chosen arrangement of furniture and instruments ensured the safety of the children, the therapist and the instruments.

3.1.2 Treatment guidelines and my approach

In addition to the study protocol (Geretsegger et al., 2012), the TIME-A research team also published treatment guidelines (Geretsegger et al., 2015) that outlined important characteristics of improvisational music therapy (IMT) for autistic children. The authors identified common core features of various clinical music therapy approaches used with this client group. To reach a widely accepted consensus on these principles, three focus-group workshops were conducted, and experienced music therapists from ten countries were invited through an online survey to evaluate the treatment guidelines and suggest amendments. The authors of the guidelines acknowledge that IMT is and must be a highly individualised and flexible approach. However, the guidelines can serve as a reference for clinical practice, future research, and training, and they were an attempt to standardise, to a certain extent, the treatment provided in the TIME-A study. Three unique and essential principles within IMT for children with ASD are listed in the guidelines: ‘Facilitate musical and emotional attunement’, ‘scaffold the flow of interaction musically’, and ‘tap into the shared history of musical interaction’. Furthermore, five essential but not unique principles within IMT for children with ASD were determined: ‘Build and maintain a positive therapeutic relationship’, ‘provide a secure environment’, ‘follow the child’s lead’, ‘set treatment goals and evaluate progress’, and ‘facilitate enjoyment’. ‘Adjusting the setting according to children’s or families’ needs, clinical judgement, and practical possibilities’ was named a compatible principle within IMT for children with ASD.

All principles of the treatment guidelines are in accordance with my clinical approach, and it was thus easy to implement them in my therapy sessions. The principle ‘facilitate musical and emotional attunement’ is described as follows: ‘The music played or sung by the therapist is closely attuned to the child’s immediate display of (musical or other) behaviour, focus of attention, and/or emotional expression’ (Geretsegger et al., 2015, p. 270). Imitating, mirroring, varying, elaborating, regulating, supporting, responding, or contextualising are named appropriate therapeutic techniques to facilitate moments of synchronisation. To create an initial contact with a child with ASD in music therapy, I often mirror their sounds and expression, and thereby attune to their feeling state. In this way, I show them that they have been heard, which may increase self-awareness and the motivation to use music as a means of self-expression. The empowering experiences of being in control of our music in a positive way allow children to also follow my musical suggestions at times, to participate in more spontaneous exchanges or turn-taking exercises, and to explore different ways of communicating.

‘Scaffold the flow of interaction musically’ means that the therapist matches or shapes the music or utterances of the child in a way that gives meaning to them. The therapist thereby supports the child’s comprehension, expressiveness and participation in musical interaction. This principle reminds of Pavlicevic’s interpretation of babbling exchanges between parents and their babies where ‘parents respond to their infants’ vocalisations as though these are communicatively meaningful, and this encourages and invites infants to develop their capacity to use their voices in a communicative sense’ (Pavlicevic, 1995, p. 169). Over the course of therapy, each dyad of therapist and child will develop a repertoire of activities, songs and musical motifs that are repeated or varied by them in several sessions and that have meaning to them. This is an important process to build and foster their relationship. By ‘tapping into the shared history of musical interactions’ the therapist facilitates ‘both a feeling of safety and predictability and the capacity for flexibility and coping with change’ (Gerestegger et al., 2015, p. 272). The child is enabled to understand, to anticipate and to be creative within a supportive framework.

In the definitions of these three principles, which are unique and essential to music therapy, the treatment guide remains vague about the quality or aesthetic of the music that should be used. I believe that it is important to offer interesting music in a variety of styles and genres including engaging melodies, rhythms and harmonies. In order to captivate the child's interest over a longer time it is, from my experience, hardly sufficient to only mirror and contextualise the child's sounds or expressions. As in the interactions between parent and infant we must be careful that the exchanges do 'not remain a stereotypic boring sequence of repeats, back and forth' (Stern, 1985, p. 139). In order to foster development, the therapist must offer own musical contributions so that the play partner mutually create the musical dialogues. I mainly use music in therapy as a means to achieve non-musical goals, such as improved interaction skills, self-esteem, and resilience. However, I also believe that 'musical experience and expression are inherently beneficial human activities' (Aigen, 2014, p. 20). For these music-specific benefits to occur, it is necessary that the therapist offers a rich and stimulating musical environment.

'Build and maintain a positive therapeutic relationship' is the first essential but not unique principle described in the treatment guidelines. I understand the positive relationship between client and therapist as key to any successful intervention. This is in accordance with the psychoanalyst William Fairbairn who named the relationship 'the single most important factor in helping the patient to change' (Gomez, 1997, p. 74). I try to establish trust and a positive relationship through presenting as a reliable, attentive and supportive person with a warm and welcoming attitude towards the child. Similarly, providing a secure environment is paramount in any therapy intervention. This principle can be met by maintaining the same time and room for therapy sessions, removing hazardous objects from the room, showing consistency and reliability in behaviour and responses, establishing boundaries, and preparing for interruptions and endings. The psychoanalyst John Bowlby thought beyond the external environment when he stated that the therapist needs to 'provide the patient with a secure base' (Bowlby, 1988, p. 138) to allow for change. I believe that music offers the therapist the possibility to provide a secure base also through using musical techniques such as holding and rhythmic grounding. Difficult emotions, maybe displayed in chaotic or aggressive music, can be held and contained with long chords, a stable rhythm or repetitive pattern. Music can also be used to regulate the level of excitement and arousal, and to structure the session with reassuring musical activities, like a hello and a goodbye song, and with providing clear beginnings and endings to each improvisation.

The therapist should generally 'follow the child's lead', i.e. 'follow the child's focus of attention, behaviours, and interests' (Geretsegger et al., 2015, p. 274), and incorporate these interests into meaningful activities and interactions. At times I am rather explicit about this process and encourage children to express and communicate wishes by offering choices regarding instruments, songs and activities. While I find it important to follow the child, I find it equally important to initiate my own ideas, provide structure, carefully challenge the child's sense of control, and offer new elements and thus opportunities for development. The therapist as an active partner in the musical interaction can model alternative ways of playing and therefore of being. Oldfield (1995, 2006) has written in detail about the balancing act between following and initiating and its benefits in work with autistic children.

As mentioned above, the developmental stage and individual needs of each child were different and needed to be assessed carefully. Therefore, it was important to 'set treatment goals and evaluate progress'. Objectives for the individual therapy were usually determined after two to three assessment sessions and after conversations with parents and teachers. Progress towards these aims was documented after each therapy session and discussed regularly with parents and staff. When necessary, objectives were adjusted. The treatment guide lists 'facilitate enjoyment' as the final essential but not unique principle of music therapy. In my work, this aspect was of utmost importance. I chose activities according to the child's interests, included elements of drama and humour, focused on strengths, and celebrated even the smallest steps towards positive change. Many children with ASD find verbal communication and social interactions confusing or difficult. But as most children in my cohort were interested in sounds and music, they were intrinsically motivated to playfully engage in interactions during sessions, and music making provided ample opportunities to experience successful relating and mutual enjoyment. The fact that many of the children enjoyed music and felt they were good at it helped them to build up self-esteem and to feel proud and happy about themselves. I wholeheartedly agree with the following statement by Clive Robbins:

> 'It is important not to undervalue *joy*. Joy is more than fun, more than just having a good time. There is something transcendent about the purity of joy, something that relates to an original realisation of one's full humanness. … Joy in discovering self-expression or in achieving musical creation with a therapist can be momentous. Such events bring release from feelings of confusion, restriction, inadequacy and dependency.' (Robbins, 1993, p. 15).

Little emphasis is placed in the treatment guide on playing and playfulness. The paediatrician and psychoanalyst Winnicott contributed to the theory of child development by focusing on the character and importance of playing (Winnicott, 2005). Playing is essential, spontaneous and universal, and can be seen as a way of relating inner and outer reality. Winnicott stressed the relevance of playing to therapy and reminded us that 'playing is itself a therapy' (2005, p. 67). He understood psychotherapy as an activity of 'two people playing together' (2005, p. 51). Due to the characteristics of the disability, many children with ASD have difficulties in being playful and playing with others. Their playing might be rigid, repetitive or restricted, and might lack spontaneity or creativity. It is therefore important to focus on healthy and fulfilling play when working with children with ASD. Music therapy provides opportunities to play (music) together in a non-threatening and supportive environment. During mutual music making different ways of relating to oneself and to others can be explored in a playful way. Thereby, creativity, the development of a sense of self and of health are supported:

> ‘It is in playing and only in playing that the individual child or adult is able to be creative and to use the whole personality, and it is only in being creative that the individual discovers the self.’ (Winnicott, 2005, pp. 72-73).

My clinical approach is influenced by my understanding of music therapy as an intervention that aims to support children with ASD but not to cure them or change their personality. I strive to provide a treatment that helps children to cope with their condition and become more resilient. As outlined in the previous chapter, resilience can be enhanced by strengthening protective factors. These protective factors include, among others, self-esteem and confidence, feeling loved and accepted, the ability to express oneself, the capacity to manage strong feelings, and the ability to relate comfortably with others (American Psychological Association, 2018; Brooks & Goldstein, 2015; Naglieri, LeBuffe, & Shapiro, 2013). The aim to promote these factors through positive experiences in music therapy guides my clinical approach.

3.1.3 Supervision

When I started the work for this research project, I continued with my regular clinical supervision sessions. These included a monthly individual supervision session, and a bimonthly group session organised by my employer for the whole music therapy team. In both sessions, I discussed clinical work that was part of the study as well as other clinical work that I was conducting at the same time with a different client group. As TIME-A was a multi-site project with, in total, six music therapists working in the UK, it was also possible to set up an additional supervision group that focused exclusively on the clinical work carried out for TIME-A. The group met every two months and was attended by five music therapists and the site managers. These supervision sessions proved to be very important to my professional development and my wellbeing. All the music therapists in the group worked for the same international RCT, adhering to the same treatment guidelines and the same specifications as to how to document each session. All of them worked with children of the same age (four to seven years), with the same diagnosis (ASD), and in the same setting (school). Furthermore, all the therapists worked with children who had been randomised to the high-intensity treatment, receiving music therapy sessions three times a week. We thus shared very similar experiences and faced similar difficulties.

The core features of ASD are deficits in social interaction and restricted, repetitive patterns of behaviour (American Psychiatric Association, 2013). Having such a big case load only of children with this diagnosis can be challenging, for example when I noticed that the therapy sessions seemed to become rather repetitive, or when I felt frustrated because the possibilities for social communication with the children seemed so limited. This is even more the case when seeing children of this client group three times a week. The intense work has sometimes become tiring and demanding in terms of creativity. I felt well supported by the supervision group during the whole experience and I benefited from a regular exchange of feelings, thoughts, and ideas. As every music therapist in the group video recorded their clinical sessions, the conversations in the supervision group were always based on video material that was presented to the group. This procedure enriched the discussions immensely as we got a clear idea of the client and of the therapist's way of working. We chose video excerpts of situations in which we felt stuck in order to get help with difficult cases, but we also chose positive moments to exchange ideas about what might work particularly well with this client group. Thus, the supervision group became not only a safe space in which I could share experiences and explore difficulties or negative feelings, but also a stimulating learning environment in which I encountered alternative techniques and approaches.

3.2 Parent counselling sessions

All families enrolled in TIME were offered three parent counselling sessions each. Previous work experience, for example at a child development centre and at a child and family psychiatric unit, had convinced me that family-centred approaches have very positive effects. I was therefore excited to be able to work as a parent counsellor for the research trial. At the same time, however, I was aware that meeting with and counselling parents requires 'skills that are complementary to, but different from, clinical music therapy.' (Grogan & Knak, 2002, p. 210). Whereas the TIME-A team published detailed treatment guidelines to standardise the music therapy sessions conducted within the study, no guidelines specified the desirable approach for the parent counselling sessions. It was only determined that sessions should last approximately 60 minutes each, and the TIME-A study protocol defined the content and purpose of the parent counselling sessions as follows:

> 'Counselling sessions will comprise supporting conversations with a focus on current concerns, problems, and difficulties arising from the child's diagnosis, behaviour, and development over time as well as providing information about ASD, child development, and social communication relevant to the families' everyday life situations.' (Geretsegger et al., 2012, p. 4).

As the protocol offered no further guidance, I consulted music therapy and psychology literature pertinent to my new responsibilities to prepare for my role as a parent counsellor. The sessions were termed 'counselling' in the TIME-A study protocol and I therefore adopt the same term in this thesis. However, our team in the UK discussed alternative descriptions, such as parent meetings. As I had no formal training in counselling, the service offered must be distinguished from the therapy provided by a specialist counsellor.

3.2.1 Simultaneous treatment of parents and children

As presented in section 2.1.4.2 of this thesis, many music therapists provide sessions for children and their parents, and a growing body of literature and research focuses on family-centred approaches (e.g. Jacobsen & Thompson, 2017). An increased awareness of the importance of family engagement can also be observed among music therapists working with children with ASD (e.g. Bull, 2008; Oldfield, 2006; Thompson, 2017). In most described approaches, carers are present and, depending on their needs and preferences, take an active part in the music therapy sessions. Conversations between the music therapist and parent are usually short, as they happen during or after the session while the child plays.

In child psychotherapy, the model of simultaneous treatment, during which child and parent are seen separately by the same therapist, is well established (Burlingham, Goldberger, & Lussier, 1955; Chazan, 2003; Nilsson, 2006). Simultaneous treatment is influenced by attachment theory (Bowlby, 1988) and developmental theory (Stern, 1985; Winnicott, 2005) – models that understand the dyadic relationship between child and parent, and thus working with parents, as central. Simultaneous treatment accepts and deals with the reality that a child does not live and develop in isolation but within a family system of complex relationships. As a result, therapeutic effects are more likely to be sustaining (Chazan, 2003). However, literature in music therapy that explores simultaneous treatment of child and parent remains scarce. Grogan and Knak (2002) propose the idea of a 'discussion group for parents in parallel to a children's group' (p. 211) and suggest that this may be run by another professional. Simultaneous treatment for children with ASD and their parents is described by the music therapist Tali Gottfried (2017). She has directed both music therapy and parent counselling sessions for the TIME-A site in Israel. Gottfried investigated the effects of her specific approach, which she called Music-Oriented Parent Counselling (MOPC), and reported improvements in parental stress level, quality-of-life perception, and the use of music in everyday life. MOPC comprises supportive conversations and music therapy-like techniques (e.g. musical improvisation with parents) but does not, differing from my approach, include video feedback as an essential element. I am not aware of any model outside the TIME-A context that offers separate parent counselling sessions alongside music therapy for the child.

The child psychologist Oren (2011) categorised four main types of work with parents: 1) Meeting to update and to accompany parents, 2) Parental counselling, 3) Parent-child therapy, and 4) Family therapy. My approach for this study combined elements of 1) and 2). The parent counselling sessions aimed to build a partnership with parents, update them, learn about their point of view, and respond to their own needs. At the same time, guidance, counselling and advice were offered when parents asked for them and when they seemed beneficial for the child and family.

3.2.2 Counselling skills

To acquire more specific ideas about counselling, I consulted literature in psychology. Especially the person-centred approach developed by Carl Rogers (1951, 1961) was influential and inspirational. He believed that the therapist had to hold certain attitudes towards the client in order to help and promote change. The first attitude is called unconditional positive regard, which implies showing respect and warmth to the client and being absolutely non-judgmental. Further attitudes are termed empathy and congruence. Empathy describes the attempt to see the world from the client's perspective and to communicate this understanding. Being congruent means being genuine, authentic and transparent. As these personal attitudes determine the quality of the relationship, they seem paramount to me and provided helpful guidance for the work.

Davis (1993) and Pelham and Stacey (1999) outline basic skills that complement these attitudes. A distinction must be made between formal counselling and the use of counselling skills which can be employed by anyone to facilitate communication. Davis delineates them as attending, active listening, prompting, demonstrating empathy, and basic exploration. A similar set of fundamental counselling skills is described by Pelham and Stacey (1999): 'Just' being there, facilitating the person to tell his or her story, attending to repeating patterns of behaviour, and use of the therapeutic frame. Being able to hold a silence, the awareness of transference and counter-transference processes, as well as the ability to hold and contain the therapeutic relationship form essential principles. The most important elements for successful parent consultation in the school and community context have been named values, such as caring and compassion, human diversity, self-determination and participation, and partnerships (Nelson, Amio, Prilleltensky, & Nickels, 2000). Similarly, Bidmead, Davis, and Day (2002) emphasise the importance of working in a partnership with parents when providing counselling sessions. In this model the professional is aware of and utilises own skills and knowledge but also acknowledges and values the expertise and life experience of parents. With regard to work with parents of children with ASD the relevance of this approach has been emphasised: 'It is important to realise that parents may or may not be experts on autism, but they *are* experts on their child' (Altiere & von Kluge, 2009, p. 150). Bidmead et al. (2002) mention open communication as a basic principle of this model as well as certain helper qualities that need to complement excellent communication skills. These qualities include empathy, respect, humility, genuineness or congruence, quiet enthusiasm, and personal strength or integrity. Parents themselves have voiced that they want counsellors to be supportive, open, confidential, and non-judgemental (Attride-Stirling, Davis, Markless, Selare, & Day, 2001). They expressed their need for 'someone to talk to who'll listen' (Attride-Stirling et al., 2001, p. 179). Altiere and von der Kluge (2009), who conducted a qualitative research study with families of children with ASD, reported that 'parents seemed to find the experience of telling their story cathartic' (p. 151).

Counselling clients as well as parents of clients requires cultural sensitivity (e.g. Holcomb-McCoy, 2009; Martin, 2015; Paniagua, 2014). In my study cohort of 25 families in the UK, less than half of them self-identified as White British. Parents in this study stated that they had a Black, Asian, Mixed, or White European ethnic background. The diversity of this group reflects the ethnic diversity typically found in schools and communities in the area I worked in. However, ethnicity is only one factor when considering cultural awareness. The American Psychological Association (2017) specified in their *Ethical Principles of Psychologists and Code of Conduct* that professionals should be ‘aware of and respect cultural, individual, and role differences, including those based on age, gender, gender identity, race, ethnicity, culture, national origin, religion, sexual orientation, disability, language, and socioeconomic status’ (p. 4). Thus, an essential element of my approach was always trying to be aware of my own cultural assumptions and beliefs, to reflect on the aspect of cultural, individual, and role differences in the counselling sessions, to listen attentively, be open-minded, respectful, and to remain sensitive towards cultural issues. For almost half of the parents in this doctoral study, English was not their first language. Therefore, being conscious about my use of language was crucial. The fact that I was easily identified by the parents as ‘foreign’ seemed to create an immediate bond and partnership with some parents but also seemed to elicit scepticism or alienation in others. In all the counselling sessions, I tried to provide a positive, supportive and safe environment, and offered opportunities for parents to voice questions, doubts or criticism. Cultural sensitivity and an awareness of cultural differences or biases, while staying non-judgmental, were paramount in my work with a culturally diverse group.

3.2.3 Video feedback

From my work experience at a child and family psychiatric unit I was familiar with the use of video feedback, as it is applied regularly by different team members in the unit (Holmes, Oldfield, & Polichroniadis, 2011). I decided to use video feedback in the parent counselling sessions to include parents as much as possible in the therapy process, to get their views about certain behaviours and treatment aims, and to share positive moments with them. Video feedback focused on the child’s strengths and provided opportunities to celebrate progress together. It has been argued that it is important to apply a strength-based approach to parent work and to focus on positive characteristics of children with ASD, because the disability and resulting stressors might persist throughout life and, thus, parents need help to cope and to embrace positives (Bekhet et al, 2012; Gray, 2006). Results of a study by Steiner (2011) indicate that a strength-based approach improves parent affect, facilitates parental wellbeing, assists parents in coping, and enhances parent-child interactions. Accordingly, I selected mainly video excerpts that showed the child being involved in positive interactions and mutual music making, or excerpts that captured a successful intervention engaging the child in communicative behaviour.

Over recent decades, awareness of the possibilities and benefits of video feedback in family work has become widespread and the method has increasingly received attention in clinical practice and research. A meta-analysis of family programmes, comprising 29 studies, concluded that interventions using video feedback have a positive effect on families with young children (Fukkink, 2008). Parenting behaviour, attitude of parents, and, consequently, the development of the child all showed significant improvements. Juffer, Bakermans-Kranenburg, and Van Ijzendoorn (2008) present an attachment-based intervention programme that utilises video feedback to enhance parental sensitivity, called video-feedback intervention to promote positive parenting (VIPP). It has been successfully applied with clinical and nonclinical populations. A recent randomised controlled trial (Poslawsky et al., 2015) demonstrated that VIPP adapted to autism reduced parental intrusiveness and increased feelings of self-efficacy. Another modification of VIPP was investigated in a parallel, single-blind, randomised trial with infants at high familial risk of autism (Green et al., 2015). Results suggested increased infant attentiveness to parents and increased parental non-directiveness, reduced autism-risk behaviours as well as improved parent-rated infant adaptive function. The largest study of parent-mediated interventions for children with ASD that utilised video feedback was the Preschool Autism Communication Therapy trial (PACT; Green et al., 2010). Play sessions with 152 dyads were video recorded and followed by feedback sessions during which parents were helped to recognise communicative attempts of their children and to reflect on positive elements of their interaction style (Aldred et al., 2010). A long-term follow up of this trial showed a significant reduction in symptom severity as measured by the ADOS, as well as increased child initiations in dyadic communication in the treatment group (Pickles et al., 2016).

Several music therapists working with families also choose the technique of video feedback. Oldfield (2006, 2017) has written extensively about her use of video recordings with parents. When describing her work with emotionally neglected children and their families, Jacobsen (2017) refers to Marte Meo, an approach based on analysing videos of the parent interacting with the child (Aarts, 2000). These videos are shown to the parents in order to point out positive moments, to understand unfortunate interaction patterns and to promote change. In the UK, the development of increased use of video feedback in mental-health professions is also supported by several councils (e.g. Cornwall Council, 2018; Northamptonshire County Council, 2018) which advocate training in the method Video Interaction Guidance.

For my role as a parent counsellor in TIME-A, my procedure had to be slightly different from these models in the sense that I was not primarily utilising feedback of parent interactions but offering video feedback of their child’s music therapy to parents. As parents in my study were not video recorded when interacting with their children, no feelings of insecurity or embarrassment restricted their delight at watching videos showing strengths and positive behaviour on the part of their children. Despite the differences, effective techniques could be learned from the above-mentioned studies, such as exploring the child's interaction patterns in a partnership with the parent, focusing the feedback on positive child behaviour, as well as keeping the needs, wishes and skills of parents in mind. The literature review strengthened the belief that using video feedback in an intervention like parent counselling sessions could be highly beneficial. In my research study, video feedback could further be used to share effective musical techniques with parents and thereby promote a sustainable use of music outside therapy sessions.

3.3 Summary of my clinical approach

My clinical approaches for both the music therapy as well as the parent counselling sessions were presented in this chapter. For a successful music therapy intervention, I believe that it is essential to establish a good working alliance with the school staff and to provide a safe, consistent but stimulating environment. In the treatment guidelines published by the TIME-A study team, principles for IMT with autistic children were defined: 'Facilitate musical and emotional attunement', 'scaffold the flow of interaction musically', 'tap into the shared history of musical interaction', 'build and maintain a positive therapeutic relationship', 'provide a secure environment', 'follow the child's lead', 'set treatment goals and evaluate progress', 'facilitate enjoyment', and 'adjust the setting according to children's or families' needs' (Geretsegger et al., 2012). These principles were in accordance with my own clinical approach and were thus implemented in my sessions. I further pointed to the importance of using interesting and engaging music, balancing between following and initiating, and being playful. All of these elements were integrated in an approach that aimed to foster children's resilience. The benefits of a regular supervision group consisting of music therapists working with a similar client group were outlined.

I described the literature and research that influenced my approach to the parent counselling sessions. Working collaboratively with parents, sharing ideas with them, and valuing their expertise and opinion are understood to be necessary and beneficial. Simultaneous treatment of children with ASD and their parents, as requested by the TIME-A research protocol, provided a suitable treatment model. My relationship with parents was characterised by a positive, non-judgmental, empathic and genuine attitude towards them. An essential technique used in the counselling sessions was showing video excerpts that demonstrated the child's strengths and successful interactions. My clinical approach was influenced by the aim to support children and parents and enhance their resilience.

CHAPTER FOUR
METHODOLOGY

In this chapter, the methodological approach and the methods used are described. The outline of the chapter follows the structure of my study design with different sections for different research phases. At first, however, I describe the methodological background of my study (4.1), and the development of my study design (4.2), discussing how the methods relate to previous research in music therapy. The third section depicts ethical considerations and the ethical procedures followed before the start of my research project (4.3). I then attend to each research stage, first describing the selection process and allocation of participants to the low-intensity treatment group, the high-intensity treatment group, or the control group (4.4). This is followed by a section presenting the data-collection phase (4.5). Data collecting consisted of conducting and video recording music therapy sessions, conducting and video recording parent counselling sessions, and collecting scales measuring the quality of life of participants. Before the data could be analysed, video recordings needed to be selected and transcribed. These processes of data preparation are specified in the subsequent section (4.6). Finally, the various stages of data analysis are described (4.7).

4.1 Methodological background

As described in the first chapter of this thesis, my PhD investigation was inspired and influenced by my involvement in the music therapy research project TIME-A. In my doctoral study, I used data generated during interventions that were part of TIME-A to answer my research question:

> Do music therapy and parent counselling sessions enhance resilience in young children with ASD?

On the one hand, carrying out a retrospective evaluation of data collected for an international RCT meant that several methodological decisions had been made for me. For example, the guidelines of the TIME-A study regulated the inclusion and exclusion criteria of participants, the randomisation algorithm that allocated children to the different treatment groups, and the selection and timing of tests that were carried out to collect demographic details as well as to assess change over the course of treatment. My doctoral study was based on this predetermined structure, which, on the other hand, also had some advantages. For example, my involvement in TIME-A allowed for a unique design of my PhD research, as I could compare data of children who received music therapy three times a week with data of children who had music therapy sessions once a week. This enabled me to explore whether different treatment intensity results in different increase or decrease in behaviours indicative of resilience. Furthermore, as a parent counsellor in TIME-A I had the privilege to meet the parents of each child for counselling sessions. Thereby, I was able to collect valuable data to analyse the effects of parent counselling sessions offered to the families alongside music therapy sessions on resilience in children with ASD and their families. The large quantity of data collected but not analysed for TIME-A contained a wealth of information that I could use. In TIME-A, the video recordings of music therapy and parent counselling sessions, for instance, were only used for assessing adherence to the treatment protocol but not for any further analyses. I was in the fortunate position to develop my own system for selecting and analysing these data in the way that was most suitable for my research questions. Thus, though the fact that my doctoral study was based on TIME-A entailed a few methodological limitations, it also meant that my study could benefit from the TIME-A design and develop it further to adequately suit the needs of my research.

4.2 Study design

My research uses a mixed methods design, combining quantitative and qualitative data to investigate the effects of music therapy and parent counselling sessions on resilience in young children with ASD and their families. For this study, utilising and integrating different methods is important as it ensures a more holistic approach to the research question, enables multiple perspectives on the complex phenomena of music therapy, parent counselling and resilience, and enhances our understanding and interpretation of results. A comprehensive definition of mixed methods research is given by Creswell, Klassen, Plano Clark, and Smith (2011):

‘- focussing on research questions that call for real-life contextual understandings, multi-level perspectives, and cultural influences;
- employing rigorous quantitative research assessing magnitude and frequency of constructs and rigorous qualitative research exploring the meaning and understanding of constructs;
- utilizing multiple methods (e.g., intervention trials and in-depth interviews);
- intentionally integrating or combining these methods to draw on the strengths of each; and
- framing the investigation within philosophical and theoretical positions’ (p. 4).

Even though the explicit term ‘mixed methods research’ is relatively new[3], research combining and integrating quantitative and qualitative approaches has been conducted in both the natural as well as the social sciences for centuries (Maxwell, 2016). Similarly, in the history of music therapy, the common practice of describing studies as mixed methods research has emerged only in more recent years (e.g. Bradt et al., 2015; Cook & Silverman, 2013; Lindenfelser, Hense, & McFerran, 2012). However, numerous music therapy research studies have integrated quantitative and qualitative methods from an earlier time

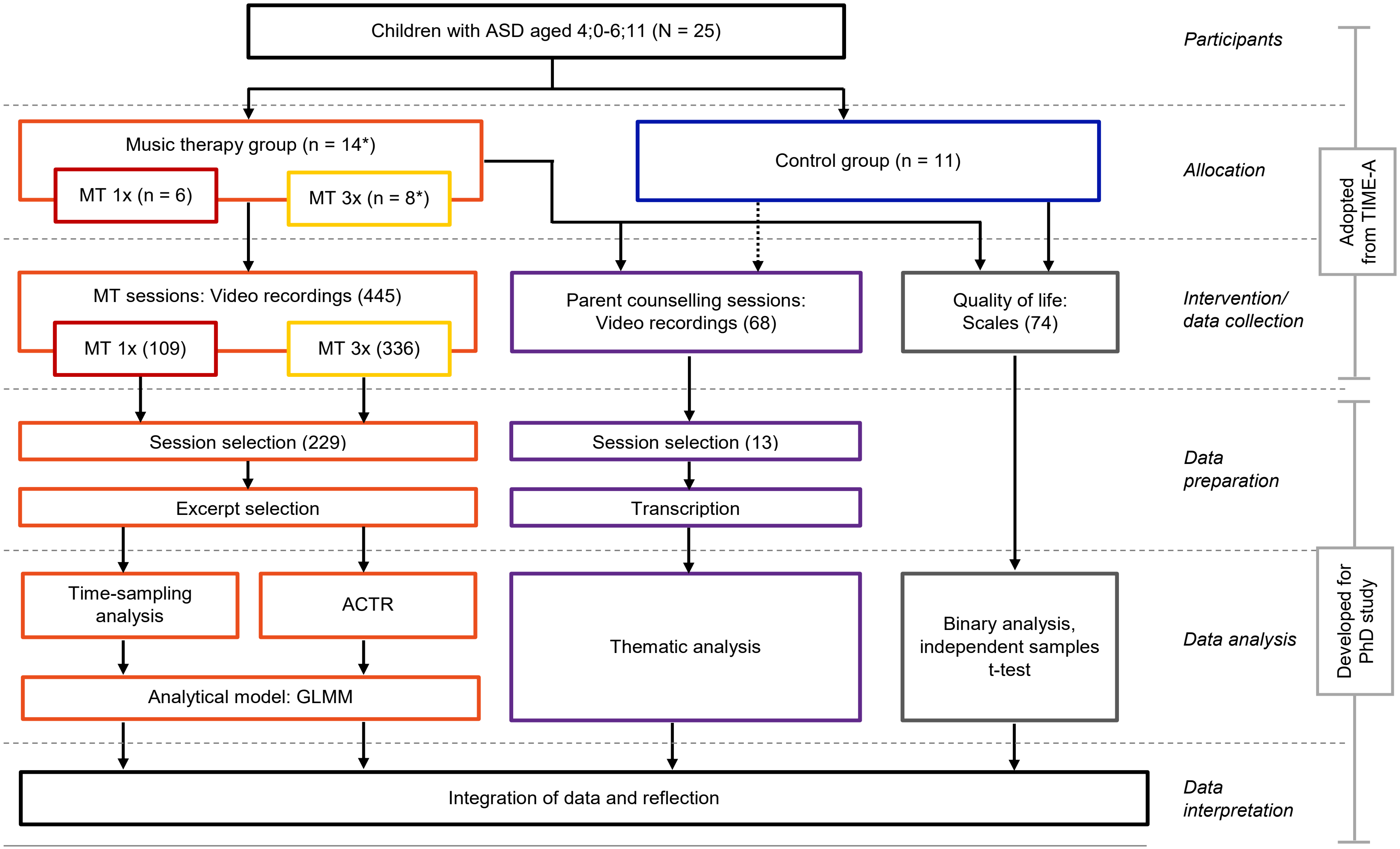
[3] Creswell and Plano Clark (2011), for example, date the beginning of the formative period of mixed methods research to the 1950s and the systematic elaboration as well as application of the approach to the late 1980s and early 1990s.

(Aigen, 2008; Bonde, 2007). It is noteworthy that literature describing the history of mixed methods research in music therapy (e.g. Bradt, Burns, & Creswell, 2013; Burns & Masko, 2016) often only mentions the studies that use the distinct label 'mixed methods', and fail to recognise the impact and importance of earlier research.

Creswell and Plano Clark (2011) have identified different variations of mixed methods designs. These are based on decisions regarding, for example, the timing of data strands or the point of data integration. According to their typology, my study uses a convergent parallel design which is characterised by a) collecting quantitative and qualitative data concurrently as opposed to sequentially, b) analysing the data strands independently, and c) integrating data at the level of interpretation. The convergent parallel design facilitates the researcher 'to obtain different but complementary data on the same topic' (Morse, 1991, p. 122). One example of a convergent mixed methods design in music therapy is the study by Barry, O'Callaghan, Wheeler, and Grocke (2010) that examined the effect of music therapy CD-creation on distress and coping of children during initial radiation therapy.

In my doctoral research study, I concurrently collected quantitative and qualitative data which have been derived from three sources, namely video recordings of music therapy sessions, video recordings of parent counselling sessions, and analogue scales measuring the quality of life of participants at different time points. The different data strands were analysed independently before they were integrated at the level of interpretation. The processes of my research project were structured into the following successive phases: Selection of participants, allocation to different treatment conditions, data collection, data preparation, data analysis, and data interpretation. Whereas the first three stages were adopted from the TIME-A design, the latter three phases were developed specifically for my PhD study. Figure 5 illustrates the full study design of this doctoral research project.

Figure 5: Study design



*One child was excluded from video analysis because of non-existent video recordings
Abbreviations: ACTR, Assessment of child-therapist relationship; GLMM, Generalised linear mixed models; MT, Music therapy

The quantitative methods used in my research are a time-sampling video analysis of music therapy session excerpts, assessments of the child-therapist relationship in these excerpts, and statistical analyses of the quality-of-life measurement. Video analysis is a method commonly used by music therapy researchers (e.g. Holck, 2007; Plahl, 2007; Ridder, 2007). It is especially suited to the discipline as video analysis allows for a holistic perspective on what is happening in the session, including musical elements, facial expressions, gestures, movements and spatial aspects. A time-sampling method to detect occurrences of specified behaviour is chosen frequently by music therapists conducting studies with children with ASD (e.g. Davis, 2016; Oldfield, 2004; Tomlinson, 2016) because time-sampling enables the researcher to pick up even the small changes that are typical in this client group. The quality of the client-therapist relationship is assessed by several music therapists (e.g. Nordoff & Robbins, 1977; Raglio et al., 2017; Schumacher & Calvet, 2007) who define the therapeutic relationship as a key element of music therapy. Quality of life is acknowledged by many music therapists as an important outcome of the intervention, and its assessment is thus commonly included in music therapy research studies (e.g. McConnell et al., 2016; Thompson, 2017; Van Bruggen-Rufi, Vink, Achterberg, & Roos, 2018).

The qualitative aspects of my study include applying thematic analysis to transcriptions of parent counselling sessions. In recent years, thematic analysis has been used increasingly by music therapy researchers, both as the main method in interpretivist studies and as one of several methods in mixed methods designs (e.g. Hoskyns, 2013; Loth, 2014; Potvin, Bradt, & Kesslick, 2015). In my study, this qualitative data provided further insight into the effects of the work with autistic children and their families. Finally, the different data strands were combined, and the findings were integrated. This allowed me to approach my research question from different angles and to gain a comprehensive understanding of the phenomena involved. All the data and results were used for a reflection on whether music therapy and parent counselling sessions enhance resilience in young children with ASD.

4.3 Ethical considerations

The procedure of my research was a retrospective evaluation of data collected through my involvement as a music therapist and parent counsellor in the music therapy investigation TIME-A. This international RCT had already gone through extensive ethical procedures before schools were approached and families recruited. All parents gave full written and informed consent prior to any assessments or intervention, including music therapy and parent counselling sessions. Before their enrolment in the RCT, they also gave written permission for the sessions to be video recorded. For my PhD investigation, no additional work with children or other participants was carried out. I exclusively used data that had already been collected as part of TIME-A. Before I started using and analysing any of these data for my doctoral research, the purpose of my study was explained to parents and additional consent was sought (see Appendix 4.3). Families had the opportunity to ask questions or to refuse participation in this study without giving any reason. Parents were only presented with the consent form for this PhD study after all the interventions had been completed to ensure that their decisions were not influenced by any feelings of dependence.

Throughout the study, confidentiality was of utmost importance. All the digital data derived from music therapy and parent counselling sessions, such as video recordings, session notes, transcriptions, analysed excerpts and analysis results, were stored on a password-protected device which was kept in a locked place. The collected scales measuring quality of life and the non-digital notes were kept in a locked filing cabinet. Data have only been included in this doctoral thesis in an anonymised form, i.e. names of children and parents have been changed, names of schools and places have not been revealed, and information that could lead to identification has not been included. All ethical decisions and procedures were overseen and approved by the Anglia Ruskin University Ethics Panel within the Faculty of Arts, Law and Social Sciences.

4.4 Selection and allocation of participants

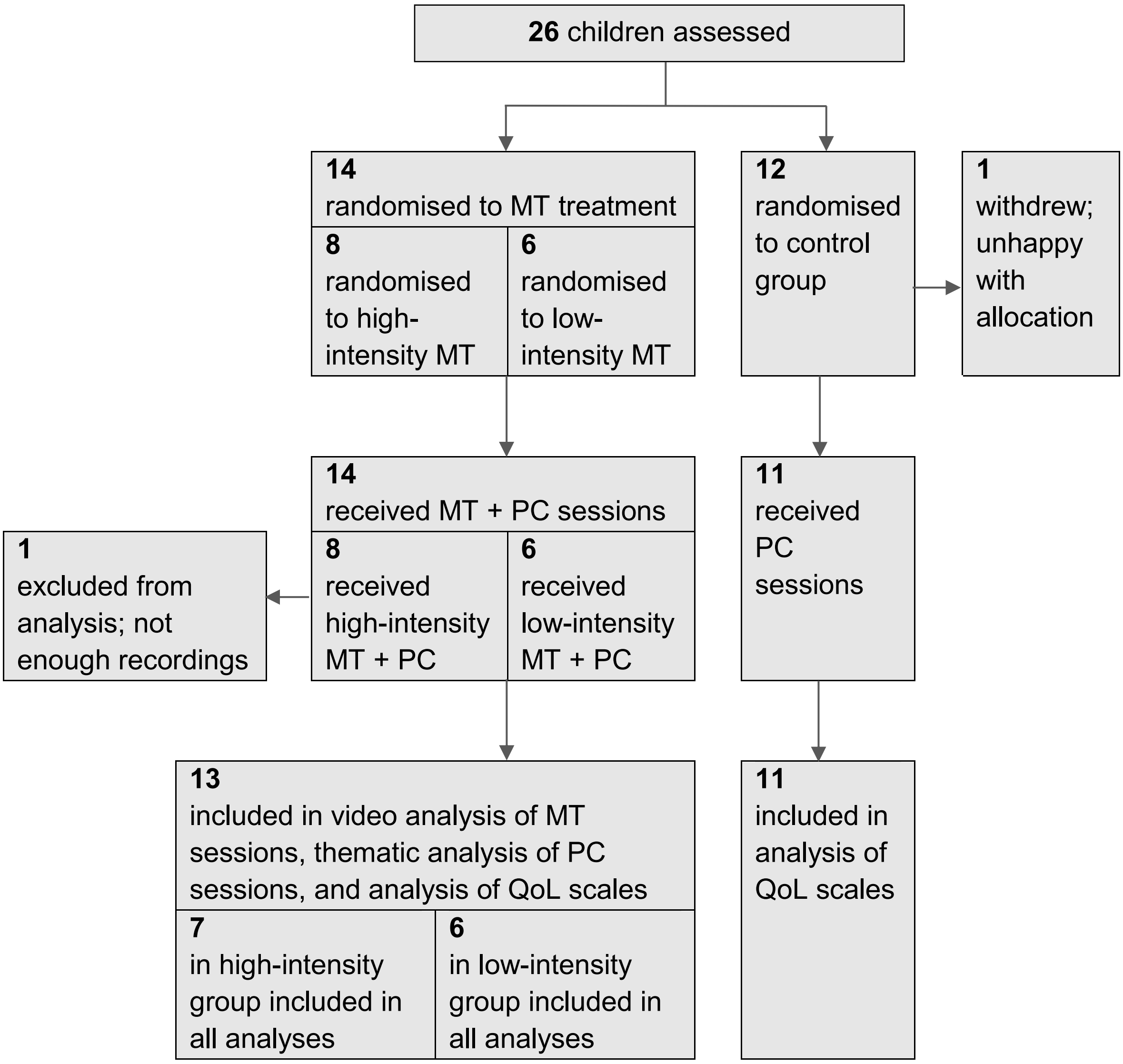
As described in previous sections, procedures for the selection and allocation of participants were determined by TIME-A and I did not define further inclusion or exclusion criteria for my doctoral study. Children within a specified age range (four to seven years) and diagnosis (ASD) were selected for the research project. Serious sensory disorders, such as blindness or deafness, were exclusion criteria, as was the receipt of music therapy treatment in the last year. All the families with eligible children that were approached at our site of the RCT in the UK agreed to take part, indicating that participation in the study seemed acceptable and feasible. After enrolment and baseline assessments, children were randomly allocated to one of three conditions:

1. Low-intensity music therapy: Individual music therapy once a week for five months, and three parent counselling sessions as a standard care condition.
2. High-intensity music therapy: Individual music therapy three times a week for five months, and three parent counselling sessions as a standard care condition.
3. Enhanced standard care: Three parent counselling sessions.

The allocation ratio of 1:1:2 resulted in half of the children receiving music therapy. As a music therapist and parent counsellor, I was responsible for 26 families who were enrolled at our site of TIME-A. Of this group, six children were randomised to low-intensity music therapy, eight children to high-intensity music therapy, and twelve children were allocated to the enhanced standard care condition. One family dropped out of the study after their child had been randomised to enhanced standard care because they were unhappy with the allocation result.

In my PhD research, I investigated data generated from all the remaining 25 children regarding the analysis of quality-of-life scales. Thereby I could compare the development of quality of life of children receiving music therapy treatment with the development of quality of life of children in a control group. Of the 14 children allocated to the music therapy treatment, one child needed to be excluded from the video analysis because the music therapy sessions could not be recorded consistently owing to room and organisational issues. This resulted in a more equal number of children in the two treatment groups. I focused the video analysis on 13 children, of which six received music therapy sessions once a week, and seven received music therapy sessions three times a week. For the thematic analysis of parent counselling sessions, I transcribed one session of each of these 13 families. The flow of participants through the study stages, including allocation, treatment, and analysis, is illustrated in Figure 6.

Figure 6: Flow of participants through the study



Abbreviations: MT, Music therapy; PC, Parent counselling; QoL, Quality of life

The randomisation algorithm did not factor in preferences of families, children's previous music experiences, or diagnostic results. This presents an important difference to general music therapy practices in schools where the therapists usually see children who have been referred by teachers or other professionals because of specific identified needs or because of a special aptitude or liking for music. However, parents and teachers had approved the suitability of a music therapy intervention for each child before the child was enrolled in the study. During the course of therapy, I carefully observed if the child seemed happy attending the therapy, and regularly discussed with teachers and parents whether the therapy seemed helpful. I would not have continued the sessions if we had the feeling that the child was distressed because of the therapy.

4.5 Data collection

Conforming to the TIME-A study protocol, the individual music therapy sessions for children in the treatment group lasted approximately 30 minutes each. All three schools provided a separate room that I could use consistently for sessions. Room size and instrumental equipment varied between schools, but I was allowed to re-arrange rooms to accommodate the needs of the child, and I was able to add further instruments when needed. Of the 14 children who had been randomised to receive music therapy, sessions of 13 children could be video recorded consistently and thus included in the video analysis. All the therapy sessions were recorded with a camcorder that was placed on a tripod in the corner of the room. Some children seemed oblivious to the camera, others seemed to notice it but did not seem interested in or affected by it. Over the course of therapy, only one child developed an interest in the camera to an extent that it disrupted the therapy sessions occasionally. When seeing this child, I eventually had to place the camera on the top of a shelf where the child would not be distracted by it. Of the 445 music therapy sessions conducted, 19 sessions could not be video recorded because of technical difficulties or faulty equipment.

All 25 families in the study, regardless of their child's allocation, were offered three parent counselling sessions of approximately 60 minutes each. They were conducted at baseline, after two months and at five months. Counselling sessions took place in the child's school. The availability and consistency of a suitable room proved to be a challenge in some schools, but it was always possible to find a place eventually. Of the 68 parent counselling sessions conducted, 64 sessions were videotaped using the same equipment as for the music therapy recordings. In the four other sessions parents preferred not to be recorded. After each appointment, detailed session notes were prepared, and significant events, emergent topics and parent behaviours documented. In addition, I recorded my emotional responses to each session in order to separate a more factual description from my interpretation. The notes were extended with quotes and further information after all 64 video tapes had been watched once. Video recording rather than audio recording of sessions provided further insight into parents' emotional responses, such as facial expressions and body language. In addition, video examples from these parent counselling sessions proved to be powerful material that I was able to show, with parents' consent, to school staff and professionals when advocating music therapy as well as parent support.

Data had also been gathered from a one-item visual analogue scale to measure participants' quality of life (see Appendix 4.5). The scale from 0 to 100 is divided into main intervals of ten and auxiliary intervals of five. To assess the quality of life of participants, parents were asked to draw a line on the scale at the number that, in their opinion, reflected the current quality of life of their child most accurately. It had been explained to them that 0 equaled the worst imaginable quality of life and 100 the best imaginable quality of life. The term 'quality of life' was not further defined. This information was requested at baseline (0 months), mid-intervention (2 months), post-intervention (5 months), and at follow-up (12 months) from all 25 families. In total, 74 completed quality-of-life scales were collected.

4.6 Data preparation

The video recordings of music therapy sessions and parent counselling sessions collected during the intervention phase produced very large amounts of data. Before I could start the analyses, data needed to be selected and prepared. This step comprised four elements: Selection of music therapy sessions, selection of excerpts of music therapy sessions, selection of parent counselling sessions, and transcription of parent counselling sessions.

4.6.1 Session selection and excerpt selection of music therapy videos

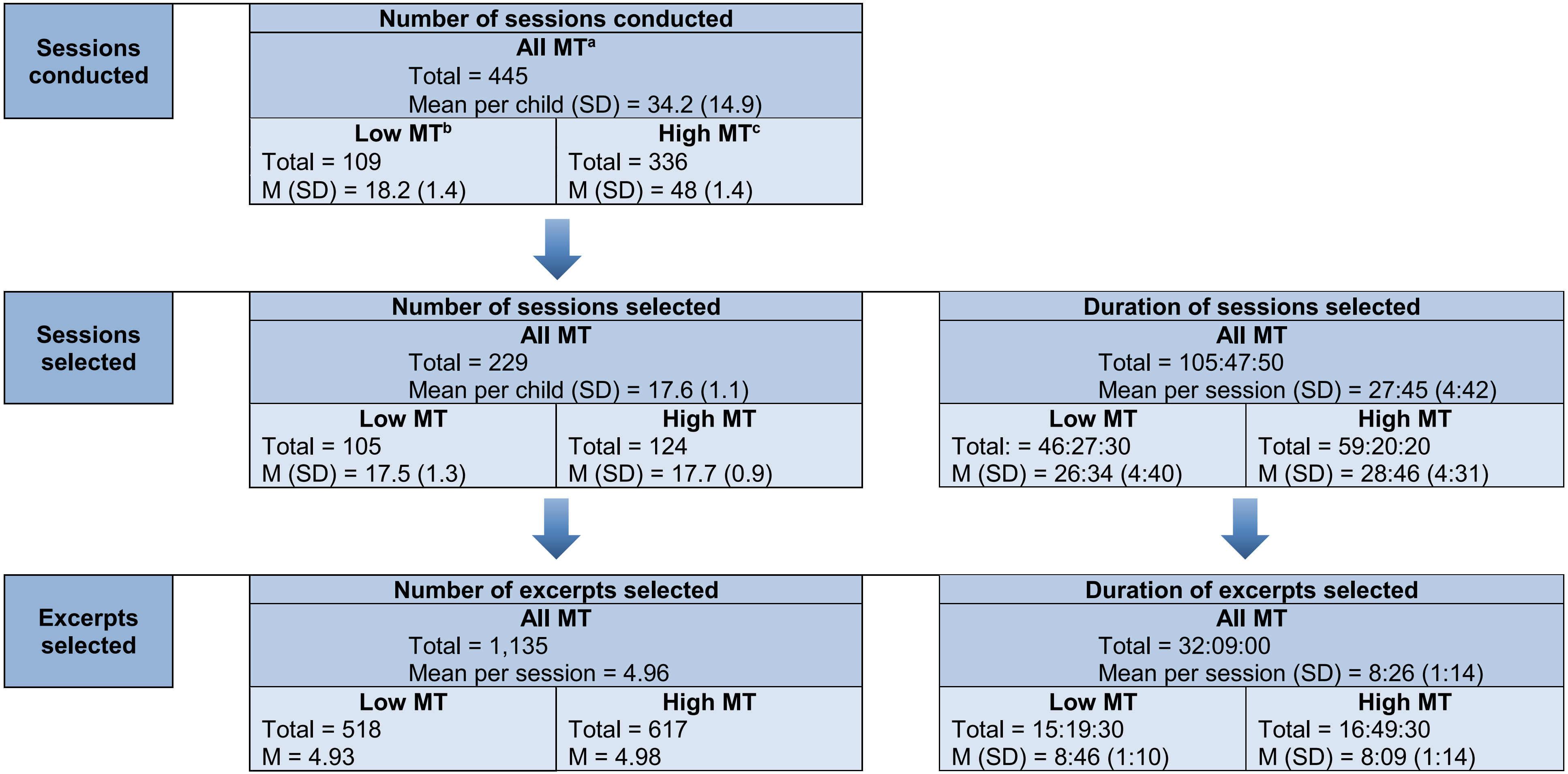
At the end of the intervention phase, I had accumulated more than 200 hours of video material. To ensure feasibility of the research and to enable comparability between the low-intensity and the high-intensity groups, I decided to look at one session per week per child. This meant that all music therapy sessions of the six children who were allocated to the low-intensity group were included. The number of recorded sessions in this group varied between 16 and 19 for each participant, with a mean (M) of 17.5, and a standard deviation (SD) of 1.3, and added up to 105 sessions. The seven children randomised to the high-intensity group received three music therapy sessions a week. To achieve consistency, I selected the second, usually the middle session of the week for analysis. The second session as opposed to the first session was chosen because it better represents the distinctive characteristics of high-intensity treatment. The second as opposed to the third session was chosen because many children only received two sessions in several weeks due to illness, holidays or school events. If only one session was conducted or recorded in a week, this session was included in the analysis. After this selection process, the number of sessions in the high-intensity treatment group varied between 16 and 19 for each participant (M = 17.7, SD = 0.9) and added up to 124 sessions. In total, 229 video-recorded music therapy sessions were included in the analysis. The mean duration of selected sessions was 27 minutes 45 seconds (SD = 4:42).

Once all sessions were selected, I could start with the selection of excerpts. Music therapists interested in the proportion of certain behaviours during a session have analysed whole sessions in their research studies (e.g. Oldfield, 2004; Tomlinson, 2016). For my topic of resilience, however, it was more appropriate to further reduce the data in a systematic way. Rather than eliminating more sessions, I decided to select short excerpts from all selected sessions in order to keep material representing each treatment week. This follows the recommendation by Kalisch et al. (2017) that resilience research should use ‘repeated measurements at high temporal resolution’ (p. 787) to capture the dynamic processes of adaptation characteristic of resilience. Selecting session sequences can be based on time-sampling or event-sampling, depending on the focus of the research. As the aim of my study was to investigate moments in music therapy that foster resilience, it was necessary to take event samples and choose excerpts that contain relevant information related to my research questions.

The selection procedure followed two steps. First, I watched the whole session and simultaneously wrote down the events and activities I observed. Similar to the model presented by De Backer and Wigram (2007), I started with creating an overview of improvisations and activities and their duration in each session. This could read, for example, ‘hello song 0:40-1:50, improvisation on piano 3:10-7:30, movement game with tambourine 8:20-10:40’, et cetera. At the same time, I made notes about the relevance of each session episode to resilience and its suitability for being micro analysed. For each child, individual clinical aims related to resilience were outlined before the start of the selection process. In the second step, I watched the sections that I had identified as significant again and narrowed the selection down to the most pertinent moments according to these individual clinical aims related to resilience. In agreement with most resilience scales for children (e.g. BERS-2, DESSA; for a description of these scales see section 2.2.3.1), I focused on assessing strengths and protective factors. This assessment model reflects the theoretical construct of resilience (e.g. Naglieri, LeBuffe, & Shapiro, 2013) and my music therapy approach. The music therapist Ulla Holck (2007) suggested two approaches informing the data selection: a problem-based analysis approach or an open analysis approach. I chose a different option, a strength-based analysis approach, because professionals in psychology, social work and the arts therapies are increasingly advocating a shift from assessing the reduction of negative behaviour to measuring the increase of desirable behaviour (e.g. Nickerson, 2007; Saleebey, 2008).

To ensure that the excerpt-selection process was transparent and verifiable, I defined the selection criteria to allow for the selection to be repeated at later times and by other music therapists (see Appendix 4.6.1). Four or five excerpts were selected per session. It was a requirement that the selected excerpts include some form of music making, and that the face of the child be visible in order to be able to code eye gaze and facial expression. The minimum and maximum durations of any one excerpt were 30 seconds and 180 seconds, respectively. Any length in between these numbers had to be in intervals of ten seconds (i.e. 40 seconds, 50 seconds, 60 seconds, etc.). The overall length of video material from one session could not exceed ten minutes. Applying these guidelines across all the videos resulted in 1,135 selected excerpts with a mean length of 8 minutes 26 seconds extracted per session and a total duration of 32 hours 9 minutes. The whole procedure took me approximately one hour for each 30-minute session. This rather extensive and time-consuming selection process was an important part of my study, because it generated the central research material. Several authors have highlighted the importance of carefully selecting the material before starting the video analysis (e.g. De Backer & Wigram, 2007; Holck, Oldfield, & Plahl, 2005; Ridder 2007; Wigram 2007). This process of data reduction by selecting sessions and excerpts is illustrated in the following flow chart.

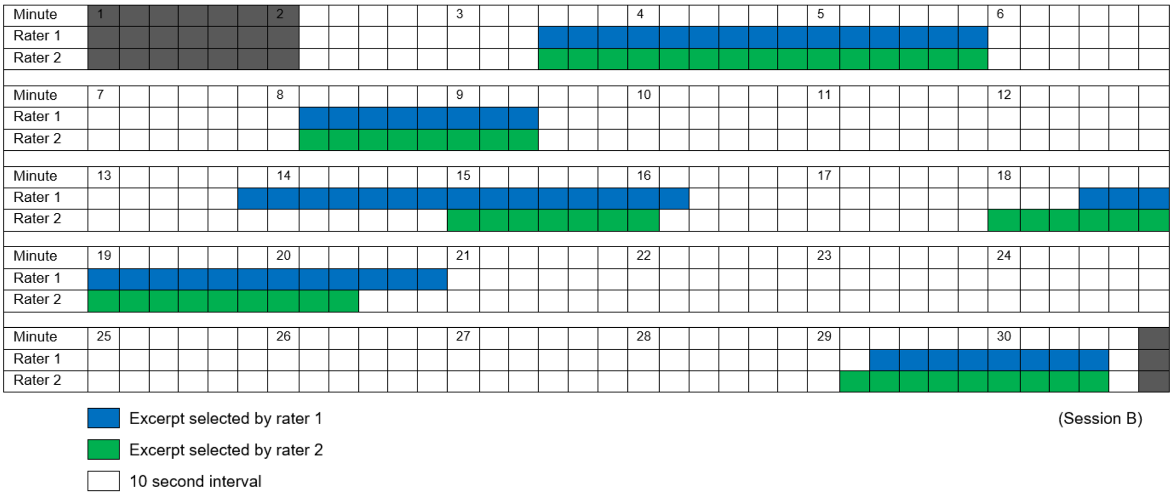
Figure 7: Selection of music therapy sessions and of session excerpts



[a] All 13 children in the music therapy treatment group included in the video analysis
[b] Subgroup of 6 children in the low-intensity treatment group (music therapy sessions once a week)
[c] Subgroup of 7 children in the high-intensity treatment group (music therapy sessions three times a week)

Before I proceeded to select excerpts from all sessions, the system was checked for inter-rater agreement and reliability. An independent and experienced music therapist was asked to apply my selection method to four videos. These four videos were composed of two videos each from a child in the low-intensity and a child in the high-intensity group. It was determined that a minimum of 80% agreement had to be reached. We achieved an agreement rate of 91.3% (Session A: 94.4%, Session B: 90%, Session C: 97.3%, Session D: 84%). Figure 8 shows a visual representation of the inter-rater agreement in Session B.

Figure 8: Inter-rater agreement for excerpt selection



However, when reading the article by Hallgren (2012) I became aware that in addition to calculating agreement it was important also to calculate inter-rater reliability for the selection process to correct for agreements that might have been caused by chance. As marginal distributions suggested prevalence problems, the prevalence-adjusted bias-adjusted kappa by Byrt, Bishop, and Carlin (1993) was chosen. The resulting kappa $\kappa = 0.83$ indicated almost perfect agreement (Landis & Koch, 1977) so that I could proceed to apply my method to all videos.

4.6.2 Session selection and transcription of parent counselling videos

Parents of all children, regardless of their group allocation, were offered three parent counselling sessions each. A total of 68 parent counselling sessions were conducted with 25 families. Most of these sessions (64 out of 68) were videotaped, resulting in 64 hours of video material. To be able to subject the content of these sessions to a thematic analysis, I needed to transcribe them first. It has been emphasised repeatedly that a thorough transcription carried out by the researcher is a crucial part of the analysis and allows familiarisation with the data (e.g. Braun & Clarke, 2006; Lapadat & Lindsay, 1999; Riessman, 1993). A verbatim transcription is very time-consuming, which is why I decided to limit my transcriptions and analysis to a selection of sessions. As I am specifically interested in the effects of counselling sessions offered alongside music therapy, I transcribed 13 sessions conducted with parents of all the children who were randomised to the treatment group and whose session videos were included in the video analysis. To help me with my transcriptions, I utilised the speech recognition software which is in-built in Windows systems. An example of a fully transcribed parent counselling session can be found in the appendix.

Because of time constraints I chose to transcribe only one, namely the second, of the three sessions each family was offered. I believe that using video feedback as a way of sharing positive development of the child with the parents can be beneficial for the families and improve their resilience. The first counselling sessions often centred on providing general information about music therapy, as well as learning about the background and current situation of the child and family. Video feedback did not play a major part here as the first counselling sessions coincided with the beginning of the music therapy treatment. Even though the third meetings usually encompassed extensive video feedback, questions about future treatment possibilities and recommendations proved to be a substantive part of all the final meetings. The second parent counselling sessions were scheduled two months after the beginning of the music therapy intervention and therefore provided ample opportunities to include video feedback. The relationship between parents and counsellor was already established, and thoughts about ending did not yet dominate the conversation.

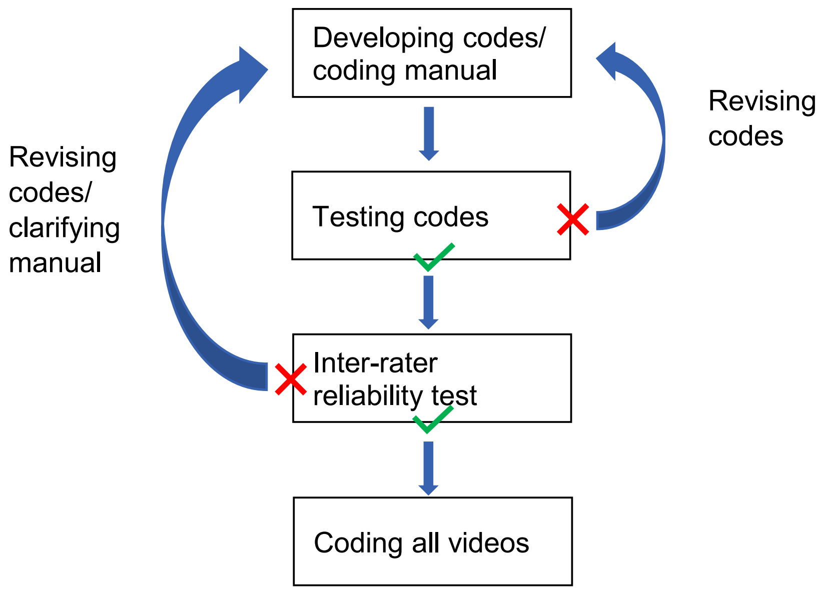
4.7 Data analysis

In this section, I describe the data analysis of music therapy sessions (4.7.1), of parent counselling sessions (4.7.2), and of quality-of-life scales (4.7.3). Video-recorded excerpts of music therapy sessions were analysed using a time-sampling method. This procedure was supported by an annotation software (4.7.1.1). An assessment of the quality of the child-therapist relationship (4.7.1.2) complements the time-sampling analysis. The analytical model with which all the data from music therapy sessions were evaluated is depicted (4.7.1.3). The transcribed parent counselling sessions were investigated using thematic analysis (4.7.2), whereas statistical analyses, including binary analysis and independent sample t-test, were applied to the data from the quality-of-life scales (4.7.3).

4.7.1 Data analysis of music therapy sessions

The selected excerpts from the music therapy sessions were examined using video microanalysis. I used a time-sampling method with a five-second time interval. For every five-second interval, observed behaviour, for which codes had been previously specified, was documented using video annotation software. The software tool is further described in section 4.7.1.1. Designing the coding criteria for the analysis was very important and was done with great care, as the codes determined the focus of observation and analysis. The iterative process included steps of developing, testing and revising the codes. The procedure followed to develop the final coding manual is illustrated in Figure 9.

Figure 9: Development of coding manual



My objective was to find out whether music therapy sessions foster resilience in young children with ASD. Resilience is a multidimensional outcome. It is thus difficult to measure resilience directly or to concretely identify it by observation. ‘Rather than measuring resilience per se, assessments have instead focused on measuring protective factors that predict resilience.’ (Naglieri, LeBuffe, & Ross, 2013, p. 242). Accordingly, the codes used in this study were developed with the aim to detect occurrences of protective factors and behaviours indicative of resilience. These protective factors include self-esteem and confidence in own skills, the ability to recognise own emotions and those of other people, the ability to express oneself, the capacity to manage strong feelings, the ability to relate comfortably to others, the capacity to develop realistic goals and to recover from disappointments (American Psychological Association, 2018; Brooks & Goldstein, 2015; Naglieri, LeBuffe, & Shapiro, 2013). I translated these factors into 17 codes for the children. Most of these codes were applied to video excerpts for all children. Some codes were only relevant for a subgroup, for example the code ‘Talk’ was only used for verbal children. In addition to the codes for children, 12 codes were specified for the therapist. The following tables show all codes that were used in my study. A short description and a longer explanation, including some examples, are given for each code. This detailed description of the coding process ensured that the analysis was comprehensible and repeatable.

Table 2: Codes for children

Code	Short Description	Explanation/Examples
Play	Plays instrument	Child plays instrument independently and with intent, e.g. hits drum or strums guitar.
Asst-Play	Plays instrument with assistance	Child tolerates that the therapist or TA help him or her to play instrument, e.g. by holding and guiding child's hand to strum guitar, play wind-chimes, or use beater on a xylophone.
Vocal	Sings or vocalises (with or without words)	Child uses voice in a musical way and with intent, e.g. vocalises freely without words, hums a melody, or sings a song.
Move	Moves expressively	Child moves expressively, e.g. dances to music, uses movements in an action song, or exaggerates movements in a musical interaction with intent to communicate or express.
Talk	Uses words or word approximations	Child uses words or word approximations to communicate in a non-musical way.
Object	Plays with object	Child plays with an object or several objects in a creative and interactive way, e.g. uses blanket to play hiding games, uses pieces of material to put them on head or arms and shake them off, uses rainbow bells to create shapes on the floor.
Smile	Smiles or laughs	Child smiles, grins, giggles or laughs as an expression of enjoyment.
Look	Looks at or towards therapist	Child looks at or towards therapist's face, e.g. holds eye-contact or reads facial expression of therapist.
Look-TA	Looks at or towards TA	Child looks at or towards TA's face, e.g. holds eye-contact or reads facial expression of TA.
Initiate	Initiates new ideas or change	Child initiates new ideas or elements that change the interaction, e.g. starts playing a new instrument, starts a new game or song, pauses or stops music with intent (not because child gets distracted), changes from plucking to strumming the guitar, or changes the dynamic/tempo/rhythm/style of music with intent. Do not code if the child changes musical elements in a chaotic, frantic way.
Respond	Responds to therapist	Child responds (verbally or non-verbally) to therapist's prompt or invitation, e.g. joins in playing the instrument, follows the therapist's music regarding changes in dynamic/tempo/rhythm/style, adds suspended words of a song, answers a question, or takes offered beater.

Code	Short Description	Explanation/Examples
Engaged	Engaged in interaction	Child is engaged in the musical interaction with therapist. Can be shown through bodily and/or facial direction towards therapist and/or instrument, through focused attention, or through musical and non-musical as well as verbal and non-verbal responses to therapist.
Contact	Initiates physical contact with therapist	Child initiates physical contact with therapist, e.g. hugs therapist, takes therapist's hand, guides therapist to an instrument. Do not code if child hits, kicks or pinches therapist.
Contact-TA	Initiates physical contact with TA	Child initiates physical contact with TA, e.g. hugs TA or holds TA's hand. Do not code if child hits, kicks or pinches TA.
Fidget	Fidgety or stereotypical behaviour	Child fidgets, displays repetitive, non-communicative, stereotypical behaviour, e.g. flaps hands, spins the cymbal, mouths beaters, or covers ears to block out sound but without signs of anxiety.
Anxiety	Anxious behaviour	Child shows anxious, nervous or controlling behaviour, e.g. cries, screams, freezes, tries to leave therapy room, throws instruments, hits or kicks or pinches therapist.
Out	Not visible	Child's face or whole body is not visible on camera so that it is impossible to code 'Smile' or 'Look'.

Table 3: Codes for therapist

Code	Short Description	Explanation/Examples
T-Play	Plays instrument	Therapist plays instrument with intent, e.g. plays piano or shakes ocean-drum.
T-Vocal	Sings or vocalises (with or without words)	Therapist uses voice in a musical way and with intent, e.g. vocalises freely without words, hums a melody, or sings a song.
T-Move	Moves expressively	Therapist moves expressively, e.g. dances to music, uses movements in an action song, or exaggerates movements in a musical interaction with intent to engage child and to interact with child.
T-Talk	Uses words	Therapist uses words to talk and communicate with child without using a melody or musical phrases.
T-Object	Plays with object	Therapist uses an object or several objects to engage child, e.g. uses blanket to play hiding games, uses pieces of material in action songs, or uses rainbow bells to create shapes on the floor.
T-Smile	Smiles or laughs	Therapist smiles, grins, giggles or laughs as an expression of enjoyment.
T-Look	Looks at or towards child	Therapist looks at or towards child's face, e.g. holds eye-contact or reads facial expression of child.
T-Initiate	Initiates new ideas or change	Therapist initiates new ideas or elements that change the interaction, e.g. starts playing a new instrument, starts a new game or song, pauses or stops music with intent, changes from plucking to strumming the guitar, or changes the dynamic/tempo/rhythm/style of music.
T-Name	Uses name of child	Therapist says or sings the name of the child.
T-Praise	Praises child	Therapist praises or encourages child, e.g. by saying 'well done' or by applauding.
T-Contact	Initiates physical contact with child	Therapist initiates physical contact with child to help the child play an instrument, to calm and reassure a child, or to help the child focus on the interaction. Examples: Therapist holds child's hand to guide it along the guitar strings, therapist strokes child's arm to console him or her when child seems anxious, therapist touches child's shoulder while calling his or her name to help child to focus the attention on interaction with therapist.
T-Out	Not visible	Therapist's face or whole body is not visible on camera so that it is impossible to code 'T-Smile' or 'T-Look'.

Applying the time-sampling analysis method and these codes to the selected video excerpts allowed me to measure the percentage of certain behaviours that suggest the presence of protective factors and of an increased likelihood of resilience. The proportion of these behaviours was ascertained for the therapy sequences that seemed to be especially important to foster and further resilience in the children. Thereby, I could determine whether the child showed behaviour indicative of resilience during these moments and which behaviours were most prominent. Comparing the percentage of behaviours over time, I could further find out whether certain behaviours increased or decreased during the five-month therapy. In a similar way, the analysis measured the behaviour of the therapist. The results of this analysis are presented in section 5.2.2.

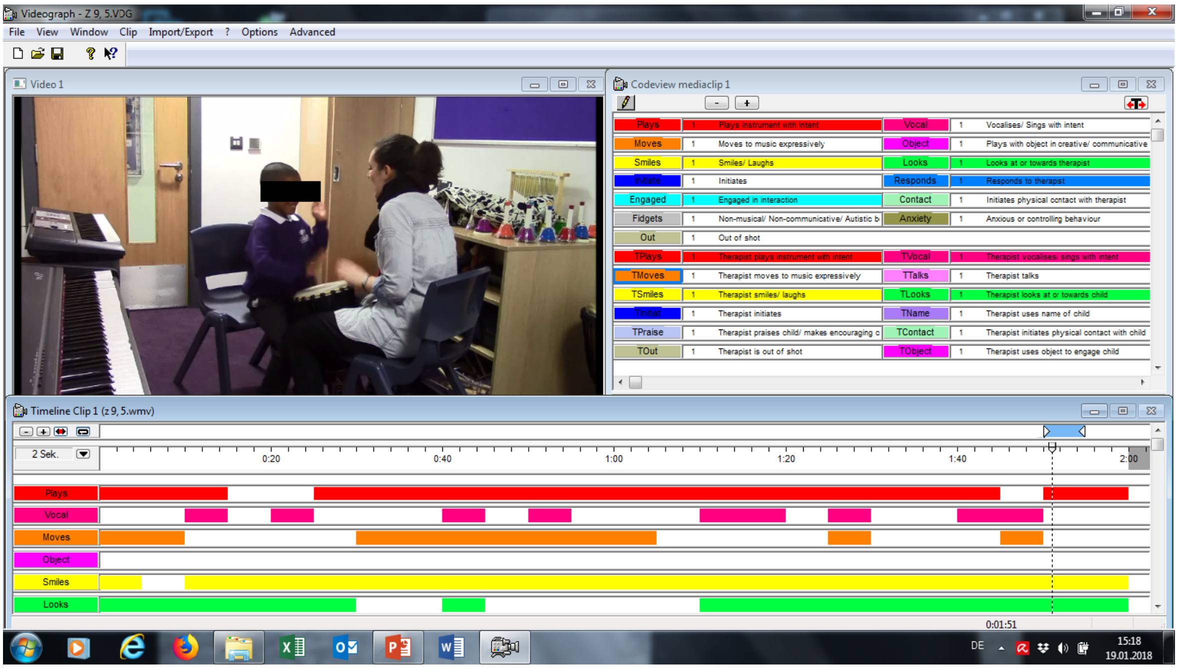
After I had finished coding the excerpts of two children, a music therapist was asked to check my system for consistency. She used my coding manual to analyse four of the excerpts that I had completed. Two of the four excerpts were randomly selected from a child receiving low-intensity music therapy, the other two excerpts were randomly taken from a child in the high-intensity treatment group. We were aiming for a minimum of 80% agreement. Before the second rating started, I trained the therapist in my coding system using one practice excerpt. The high percentage of 96.5% that we achieved as the inter-rater agreement (Excerpt A: 97.6%, Excerpt B: 92.2%, Excerpt C: 98.2%, Excerpt D: 98.1%) suggested that the coding manual was sufficiently clear and unambiguous. Inter-rater reliability for the video analysis was also calculated to correct for agreements that were caused by chance (Hallgren, 2012). The variant by Byrt, Bishop, and Carlin (1993) of Cohen's kappa was considered the most appropriate variant and statistic because marginal distributions indicated prevalence problems. The kappa value of $\kappa = 0.93$ indicated almost perfect agreement (Landis & Koch, 1977).

4.7.1.1 Video annotation software

Until recently it was common for music therapy researchers using time-sampling video analysis to work with playback software and a separate marking sheet (e.g. Tomlinson, 2016). This method is time-consuming as the video has to be paused manually after each five-second interval. Similarly, it must be rewound manually to the beginning of a five-second interval for the rater to be able to watch the interval again. A separate (analogue or digital) marking-sheet can be a potential source of errors if the data are later transferred manually to a statistics programme. This method is thus only suitable if the data set that needs to be analysed is relatively small. Tomlinson (2016), for example, subjected 16 video-recorded music therapy sessions of 20-25 minutes each to the time-sampling analysis. This amounted to approximately six hours of recorded material that was analysed using the time-sampling method. For my study, excerpts from 229 music therapy sessions with a total length of more than 32 hours were included in the video analysis. The traditional method did not seem feasible for this quantity of video material and I decided to investigate the possibilities of working with video annotation software to assist me in the coding process.

Having investigated four software programmes (Anvil, BORIS, Datavyu, Observer XT) and dismissed them because of lacking features, security concerns or high price, I came across Videograph, a multimedia player initially developed by Rimmele (2017) to analyse teaching practices. The programme is flexible, easy to use, and instructions are available in English and German. Videograph allows the researcher to do event-sampling as well as time-sampling, and to construct observation categories and coding variables as needed. The process of time-sampling analysis is facilitated through individually adjustable time segments and automated loops which accelerate and ease the time-consuming annotation. A simultaneous graphic representation of the coding data allows for an easy revision of the coding accuracy. The data can be transferred for statistical calculations to an external file format, including tab-delimited text format. This offers the researcher the possibility to work with the data in any chosen statistical, word processing or spreadsheet programme. Figure 10 gives an example of the Videograph workspace, including the window for the media file, the coding window and the timeline window.

Figure 10: Videograph workspace



4.7.1.2 Assessment of child-therapist relationship

While I was conducting the time-sampling analysis, I realised that one aspect I was interested in was not sufficiently represented by my coding system. Many resilience researchers have highlighted that having caring and supportive relationships with adults is one of the key protective factors for developing resilience (e.g. American Psychological Association, 2018; Luthar, 2006; Masten et al., 1990). My hypothesis was that individual music therapy sessions could provide autistic children with the experience of such a positive relationship with the music therapist and thereby foster resilience. My coding manual focused on aspects of the child-therapist relationship, measured by codes such as 'Look' or 'Respond', but it did not seem to pick up the overall quality of the relationship satisfactorily. It also seemed that simply adding more codes would not solve the issue, but that an additional measurement tool was necessary. This tool needed to provide an assessment of the child-therapist relationship with reference to the behaviour of the child. It should rate the relationship considering the emotional state of the child, the child's ability to participate in reciprocal musical interactions, and the child's ways of relating to the therapist to get an overall picture of the quality of relationship. Furthermore, the assessment tool needed to be user-friendly and quickly and simply implementable as the other analyses applied in the research study were already too time-consuming for another tool of similar complexity to be added.

A literature search disclosed three available assessment tools that focus on measuring the therapist-client relationship and are applicable to my client group. These are the Assessment of the Quality of Relationship (AQR; Schumacher & Calvet, 2007), the Nordoff-Robbins-Scale I: Child-Therapist Relationship in Coactive Musical Experience (Nordoff & Robbins, 1977), and the Music Therapy Session Assessment Scale (MT-SAS; Raglio et al., 2017). The AQR aims to assess and comprehensively classify the quality of the interpersonal relationship. Four different scales with seven or eight levels each focus on the instrumental quality of relationship, the vocal-pre-speech quality of relationship, the physical-emotional quality of relationship, and the therapeutic quality of relationship. The AQR is a microanalysis method that requires familiarisation and extensive training. It is based on a different music therapy approach which, for example, utilises special equipment, such as hammocks and trampolines, that I could not use in my study. It was thus not suitable as an additional assessment tool in my study. The Nordoff-Robbins-Scale I is a similarly elaborate measurement tool, which proved to be too extensive for the purpose of this study. It distinguishes seven levels of participation and seven levels of resistance and provides detailed rating criteria for each level. The structure of the MT-SAS, on the other hand, matches the needs for this study very well. Seven behaviours in the domains of countenance, non-verbal communication, and sound-music communication are rated as predominantly absent or predominantly present, which results in a total score that conveys an overall impression of the relationship. Each item is defined in a succinct way. However, the seven items had too many overlaps with my coding manual (for example eye-contact, smiles, or anxiety) and the scale was thus not going to provide me with the additional information about the child-therapist relationship I was interested in.

After the review of the existing scales I decided to design a new bespoke assessment tool which I call Assessment of Child-Therapist Relationship (ACTR). The MT-SAS was an inspiration for me to use a similarly clear structure and the concise descriptions. The Nordoff-Robbins-Scale was helpful because it provided a comprehensive understanding of the interpersonal child-therapist relationship in a coactive musical experience. Furthermore, I adopted their format of a hierarchical scale but reduced their seven levels to five. I did this for two reasons. First, the two lowest levels could be collapsed in my assessment tool as the excerpts that were to be rated comprised positive moments of the sessions, making it unnecessary to distinguish between different expressions of anxiety and rejection. Second, the Nordoff-Robbins-Scale I was designed to be used for whole sessions. I only rated short session segments that did not require the same detailed distinctions between different nuances, because the displayed behaviour and observed relationship was usually not as multifaceted as during a whole session.

The ACTR provides five ranks that describe the quality of relationship as 1 = difficult, 2 = slightly difficult, 3 = moderate, 4 = positive, 5 = very positive. Each level is defined by three descriptions about (a) the child's emotional state and way of being in the room, (b) the child's ability to engage in reciprocal musical interactions, and (c) the child's ways of relating to the therapist. The assessment manual and the blank rating form are shown in Figures 11 and 12, respectively. The completed rating forms can be found in the appendix. In this study, I rated each excerpt with one level. As I had selected four or five excerpts per session, the relationship rating resulted in four to five numbers per session. I calculated the mean of these numbers for each session, which allowed me to look at the development of the relationship mean scores for each child over the course of the 20-week therapy. Results of the ACTR analysis are presented in section 5.2.3.

Figure 11: ACTR manual

Assessment of Child-Therapist Relationship (ACTR)

5 = very positive	(a) Child feels secure and confident. (b) Child is able to be both responsive to the therapist and in charge of the interaction. Child is able to be creative, to use humour, to share emotions and to swap roles with therapist. (c) Child seems to enjoy interacting with therapist and initiates communication. The relationship is characterised by mutuality and a sense of partnership.
4 = positive	(a) Child appears relaxed and comfortable, shows no signs of distress. (b) Child is actively involved in music making. Child engages in turn-taking activities and responds to most prompts and musical suggestions. (c) Child seems interested in interacting with therapist.
3 = moderate	(a) Child appears mainly relaxed and comfortable, generally at ease in therapy situation. (b) Child participates in musical activities and responds to some prompts or musical suggestions. Child may only be attentive for short periods of time so that meaningful interactions only occur occasionally. (c) Child tolerates therapist and seems somewhat interested in interacting with therapist.
2 = slightly difficult	(a) Child seems uncertain, wary and uneasy. When approached too directly by therapist child might become anxious, distressed or withdrawn. (b) Child responds reluctantly or with resistance to musical invitations. Child's involvement in interaction can be evoked by interesting or matching music but is intermittent and fleeting. (c) Child might accept therapist when interaction is on child's terms but is mainly unresponsive to therapist
1 = difficult	(a) Child appears anxious, distressed or withdrawn. (b) Child's engagement in musical interactions is prevented by being cut-off or isolated, or by reactions of panic, rage or rejection (such as pushing or throwing instruments). (c) Child seems to be completely oblivious of therapist or child tries to actively block out and reject therapist by screaming, kicking, hitting or turning away.

(a) Child's emotional state and way of being in the room
(b) Child's ability to engage in reciprocal musical interactions
(c) Child's way of relating to the therapist

Figure 12: ACTR rating form

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																				
2																				
3																				
4																				
5																				
Ø																				

Before I carried out the ACTR on all excerpts, inter-rater reliability was checked. The test was conducted on four sessions of five excerpts each, resulting in 20 excerpts. Two sessions each had been selected from two different children. For both children, one session was randomly picked from the first five, and one session from the last five therapy sessions of the child's treatment because I speculated that this would result in a broader spectrum of the observed quality of relationship. As I had conducted the therapy sessions myself, I could not be blinded to the phase of the treatment period. The music therapist who carried out the second rating, however, applied the ACTR without knowing any details about the chronological order of the session excerpts. We obtained an exact agreement in 12 out of 20 excerpts. In all the remaining eight excerpts, our ratings differed by only one point (e.g. Rater A and B chose 4 = positive and 5 = very positive, respectively). As the data are measured on a continuous rather than a categorical scale, inter-rater reliability was assessed using intraclass correlation (ICC). To determine whether the two raters provided scores that were similar in absolute value, a two-way random-effects, absolute-agreement, single-measures ICC (McGraw & Wong, 1996), also called ICC 2,1 (Shrout & Fleiss, 1979), was chosen. The ICC estimate was 0.87 with a 95% confidence interval of 0.70-0.95, indicating good to excellent reliability (Koo & Li, 2016).

4.7.1.3 Analytical model: Generalised linear mixed model

Once I had decided how to code the video material and how to document the data, I approached a statistician and statistically adept researchers to get advice regarding the statistical analysis that would be most suited to my research questions and my data set. The analysis of music therapy session videos was supposed to answer my research subquestions 2-4, as outlined in the introductory chapter, which are:

- Do music therapy sessions increase behaviours indicative of resilience in young children with ASD?
- Does different treatment intensity result in different increase or decrease in behaviours indicative of resilience?
- Does verbal ability of children influence increase or decrease in behaviours indicative of resilience?

Therefore, the statistical analysis needed to provide answers to the following three questions:

1) Does the relative frequency of each target behaviour change over the course of the 20-week therapy?
2) Does the relative frequency of each target behaviour differ between children receiving low- and high-intensity therapy?
3) Does the relative frequency of each target behaviour differ between verbal and non-verbal children?

I decided to use a generalised linear mixed model (GLMM; McCullagh & Nelder, 1989). GLMMs are extensions of the more traditional statistical techniques, such as ANOVA or regression, and provide more flexibility regarding the data and designs that can be studied. GLMMs 'enhance our options to gain insight into what our data reveal' (Mundry, 2017). As far as I have been able to find out, GLMMs have not been used by music therapists. However, in other research fields relevant to music therapy, such as medicine (e.g. Yarkiner, Hunter, O'Neil, & de Lusignan, 2013), psychology (e.g. Andersen et al., 2016), and occupational therapy (e.g. Piek et al., 2015), GLMMs are already used more routinely. GLMMs are especially suited to analyse longitudinal data and 'this methodological approach is a useful and appropriate mechanism for investigating dynamic relationships within health-related data' (Yarkiner et al., 2013, p. 1). I chose GLMM because it allowed me to investigate all three questions in a single analysis. This was very important, because the ability to model all three effects at the same time meant that I could use the entire data set. There was no need to split the data set, which would have caused loss of information and power. A GLMM enabled me to combine the continuous and categorical predictor variables into one analysis. Furthermore, the model provided the possibility to model non-linear effects.

Linear models in general model a single response as a function of predictor variables. The response variables in this study are the pre-determined target behaviours. Each behaviour was expressed as a proportion of observations in which the behaviour was present relative to the session-excerpt length. Table 4 lists the eleven different response variables (target behaviours), specifies the individual coding variables that comprise each response variable, and names the protective factors which the response variables represent. The relative frequency of behaviour was modelled as a function of three predictor variables that were determined by the three questions listed above. The predictor variables were:

1) Session number
2) Therapy intensity
3) Verbal ability

Session number is a continuous, quantitative predictor variable which was coded from one to 20. It is unlikely that the responses to session number are always linear. Children do not usually respond to more therapy sessions with a linear improvement in a specific behaviour. They often develop in a more irregular way with sudden improvements, slow progress, and plateaus in their developments all being observable at different times with different children. To account for this in the model, I also included ‘session number^2’ as a predictor variable. Anticipated effects of the predictor variable ‘session number’ on each response variable, and explanations for the anticipated effects, can be found in Table 4. Both ‘therapy intensity’ and ‘verbal ability’ are categorical predictor variables, with the factor low/high and the factor yes/no, respectively. No separate tables were designed for the predictor variables ‘therapy intensity’ and ‘verbal ability’ because the anticipated effect of these categorical predictors on all response variables was likely to differ and thus determined ‘not consistent’.

Table 4: Anticipated effects of predictor ‘session number’ on response variables

Response variable	**Composed of codes**	**Representing protective factors**	**Anticipated effect**	**Explanation**
Play total	Play, Asst-Play	Ability to express emotions Goal-directed behaviour Self-efficacy	Not consistent	Different aims for children. While some children were encouraged to play more, others who might have masked anxiety by frantic playing were helped to relax and listen.
Vocal	Vocal	Ability to express emotions Goal-directed behaviour Self-efficacy	Positive	Children were encouraged to use their voice more often to express themselves and to communicate.
Move	Move	Ability to express emotions Goal-directed behaviour Self-efficacy	Not consistent	Different aims for children. While some children were encouraged to move more, others who might have been hyperactive were helped to relax and control their movements.
Expression	Play, Asst-Play, Talk, Vocal, Move, Object	Ability to express emotions Goal-directed behaviour Self-efficacy	Positive	Children were encouraged to express themselves.

Response variable	**Composed of codes**	**Representing protective factors**	**Anticipated effect**	**Explanation**
Smile	Smile	Ability to express emotions Reaching out to others	Positive	I hypothesised that children developed a positive relationship with the therapist and enjoyed music making and interacting more.
Look total	Look, Look-TA	Awareness of others Reaching out to others	Positive	I hypothesised that children developed a greater interest in the therapist and TA and in communicating with them.
Initiate	Initiate	Goal-directed behaviour Self-efficacy Reaching out to others	Positive	I hypothesised that children gained confidence and initiated new ideas more often.
Respond	Respond	Awareness of others Reaching out to others	Positive	I hypothesised that children developed more awareness of the therapist and were more likely to respond to her.
Engaged	Engaged	Goal-directed behaviour	Positive	I hypothesised that children developed more interest in mutual activities and were more able to focus in interactions for longer.
Contact total	Contact, Contact-TA	Ability to regulate emotions Reaching out to others	Not consistent	Different reasons for initiating physical contact. While some children expressed their trust or affection with hugs or taking the therapist's hand, others sought physical closeness when they were anxious.
Difficulty	Fidget, Anxiety	Ability to regulate emotions Impulse control	Negative	Children were helped to channel repetitive behaviour into more expressive and communicative behaviour, and to find more appropriate ways to regulate emotions. I hypothesised that children felt more comfortable and less anxious.

For each of the eleven target behaviours I fitted a separate GLMM with the proportion of the target behaviour as a response. Depending on the characteristics of the variable, Gaussian error distribution with identity link function or beta probability distribution were used (see 5.2.2.1 for a detailed description of this process). I included the three predictors ‘session number’, ‘therapy type’, and ‘verbal ability’ as test predictors (Mundry, 2014) into the model. With a GLMM I was able to control for the fact that there are differences between individuals. Children are likely to differ in their response to the therapy and to account for this in the research model, I needed to include child-ID as a random effect. Specifically, I modelled individual differences by including random intercept and random slope:

1) Children are likely to start at different levels, for example the proportion of playing instruments or the proportion of initiating interactions at baseline varies from child to child. To account for this in the research model, I needed to include a random intercept for each child.
2) Children are likely to differ in how they respond to the treatment, for example some might show strong and others weak changes, or they might show an increase or a decrease in the display of certain behaviours. To account for this in the GLMM, I needed to include a random slope for ‘session number’ and for ‘session number^2’ in child-ID (Barr, Levy, Scheepers, & Tily, 2013; Schielzeth & Forstmeier, 2009).

I included individual child-ID as a random effect, consisting of random intercept and random slope. Thereby I controlled for the non-independence of data points from each child. As my data set included repeated observations of the same children (longitudinal data), it was obligatory to account for this. Including child-ID as a random effect meant that I looked at changes and progress made by individual children and related that back to their starting point rather than expecting all children to reach a certain developmental outcome. My research question focuses on the within-subjects predictor. The random effect controls for variation between children with regard to their average response. Ignoring this effect may lead to power loss and erroneously non-significant findings (Mundry, 2017). The model included random intercepts (difference of individual starting points), random slopes (difference in individual response to music therapy treatment), and the interaction between both. The full model was:

Proportion of behaviour ~ session number + session number^2 + therapy intensity + verbal ability + (1 + session number + session number^2 | child-ID).

All the analyses were implemented in R version 3.5.0 (R Core Team, 2018). Although most quantitative research studies in music therapy have used SPSS, I chose R because it allows the researcher to process, analyse and plot the data using only one software programme. R is free and open-source, which means that its functions are transparent, and that researchers are able to always use R independently of what their institutions might provide.

To learn and use R, I received guidance from a team of statisticians and researchers based at the Max Planck Institute for Evolutionary Anthropology in Leipzig, as they have ample experience with R. The full R script including codes for data cleansing, model implementation and data plotting is added to this thesis (Appendix 4.7.1.3). All models were fitted with the R function 'lmer' of the R package 'lme4' version 1.1-11 (Bates, Mächler, Bolker, & Walker, 2015). I carried out all the tests needed in rigorous quantitative research. To test the significance of the fixed effects as a whole, I compared the fit of the full model with that of a null model lacking all test predictors but comprising the same random-effects structure as the full model (Forstmeier & Schielzeth, 2011) using a likelihood ratio test (Dobson & Barnett, 2008). Model stability was assessed by comparing the estimates of the model based on all the data, compared to models based on data excluding children one at a time. The model was stable regarding the effects of all significant predictors.

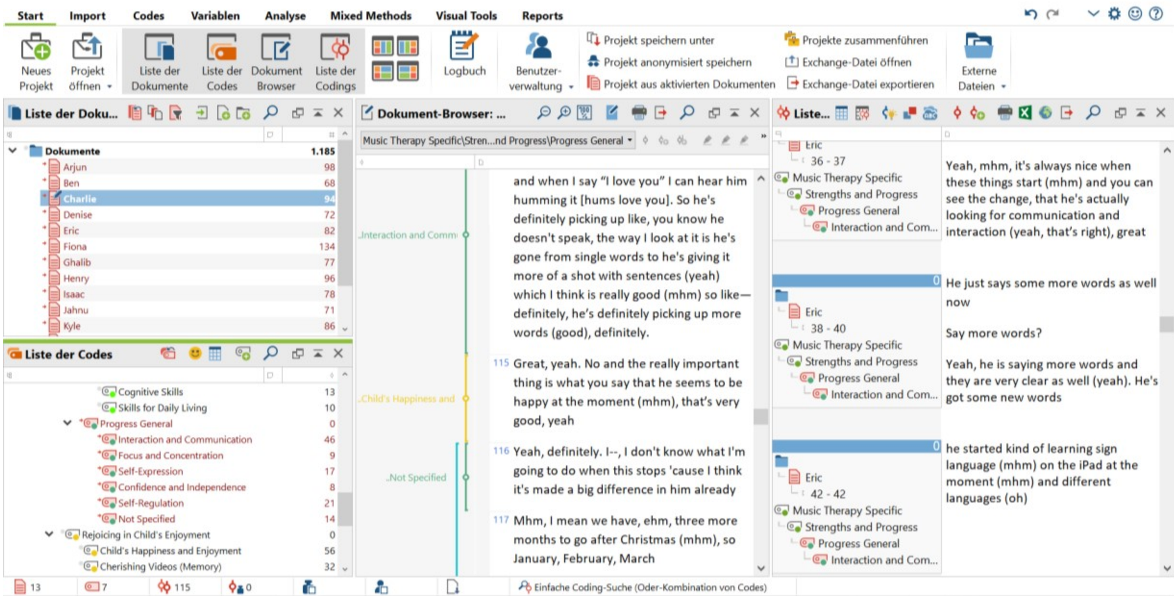
4.7.2 Data analysis of parent counselling sessions

One objective of my research was to explore the effects of parent counselling sessions offered alongside music therapy sessions on the resilience of young children with ASD and their families. As discussed above, literature in music therapy that examines simultaneous but separate treatment of child and parent remains scarce, and no research investigating the effects of the clinical approach applied in this study has been undertaken so far. Hence, little is known about the views of the participants. I felt it was important to analyse the data of the parent counselling sessions with a method that provides a detailed description of the data set and thereby enables a first understanding of the participants' thoughts. Thematic analysis has been deemed especially suitable for such unexplored research topics (Manning & Kunkel, 2014) as it involves identifying repeated and prominent patterns of meaning across a data set (Braun & Clarke, 2006). Boyatzis (1998) has called thematic analysis 'a way of seeing' (p. 1) and explained that the method helps to systematically analyse information which increases the researcher's 'accuracy or sensitivity in understanding and interpreting observations about people, events, situations, and organizations' (p. 5). To gain insight into the opinions of parents regarding my research question, thematic analysis was chosen as the most fitting method.

Thematic analysis is sometimes described as one method of, or even equated with, qualitative content analysis (e.g. Schreier, 2014). It was developed out of quantitative content analysis in the second half of the 20th century as a response to the observed need 'to expand and refine interpretive methods that could explore complex phenomena in naturalistic environments' (Hoskyns, 2016, p. 563). While some authors place thematic analysis more within a realist framework (e.g. Roulston, 2001), others link the method more to a constructivist paradigm (e.g. Hoskyns, 2016). Most researchers, however, emphasise the epistemological flexibility and independence of thematic analysis (e.g. Braun & Clarke, 2006; Guest, MacQueen, & Namey, 2012), and even highlight that thematic analysis can be used as a methodological bridge assisting the communication between researchers from different research traditions (Boyatzis, 1998). It can thus also be integrated well into research studies using a mixed methods design.

I based the analysis of data from the parent counselling sessions upon the six phases of thematic analysis outlined by Braun and Clarke (2006), which are 1) Familiarising yourself with the data, 2) Generating initial codes, 3) Searching for themes, 4) Reviewing themes, 5) Defining and naming themes, and 6) Producing the report. As I had conducted the parent counselling sessions myself, I already had some knowledge of the material before I started with the analysis. The transcription furthered my understanding and repeated reading of the transcribed sessions helped me to become more familiar with the data. I then coded extracts of the text using the computer-assisted qualitative data-analysis software MAXQDA (2018). The advantages of using computer-assisted qualitative data-analysis software for music therapy researchers have been summarised by Baker (2016) and include a more efficient process of organising, coding and revisiting data. The following figure shows the workspace of the annotation software used, including windows with a list of documents, a list of codes, an extract from one document, and a list of coded excerpts.

Figure 13: MAXQDA workspace



After I had coded the whole material, I tried to group the codes together, to find patterns and ascertain overarching themes. The iterative process of testing and reviewing the themes was complemented by re-reading the entire data set one more time before I defined and named the final themes and subthemes. As my study was concerned with an area which is under-researched, I aimed to give a comprehensive description of the data set and define themes that reflect the entire data set as opposed to just one aspect of it. For the same reason, I applied a data-driven inductive analysis trying to develop themes without fitting them to pre-existing theories. However, as Braun and Clarke (2006) point out, a researcher is never completely free from assumptions, and my professional as well as personal experiences, my training and my reading will have had an influence on my decisions while applying this interpretative analysis method. Results of the thematic analysis are presented in section 5.3.

4.7.3 Data analysis of quality-of-life scales

My last research subquestion was whether quality of life of young children with ASD develops differently in children receiving music therapy compared to children in a control group. One of the secondary outcomes investigated in the TIME-A study was evaluated through a scale measuring the quality of life of participants. Being only a secondary outcome, no emphasis was placed in the TIME-A report on analysing and discussing the results generated by this scale. As quality of life is closely related to and highly relevant for resilience (e.g. Lawford & Eiser, 2001), I decided to explore this available data set for my participants in more depth.

Quantitative methods have been used to analyse the data collected with the quality-of-life scales. In order to assess quality of life of participants, parents were asked at baseline, after two months, after five months, and after 12 months to mark the number on a scale from 0 to 100 that, in their opinion, reflected the current quality of life of their child most accurately. Analysing these data has allowed me some insight into the development of participants' quality of life over time as perceived by parents. Mean scores of the treatment and the control groups were compared and the development of mean scores of the low-intensity therapy group, the high-intensity therapy group and the control group examined. In addition, a binary analysis of positive response rates was carried out. To investigate the data further, I ran an independent-samples t-test on the difference scores. The results of the statistical analyses conducted with the data from quality-of-life scales can be found in section 5.4.

4.8 Summary of the methodology

Different aspects of my methodology were presented in this chapter. First, I outlined the methodological background of my research, which was influenced and inspired by my involvement in the international RCT TIME-A. Before I discussed ethical considerations important for my study, I delineated my study design. Further sections were concerned with the different stages of my research, i.e. the selection of participants and their allocation to different treatment conditions, the data collection, data preparation, and data analysis. Some elements of my research methodology have been applied successfully in previous music therapy research studies. These approved methods include time-sampling video analysis used for music therapy videos, and thematic analysis that I used for transcribed parent counselling sessions. Other aspects of my research methodology were novel to music therapy research. The video annotation software Videograph has, to my knowledge, not been used by music therapy researchers before. Furthermore, I presented a new assessment tool, the ACTR, which I developed for this research study. Adopting the analytical model GLMM for my statistical analysis was encouraged by the current general shift in several research disciplines towards this method. I thereby hope to introduce statistical cutting-edge methods to music therapy which will enhance our ability to understand and interpret the rich data we collect.

CHAPTER FIVE
RESULTS

This chapter is organised in four main parts. In the first section, the participant data that were collected at baseline are presented (5.1). After that, the key findings related to the music therapy sessions (5.2), to the parent counselling sessions (5.3), and to the quality-of-life scales (5.4) are reported.

5.1 Results: Baseline characteristics

Demographic data of all 25 participants were collected at baseline. These data are provided in the following table, which also lists the characteristics of the children in the music therapy treatment group. The column presenting the data of the music therapy group is divided to specify numbers and percentages for the whole music therapy group (13 children), for the subgroup of children receiving low-intensity music therapy (6 children), and for the subgroup of children receiving high-intensity music therapy (7 children). The data were collected as part of the TIME-A study which determined the use of the diagnostic assessment tools Autism Diagnostic Observation Schedule (ADOS) and Social Responsiveness Scale (SRS).

Table 5: Baseline characteristics

	All children (N = 25)	**Music therapy group (n = 13)**		
		Low + High (n = 13)	Low-intensity (n = 6)	High-intensity (n = 7)
	No (%)	No (%)	No (%)	No (%)
Sex				
Male	21 (84)	10 (76.9)	4 (66.7)	6 (85.7)
Female	4 (16)	3 (23.1)	2 (33.3)	1 (14.3)
School				
Special school	20 (80)	10 (76.9)	5 (83.3)	5 (71.4)
Mainstream school	5 (20)	3 (23.1)	1 (16.7)	2 (28.6)
Verbal ability				
Verbal	12 (48)	7 (53.8)	4 (66.7)	3 (42.9)
Non-verbal	13 (52)	6 (46.2)	2 (33.3)	4 (57.1)
IQ[a]				
> 70	9 (36)	6 (46.2)	4 (66.7)	2 (28.6
≤ 70	16 (64)	7 (53.8)	2 (33.3)	5 (71.4)
ADOS module				
Module 1	22 (88)	11 (84.6)	4 (66.7)	7 (100)
Module 2	3 (12)	2 (15.4)	2 (33.3)	0 (0)

	All children (N = 25)		Music therapy group (n = 13)					
			Low + High (n = 13)		Low-intensity (n = 6)		High-intensity (n = 7)	
	No	(%)	No	(%)	No	(%)	No	(%)
SRS range[b]								
Severe range	22	(91.7)	11	(91.7)	6	(100)	5	(83.3)
Moderate range	2	(8.3)	1	(8.3)	0	(0)	1	(16.7)
Ethnicity								
White British	12	(48)	4	(30.8)	2	(33.3)	2	(28.6)
Other	13	(52)	9	(69.2)	4	(66.7)	5	(71.4)
Family								
Two parents	15	(60)	6	(46.2)	4	(66.7)	2	(28.6)
Single parent	6	(24)	4	(30.8)	2	(33.3)	2	(28.6)
Foster family	4	(16)	3	(23.1)	0	(0)	3	(42.9)

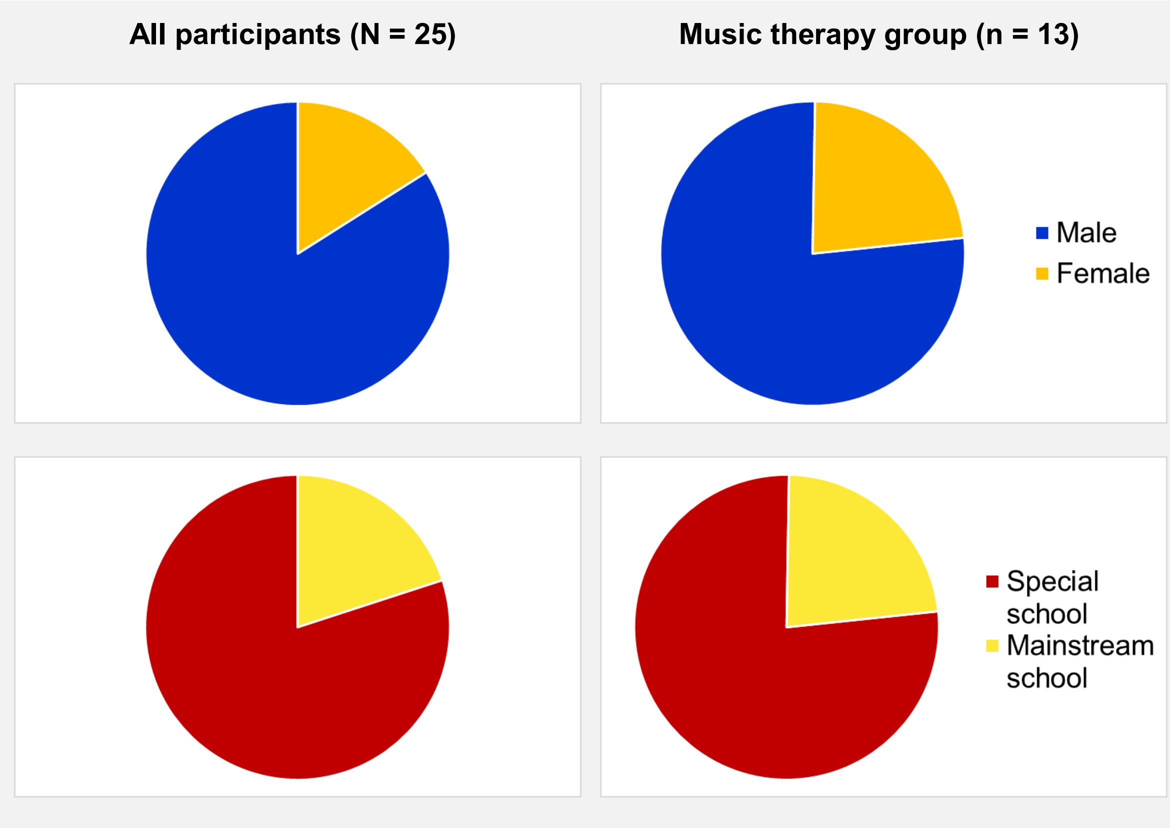
Abbreviations: ADOS, Autism Diagnostic Observation Schedule; High, High-intensity music therapy treatment group (three sessions each week); Low, Low-intensity music therapy treatment group (one session each week); No, Number; SRS, Social Responsiveness Scale

[a] No quantitative IQ assessment was conducted, only a categorical clinical judgment whether a learning disability (IQ ≤ 70) was present

[b] The SRS of one child in the music therapy treatment group (high-intensity) could not be scored because too many item responses were missing. As a result, sample sizes for SRS range are N = 24 for all children and n = 12 for the music therapy group.

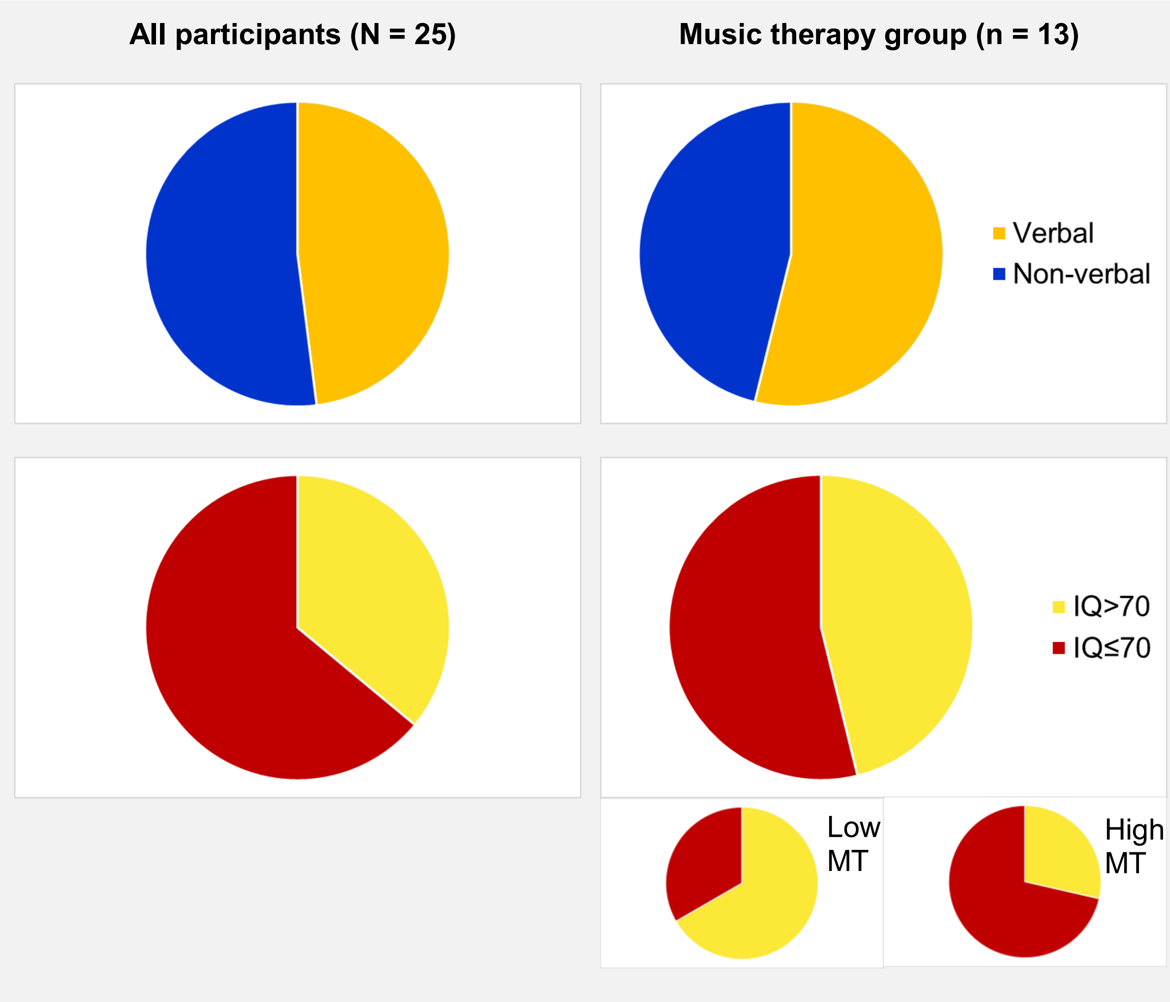
Baseline characteristics of the 13 children in the music therapy treatment subgroup were similar to the baseline characteristics of the whole group in most respects. They had a mean age of 5 years 4 months (SD = 10 months), compared to 5 years 6 months, at randomisation. The majority of participants were male (76.9% in the music therapy group, 84% amongst all participants). Children were recruited from three schools. In the cohort, 20 children (80%) attended special schools and five children attended a mainstream school, of which ten children in special schools and three children in the mainstream school were allocated to music therapy.

Figure 14: Baseline characteristics - Sex and school



At baseline, 13 children (52%) were non-verbal. In order to be considered verbal, children had to use at least five meaningful words in more than one situation. According to the judgement of the clinical psychologist administrating the ADOS, 16 children (64%) had an IQ ≤ 70. In the music therapy treatment group, the proportion of non-verbal children and the percentage of children with an IQ ≤ 70 were slightly lower (46.2% and 53.8%, respectively). The low- and high-intensity treatment subgroups were not well-balanced regarding IQ scores. Only 33.3% of the children in the low-intensity group were judged to have an IQ ≤ 70, whereas 71.4% of the children in the high-intensity treatment group had an IQ ≤ 70.

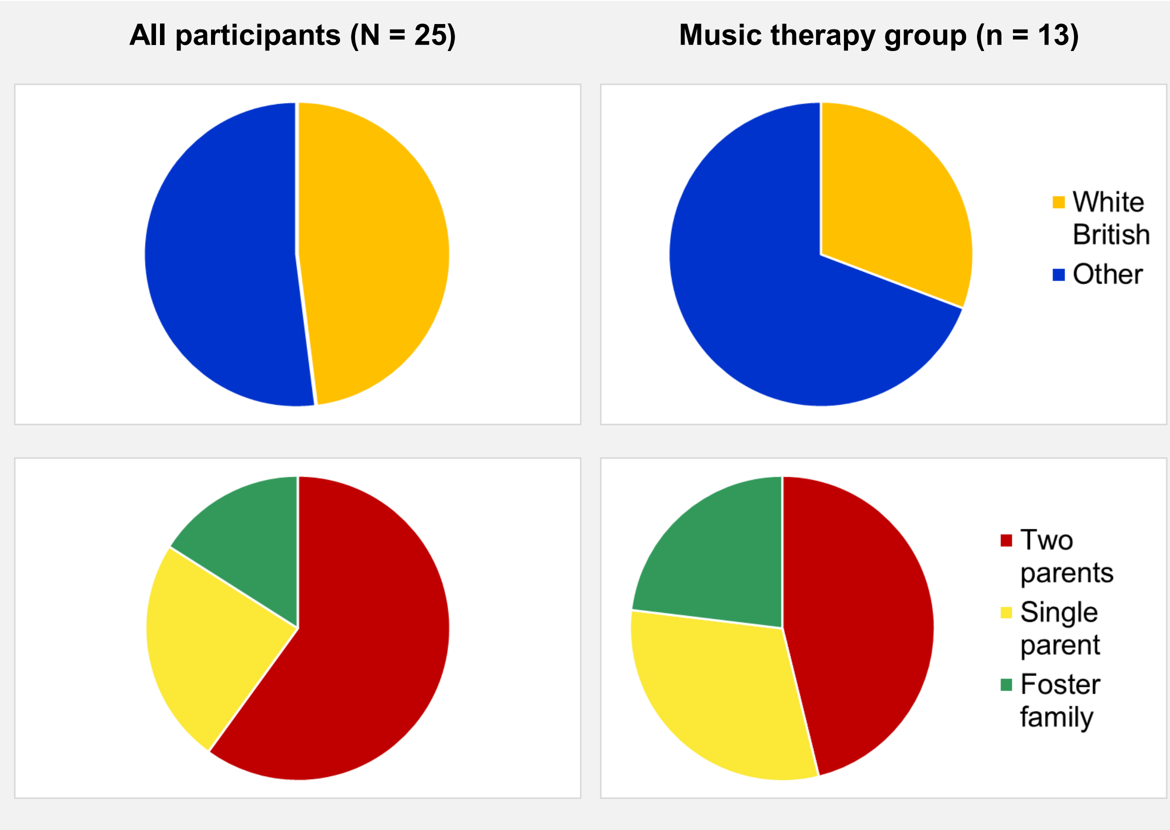
Figure 15: Baseline characteristics - Verbal ability and IQ



Most children at this site were assessed with ADOS Module 1 (88%), receiving a mean summary score of M = 18.1 (SD = 4.3). ADOS Module 1 is used with children who do not consistently use phrase speech. Three children were evaluated using ADOS Module 2 with a mean summary score of M = 11.3 (SD = 4.7). ADOS Module 2 is applied with children who use phrase speech but who are not verbally fluent. No child in this group was assessed with ADOS Module 3, which is administered with verbally fluent children. In the SRS rated by parents, 22 children obtained a raw score ≥ 98 (T-score ≥ 76) and thus fell into the category ‘severe range’. Two children received a score corresponding with the ‘moderate range’. The SRS of one child could not be scored, as more than 16 item responses were missing (see Constantino & Gruber, 2005, p. 5). The total SRS mean score was M = 120.8 (SD = 21.4). ADOS scores and SRS scores of children in the music therapy treatment group were almost identical to the respective scores in the group of all participants. Both standardised tests, the ADOS which is administered by a psychologist and the SRS which is administered by parents, indicate that the majority of children in this cohort fell into the severe range of ASD.

Whereas approximately half of the children in the group of all participants had an ethnicity other than White British, more than two-thirds of the children in the music therapy group fell into the category 'Other ethnicity'. A high proportion of children lived with a single parent (24%) or with foster parents (16%). In the treatment subgroup, the percentage of children living with single or foster parents was even higher and accounted for 30.8% and 23.1%, respectively, of the participants in this group.

Figure 16: Baseline characteristics - Ethnicity and family



In the following sections, I present results from the data analysis of music therapy sessions and of parent counselling sessions. Sessions from the 13 children in the music therapy group were included in these analyses. To illustrate findings, names of children in the treatment group are used in the text or in figures. For confidentiality reasons, all the names of children have been changed. Table 6 lists the assigned names, the children's allocation to the low- or high-intensity treatment subgroup, and their verbal ability.

Table 6: Assigned names, treatment intensity, and verbal ability of children

Assigned name		Treatment intensity	Verbal ability
Arjun	(male)	Low-intensity	No
Ben	(male)	Low-intensity	Yes
Charlie	(male)	High-intensity	No
Denise	(female)	Low-intensity	Yes
Eric	(male)	High-intensity	Yes
Fiona	(female)	Low-intensity	Yes
Ghalib	(male)	Low-intensity	Yes
Henry	(male)	High-intensity	No
Isaac	(male)	High-intensity	Yes
Jahnu	(male)	High-intensity	Yes
Kyle	(male)	Low-intensity	No
Leanne	(female)	High-intensity	No
Malik	(male)	High-intensity	No

5.2 Results: Music therapy sessions

In this section, findings related to the music therapy sessions are presented. First, the data generated from the excerpt selection procedure are shown, providing information about the music therapy activities in these excerpts (5.2.1). After that, the main part of this section focuses on results from the time-sampling analysis (5.2.2). A prerequisite for a statistically sound analysis of these data was choosing the most suitable probability distribution for each of the response variables. For this, data distribution and diagnostic tests were necessary. Corresponding results are reported (5.2.2.1), followed by a presentation of the model results (5.2.2.2). These show how child behaviours indicative of resilience developed over the course of the music therapy intervention. Results for the eleven different response variables are illustrated using scatter plots. As an example, a more detailed exploratory data analysis has been performed on the response variable ‘Vocal’ (5.2.2.3), and this is followed by results concerning therapist variables (5.2.2.4). Finally, I reflect on issues and difficulties that could arise as a result of having only one camera to draw my video analysis from (5.2.2.5). The subsequent section presents results of the child-therapist relationship rating that was performed using the assessment tool ACTR (5.2.3). Individual developments (5.2.3.1) as well as model results for the response variable ‘ACTR score’ (5.2.3.2) are displayed.

5.2.1 Excerpt selection

Before the video analysis could be conducted, it was necessary to reduce data by selecting music therapy sessions and then session excerpts from these selected sessions. This procedure has been described in detail in the methodology chapter (4.6.1). The excerpt selection followed a strength-based approach informed by resilience theory. The most pertinent moments according to individual clinical aims related to resilience were extracted from each session. I decided to explore which events and activities occurred during these session excerpts. If certain instruments or activities appeared often, they might be especially suited to promoting positive interactions that foster resilience in young children with ASD. To investigate this, each selected excerpt was labelled using short descriptions, such as 'improvisation on two guitars' or 'making up a song while playing with pieces of colourful material'. Four to five excerpts were chosen per session, resulting in a total of 1,135 fragments of 30 to 180 seconds each. Once this process was completed, I created broader categories under which the activities in the extracts could be subsumed. These categories were naturally influenced by my personal therapy style. As the sessions predominantly included improvisations, I decided to use the instruments on which the improvisations were played as defining categories. In addition, recurring pre-composed or original songs played an important role in most sessions and they thus lent themselves to making up categories as well. Further activities, such as listening to music or body percussion, were combined in the category 'other'. If several instruments were played in an excerpt or if the attribution was unclear, the video extract was assigned to the category that best described the focus of the child's attention. The following categories were devised: 'hello songs', 'action songs', 'drums', 'guitar', 'objects', 'piano', 'tuned percussion', 'untuned percussion', 'wind instruments', 'other', and 'goodbye songs'. I decided not to make up separate categories for singing or moving because these behaviours occurred in almost every excerpt. In these therapy sessions, singing or moving did not seem to be discrete activities, but rather they seemed to be integral elements of most interactions.

After all the video excerpts were assigned to a category, the proportion of session extracts falling under the respective categories was calculated for each child. Mean scores were computed for the whole music therapy treatment group and for the subgroups low-intensity music therapy and high-intensity music therapy. Table 7 provides an overview of the occurrences of activities. The first column lists the categories with clarifying examples. In addition to the group mean scores, the range of individual child mean scores is reported for each category and group.

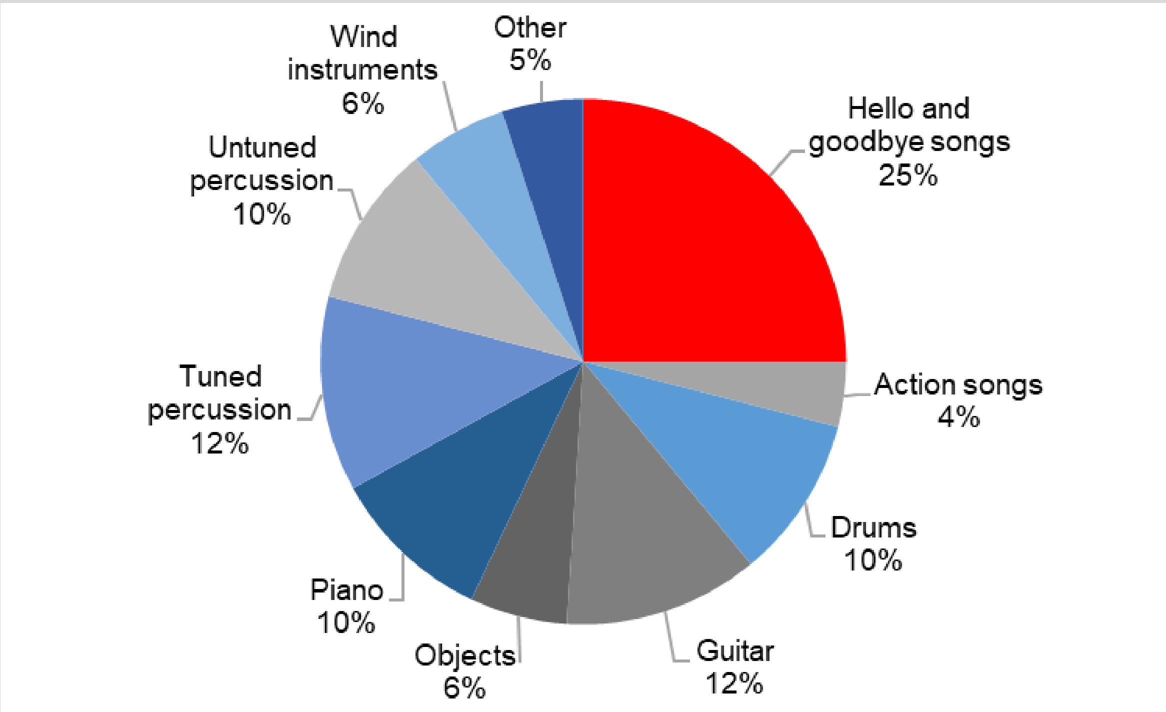
Table 7: Activities in selected excerpts

Activities		**Treatment group (Low + High)**		**Low-intensity group**		**High-intensity group**	
Category	(Examples)	Mean %	(Range)	Mean %	(Range)	Mean %	(Range)
Hello songs	(greeting song at the beginning of each session)	**10%**	(6-17%)	10%	(7-14%)	11%	(6-17%)
Action songs	(wheels on the bus, head and shoulders)	**4%**	(0-14%)	5%	(0-14%)	3%	(0-9%)
Drums	(bongo, drum, djembe)	**10%**	(0-22%)	11%	(7-16%)	9%	(0-22%)
Guitar	(guitar, ukulele)	**12%**	(4-22%)	12%	(5-17%)	11%	(4-22%)
Objects	(blanket, toys, colourful material)	**6%**	(0-19%)	7%	(0-19%)	5%	(0-12%)
Piano	(keyboard, piano)	**10%**	(1-25%)	5%	(1-13%)	13%	(6-25%)
Tuned percussion	(boomwhacker, chime bar, glockenspiel, triangle, bell, xylophone)	**12%**	(3-22%)	13%	(3-18%)	12%	(7-22%)
Untuned percussion	(egg shaker, maraca, ocean-drum, tambourine)	**10%**	(1-20%)	12%	(4-20%)	9%	(1-14%)
Wind instruments	(horn, kazoo, recorder, saxophone, whistle)	**6%**	(0-13%)	5%	(0-13%)	8%	(1-12%)
Other	(body percussion, dancing, role play, listening)	**5%**	(0-16%)	6%	(0-15%)	4%	(0-16%)
Goodbye songs	(farewell song at the end of each session)	**15%**	(8-20%)	14%	(8-19%)	15%	(9-20%)
Total		**100%**		100%		100%	

Each of the eleven devised categories accounted for 4% (‘action songs’) to 15% (‘goodbye song’) of the selected excerpts. When the related activities ‘hello songs’ and ‘goodbye songs’ are combined, they form by far the biggest category (25%), with one quarter of all selected session excerpts having been classified as hello or goodbye songs. For all 13 children, the selected video excerpts included the following six categories: ‘hello songs’, ‘guitar’, ‘piano’, ‘tuned percussion’, ‘untuned percussion’, ‘goodbye songs’. The categories ‘drums’ and ‘wind instruments’ comprised session excerpts from twelve children. For nine children, video excerpts further appeared in the category ‘objects’, and session extracts from eight children occurred in the categories ‘action songs’ and ‘other’. Overall, the two subgroups of children who received low- or high-intensity music therapy had very similar mean percentage scores, with the mean mostly differing by only 1 or 2 percentage points. Exceptions were the three categories ‘piano’ (M = 5% and M = 13%), ‘untuned percussion’ (M = 12% and M = 9%), and ‘wind instruments’ (M = 5% and M = 8%).

The proportion of time spent on an activity varied enormously between children. For example, while 25% of the excerpts selected from Leanne’s sessions included piano playing as the main activity, only 1% of the excerpts selected from Fiona’s sessions focused on the piano. Drums played an important role in music therapy with Eric, which is reflected by the fact that 22% of his excerpts featured drum playing. In contrast, Leanne was not interested in drums, and, thus, no single excerpt from her sessions was grouped under this category. Even though the overall mean score for the category ‘objects’ was relatively low (6%), 19% of excerpts from Denise’s sessions showed how we used toys and material to play and make up songs. For Arjun, Henry, Jahnu and Kyle, on the other hand, playing with non-musical objects was not important, so this category accounted for 0% of their selected excerpts. The following figure provides a graphic representation of the proportions with which activity categories occurred in selected excerpts of the music therapy treatment group. In this pie chart, hello and goodbye songs are combined to one category.

Figure 17: Activities in selected excerpts



This diagram illustrates the importance of hello and goodbye songs to generate positive and resilience-enhancing interactions in music therapy sessions with children with ASD. In the sessions that were included in this analysis, hello and goodbye songs had a very similar function. They were original compositions with a high recognition value. The songs were repeated at the beginning and end of every single session so that they became rituals that gave shape to the sessions. Many children seemed to feel reassured by the predictability and familiarity of these activities. Especially for very anxious or fidgety children, these rituals seemed highly important, as they allowed them to feel safe, to relax and to engage. At the same time, the structure of the hello and goodbye songs provided room for great flexibility. Depending on the needs and preferences of the child on the day, they could take a more passive or active role. Sometimes I played and sang the song to the child just once before he or she wanted to move on. In other sessions, the hello or goodbye song was the starting point for a long interaction during which the child played on chosen instruments, joined in singing, or invented expressive dance movements. The song provided the structure for a free exploration of the theme during which we changed dynamics, speed, lyrics, the rhythm, or harmonics. Many familiar songs could be used in music therapy sessions in this way but the hello and goodbye songs seemed to be especially appealing to the children as they addressed them directly and referred to their individual experience in this particular session. The ritualised repetition further enabled children to try out their own ideas and new roles. The ever-changing and mutually developed songs were part of our shared history of musical interactions. As described above, the excerpt selection was informed by resilience theory. Welcome and farewell rituals accounted for 25% of the most significant moments in the analysed music therapy sessions. This indicates that these activities might be especially suited to promoting resilience-enhancing interactions in young children with ASD.

5.2.2 Time-sampling analysis

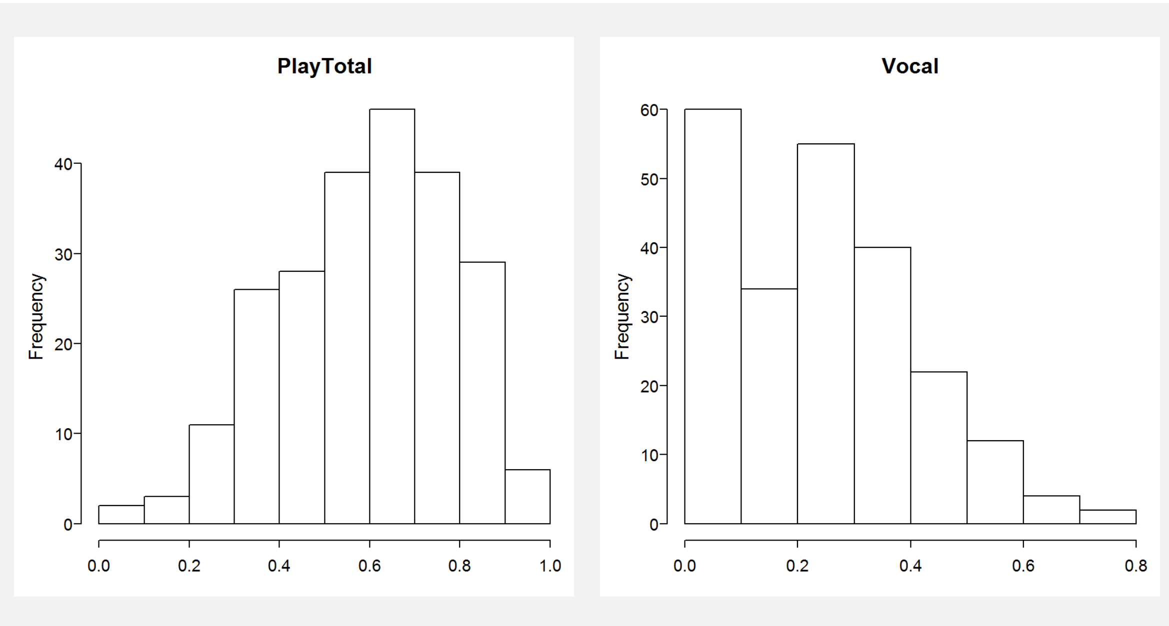
The time-sampling analysis of music therapy video excerpts is the centrepiece of this research study. For this analysis, all selected video excerpts were annotated using the coding system outlined in the methodology (4.7.1). The software Videograph supported this process. Codes were combined to eleven response variables that captured child behaviours indicative of resilience. In order to model the effects of the identified predictor variables, which were ‘session number’, ‘treatment intensity’, and ‘verbal ability’, on each of the determined target behaviours, I applied GLMM. In this section, the findings of this analysis are presented. Before the model results are looked at in more detail (5.2.2.2), specifics of data distribution and results of diagnostic tests concerning probability distributions are explained (5.2.2.1). The initial data analysis has been complemented by an exploratory data analysis on the response variable ‘Vocal’ (5.2.2.3). Finally, therapist variables (5.2.2.4) and the visibility of children and therapist on the video material (5.2.2.5) are considered.

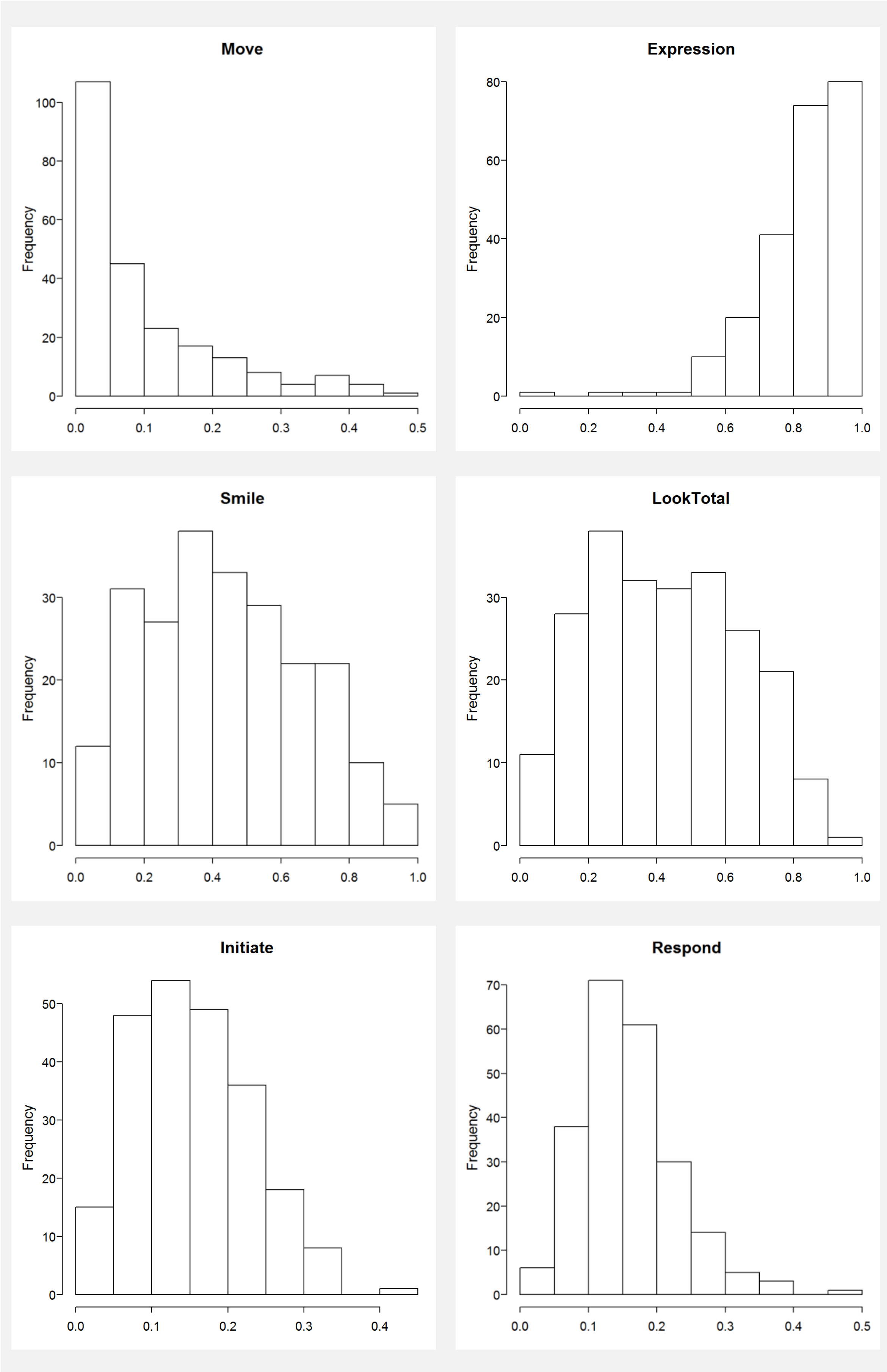
5.2.2.1 Data distribution and diagnostics

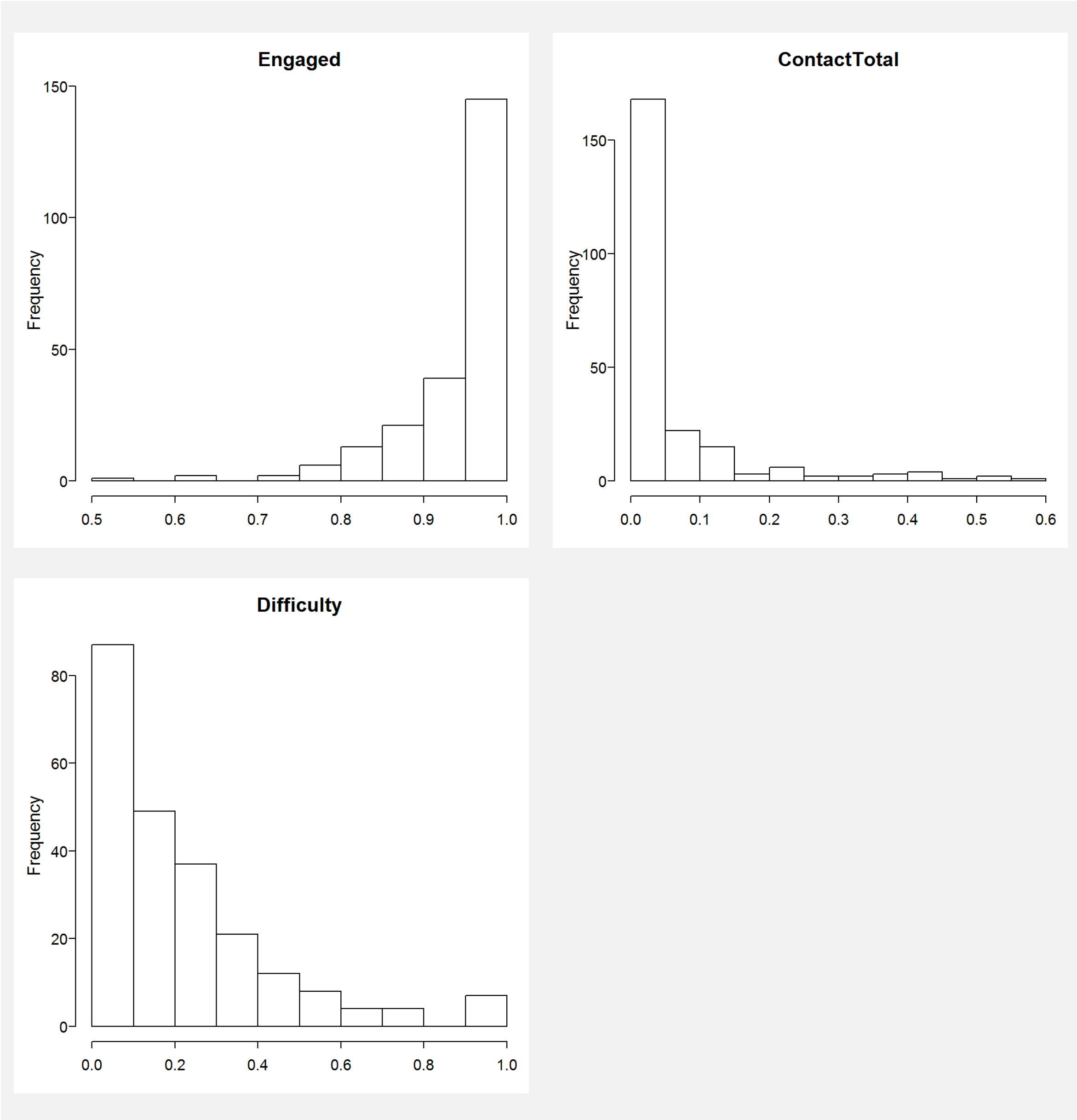
Before I started to fit and run the models for the variables, I checked the distribution of the response data. This was an important first step to determine which error distribution (normal or beta) was most suitable for the different response variables. I had predicted that not all the data would be normally distributed, i.e. follow the shape of a bell curve. Choosing the probability distribution that best describes the variable is essential to be able to calculate relevant results.

The following figure displays bar plots showing the data distribution of all eleven response variables. They all follow the same layout. On the x-axis, the proportion of the target behaviour is displayed. The y-axis represents the frequency with which the proportion of the target behaviour occurred during coded sessions. As excerpts from 229 sessions were included in the analysis, the frequency of all bars within one diagram always totals 229. For example, the plot for 'Vocal' shows that, considering all participants over the course of the whole intervention, children vocalised 0-10% of the time in 60 sessions, 10-20% of the time in 33 sessions, 20-30% of the time in 55 sessions, 30-40% of the time in 40 sessions, 40-50% of the time in 22 sessions, 50-60% of the time in 13 sessions, 60-70% of the time in four sessions, and 70-80% of the time in two sessions. No child vocalised for more than 80% of the time in any session.

Figure 18: Distribution plots for response variables

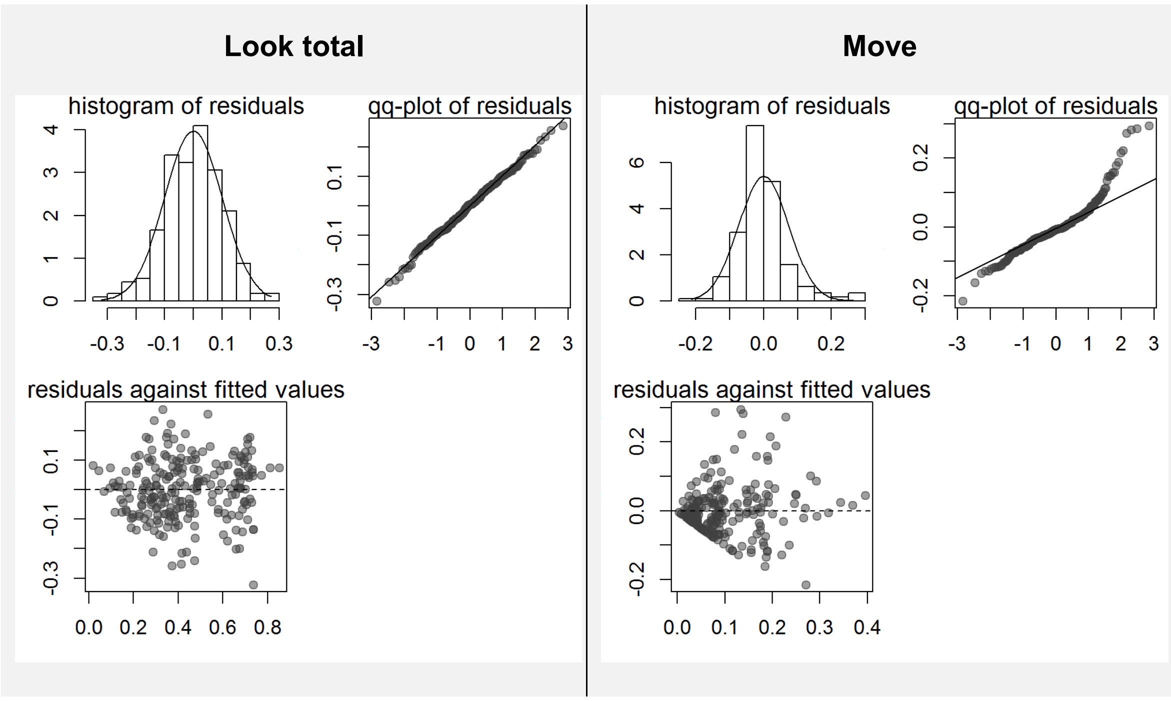



Move
Frequency
Expression
Frequency
Smile
Frequency
LookTotal
Frequency
Initiate
Frequency
Respond
Frequency



The plots show that while some variables seem to be well characterised by the normal (also referred to as Gaussian) distribution, others are clearly not. A first examination suggests that the data of ‘Play total’, ‘Smile’, ‘Look total’, ‘Initiate’ and ‘Respond’ might be almost normally distributed. Before a probability distribution was determined, further diagnostic tests were carried out, including the chi-squared test. For a graphic assessment of goodness of fit, a histogram of residuals, a quantile-quantile-plot (qq-plot) for residuals, and a scatter plot showing residuals against fitted values were issued. Examples for two variables are presented in Figure 19. All diagnostic test results and plots can be found in the appendix.

Figure 19: Diagnostic plots for two exemplary response variables



The diagnostic plots for ‘Look total’ and ‘Move’ demonstrate two very different variable properties. For ‘Look total’, the histogram of residuals fits well under the bell curve, the dots in the qq-plot follow the line of the theoretical distribution, and the residuals are distributed randomly against fitted values. These are all graphic assessments of goodness of fit against the Gaussian probability distribution, indicating that the generated data of my sample for the variable ‘Look total’ are normally distributed. For ‘Move’, however, the histogram of residuals deviates from the bell curve, the dots in the qq-plot are skewed and do not follow the line of the theoretical distribution, and the residuals form a strong pattern on the lower left side of the diagram. All these graphs indicate that the generated data of my sample for the variable ‘Move’ are not normally distributed and that, thus, the Gaussian probability distribution is not appropriate. When I fitted the model for ‘Move’, the beta distribution was used instead.

5.2.2.2 Model results – Response variables

All the model results are presented in the following table. In the first column, the eleven response variables (‘Play total’, ‘Vocal’, ‘Move’, ‘Expression’, ‘Smile’, ‘Look total’, ‘Initiate’, ‘Respond’, ‘Engaged’, ‘Contact total’, and ‘Difficulty’) are listed. The second column informs the reader about the probability distribution (normal or beta) that was used for each response variable after the above-mentioned diagnostic tests had determined the appropriate error distribution for each data set. The third column displays the *p*-value of the full-null model comparison. It is the single most important value for each response, as it answers whether the statistical model, including all test predictors, explained the data better than the null-model, which included the same random effects but had all test predictors removed. Using the most common convention, the significance level of the *p*-value was set to 0.05. Significance is highlighted in the table by presenting the respective response variable and *p*-value in bold. If $p \leq 0.05$, further assumptions, i.e. effects of predictors on the response, were investigated. First, the full model was considered, with values for the estimate, standard error, z-value, *p*-value, and the lower and upper confidence limits being reported for all model terms (intercept, session number, session number^2, therapy intensity, verbal ability). These terms were defined in the methodology (4.7.1.3) and their meaning is discussed after the table. If the *p*-value for 'session number^2' was not significant, the reduced model, not including the squared term, was conducted to infer the effect of the linear term 'session number'. Again, the significance of any of the continuous or categorical predictor variables is highlighted in the table by showing the respective rows in bold.

Table 8: Model results - Response variables

Response	Probability distribution	*p*-value full-null model comparison	Model type	Model term[a]	Estimate	SE	z-value	*p*-value	CL lower[b]	CL upper[b]
Play total	Normal	0.148	Full model	Intercept	0.634	0.056	11.408	[c]	0.516	0.748
				Session number	-0.013	0.025	-0.506	0.615	-0.068	0.037
				Session number²	-0.019	0.012	-1.519	0.142	-0.041	0.005
				Therapy intensity	-0.077	0.051	-1.507	0.146	-0.191	0.036
				Verbal ability	0.035	0.051	0.692	0.511	-0.073	0.145
Vocal	Beta	0.056	Full model	Intercept	-1.758	0.472	-3.725	[c]	-2.683	-0.833
				Session number	0.493	0.145	3.408	0.004	0.210	0.777
				Session number²	-0.047	0.098	-0.484	0.626	-0.239	0.144
				Therapy intensity	0.046	0.414	0.112	0.911	-0.764	0.857
				Verbal ability	0.653	0.691	0.946	0.388	-0.700	2.007
Move	Beta	**0.010**	Full model	Intercept	-2.677	0.371	-7.214	[c]	-3.404	-1.950
				Session number	0.511	0.134	3.800	[c]	0.247	0.774
				Session number²	-0.110	0.076	-1.454	0.143	-0.259	0.038
				Therapy intensity	-0.003	0.366	-0.009	0.992	-0.720	0.714
				Verbal ability	0.392	0.366	1.070	0.294	-0.326	1.110
			Reduced model	Intercept	-2.765	0.366	-7.548	[c]	-3.484	-2.047
				Session number	**0.501**	**0.134**	**3.733**	**0.002**	**0.238**	**0.764**
				Therapy intensity	-0.013	0.366	-0.036	0.971	-0.730	0.704
				Verbal ability	0.383	0.366	1.045	0.305	-0.335	1.101

Response	**Probability distribution**	***p*-value full-null model comparison**	**Model type**	**Model term[a]**	**Estimate**	**SE**	**z-value**	***p*-value**	**CL lower[b]**	**CL upper[b]**
Expression	Beta	**0.003**	Full model	Intercept	1.463	0.246	5.943	[c]	0.980	1.945
				Session number	0.286	0.075	3.829	[c]	0.140	0.433
				Session number^2	-0.083	0.063	-1.319	0.195	-0.206	0.040
				Therapy intensity	-0.099	0.257	-0.385	0.700	-0.602	0.405
				Verbal ability	**0.583**	**0.241**	**2.421**	**0.028**	**0.111**	**1.055**
			Reduced model	Intercept	1.381	0.254	5.445	[c]	0.884	1.878
				Session number	**0.281**	**0.081**	**3.474**	**0.003**	**0.122**	**0.440**
				Therapy intensity	-0.092	0.253	-0.363	0.717	-0.587	0.404
				Verbal ability	**0.588**	**0.238**	**2.468**	**0.026**	**0.121**	**1.055**
Smile	Normal	**< 0.001**	Full model	Intercept	0.350	0.059	5.913	[c]	0.230	0.474
				Session number	0.106	0.016	6.804	[c]	0.074	0.140
				Session number^2	-0.038	0.018	-2.067	0.051	-0.078	0.000
				Therapy intensity	**0.182**	**0.045**	**4.081**	**0.001**	**0.090**	**0.278**
				Verbal ability	0.059	0.045	1.315	0.241	-0.045	0.154
			Reduced model	Intercept	0.281	0.049	5.731	[c]	0.165	0.389
				Session number	**0.106**	**0.016**	**6.593**	**< 0.001**	**0.072**	**0.139**
				Therapy intensity	**0.183**	**0.044**	**4.131**	**0.001**	**0.078**	**0.283**
				Verbal ability	0.060	0.044	1.349	0.231	-0.034	0.167

Response	Probability distribution	*p*-value full-null model comparison	Model type	Model term[a]	Estimate	SE	z-value	*p*-value	CL lower[b]	CL upper[b]
Look total	Normal	**< 0.001**	Full model	Intercept	0.354	0.070	5.018	[c]	0.181	0.519
				Session number	0.055	0.019	2.811	[c]	0.013	0.096
				Session number²	-0.016	0.009	-1.820	0.092	-0.035	0.003
				Therapy intensity	-0.040	0.070	-0.564	0.647	-0.222	0.142
				Verbal ability	**0.225**	**0.070**	**3.206**	**0.008**	**0.071**	**0.380**
			Reduced model	Intercept	0.313	0.052	5.993	[c]	0.188	0.432
				Session number	**0.070**	**0.018**	**3.781**	**0.005**	**0.025**	**0.112**
				Therapy intensity	-0.048	0.071	-0.678	0.579	-0.230	0.134
				Verbal ability	**0.223**	**0.071**	**3.144**	**0.009**	**0.067**	**0.380**
Initiate	Normal	**< 0.001**	Full model	Intercept	0.126	0.019	6.456	[c]	0.085	0.166
				Session number	0.034	0.005	6.136	[c]	0.022	0.045
				Session number²	**-0.015**	**0.004**	**-3.559**	**0.002**	-0.023	-0.006
				Therapy intensity	0.023	0.017	1.311	0.212	-0.015	0.059
				Verbal ability	**0.062**	**0.017**	**3.600**	**0.003**	0.026	0.099
Respond	Normal	0.088	Full model	Intercept	0.148	0.014	10.294	[c]	0.117	0.177
				Session number	0.025	0.009	2.726	0.015	0.007	0.042
				Session number²	0.002	0.005	0.465	0.647	-0.007	0.012
				Therapy intensity	0.003	0.013	0.238	0.831	-0.024	0.033
				Verbal ability	0.020	0.013	1.510	0.168	-0.012	0.048

Response	Probability distribution	*p*-value full-null model comparison	Model type	Model term[a]	Estimate	SE	z-value	*p*-value	CL lower[b]	CL upper[b]
Engaged	Beta	**< 0.001**	Full model	Intercept	2.806	0.360	7.804	[c]	2.101	3.511
				Session number	0.693	0.106	6.538	[c]	0.485	0.901
				Session number²	**-0.217**	**0.083**	**-2.610**	**0.019**	**-0.380**	**-0.054**
				Therapy intensity	0.642	0.362	1.773	0.090	-0.067	1.351
				Verbal ability	0.712	0.367	1.937	0.062	-0.008	1.432
Contact total	Beta	0.209	Full model	Intercept	-2.795	0.432	-6.476	[c]	-3.641	-1.949
				Session number	-0.089	0.099	-0.900	0.378	-0.283	0.105
				Session number²	0.008	0.074	0.111	0.911	-0.137	0.154
				Therapy intensity	0.179	0.429	0.418	0.676	-0.661	1.020
				Verbal ability	-0.978	0.430	-2.273	0.037	-1.822	-0.135
Difficulty	Beta	**< 0.001**	Full model	Intercept	-0.398	0.543	-0.733	[c]	-1.462	0.666
				Session number	-0.554	0.102	-5.417	[c]	-0.754	-0.353
				Session number²	0.086	0.066	1.310	0.193	-0.043	0.216
				Therapy intensity	-0.706	0.554	-1.273	0.217	-1.793	0.381
				Verbal ability	**-1.509**	**0.555**	**-2.718**	**0.015**	**-2.597**	**-0.421**
			Reduced model	Intercept	-0.326	0.539	-0.606	[c]	-1.382	0.729
				Session number	**-0.558**	**0.098**	**-5.690**	**< 0.001**	**-0.750**	**-0.366**
				Therapy intensity	-0.701	0.553	-1.267	0.219	-1.785	0.383
				Verbal ability	**-1.504**	**0.554**	**-2.717**	**0.016**	**-2.589**	**-0.419**

Abbreviations: CL, Confidence limits; SE, Standard error

[a] All predictors were z-transformed to a mean of zero and a standard deviation of one

[b] 95% confidence limits

[c] *p*-values not shown for intercept and model terms that are conditional on other model terms because of very limited interpretability

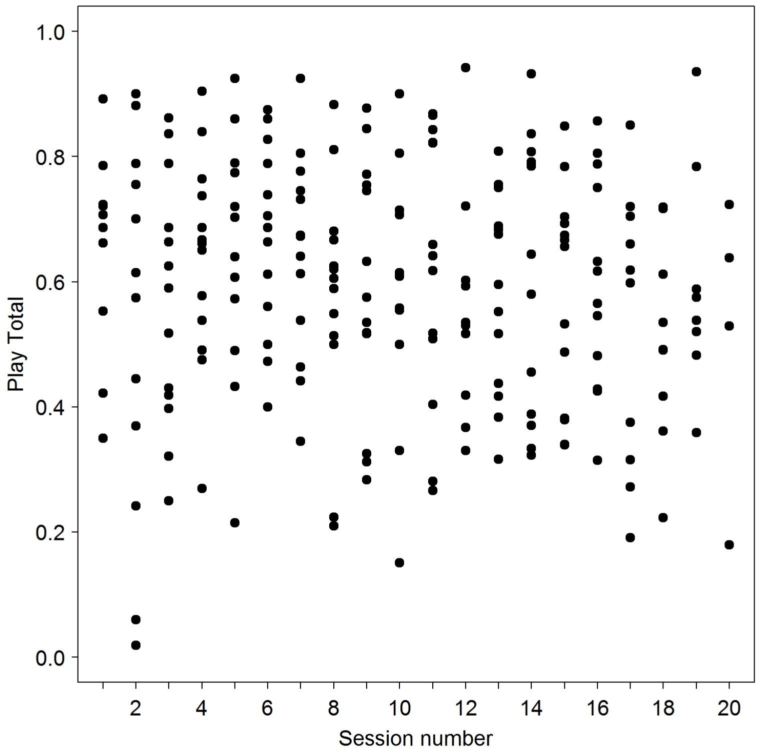
Out of the eleven response variables, four did not yield a significant *p*-value: ‘Play total’, ‘Vocal’, ‘Respond’, and ‘Contact total’. Thus, no assumptions can be made about the effects of the test predictors on these target behaviours when using this statistical model and data set. The full-null model comparison was significant for seven response variables: ‘Move’, ‘Expression’, ‘Smile’, ‘Look total’, ‘Initiate’, ‘Engaged’, and ‘Difficulty’. In the full model, the term ‘session number^2’ had a significant effect on ‘Initiate’ and ‘Engaged’. The estimates for these response variables were negative, indicating a development that can be illustrated by a concave curve. For example, children initiated more often as music therapy sessions progressed, but the amount of initiating behaviour reached a plateau after a while and did not increase further. The linear term ‘session number’ had a significant effect on ‘Move’, ‘Expression’, ‘Smile’, ‘Look total’, and ‘Difficulty’. The correlation between session number and response variable was positive for all of these target behaviours except for ‘Difficulty’. This means that the proportion of moving, expressing, smiling, and looking increased as the intervention progressed. The correlation between session number and ‘Difficulty’ was negative, indicating that the proportion of difficult behaviour decreased over the course of the intervention.

In addition to the continuous, quantitative predictor ‘session number’, the categorical predictor variables had a significant effect on several response variables. ‘Therapy intensity’ was significant for ‘Smile’, implying that whether a child received music therapy sessions once or three times a week had a significant influence on how often he or she smiled and laughed during a session. ‘Verbal ability’ was significant for ‘Expression’, ‘Look total’, ‘Initiate’, and ‘Difficulty’. This suggests that whether a child was verbal or non-verbal at the beginning of the intervention made a significant difference to the amount of looking, initiating, expressive behaviour, and difficult behaviour during music therapy.

In the following, scatter plots are used to visualise the results for all eleven response variables. Each response is presented in a separate figure. All diagrams have the same layout: The x-axis, labelled session number, displays the week of intervention from 1 to 20, while the y-axis shows the proportion of the target behaviour in the video excerpts. The y-axis has a range from 0.0 (equalling 0%) to 1.0 (equalling 100%). Each dot in the scatter plot represents one observation, that is the proportion of the respective target behaviour of one child in one session. For example, Leanne played instruments 35% of the time during the selected excerpts of the music therapy session in her first week. This is depicted by the single dot on the scatter plot in Figure 20 at the correspondent point (1, 0.35) in the coordinates. As 229 videos were included in the analysis, each scatter plot shows 229 observations (i.e. dots). In the third intervention week, videos of all 13 children were available and coded. Therefore, 13 dots can be found on an imaginary vertical line above session number 3. As in intervention week 20, only four children received music therapy, four dots are assembled on the imaginary vertical line above session number 20.

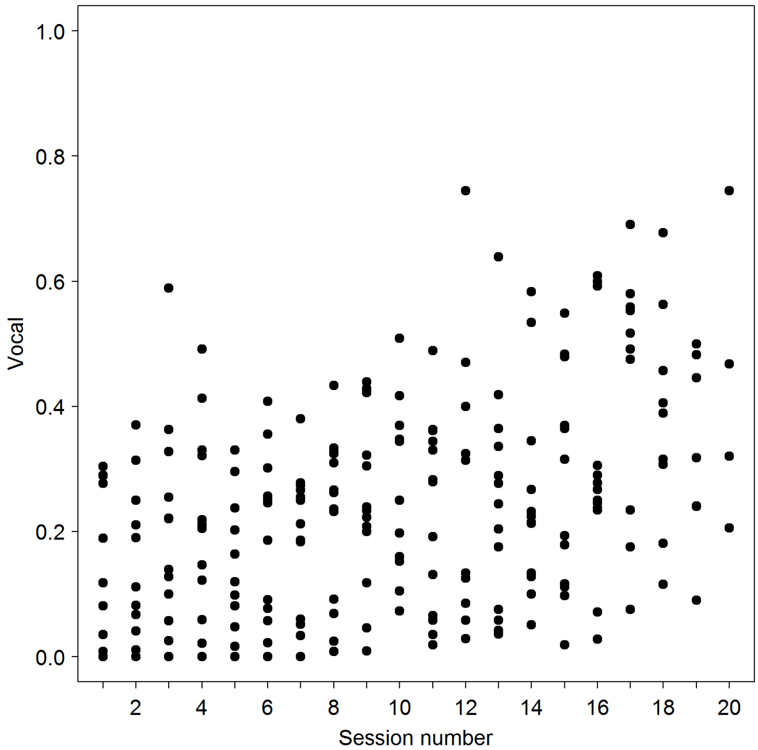
If the full-null model comparison was not significant, the raw data are presented in the scatter plots. If the full-null model comparison was significant, the effect of the predictor 'session number' is illustrated by a trendline. This trendline is determined by the model estimates that are presented in Table 8. The trendline is linear if the data were normally distributed and if the reduced model was implemented. If beta distribution was applied or if the full model yielded significant results for 'session number^2', the line is non-linear. For several response variables, significant effects of one of the categorical predictors 'therapy intensity' or 'verbal ability' were detected in addition to the effect of the continuous predictor. In these cases, the different categories of the factor are illustrated by different colours. For example, dots representing children who were receiving high-intensity treatment are blue, while the dots representing children who were receiving low-intensity music therapy are green. If the factor 'verbal ability' had a significant effect on the response variable, data for verbal children are shown in red while data for non-verbal children are presented in grey.

Figure 20: Results for 'Play total'



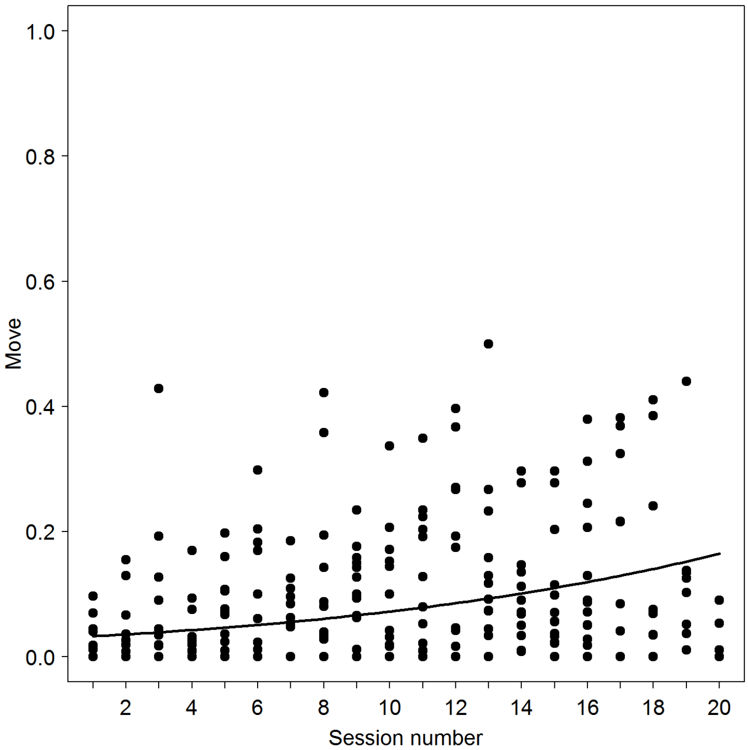
This scatter plot visualises the proportion of the target behaviour 'Play total' across all 13 children over the course of 20 weeks of music therapy. As the full-null model comparison was not significant (p = 0.148), we cannot draw conclusions about any correlation between the predictors (session number, therapy intensity, verbal ability) and this response variable. However, it is noticeable that dots are almost evenly distributed across the whole diagram, and that no trends or patterns become immediately evident. The proportion of one child playing instruments during excerpts of one session ranges between 1.2% (occurring in week 2) and 94.2% (occurring in week 12).

Figure 21: Results for 'Vocal'



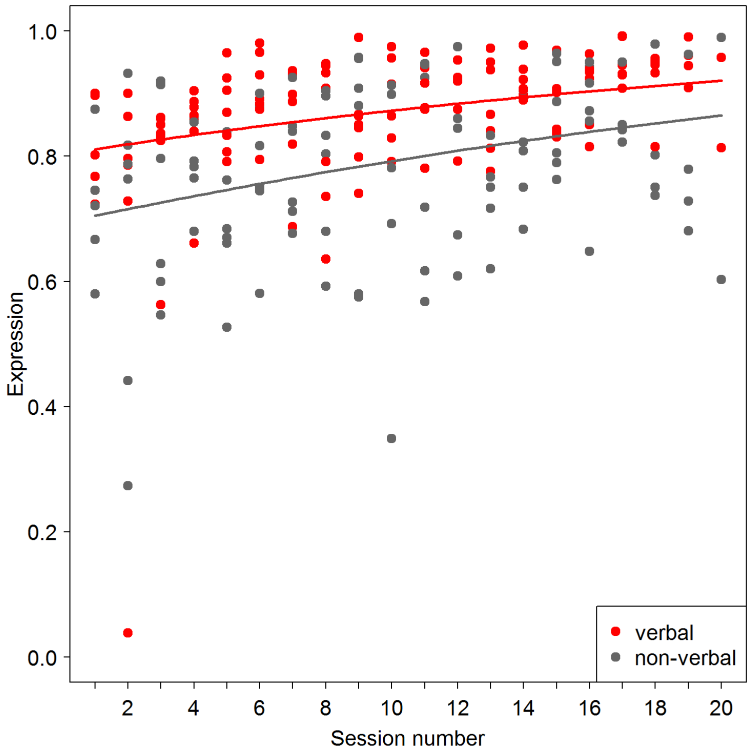
This plot displays all data points for the response variable 'Vocal'. The proportion of vocalising observed during the excerpts of one session covers the range from 0% (occurring in weeks 1, 2, 3, 4, 5, 6, 7) up to 74.4% (occurring in weeks 12 and 20). The full-null model comparison using the beta distribution was not significant (p = 0.056), which means that no correlation between the predictors and the response variable 'Vocal' could be found with the applied analytical model and this data set. However, as the p-value is so close to the somewhat arbitrary threshold for significance level (e.g. Dahiru, 2008), exploratory data analysis was performed in addition to the initial data analysis. This more detailed exploration of the data is presented and discussed in section 5.2.2.3.

Figure 22: Results for 'Move'



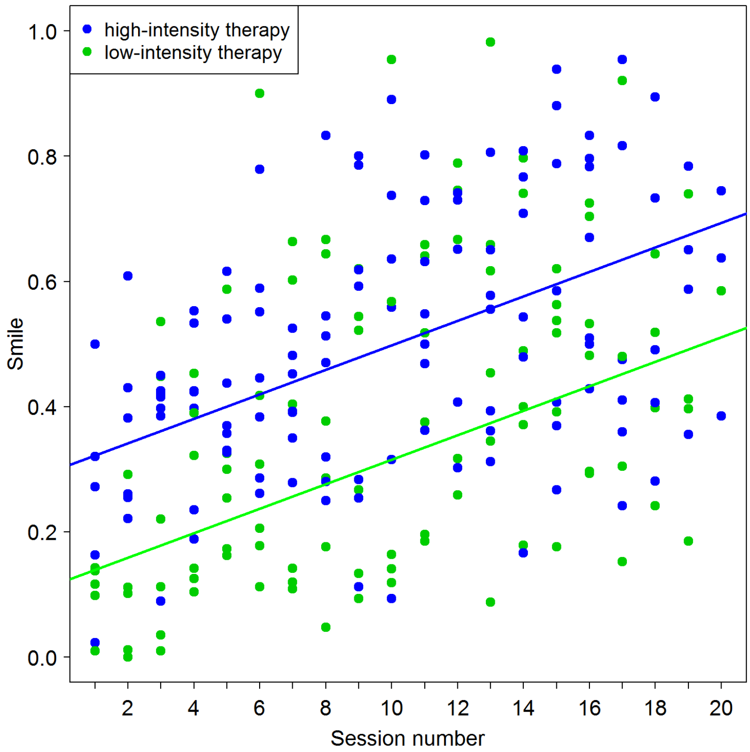
In this scatter graph, the proportion of the response variable 'Move' is presented. The effect of the predictor variable 'session number' on this response variable was significant (p = 0.002). The correlation was positive, which means that children used more expressive movements as music therapy sessions progressed. Neither of the categorical predictor variables 'therapy intensity' or 'verbal ability' had a significant effect on the response. Dots conglomorate in the lower half of the diagram, indicating that the proportion of moving observed in one session ranges between 0% (occurring in all weeks except weeks 14 and 19) and 50% (occurring in week 13).

Figure 23: Results for 'Expression'



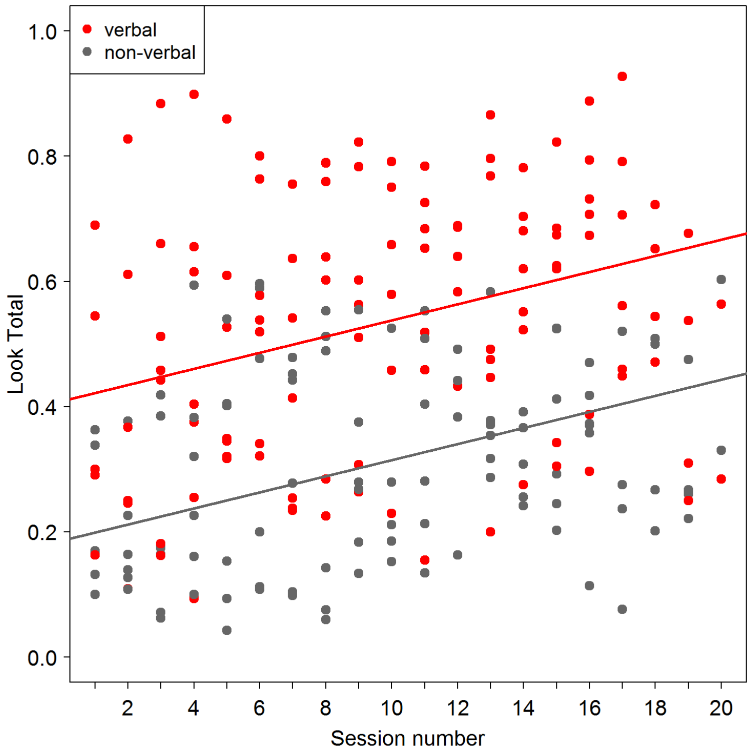
This scatter diagram shows all data points of the response variable 'Expression' for all children and coded sessions. The effect of the continuous predictor variable on this response was significant (*p* = 0.003). The positive correlation between session number and expressive behaviour is illustrated by the trendlines. As the factor 'verbal ability' had a significant effect on the response (*p* = 0.026), dots and trendlines are displayed in red and grey, representing verbal and non-verbal children, respectively. The group of verbal children was on average more expressive than the group of non-verbal children. However, while the verbal children started on a higher level, the non-verbal children progressed more steeply over the course of the 20-week intervention. The categorical predictor variable 'treatment intensity' had no significant effect on 'Expression'. The response variable 'Expression' is composed of the codes 'Play', 'Asst-Play', 'Vocal', 'Move', 'Object', and 'Talk'. It is therefore not surprising that the majority of data points can be found in the upper half of the diagram, indicating that the proportion of expressive behaviour was high in the selected excerpts of most sessions. Only four dots are located below 50%, namely at 3.8%, 27.4%, 44.2% (all occurring in week 2), and 34.9% (occurring in week 10). The full range of the proportion of this target behaviour during one session is 3.8% (occurring in week 2) to 99.2% (occurring in week 17).

Figure 24: Results for 'Smile'



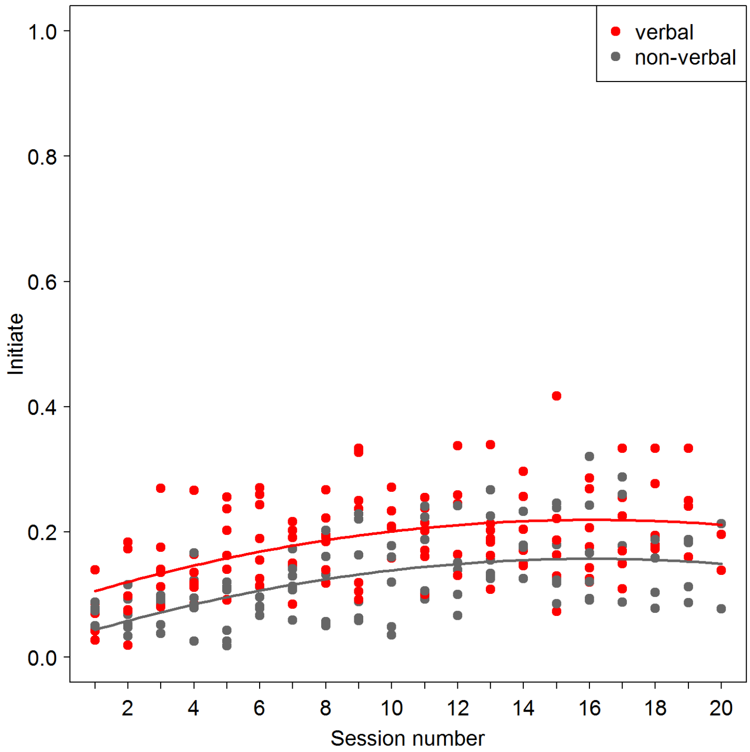
In this scatter plot, the results for the response variable 'Smile' are visualised. The predictor variable 'session number' had a significant effect on the response (p < 0.001). The strong positive correlation between these two variables is represented by the steep upwards slope of the trendlines. 'Smile' is the only response variable on which the factor 'treatment intensity' had a significant effect (p = 0.001). The difference between the two groups is illustrated by the different-coloured dots and trendlines, with blue representing children in the high-intensity treatment group and green representing children in the low-intensity treatment group. Children who were receiving music therapy sessions three times a week expressed enjoyment through facial expressions significantly more often than the children who were receiving sessions only once a week. The gap between the two lines is 0.183. That means that the average proportion of smiling and laughing during any one session differed by almost 20% between the treatment groups. Verbal ability had no significant effect on this response variable. Considering all children, the proportion of the target behaviour 'Smile' observed during one session ranges from 0% (occurring in week 2) to 98.2% (occurring in week 13).

Figure 25: Results for 'Look total'



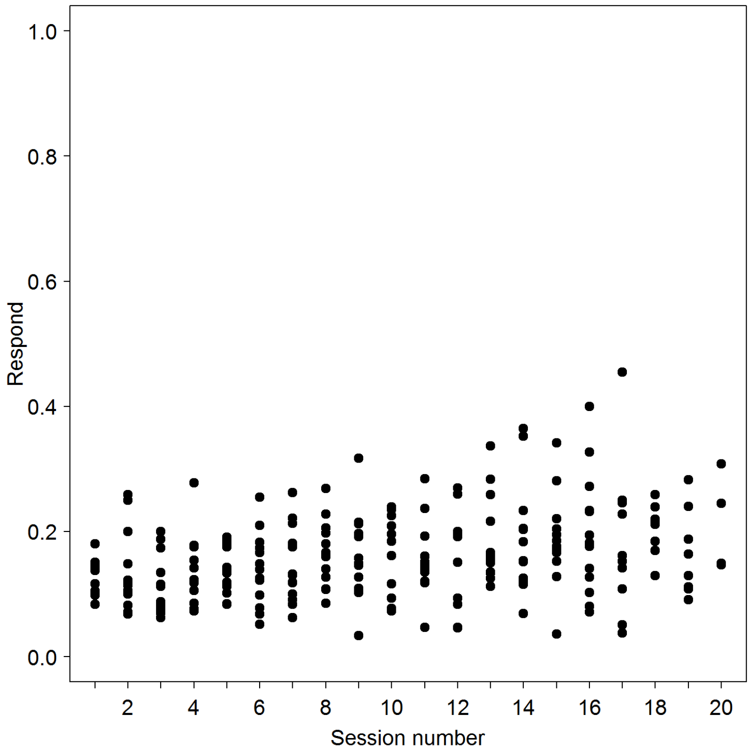
In this scatter plot, the results for the variable 'Look total' are displayed. This response variable is composed of the two codes 'Look' and 'Look-TA', thereby combining all behaviour of the child that indicates an interest in one of the adults (therapist or teaching assistant) by focusing on their face. The significant positive correlation ($p = 0.005$) between the continuous predictor 'session number' and the response variable is illustrated by the ascending slope of the trendlines. In addition, the factor 'verbal ability' had a significant effect ($p = 0.009$). The dots and trendlines in red and grey represent verbal and non-verbal children, respectively. Throughout the course of the intervention, the group of verbal children looked at one of the adults more often than the group of non-verbal children. The gap between the trendlines is 0.223, which means that the difference between the two groups regarding the average proportion of looking amounts to more than 20%. The noteworthy difference between the groups also becomes apparent when one examines the lowest and highest sections of the graph. Whereas 21 grey data points indicate that several non-verbal children looked less than 15% of the time during the excerpts of a session, only one red data point falls within that range (occurring in week 4). Even more strikingly, no non-verbal child looked at the therapist or the TA for more than 60% of the time during any one session. However, the 55 red dots at the top of the diagram indicate that this occurred for many children in the verbal group. The categorical predictor 'therapy intensity', on the other hand, had no significant effect on 'Look total'. Overall, data points of this response variable lie between 4.2% (occurring in week 5) and 92.7% (occurring in week 17).

Figure 26: Results for 'Initiate'



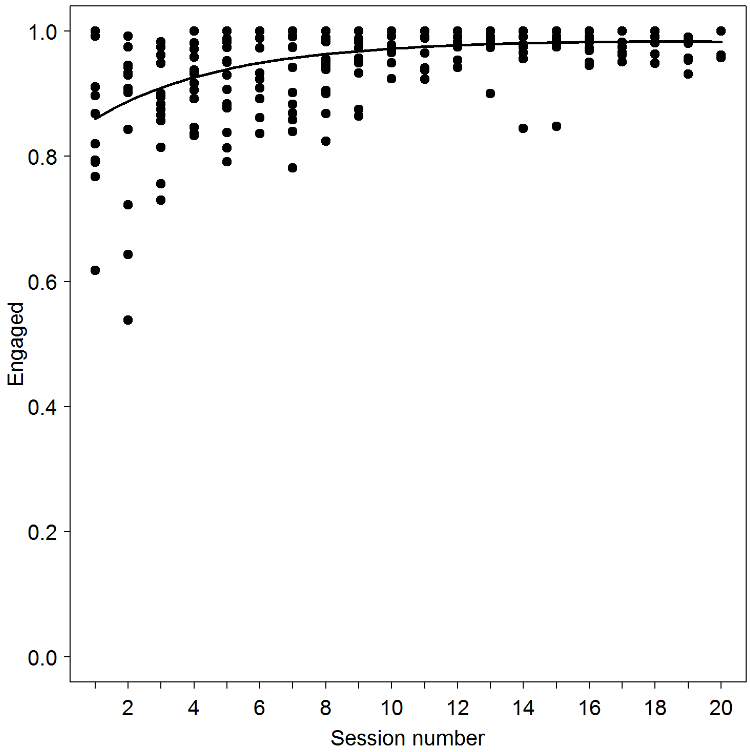
This diagram is a visual representation of the results for the response variable 'Initiate'. In the full model, 'session number^2' had a significant effect on the proportion of the target behaviour (p = 0.002). The correlation between 'session number^2' and initiating is shown by the non-linear trendlines. After an initial ascending slope, the lines level out at approximately week 13 of the intervention. The categorical predictor variable 'verbal ability' had a significant effect, which is illustrated by the colours red and grey. On average, verbal children initiated changes more often during sessions than non-verbal children. The gap between the trendlines is 0.062, meaning that the average proportion of initiating during the excerpts of a session of the two groups differed by approximately 6%. 'Therapy intensity' had no significant effect on the response variable. In a typical interaction between two people, both individuals contribute by initiating, responding to, waiting for, processing and developing information and activities. It would be highly unusual for any one person to dominate the interaction by constantly initiating. Therefore, it is not surprising that all of the dots conglomerate in the lower half of the diagram. The full range of observations is 1.8% (occurring in week 5) to 41.7% (occurring in week 15).

Figure 27: Results for ‘Respond’



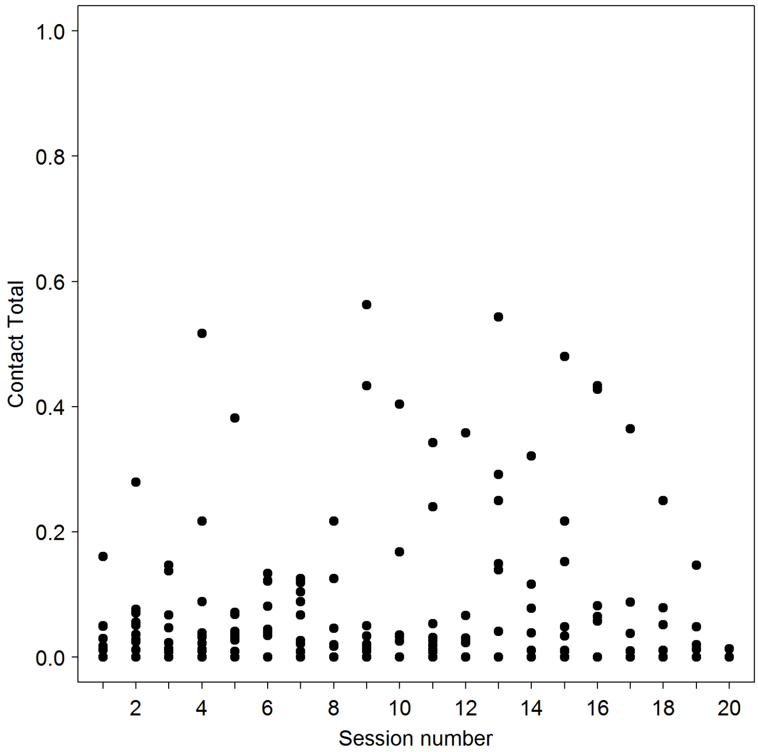
The results for the response variable ‘Respond’ are visualised in this scatter plot. The full-null model comparison was not significant (p = 0.088). Therefore, we cannot make further assumptions about the correlation between the predictor variables and the response variable. The distribution of the data points is somewhat similar to the distribution for the variable ‘Initiate’ in the sense that almost all of the dots accumulate below 40%. In my data set, the observed proportion of the target behaviour ‘Respond’ ranges from 3.3% (occurring in week 9) to 45.5% (occurring in week 17).

Figure 28: Results for ‘Engaged’



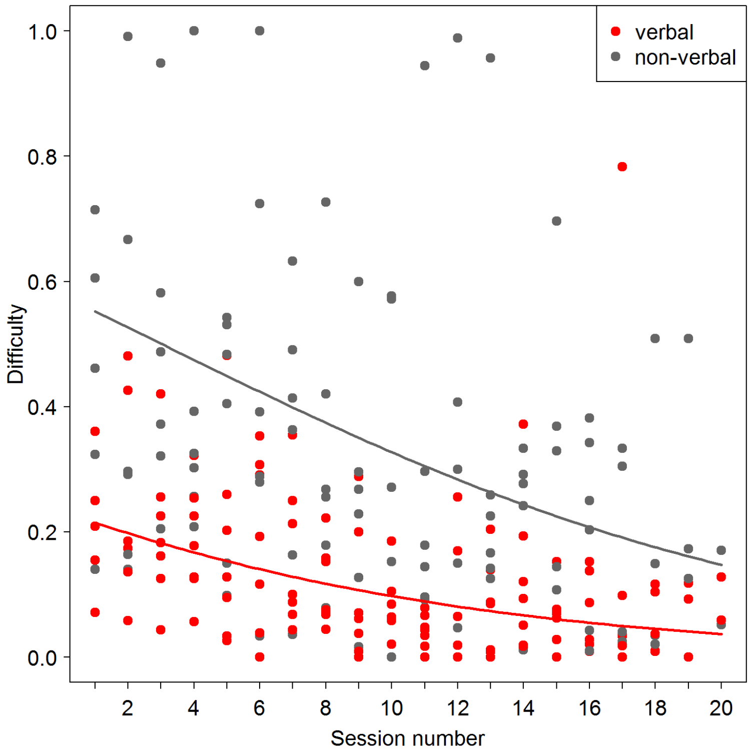
In this scatter graph, the results for the variable ‘Engaged’ are presented. ‘Session number[2]’ had a significant effect on the response (p = 0.019). The correlation between these two variables is visualised by the non-linear trendline. An initial ascending slope is followed by a more level progression starting from approximately week 12 of the intervention. Neither the categorical predictor ‘therapy intensity’ nor the factor ‘verbal ability’ had a significant effect on children being engaged. Data points range from 53.9% (occurring in week 2) to 100% (occurring in all weeks except in weeks 2, 3, 19). It is noticeable that most dots are assembled in the highest quarter of the diagram. Only five observations are located below 75%, occurring in week 1 (61.8%), in week 2 (53.8%, 64.3%, 72.2%), and in week 3 (73%). As the best excerpts of sessions were coded, it is maybe not surprising that engagement of children was very high, but this extremely skewed distribution raises the question whether the code was defined in a useful way providing meaningful information.

Figure 29: Results for 'Contact total'



This scatter plot illustrates the proportion of the response variable 'Contact total' across all children and intervention weeks. 'Contact total' is a combination of the two codes 'Contact' and 'Contact-TA'. The variable measured the amount of time a child sought physical contact with either the therapist of the teaching assistant during a music therapy session. As the full-null model comparison was not significant ($p = 0.209$), no further assumptions about the correlation between any of the predictor variables and the response variable can be made. The plot depicts that, in my data set, more than 90% of the observations accumulate in the range from 0% to 20%, indicating that seeking physical contact for reassurance or other reasons did not play an important role for most children during music therapy sessions. The full range of data points is 0% (occurring in all 20 weeks) to 56.3% (occurring in week 9).

Figure 30: Results for 'Difficulty'



In this plot, results for the response variable 'Difficulty' are shown. The variable 'Difficulty' is composed of the codes 'Fidget' and 'Anxiety'. It thus represents various behaviours that might impede the engagement and participation of the child and the development of his or her full potential during the sessions. The continuous predictor 'session number' had a significant effect on the response (p < 0.001). These two variables were negatively correlated, which means that the proportion of difficult behaviour decreased as the intervention progressed. This development is illustrated by the downwards slope of the trendlines. The factor 'therapy intensity' had no significant effect. The factor 'verbal ability', on the other hand, was significant (p = 0.016). On average, non-verbal children (grey) displayed more difficult behaviour during sessions than verbal children (red). One easily visible difference between the two groups is the number of red and grey dots in the upper part of the diagram. Only once did a verbal child exhibit fidgety or anxious behaviour for more than 50% of the time during selected excerpts of one session (occurring in week 17), compared to 22 occurrences in the non-verbal group (in all weeks but in weeks 14, 16, 17, 20). The difference between verbal and non-verbal children is illustrated by the two trendlines. As sessions progress, the gap between the trendlines narrows and they converge, indicating that the difficult behaviour reduced more drastically in the non-verbal group over the course of the intervention. Overall, the observed proportion of the target behaviour of one child during the excerpts of one session covers the full range from 0% (occurring in weeks 6, 9, 10, 11, 12, 13, 15, 17, 19) to 100% (occurring in weeks 4 and 6).

Before running the models, I had anticipated the effect of the predictor variable 'session number' on each response variable. These hypotheses were listed and accounted for in the methodology chapter (Table 4, in section 4.7.1.3). The following table contrasts the anticipated effects with the identified effects and, thereby, allows an evaluation of the accuracy of the hypotheses. For all eleven response variables, the results of the full-null model comparison and the model estimates, including the respective *p*-values, are compiled.

Table 9: Anticipated and identified effects of predictor 'session number' on response variables

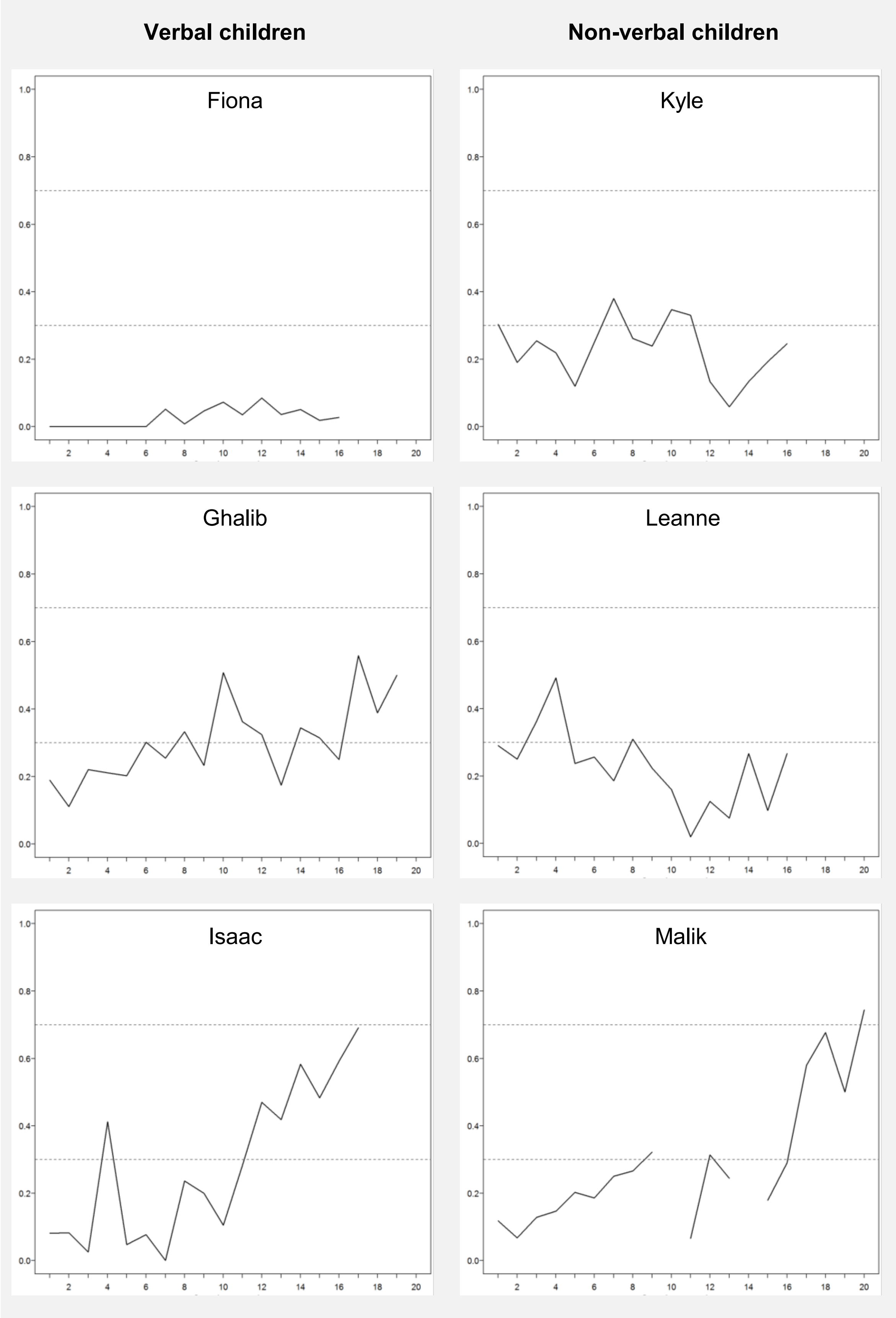
Response variable	**Composed of codes**	**Anticipated effect**	**Full-null model comparison (*p*-value)**	**Model estimate (*p*-value)**	**Hypothesis confirmed?**
Play total	Play, Asst-Play	Not consistent	Not significant (0.148)	-	Inconclusive (Yes)
Vocal	Vocal	Positive	Not significant (0.056)	-	Inconclusive (No)
Move	Move	Not consistent	Significant (0.010)	Positive (0.002)	No
Expression	Play, Asst-Play, Talk, Vocal, Move, Object	Positive	Significant (0.003)	Positive (0.003)	Yes
Smile	Smile	Positive	Significant (< 0.001)	Positive (< 0.001)	Yes
Look total	Look, Look-TA	Positive	Significant (< 0.001)	Positive (0.005)	Yes
Initiate	Initiate	Positive	Significant (< 0.001)	Positive (0.002)	Yes
Respond	Respond	Positive	Not significant (0.088)	-	Inconclusive (No)
Engaged	Engaged	Positive	Significant (< 0.001)	Positive (0.019)	Yes
Contact total	Contact, Contact-TA	Not consistent	Not significant (0.209)	-	Inconclusive (Yes)
Difficulty	Fidget, Anxiety	Negative	Significant (< 0.001)	Negative (< 0.001)	Yes

Summarising the results, I had anticipated an inconsistent effect on three response variables, namely ‘Play total’, ‘Move’, and ‘Contact total’. As predicted, the full-null model comparison was not significant for ‘Play total’ and ‘Contact total’. Differing from my hypothesis, however, was the significantly positive effect of ‘session number’ on the response ‘Move’. I had anticipated a positive effect of the predictor ‘session number’ on seven response variables, including ‘Vocal’, ‘Expression’, ‘Smile’, ‘Look total’, ‘Initiate’, ‘Respond’, and ‘Engaged’. The hypothesis could be confirmed for ‘Expression’, ‘Smile’, ‘Look total’, ‘Initiate’, and ‘Engaged’. In contrast to my prognosis, the full-null model comparison was not significant for ‘Vocal’ and ‘Respond’. It is thus not possible to make statements about the effect of ‘session number’ on these two variables. It is interesting to notice that research on the effectiveness of video-feedback to promote positive parenting also found that while initiating behaviour of children with ASD increased significantly over the course of the intervention, responding behaviour did not (Poslawsky et al., 2015). An explanation for this observed difference in intervention susceptibility of initiating and responding behaviours may be that they are associated with different attention systems (anterior and posterior attention system) and follow different pathways in neurocognitive development (Mundy, Sullivan, & Mastergeorge, 2009). For one response, ‘Difficulty’, I had predicted a negative effect of ‘session number’ on the variable. This hypothesis was confirmed.

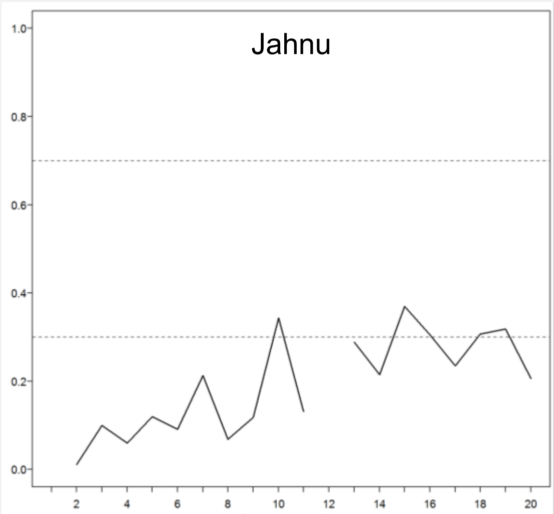
5.2.2.3 Exploratory data analysis

As the results for the variable ‘Vocal’ did not coincide with the expectations, and as the *p*-value of the full-null model comparison missed the significance level by a narrow margin, it is useful to examine this variable further. To understand the impact of music therapy on vocalising better, the individual developments of all children are considered. In the following figure, 13 line-graphs, one for each child, are displayed. Their layout is identical to the layout of the scatter plots presented in the previous section, with the x-axis depicting the twenty weeks of intervention and the y-axis showing the proportion of the observed behaviour. As a few sessions could not be video-recorded, the graphs of some children show gaps in the intervention weeks with missing recordings. The charts are organised so that all the diagrams of verbal children are placed in the left column and all the diagrams of non-verbal children are presented on the right-hand side. Within these groups, graphs are arranged in alphabetical order. Individual time-series graphs for all the other response variables and codes are displayed in the appendix.

Figure 31: Individual time-series graphs for response variable ‘Vocal’



Verbal children
Non-verbal children
Fiona
Kyle
Ghalib
Leanne
Isaac
Malik

Verbal children	**Non-verbal children**
	

When looking at the individual graphs for the response variable ‘Vocal’, several observations can be made. The development of vocalising behaviour was rarely linear and steady but rather included several spikes and indentations. However, the overall proportion of vocalising during music therapy sessions increased for most children. Arjun, Ben, Charlie, Denise, Eric, Fiona, Ghalib, Isaac, Jahnu and Malik vocalised more often as sessions progressed. Several patterns of change are distinguishable within this group. Vocalising behaviour of Arjun, Denise and Fiona did not change noticeably during the first weeks of intervention. After a while, the proportion of vocalising increased suddenly and remained on this higher level for the remaining sessions. This leap in development occurred in week 15 for Arjun, in week 14 for Denise and in week 7 for Fiona. All three children were in the low-intensity treatment group. Fiona’s progress seems to be very small. Considering the fact, however, that she was selective mute and did not produce a single vocal sound during her first six sessions, the small change was clinically relevant. Charlie and Eric show a development somewhat similar to that of Arjun, Denise and Fiona in the way that their vocalisations did not increase for a while. In weeks 13 and 8, respectively, Charlie and Eric suddenly vocalised more often than before. After that, however, the proportion of vocalisation fluctuated extremely. Ben, Ghalib, Isaac, Jahnu and Malik showed some progress in the amount of vocalisations from the beginning of the intervention and the overall development continued to be positive as sessions progressed. The graphs of Isaac and Malik especially show a steep upward slope. Extraordinary ranges are displayed by Eric (2.1% in week 4 to 74.4% in week 12), Isaac (0% in week 7 to 69% in week 17) and Malik (6.6% in week 2 to 74.5% in week 20). These three boys were all in the high-intensity treatment group.

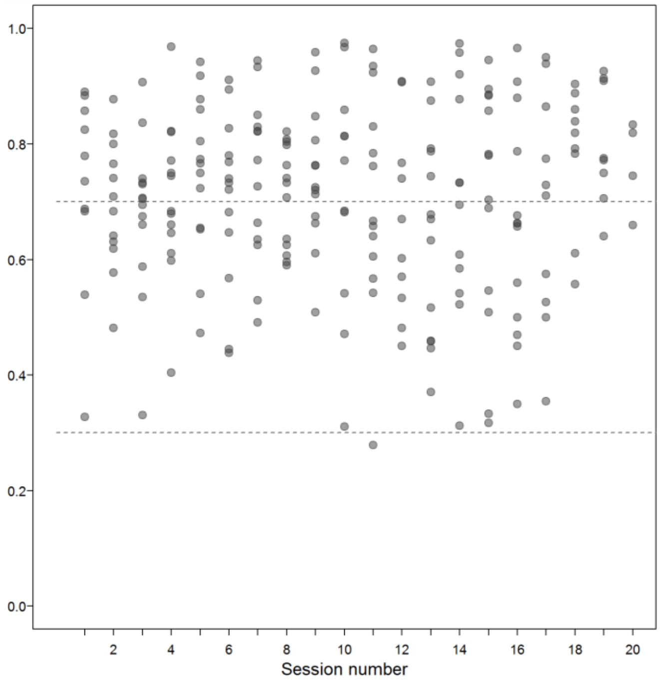
Three children, namely Henry, Kyle and Leanne, did not use vocalisations more often over the course of the music therapy intervention. Henry and Kyle seemed to remain on a similar level. Even though the proportion of vocalising behaviour varied between sessions, music therapy did not seem to have an observable effect on vocalising for these two children. The target behaviour neither increased nor decreased significantly as sessions progressed. Only one child, Leanne, seemed to vocalise slightly less often towards the end of the intervention. The three children who did not vocalise more often as sessions progressed were all non-verbal. It is striking that all children in the verbal group show an ascending development while three out of six non-verbal children show no development or a decrease in vocalising.

This exploratory data analysis does not question the results of our model, but it highlights the limitations of any statistical evaluation. The *p*-value of the full-null model comparison was not significant. This finding does not mean that the predictor ‘session number’ has no effect on the response variable ‘Vocal’. Rather, it means that no effect across all the children could be found using this specific data set and this specific analytical model. Several of the children, however, did improve significantly. This closer examination of the individual developments of all 13 children points out that the hypothesis that music therapy has an impact on vocalising behaviour of children with ASD should not be fully dismissed. Rather, the results suggest that the correlation between music therapy sessions and the amount of vocalisations should be investigated further in future research studies. In addition, the verbal ability of children may be predictive of the responses.

5.2.2.4 Therapist variables

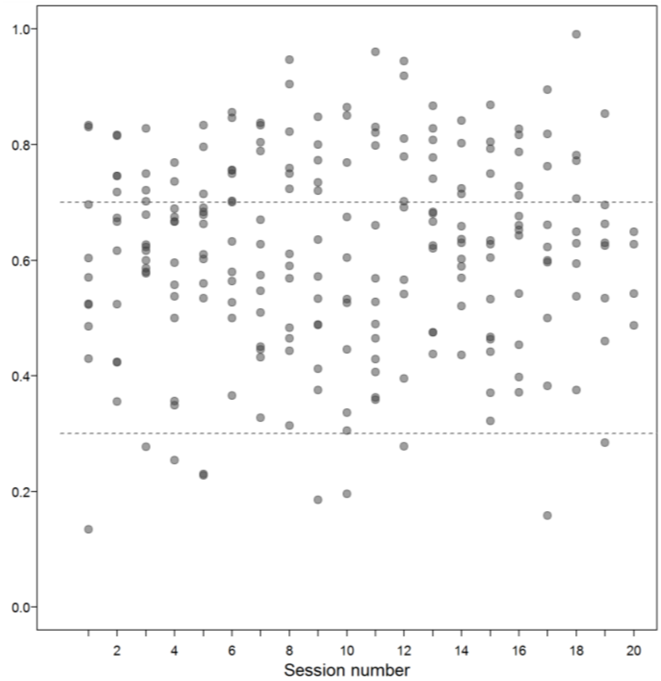
The video annotation not only involved coding child behaviours but also coding therapist behaviours. However, I was not interested in investigating the effect of predictor variables, such as session number or the child’s verbal ability, on these therapist behaviours. Rather, I hoped to generate data to further our understanding of the role of the therapist. These descriptive statistics enable us to reflect on the therapist behaviours that do or do not occur during the best moments in music therapy sessions. The frequency with which the therapist variables occurred during session excerpts is presented in scatter plots. One plot has been issued for each variable, displaying all the therapist-related observations collected across all children and intervention weeks. The x- and y-axes are identical to the axes in the scatter plots presenting the results for child variables.

Figure 32: Proportion 'T-Play'



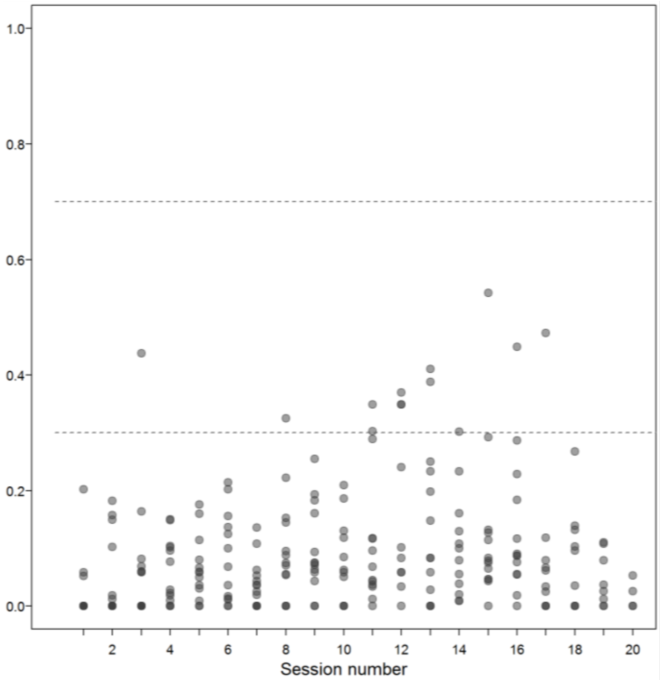
This scatter diagram shows how much time the therapist spent playing instruments during selected session excerpts. The proportion of playing has a mean of 71%, with ranges from 27.9% (occurring in week 11) to 97.5% (occurring in weeks 10 and 14). Regarding the amount of the therapist's instrumental playing, no pattern of change becomes evident over the course of the intervention.

Figure 33: Proportion 'T-Vocal'



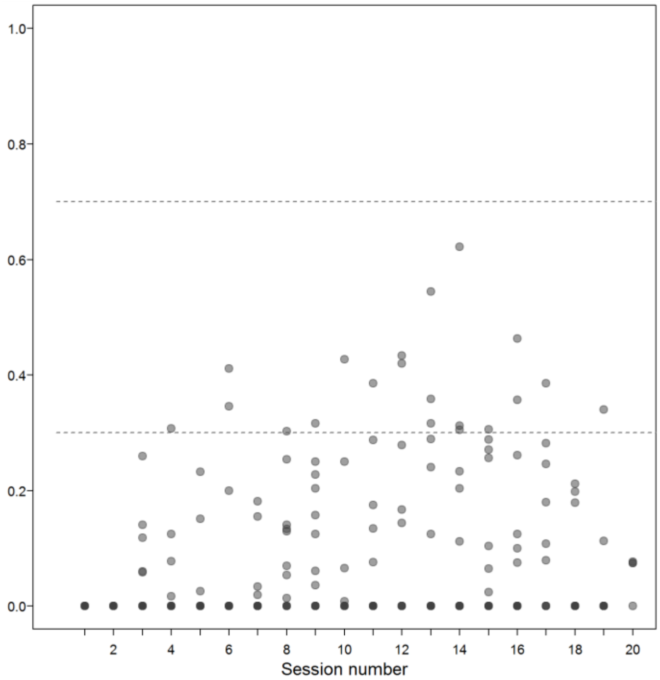
In this chart, the amount of time the therapist used her voice in a musical way and with intent is visualised. How much the therapist vocalised or sang does not seem to depend on the intervention week. Over the course of the 13 interventions, the proportion of vocalising covers almost the full range from 13.4% (occurring in week 1) to 99.1% (occurring in week 18). The mean for 'T-Vocal' is 61.4%.

Figure 34: Proportion 'T-Move'



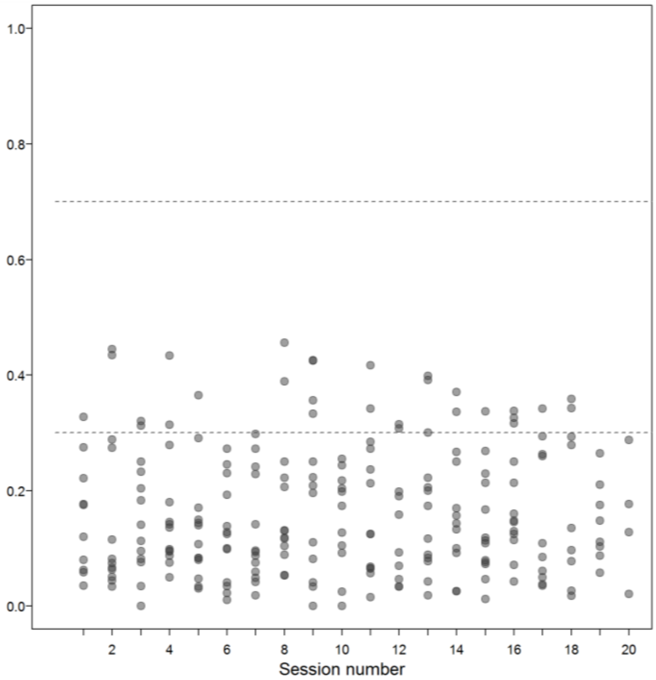
The proportion of time the therapist moved expressively during session excerpts is depicted in this diagram. With a mean of 8.9% and ranges from 0% (occurring in all weeks but week 14) to 54.2% (occurring in week 15), this form of expression was used less often by the therapist than playing instruments and vocalising.

Figure 35: Proportion 'T-Object'



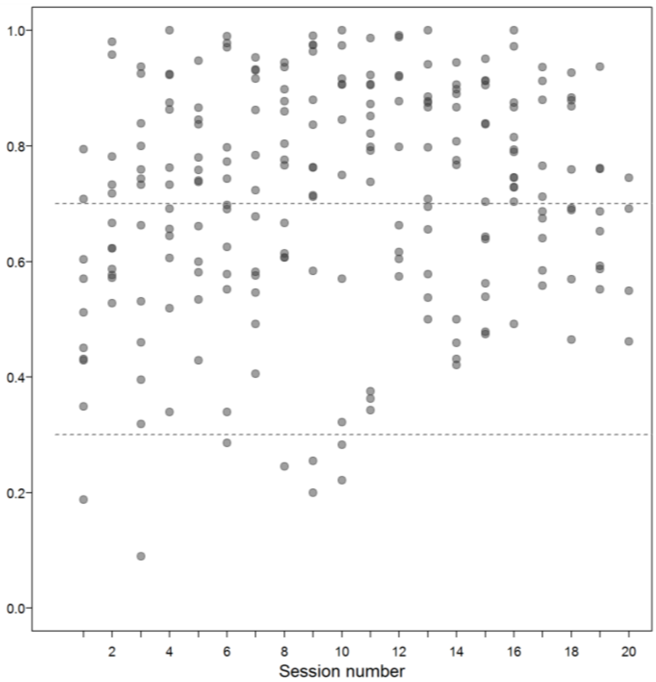
This scatter plot visualises how often the therapist used objects, such as toys or colourful pieces of material, during the selected session excerpts. It is noticeable that objects were not used with any child during the first two weeks of intervention. Once introduced, incorporating objects during sessions became an important element with some children only. The highest proportion of time objects were used by the therapist was 62.2% (occurring in week 14). The overall mean for 'T-Object' is 7.7%.

Figure 36: Proportion 'T-Talk'



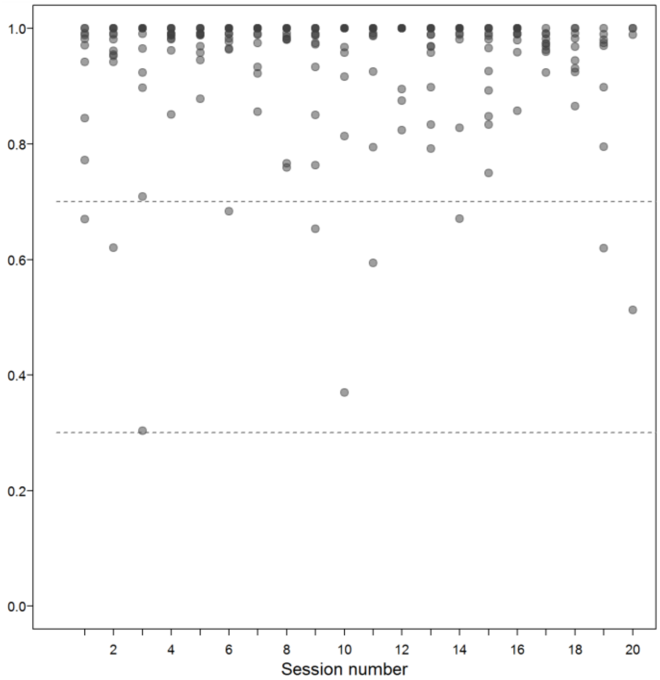
This figure shows how much time the therapist spent talking during video excerpts. No obvious pattern of change in this behaviour can be seen over the course of the 13 interventions. On average, 'T-Talk' was coded in 16% of the five-second intervals. The proportion of talking ranges from 0% (occurring in weeks 3, 9, 10) to 45.6% (occurring in week 8).

Figure 37: Proportion 'T-Smile'



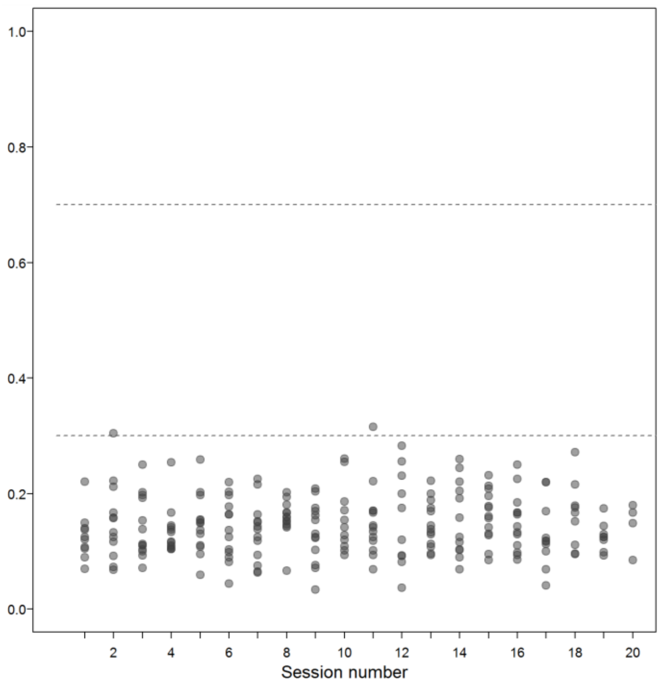
This scatter plot illustrates that the proportion of time the therapist smiled or laughed during selected session excerpts varied quite a lot. The full range is 8.9% (occurring in week 3) to 100% (occurring in weeks 4, 10, 13, 16). The overall mean for 'T-Smile' is 71.4%. A proportion of 40% or less occurred only in the first eleven weeks.

Figure 38: Proportion 'T-Look'



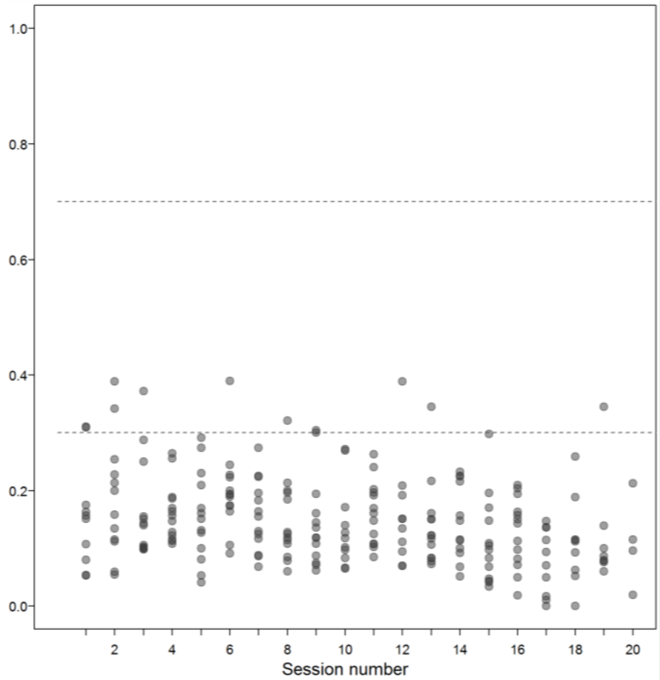
In this diagram, the proportion of time the therapist looked at the face of the child is depicted. It becomes evident that the therapist looked almost all of the time towards the child during most of the selected session excerpts. The mean for 'T-Look' is 94.9%. Only two data points represent a proportion of looking of less than 50% (occurring in weeks 3 and 10).

Figure 39: Proportion 'T-Initiate'



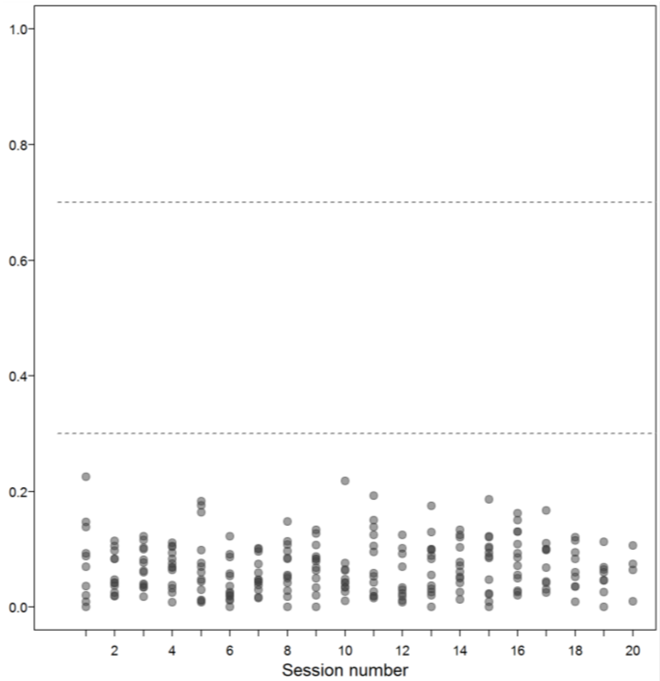
When examining the data for 'T-Initiate', it becomes clear that the therapist initiated new elements for a very similar amount of time throughout all weeks of the interventions with all children. The proportion covers the range from 3.3% (occurring in week 9) to 31.6% (occurring in week 11), with a mean of 14.6%. No pattern stands out, i.e. the therapist did not initiate significantly more or less as sessions progressed. It is interesting, that the range and mean are similar to the range (1.8% to 41.7%) and mean (15.6%) of the child variable 'Initiate'.

Figure 40: Proportion 'T-Name'



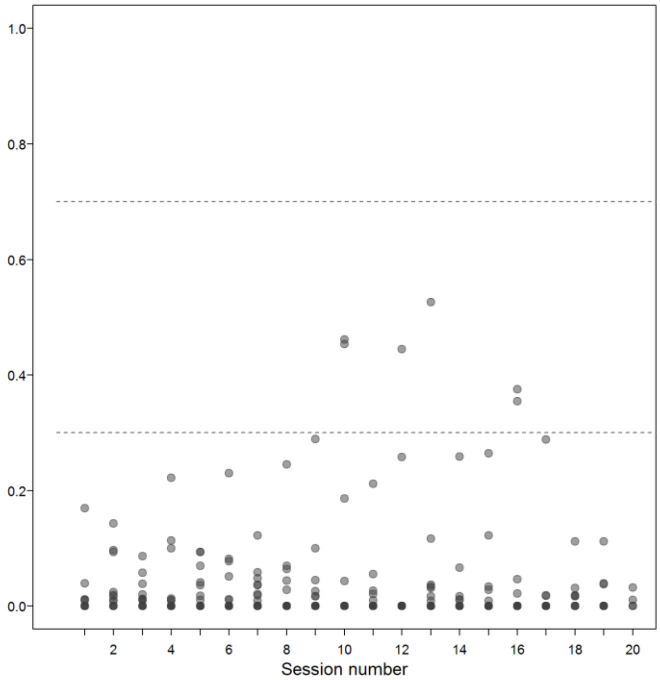
As one can see in this scatter graph, the therapist used the name of the child at least once in excerpts of almost every session with every child. The mean for 'T-Name' is 14.6%, with a range from 0% (occurring in weeks 17 and 18) to 39% (occurring in week 6). The therapist's use of the child's name during music therapy seems to be slightly negatively correlated with the week of the intervention.

Figure 41: Proportion 'T-Praise'



Praise was used by the therapist sparingly but consistently as can be seen in this scatter plot. The average proportion of 'T-Praise' is 6.8%. No distinct change in how often the therapist praised the child over the course of the intervention becomes apparent.

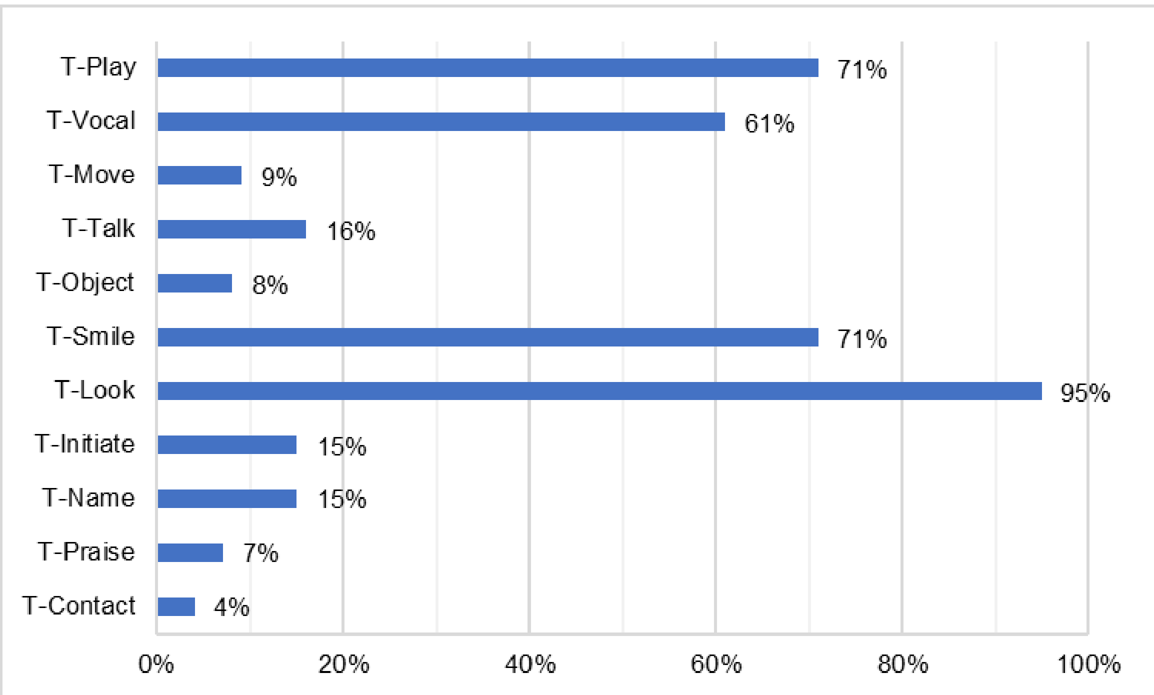
Figure 42: Proportion 'T-Contact'



This scatter plot presents the data for 'T-Contact'. Overall, the therapist did not use physical contact to reassure a child, gain their attention, or help them to play an instrument very much. The proportion of this therapist behaviour has a mean of 3.8% and ranges from 0% (occurring in all weeks) to 52.6% (occurring in week 13).

To enable a better overview of the observed therapist behaviours during the selected session excerpts, all mean values for each code are presented in the following figure. As therapist behaviours did not significantly change over the course of the interventions, overall mean scores are suitable to give an impression of therapist behaviours occurring in positive music therapy moments. Many of these behaviours can take place simultaneously. For example, the therapist can play guitar, sing, smile and look at the child at the same time. This explains why all means added together amount to more than 100%.

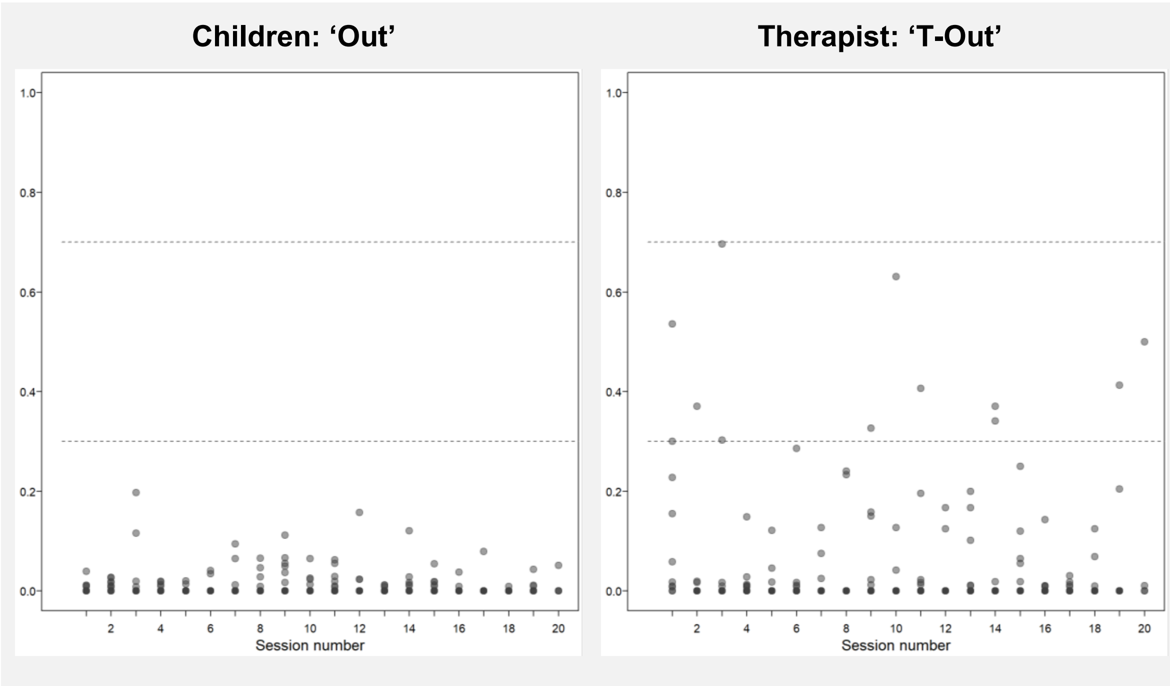
Figure 43: Therapist behaviour during selected video excerpts



5.2.2.5 Limited visibility of children and therapist

All the above-mentioned findings are based on the video annotation. The validity and usefulness of these results is thus dependent on the quality of the video material. As described in the methodology, four or five excerpts of 30 to 180 seconds each were selected per session. Apart from including some form of music making, these excerpts had to allow for a good visibility of the child's face. However, all music therapy sessions conducted within this project were video recorded by a single camera on a stand. The fixed camera could not follow the movements of the child and therapist. Even though the camera was always positioned so that most of the room was visible, a few videos still had a poor visibility of the child or the therapist. To document and assess the dimension of this limitation, I created the codes 'Out' and 'T-Out'. They were applied when the child's face ('Out') or the therapist's face ('T-Out') was not visible so that it became impossible to code 'Smile' and 'Look' or 'T-Smile' and 'T-Look', respectively. The following figure presents all the collected data regarding the codes 'Out' and 'T-Out'. For each of the codes, one scatter plot has been generated including the information for all children and sessions.

Figure 44: Proportion of time children's or therapist's faces were not visible on camera



These plots show the proportion of 'Out' and 'T-Out' observations during the selected video excerpts. The proportion of time children's faces were not visible on camera during the selected excerpts has a mean of 1.1%. In excerpts of 159 sessions (69.4%), children were visible all of the time, i.e. the proportion of 'Out' observations was 0%. Only in five sessions were children's faces not visible for more than 10% of the time, with a maximum proportion of 19.8% (occurring in week 3). For the therapist, the proportion of 'T-Out' codings during one session has a mean of 4.3%. The code was not applied in 153 sessions (66.8%) which, therefore, have a proportion of ‘T-Out’ observations of 0%. The worst visibility occurred in week 3, where ‘T-Out’ codes in excerpts of one session amounted to a proportion of 69.6%. In setting up the camera and selecting video excerpts for annotation, I prioritised the visibility of the child’s face over the visibility of the therapist’s face. Overall, the low means of 1.1% and 4.3% for ‘Out’ and ‘T-Out’, respectively, indicate that the quality of the video material was satisfactory and did not compromise the usability and interpretability of the generated data.

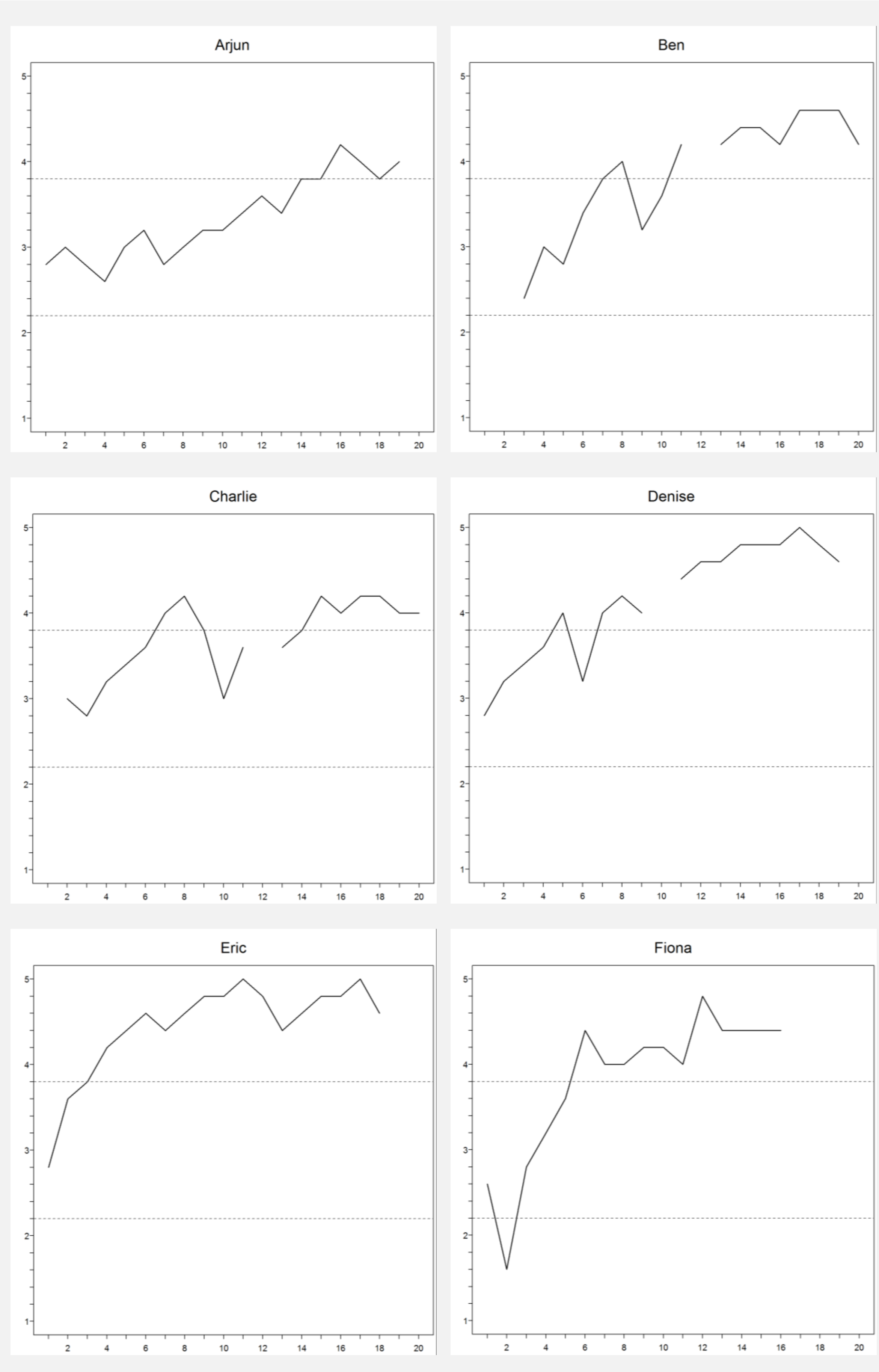
5.2.3 Relationship rating

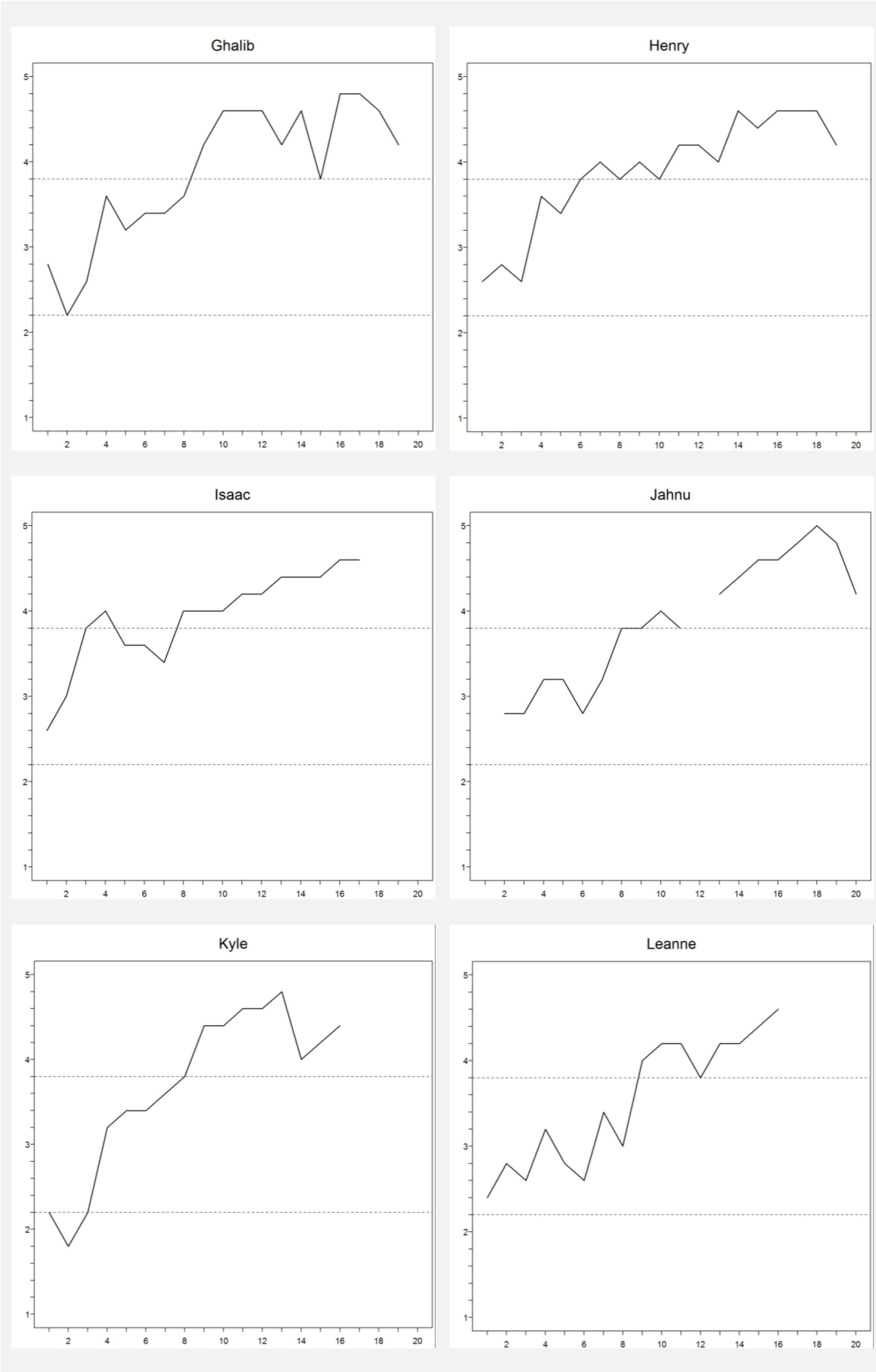
A positive relationship with a supportive adult has been determined to be one of the primary protective factors for developing resilience (American Psychological Association, 2018; Luthar, 2006). This factor is particularly relevant for children with ASD (Brooks & Goldstein, 2012). In my clinical approach, the therapeutic relationship is understood as the crucial factor for positive development. Thus, I wanted to investigate whether the music therapy intervention could provide autistic children with the experience of a resilience-enhancing relationship. However, as discussed in the methodology, I felt that this aspect was not covered sufficiently by the coding system of my video annotation. Therefore, I developed an additional bespoke assessment tool which I called ACTR. This allows the rater to evaluate the quality of relationship as 1 = difficult, 2 = slightly difficult, 3 = moderate, 4 = positive, 5 = very positive. Descriptions about the child’s emotional state and way of being in the room, the child’s ability to engage in reciprocal musical interactions, and the child’s ways of relating to the therapist define each level. The rating manual is presented in more detail in section 4.7.1.2.

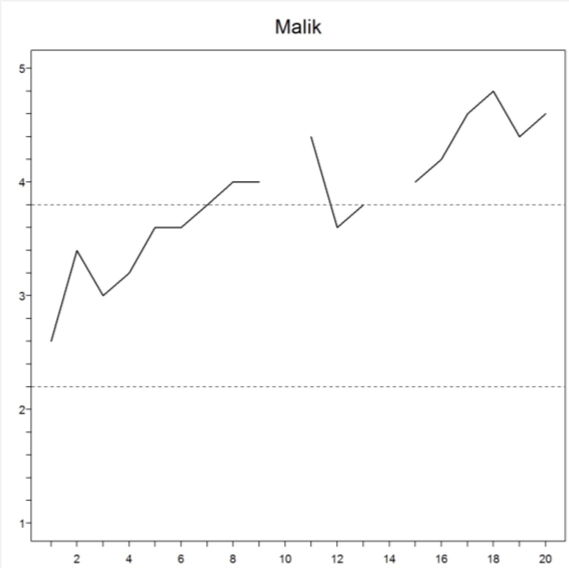
5.2.3.1 Individual developments of child-therapist relationship

All of the 1,135 video excerpts were assessed using the ACTR, and a mean score was calculated for each of the 229 sessions. In the following figure, the results are presented in time-series plots that visualise the development of the ACTR mean scores over the course of the music therapy intervention. One graph has been compiled for each of the 13 children. In all diagrams, the x-axis displays the week of intervention. On the y-axis, the ACTR mean score is shown with a possible range from 1 (difficult) to 5 (very positive). Graphs for individual children are arranged in alphabetical order.

Figure 45: Individual time-series graphs for ‘ACTR score’




Ghalib
Henry
Isaac
Jahnu
Kyle
Leanne



Even though the child-therapist relationship according to the ACTR follows a different development for each individual child, several patterns can be observed across the participants. Overall, the quality of the relationship seems to improve as sessions progress. For all 13 children, the rating of the first session falls within the range of 2 to 3, i.e. the quality of the relationship can be described as slightly difficult to moderate. In comparison, the last session of all the children received a score between 4 and 5, characterising the quality of the relationship as positive to very positive. Another similarity between the graphs is the non-linear development that includes several indentations. This result is not surprising considering that the relationship between two people is dependent on several factors, such as the persons' conditions and moods on that day, and thus liable to fluctuations. The third pattern across participants is related to the respective highest mean scores. It is noteworthy that only for two children, Isaac and Leanne, does the highest score correlate with the last week of intervention. For all the other children, the highest ACTR score was obtained in an earlier session, usually one to three weeks before the end of treatment. This finding matches my clinical observations. I prepare the children for the end of the music therapy intervention by addressing the approaching last session three weeks in advance. Several children respond to this by withdrawing some of their engagement and enthusiasm, which I understand as a healthy and normal reaction to an expected separation. Interestingly, Isaac and Leanne were two of the three children who were accompanied by a TA who participated in the sessions and who used elements and activities from the therapy outside the sessions. Maybe this finding indicates that collaborating with school staff or other adults who are important to the child can ease the potential difficulties of ending the treatment and can improve the sustainability of the intervention.

5.2.3.2 Model results - ACTR score

To be able to draw statistically supported conclusions about the impact of music therapy on the development of the child-therapist relationship, the generated data were subjected to an analysis using the same statistical model as with the behaviour variables evaluated in the previous section. All the mentioned advantages of the GLMM also apply to the ACTR data set. In order to find out whether the predictor variables ‘session number’, ‘therapy intensity’, and ‘verbal ability’ have an effect on the response variable ‘ACTR score’, the following model was implemented:

ACTR score ~ session number + *session number*^{2} + *therapy intensity* + *verbal ability* + *(1* + *session number* + *session number*^{2} | *child-ID).*

The model results are presented in Table 10. The layout is identical to the layout of Table 8, which presented the model results of the different response variables. The first two columns list the response variable and probability distribution, respectively. The *p*-value of the full-null model comparison is shown in the third column followed by values for the estimate, standard error, z-value, *p*-value, and the lower and upper confidence limits for all the model terms in the full and the reduced model. Significance ($p \leq 0.05$) is highlighted by displaying respective rows in bold. Diagnostic tests and graphic assessments of goodness of fit indicated that the data set was not normally distributed. Thus, beta distribution was chosen.

Table 10: Model results - Relationship rating

Response	**Probability distribution**	***p*-value full-null model comparison**	**Model type**	**Model term[a]**	**Estimate**	**SE**	**z-value**	***p*-value**	**CL lower[b]**	**CL upper[b]**
ACTR score	Beta	**< 0.001**	Full model	Intercept	0.760	0.282	2.694	[c]	0.207	1.312
				Session number	0.834	0.082	10.183	[c]	0.673	0.994
				Session number²	-0.118	0.069	-1.719	0.099	-0.253	0.017
				Therapy intensity	0.249	0.290	0.858	0.398	-0.320	0.817
				Verbal ability	**0.638**	**0.290**	**2.203**	**0.043**	**0.070**	**1.205**
			Reduced model	Intercept	0.743	0.287	2.591	[c]	0.181	1.305
				Session number	**0.841**	**0.084**	**10.067**	**< 0.001**	**0.677**	**1.005**
				Therapy intensity	0.239	0.295	0.812	0.423	-0.338	0.817
				Verbal ability	**0.630**	**0.294**	**2.140**	**0.048**	**0.053**	**1.207**

Abbreviations: CL, Confidence limits; SE, Standard error

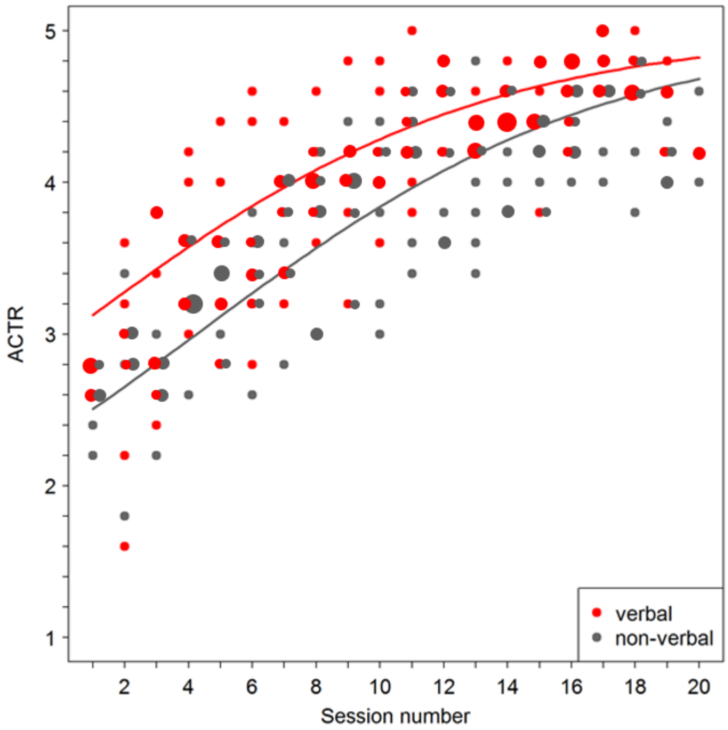
[a] All predictors were z-transformed to a mean of zero and a standard deviation of one

[b] 95% confidence limits

[c] *p*-values not shown for intercept and model terms that are conditional on other model terms because of very limited interpretability

The full-null model comparison was significant for the variable 'ACTR score' ($p < 0.001$). As the term 'session number^2' did not have a significant effect when using the full model, the effect of the linear term 'session number' on 'ACTR score' was inferred with the reduced model. The model results are visualised in the following scatter plot, which has the familiar layout with the week of intervention (1-20) being displayed on the x-axis and the response value being shown on the y-axis. Several observations conglomerating on the same point in the coordinates are represented by proportionally larger dots.

Figure 46: Results for 'ACTR score'

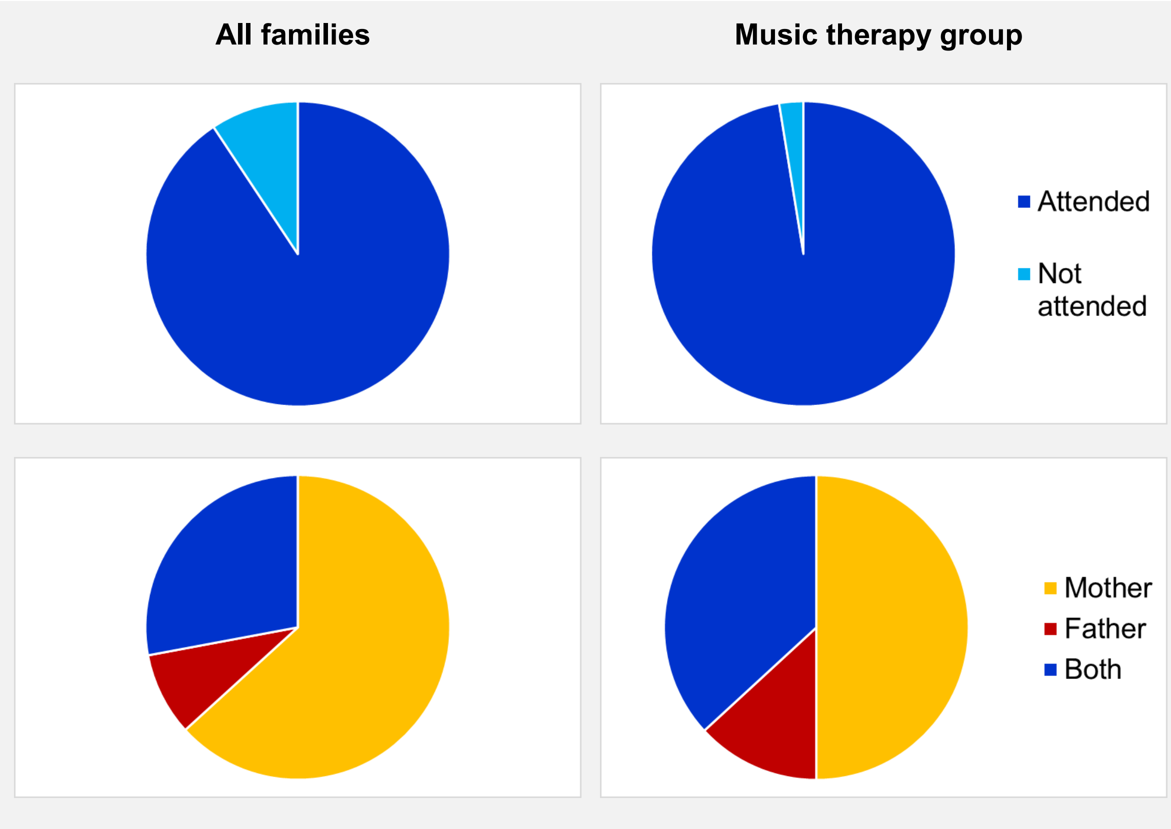


This scatter plot presents the results of the relationship rating across all 13 children over the course of 20 weeks of music therapy. The effect of the predictor 'session number' on the ACTR score was significant ($p < 0.001$). The correlation between session number and response was positive, which means that the relationship improved as sessions progressed. This correlation is illustrated by the upward slope of the trendlines. 'Therapy intensity' had no significant effect on the quality of the child-therapist relationship as measured by the ACTR, but the predictor 'verbal ability' was significant ($p = 0.048$). On average, verbal children, who are represented by the dots and trendline in red, received a higher score on the ACTR throughout the course of the intervention compared to the group of non-verbal children, who are represented by the dots and trendline in grey. However, it is noticeable that the two trendlines converge as sessions progress, indicating that the ACTR scores of verbal and non-verbal children gradually became more similar. Session mean scores ranged from 1.6 (occurring in week 2) to 5 (occurring in weeks 11, 17 and 18).

5.3 Results: Parent counselling sessions

This section concentrates on the findings from the parent counselling sessions. Of the 25 families who were offered three sessions each, parents of 20 children attended all three sessions. Overall, acceptance was very good with 68 out of 75 possible sessions being delivered (90.7%). An even higher attendance rate of 38 out of 39 possible sessions (97.4%) could be observed in the subgroup of families whose children received concurrent music therapy intervention and whose sessions were included in the thematic analysis. The family members present at these sessions varied. Most commonly, the mother attended the meeting on her own (43/68 sessions = 63.2%), significantly less often the father on his own (6/68 sessions = 8.8%). In several sessions, both parents attended together (19/68 sessions = 27.9%). Other family members, such as grandparents or siblings, were sometimes present as well. In the music therapy subgroup, the proportion of the mother attending on her own (19/38 sessions = 50%), the father attending on his own (5/38 sessions = 13.2%), and both parents being present (14/38 sessions = 36.8%) was more equally distributed. The following figure displays the proportion of parent counselling sessions that were attended, as well as the family members who were present at these sessions for both the whole group and the music therapy subgroup.

Figure 47: Parent counselling sessions - Attendance



As explained in the methodology (4.6.2), only the parent counselling sessions from the music therapy subgroup were considered for thematic analysis. For each of the 13 families in this group, the second of the three counselling sessions was transcribed and analysed according to the method outlined by Braun and Clarke (2006). For a more detailed description of this process, see section 4.7.2 above. Examining the content of the 13 parent counselling sessions, 1,175 text excerpts were coded and categorised. These comments from parents could be grouped together, which allowed for eight emergent themes to be detected. These themes are: (1) Exchange of information, (2) Experiences with others, (3) Impact of autism, (4) Worries about future, (5) Partnership with parents, (6) Empowering parents, (7) Celebrating strengths and progress, and (8) Rejoicing in child's enjoyment. Most of the themes comprise further subcategories. Table 11 provides an overview of the full codebook with all devised categories and subcategories. Furthermore, the table lists the number of coded excerpts in each subcategory as well as the number of parent counselling sessions in which these excerpts occurred.

Table 11: Codebook

Category	Number of excerpts	Number of sessions
1. Exchange of information	**135**	**13**
1.1 Development of child	47	13
1.2 Difficulties of child	31	11
1.3 Medication, diet and therapies	26	9
1.4 Autism and research study	31	13
2. Experiences with others	**68**	**12**
2.1 Family members	32	10
2.2 Professionals and school staff	23	4
2.3 Society and strangers	13	7
3. Impact of autism	**67**	**13**
3.1 Parents' mental health and wellbeing	25	12
3.2 Family and social life	29	11
3.3 Finances and work	13	6
4. Worries about future	**20**	**10**
5. Partnership with parents	**208**	**13**
5.1 Setting and dates	37	13
5.2 Aims of therapy	51	12
5.2.1 Therapist's aims	21	9
5.2.2 Parents' aims	30	10
5.3 Parents' expertise and strategies	84	13
5.3.1 Expertise – Favourites and triggers	17	8
5.3.2 Expertise – Child's behaviour	26	9
5.3.3 Strategies – Challenging/accepting	14	7
5.3.4 Strategies – Using music	6	6
5.3.5 Strategies – Using visualisation	9	3
5.3.6 Strategies – Other	12	5
5.4 Future provision of music therapy or teaching	36	10
6. Empowering parents	**220**	**13**
6.1 Boosting self-confidence of parents	55	11
6.1.1 Complimenting them on their children	11	7
6.1.2 Valuing what they do	34	9
6.1.3 Valuing what they say	10	7
6.2 Sharing therapist's strategies	104	13
6.2.1 Using structure	27	9
6.2.2 Following the child's lead	11	7
6.2.3 Motivating effect of music	14	9
6.2.4 Encouraging self-expression	14	8
6.2.5 Using playfulness and humour	15	8
6.2.6 Providing sensory integration	12	5
6.2.7 Encouraging vocalisation	11	7
6.3 Using music at home	61	12
6.3.1 Instruments	40	12
6.3.2 How to use music	21	8

Category	Number of excerpts	Number of sessions
7. Celebrating strengths and progress	**369**	**13**
7.1 Strengths apparent in video excerpts	117	13
7.1.1 Musical skills and motor control	33	13
7.1.2 Interaction and communication	18	9
7.1.3 Focus and concentration	22	10
7.1.4 Self-expression	13	8
7.1.5 Creativity, playfulness and humour	21	9
7.1.6 Confidence and independence	4	3
7.1.7 Self-regulation	3	3
7.1.8 Other	3	3
7.2 Progress apparent in video excerpts	82	13
7.2.1 Musical skills and motor control	11	9
7.2.2 Interaction and communication	15	9
7.2.3 Focus and concentration	13	7
7.2.4 Self-expression	9	6
7.2.5 Creativity, playfulness and humour	10	6
7.2.6 Confidence and independence	19	9
7.2.7 Other	5	5
7.3 Strengths outside music therapy sessions	55	12
7.3.1 Musical skills and motor control	12	7
7.3.2 Interaction and communication	4	4
7.3.3 Self-expression	7	4
7.3.4 Creativity, playfulness and humour	4	4
7.3.5 Self-regulation	5	4
7.3.6 Cognitive skills	13	6
7.3.7 Skills for daily living	10	5
7.4 Progress outside music therapy sessions	115	13
7.4.1 Interaction and communication	46	11
7.4.2 Focus and concentration	9	5
7.4.3 Self-expression	17	7
7.4.4 Confidence and independence	8	4
7.4.5 Self-regulation	21	9
7.4.6 Other	14	10
8. Rejoicing in child's enjoyment	**88**	**13**
8.1 Child's happiness and enjoyment	56	13
8.2 Cherishing videos as a memory	32	10

Even though the thematic analysis is a qualitative and not a quantitative analysis, the number of coded excerpts in the different categories and subcategories, and the number of parent counselling sessions in which the different themes were talked about, give some valuable information. Of the eight themes, the category (7) 'Celebrating strengths and progress' includes by far the largest group of subcategories and the highest number of coded excerpts (369 excerpts). This indicates the relevance of the theme in the parent counselling sessions. The categories (6) ‘Empowering parents’, and (5) ‘Partnership with parents’ also subsume more than 200 comments each. In the following, the eight main themes are presented in more detail. Examples of text excerpts, i.e. quotes from parents, illustrate the categories. The abbreviations P_A, P_B, P_C, P_D, P_E, P_F, P_G, P_H, P_I, P_J, P_K, P_L, and P_M are used for the parents of Arjun, Ben, Charlie, Denise, Eric, Fiona, Ghalib, Henry, Isaac, Jahnu, Kyle, Leanne, and Malik, respectively.

5.3.1 Exchange of information

In every parent counselling session, we exchanged information regarding the development or difficulties of the child. Furthermore, information was often shared about the treatment of the child, including therapies, medication and dietary requirements, as well as information about autism and the TIME-A research. Mostly, the contact with parents started with talking about the child’s background and development. Parents seemed keen to tell me about the early years, the medical history and their first concerns. It felt important that they could share this information with someone who showed interest and had time to listen to their narrative without diverting. Topics such as language development, sleep patterns, and the foster or adoption history were frequently talked about. For some families, thinking about the early development of their child proved to be difficult, as they were confronted with their previous hopes and unmet expectations, as becomes apparent in the following quote:

> P_A: “Till now I was thinking--, when he was very young, we were told it was Asperger’s because he was learning faster than other kids. And it was great, absolutely great.”

We discussed recent progress and changes, the child’s behaviour at school and at home, and likes or dislikes. Parents often gave a detailed description of their child’s characteristics and related them back to their memories. Most parents also used the counselling sessions to talk about difficulties of their child and challenging behaviours, such as “He's not very nice to other children” (P_M), or “She wants to dominate everything” (P_D). Parents were often very concerned about the safety and wellbeing of their child and seemed anxious to discuss their worries with a professional:

> P_M: “He used to bite me but then he started biting himself and then--, but sometimes he can hold his teeth there for so long that he’s marking all his fingers.”

Talking with parents about other interventions they were using or had used in the past was important to get an idea of whether the families had previous positive or negative experiences with therapists that might impact our work and relationship. Surprisingly, ten out of 13 families had never accessed any therapy support before. Most attributed that to a lack of services and resources in their local communities. Several parents hoped for their children to receive speech and language therapy or occupational therapy at school in the near future. Two families paid for other interventions privately and used hippo therapy, sacrocranial therapy and reflexology. Medication, namely the hormone melatonin that helps with sleep problems, was only used by two families. Special diets and supplements played an important role for two families.

The exchange of information also included knowledge about ASD and about the research study. Several parents used part of the sessions to ask questions about the condition, such as “How many children with ASD will learn to speak?” (P_C). Some parents were uncertain about their child’s behaviour and seemed glad that they could discuss their questions with a professional:

> P_B: “And the thing is, I’m confused because I don't know when he's naughty and when his behaviour is not right. I'm not really sure. Is it just because he’s naughty or is it just because of his autism?”

Parents also tried to get more information about the other children I was seeing to assess the severity of their own child’s condition. They asked for example “When you compare him to the others, is he doing well?” (P_G). Very practical questions concerning behaviour management or advice regarding visual aids were also common. All the families were interested in learning more about music therapy in general and about the research study.

5.3.2 Experiences with others

In every counselling session, parents talked with me about the experiences they or their children have had with other people. I grouped these comments into the following subcategories: Experiences with family members, experiences with professionals and school staff, and experiences with society and strangers. Experiences with family members were mostly positive. Several parents told me that their child played with siblings, that other family members were understanding, and that they were very grateful for the support they received from their relatives. Especially when the children struggled to form friendships in school or when they behaved in ways that made it difficult for families to socialise with others, it seemed to be a relief that family members were patient and persistent:

> P_E: “We used to always spend Sundays together, my mum and my sisters and all my nieces and nephews, so he’s grown up with them like his siblings really. And because they’ve grown up with him, they’re so used to him. He will kind of do his own thing while they do little games and then we’ll be like, you know, ‘You incorporate Eric’, so they are trying to get him in as well and he kind of has started to interact with them in a sense.”

A striking element of many sessions was the amount of anger and disappointment parents voiced when they talked about contact with professionals, including paediatricians and school staff. Parents talked about long waiting lists, rushed appointments, insufficient information, and the feeling of not being taken seriously:

> P_D: “Although there was things, it was just the system was not working. So, I was going to the GP and things like that and complaining, and he just said, ‘Well I can see nothing wrong’.”

The most stressful aspect, however, seemed to be that professionals usually focus on difficulties and impairments of the child. One parent communicated his discontent with this deficit-oriented approach very clearly:

> P_A: "Try to understand what are his strengths which absolutely nobody--, which is missing. So everybody is talking about his weakness all the time and saying he's weak. Yes, we--, that's an accepted thing but not talking about his strengths and saying, okay these are his strengths, let's work on his strengths and make sure he makes something out of it."

Further disappointments seem to be frequently caused by experiences with neighbours or strangers. One mother was desperate because her child's noisiness upset the neighbours to the point that they did not say hello any more. One parent reflected on an unpleasant encounter she had made when trying to visit a public place with her child. An important aspect of the counselling sessions seemed to be that they provided a safe space for parents to talk about these difficult experiences. They were listened to without being judged, and thus enabled to express feelings of disappointment, sadness and anger:

> P_K: "He doesn't understand and he's a lot bigger than most children but if he wants to play, he doesn't understand what he's doing and an awful lot of people--. There was an incident where I got a bit vocal. We went to a park and this lady was talking to him and she was getting really rude with him and obviously I was like, 'He's not looking at you, do you not understand there is something wrong with him?', and I got very, very mad and I said, 'It's people like you that make me sick because you just, you're just looking at him like he's, you know, stupid'. There is no understanding, there is no sort of sympathy towards him in that specific minute."

Some families seemed so disappointed with how other people responded to their child that they appeared depressed and hopeless at times. The following excerpt illustrates how one couple felt let down by society in general:

> T: "How have you been during the last two months?"
> P_L: "Mm, we are all right, it's just the rest, it's everybody else making it difficult."

5.3.3 Impact of autism

The impact of the child's condition on the parents' lives was obvious in all counselling sessions. Parents talked about worries caused specifically by the autism diagnosis of their child, including the impact on their own mental health and wellbeing, the impact on the family and their social life, and the impact on their finances and work situation. I never urged parents to focus on these aspects, but I explained that they could use their sessions in any way they wanted or needed to, including discussing difficult thoughts and feelings.

Parents' own wellbeing was often affected, in the sense that they were exhausted and tired because of the high demands that come with caring for a child with special needs. This problem seemed to be intensified by the lack of social support and the high expectations parents had of themselves:

> P_K: "There is times when, don't get me wrong, like it can be rock bottom for us a little bit. You have to do your best, you have to get up every day and, you know, I don't get a lot of help, but I have to, I'm his mother."

In addition, several families used the space to talk about personal problems traditionally associated with counselling. These themes included depressive symptoms, partnership problems, and traumatic experiences. One mother talked with me about the recent loss of a family member, one father described struggling to abstain from substance abuse, another father worked through some difficult aspects of his own childhood. Matrimonial problems were brought to the sessions by three families. Even though it seemed helpful that these parents were provided with a safe space to talk about their difficulties, it became apparent that the service offered was not sufficient to work together towards positive changes. I had neither received a professional counselling training, nor had I the possibility to provide more than three sessions for each family. This meant that problems could only be attended to in a limited way. I reminded parents repeatedly of our framework and referred them to other services if necessary. However, for some families it seemed beneficial to just voice their problems to a non-judgmental professional.

Apart from their partnership problems, several parents felt that other family members, especially siblings, were also affected by the autism diagnosis. Not being able to go out for meals, to go to busy places, to go on holiday, or to invite friends strained family relationships and wellbeing. The difficulty to respond appropriately to the different needs of family members was brought up frequently:

> P_C: "We don't go out a lot and that, just, cause I wanna keep him happy, to keep him happy, he doesn't like doing that so we're not doing it. So, his siblings, they're always like, 'Oh, why can't we do this and that'."

Parents were often acutely aware that this situation might not change soon and that they had to adjust to living with some of the difficulties. Others confided that friends seemed unable to cope with the special needs of the child which resulted in a compromised social life. Parents often tried to find an explanation themselves, making comments such as "I had to cancel too often. I think they've given up inviting me" (P_D). Six parents explained that their own prospects of working or attending further education were affected because of their child's difficulties. With limited possibilities for parents to work, some confided worries about their precarious financial situation to me. The stress of unsatisfactory housing or limited financial resources was discussed also in relation to insufficient support and services:

> P_L: "They are cutting our foster allowances. ... We think they are doing things they shouldn't be doing. It's a mine field, so we just got to work through it. Anyhow, bet we'll be living in a tent soon [laughs]. So we got all that worry going on."

5.3.4 Worries about future

A common theme in many conversations with parents was uncertainty about the future. They worried about the changes that will occur when their children grow older. For example, parents were concerned that when the children develop sexual desires or more physical strength they might act inappropriately or hurt other people. Three parents explicitly mentioned that they were afraid that their children would end up in psychiatric services or prison if they did not learn to control their emotions and behaviour. Several of the families felt that the interventions provided now were insufficient to prevent such a bleak outcome. Parents feared that the important window of opportunity for early intervention might be missed. Others thought that what was provided in schools focused on the wrong things. One family, for example, had a clear idea of the abilities and needs of their daughter. They communicated the concern that her strengths would not be fostered enough for her to succeed and overcome her difficulties in the future:

> P_F: "We feel that she could grow up and get degrees from universities and things like that but not have the confidence to take them out and doing things with them or be able to express herself properly. So she might as well not have them, do you know what I mean. We think her confidence, her being able to express herself and be social is much more important than her results from academic things."

Thinking about the future proved to be distressing for most families, sometimes so much so that they were clear about not wanting to discuss the topic at all. The uncertainty seemed to be an essential aspect. Even though every parent has to bear a certain amount of uncertainty, more questions must remain unanswered for parents of children with autism: How much independence will their child be able to gain? Will their child develop speech? Will their child be able to work, socialise, be happy? The following comment from a father illustrates the distress he experienced because of that uncertainty:

> P_A: "We really hope he gets better and better and better, and we don't have to take care of him rest of our lives but--. That's the biggest concern we have. We want him to live independently, find a job, bigger or smaller. Right now, I am worried sick."

5.3.5 Partnership with parents

I tried to create a trusting and respectful partnership by informing parents about practicalities, such as the setting and dates of the music therapy for their children, by discussing our aims for the music therapy, by asking about parents' opinions, their expertise and strategies, and by thinking together about wishes and possibilities for future provision of music interventions.

In counselling sessions with every parent, I showed them the music therapy room, described the setting and my approach, and mentioned the number of completed and remaining sessions. This allowed parents to get a better idea of what I was doing, and they felt more involved in the process. Parents asked me whether I saw their child only in one-to-one sessions, which days I saw their child, and about the date of the last scheduled session. The following conversation between the mother and father of one child indicates how much this information was appreciated:

P1_F: “It’s good to know cause she tells us nothing about music therapy, does she?”
P2_F: “No, not at all. Well, she did actually say to me that she has music therapy.”
P1_F: “Mm, but that’s all she says.”

Very importantly, the sessions with parents provided opportunities to discuss the suitability of music therapy aims for the child and the progress towards them. I shared my thoughts about possible aims but also invited parents to tell me what they wanted me to focus on. In this way, parents were included in the constant evaluation process and their views were taken into account. It became apparent how much parents valued being heard and seeing their aspirations informing and influencing the music therapy process. This promoted a trusting relationship and emphasised that we were working in a partnership rather than disconnected from each other. The following case vignette gives an example of how this was achieved during the counselling sessions through discussing aims and the progress towards them. It seemed important that a feeling of trust and togetherness was created in the first session and then strengthened in the second and third sessions. In order to illustrate this process, I use transcribed excerpts from all three sessions in this case vignette.

Case vignette

When I asked Charlie’s mother in the first session about her aims and wishes she told me that she hoped for her son to develop speech. At the time I started seeing Charlie, he was the only non-verbal child in his classroom and his mother found that very difficult. We therefore agreed that working on Charlie’s vocalisations and speech would be a priority in his music therapy sessions. Accordingly, I selected excerpts for the video feedback in the second and third counselling sessions that showed Charlie being engaged in vocal interactions.

Session 1

P_C: “And I think someone like Charlie is a very good example because he doesn’t even have single words, you know, and if he does start saying single words, that’s a big deal. Especially for us in our family, a very big deal. If he had that, even a little bit of understanding and communication, life would be a lot easier, definitely.”

Session 2

We are watching a video clip of Charlie singing a song with me.
P_C: “Oh my god! Oh, that’s amazing! I can’t believe he was doing--, I get what--, he wasn’t saying it like how you were saying it, but it was like he was saying it. I can’t explain it. You could tell that’s what he was trying to sing.”
T: “Yes, he was using the right vowels, he was using the right melody.”

Session 3

P_C: "I'm really disappointed that he's got his last--, he's had his last like music therapy, cause I really feel like it's really, really working for him. I don't want him to go backwards from not having it. He, actually, he sings so much! It's unbelievable. Even this morning he woke up at half six in the morning and he just sits there and sings. He's singing songs and he says all of it and it's just like, my baby can talk! He talks through that and that's amazing!"

It was a great asset that the parents met me at the beginning, in the middle and at the end of the music therapy intervention of their child. Because of this arrangement, I was able to build on the expertise of the parents. Their in-depth knowledge of their children was invaluable as they could help me choose the most appropriate activities, avoid certain triggers, and, very importantly, understand and interpret the child's behaviour and responses. For example, this was very valuable in the work with Fiona, who suffered from extreme anxiety and selective mutism. Her parents helped me to interpret her facial expressions and her body postures, and together we were able to think about the best approach for her to become more comfortable and relaxed in the sessions. Some children repeated certain melodies or phrases in the sessions that I did not recognise or understand. It was then helpful to ask parents whether they knew the song and whether they knew what meaning this particular phrase or melody might have for the child.

Parents, who are the experts regarding their child, have many years of experience with how to respond to certain behaviour. I felt that this wealth of knowledge should be used, and I thus talked with parents about different strategies they might have tried and found helpful. All the parents were excited to share their ideas with me. Most of the strategies discussed centred on using visual aids and incorporating routines. Several families already used music at home, as they had noticed that this helped their child to calm down or to interact with others. An important topic was also how much input and how much freedom they felt their child needed. It was helpful for me to know how parents interacted with their children, and how much each child was used to others following their lead or to being challenged. Parents had very different thoughts about this, as is illustrated by the following two comments:

P_B: "Sometimes he's playing properly but sometimes he's just running around, and I don't like it, so we are always doing something, like I say, 'Okay, stop running, let's go and play this or that.'"

P_D: "I think the less we're doing and the more they're doing the better. Just having that wanting is very important because, you know, you can do many things but that wanting of the child is something that needs to be there in the first place."

For almost all the families, it was important to think about what will happen after the therapy sessions will have finished. Although this topic was even more prominent in the last counselling session, several parents were anxious already in the second session to discuss possible ways of continuing music therapy or therapeutic teaching beyond the research study:

> P_C: “Just because it had such a positive effect on him, I’m scared, when it stops, will he stop singing, will he stop? Because the sessions they open him up, so when he comes home, he's completely opened up. Do you know what I mean? And then not having it…”

The fear that newly gained skills and recent development would disappear once the therapy stopped was frequently voiced. I tried to reassure parents by sharing my own belief that the positive experiences would have a long-lasting impact on the children. However, as this therapy was provided within an international research study, we had to stop the treatment after five months regardless of parents’ wishes or professional judgment. I always explained that I would write a report with recommendations at the end. I stressed the fact that we could think about options together and that I would liaise with other school staff as well. Many parents were relieved when I mentioned the possibilities of continuing with group music therapy, therapeutic teaching or community music groups after the research project:

> P_A: “I definitely think music is the way forward and I’m really--, until now out of every therapy--, I mean, of course, they all have their benefit but on the other hand music is one where I'm seeing Arjun didn't need much of help, it was naturally him, so I'm thinking more of this would actually be much better.”

5.3.6 Empowering parents

Even though parents obviously enjoyed watching their child succeed in the music therapy sessions, this also provoked difficult feelings at times. Some parents felt insecure, started thinking that the therapist had all the expertise, and questioned their own skills. I sometimes sensed envy related to the therapist’s musical skills as well as to the ability to connect with the child. Primary caregivers of autistic children often experience adversities that may have threatened their self-image as competent and ‘good-enough’ parents. Even though increased knowledge about the aetiology of autism has helped many parents of children with ASD to realise that they are not responsible for the condition, some parents may still blame themselves for their child’s difficulties. It was pointed out that these unresolved issues can lead to a parent feeling resentful towards a therapist who is establishing connections with their child (Oldfield, 2006). As a counsellor working with both the parent and the child, it was crucial to be aware of these dynamics, and to carefully avoid rivalry and competition. I tried to empower parents using several strategies, such as boosting their own confidence (5.3.6.1), sharing my strategies with them (5.3.6.2), and thinking with them about enjoyable ways of using music at home (5.3.6.3).

5.3.6.1 Boosting self-confidence of parents

One way of strengthening parents' confidence was by complimenting them on their children, pointing out their children's strengths and positive characteristics. Most parents enjoy hearing positive comments that make them proud. However, parents of children with special needs do not hear others praise their children or compliment them on their children very often. I therefore stressed these aspects and told parents that I enjoyed working with their child.

The most important influence for these young children was their parents, who have cared for them from the beginning and often worked very hard to provide them with opportunities and learning experiences. I felt that it was paramount to tell parents that I valued what they do and what they have achieved. I emphasised that it was they who enabled their child to develop well, because they provided the environment for the child to thrive. Furthermore, it felt important to also acknowledge that it was not always easy to care for a child with ASD but that their efforts were recognised and paying off:

> P_H: "And there is so many challenges every day that you can--, we can sometimes get lost in the challenges of every day. And we try always to take moments out, to enjoy those moments of positivity and creativeness and progress that he is having, getting really to know Henry, Henry interacting with us. But you can sometimes feel overwhelmed with the day-to-day-things."
> T: "Because it is very tiring."
> P_H: "Yes, it is."
> T: "And then finding the energy to celebrate the good things--, it's not always easy."
> P_H: "Yes, sometimes the first things that come to mind are the things we keep looking for as opposed to things that we are enjoying. … But I think I'm more in tune with his sounds now, in tune with him, listening for the patterns in his sounds and how they are changing. I think I see more than I've seen before."

In addition to valuing what parents do, I also highlighted how much I valued what they said in the sessions. I communicated that I was interested in their thoughts and expertise by asking them about their opinions and strategies, and explicitly voiced my appreciation for their insights.

5.3.6.2 Sharing therapist's strategies

One of the most important techniques I used to empower parents was to explain and share my approach as a music therapist. When we watched video excerpts, I described what I was doing, analysed my reasoning behind it, and pointed out strategies that worked and could be implemented by them in other situations. I hoped that skill-sharing helped the parents to gain feelings of self-efficacy and self-esteem.

The strategy that I commented on the most was the use of structure. We talked about the benefits of rituals, such as using hello and goodbye songs or elements like 1-2-3-Finish to bring an activity to a close. Several parents confirmed that finishing activities was difficult sometimes, so they appreciated discussing ways of addressing this. We talked about the different ways structure can be helpful and liberating, especially for very anxious children. For one girl who was particularly tense and stressed in the beginning, I used activities such as familiar songs and turn-taking activities that had a predictable inherent structure which allowed her to relax and to become more creative over time:

> T: “This kind of turn-taking structure--, I think that's the way for her to start being more spontaneous in the music. It feels like this gives her a kind of comfort zone because it’s so predictable. So in this safe environment she has the freedom to be creative, that's why I do these activities where we have very clear turn-taking elements.”
> P_F: “Yeah, probably because you used those structures to begin with made her feel comfortable, so she was able to get to where she is now. Whereas if it was like being too free at the start and, you know, you can go around the room, she would definitely not have been able to handle that. It would have been too difficult, wouldn’t it, she had to do it in stages to feel comfortable.”

Another aspect of my approach that was discussed frequently with parents was following the child’s lead. This included accepting the child’s choices of instruments and activities, as well as following the child’s tempo, rhythms or dynamics in the music. For some parents it was an unfamiliar idea to step back from constantly guiding their child and allowing them to lead. They sometimes commented on their child’s behaviour in the videos as “bossy” or “over dominant”. I therefore explained that I followed, copied and mirrored the child’s music to help them feel comfortable and relaxed, to increase their confidence, their self-awareness, and their awareness of me. This also showed them new ways of communicating and interacting. We discussed the motivating effect of music and how this can be used to engage children, to help them focus, learn and interact. Music making can be exciting and enjoyable. I demonstrated that mutual music making does not necessitate physical proximity, stillness or constant eye contact, while still facilitating deep connections between those involved. This feature of music seems especially beneficial for children with ASD.

How to use music as a non-verbal means of self-expression was talked about with eight parents, especially with regard to finding a safe and socially accepted way to release energy and express feelings of anger, frustration or excitement. Similarly, the benefits of using playfulness and humour to (re-)engage children were discussed frequently. Parents who had to deal with repetitive, isolating or aggressive behaviour were often surprised to see that responding to these behaviours with humour or in unexpected ways, such as incorporating repetitive behaviour into a game, could sometimes break the negative cycle and allow the child to move on and engage in playful and positive interactions. In my sessions with young children with ASD, I regularly use elements of sensory integration, such as rocking with a child to the rhythm of the music. Several parents were interested in exploring this area more and talked with me about ideas. For seven parents, the child’s lack of speech or vocalising was an area of great concern. As a music therapist I use several techniques that encourage children to use their voice more often, in more varied ways and with more confidence and enjoyment. Stimulating the muscles around the mouth and exercising breath control with the help of wind instruments, singing favourite songs and nursery rhymes with the child, using the voice to illustrate a story, or engaging in funny non-verbal babbling exchanges were among the ideas I shared with parents.

5.3.6.3 Using music at home

Another effective way to empower parents was to think together about possible implementations of music activities in their daily routines. Several parents said that watching video excerpts from the music therapy sessions encouraged them to get instruments and use them at home:

> P_G: “But it definitely has given me an insight to try and get him a little guitar to play, yeah. Cause I just loved that first video how he was calmly strumming on the guitar.”

Others were excited to tell me that they had bought an instrument because of what they saw in the first parent counselling session or because of positive session notes from myself or the teacher. Parents mostly expressed an interest in getting a guitar, a keyboard or small percussion instruments for their children. It seemed that several parents readily embraced the idea of getting musical instruments because their child did not show many other interests:

> P_K: “Yeah, because it's his birthday next month and obviously he is very limited to what he wants, so I was thinking about getting him some, like, music bits, some kind of instruments. That would be nice.”

Apart from talking about which instruments could be used at home, we discussed how they might use them. This was essential because many parents felt overwhelmed by the expectations they had of themselves. We discussed simple ideas, such as singing nursery rhymes together, listening or dancing together to a favourite song, or copying and mirroring vocal sounds the child was making or playing on instruments. I also emphasised that the aim was not to become a great musician but to enjoy a positive time together with their child. This helped some parents to experiment more freely and to cherish the mutual music making rather than to feel challenged by the idea:

> P_H: “We’ve been doing more of what you suggested, um, so I--, we did before, but we are making more time to use the instruments that he’s got at home and to mimic the sounds that he’s making. That’s one thing I took away from our last conversation. So I’ve been focusing more on that and it seems to be--, he seems to enjoy it and it does seem to create moments where we’re in the moment together, so that’s really nice.”
> T: “So something for you to enjoy as well, a positive time.”
> P_H: “Yeah, exactly.”

One couple even had the idea that they could start a little family band. Both parents enjoyed singing and listening to music and their other children already learned instruments. Before they watched the videos from the music therapy sessions, the parents had thought that their autistic daughter could not participate in musical activities. The video excerpts showed them that she was not only able to play several instruments but that she enjoyed music making, and that music making created opportunities for her to interact with others in a positive way.

5.3.7 Celebrating strengths and progress

The parent counselling sessions were an opportunity to talk with parents about the strengths and progress of their child, both within the music therapy sessions and in other settings and contexts. Parents highlighted positive characteristics of their children and changes in their children's behaviour that were indicative of improved resilience. Comments in this category could be grouped into four main subcategories that are presented in the following four sections: Strengths apparent in video excerpts (5.3.7.1), progress apparent in video excerpts (5.3.7.2), strengths outside music therapy sessions (5.3.7.3), and progress outside music therapy sessions (5.3.7.4).

5.3.7.1 Strengths apparent in video excerpts

Using video feedback in the counselling sessions not only improved a sense of partnership with the parents, but also helped parents to see and appreciate their child's strengths and skills. The music therapy sessions allowed children to succeed and to enjoy expressing themselves and being playful. I deliberately chose video excerpts that revealed positive interactions and developments because, for some of these families, music therapy was the first setting where attention was drawn to the child's abilities rather than weaknesses. Of the 13 families, 11 responded to that opportunity with enthusiasm and they pointed out the various positive behaviours of their children while watching the clips. The two other parents seemed to enjoy watching the videos as well, but I had the impression that they almost felt they were not allowed to praise their child as they were so used to discussing the child's difficulties. With them, I commented on the videos myself, mentioning even the smallest achievement of their child and expressing my excitement about this. Once they realised that my praise was genuine, they seemed to relax and make their own positive observations.

The majority of parents had not seen their child making music before and they were surprised and moved by their musical skills. Strengths related to playing an instrument or singing were pointed out by all 13 families when watching the video excerpts:

> P_J: "He just seems so natural with all those musical instruments, doesn't he? He played them so beautifully at the beginning, and it was interesting how he was copying your singing with some of the notes being exactly the same as yours."

Music making is a culturally valued form of expression. Playing instruments requires fine motor skills and cognitive abilities. Parents seemed proud to see their child handling big guitars or the drum set, playing the piano or producing sounds on wind instruments. All of them were pleased to discover a new area of strength in their child. Many of the children struggled with communication and interaction. However, in the music therapy sessions, they showed that they were able to communicate and interact when using a different medium and when feeling comfortable. Nine parents were very excited about that potential. They were surprised by the amount of eye-contact and by the child's ability to respond to musical phrases and cues, using instruments and their voice. Similarly, parents were delighted to see their child being engaged and focused during the sessions while they seemed to struggle with focus and concentration at other times:

> P_H: “And his attention when watching you, while being able to sit and to watch and to allow you to play and be part of that. Really good concentration, really good looking, wasn't it, really good looking! So he's really in that moment which is--, it's lovely.”

Parents of non-verbal children especially were amazed to see their children expressing themselves in elaborate ways using music. They commented on the variety of sounds encompassing a range of dynamics and emotions. Several parents specifically referred to the fact that their child's music seemed purposeful, reflecting personality and mood. Nine parents were equally excited to see their child being creative. This seemed to be one of the characteristics that they did not associate with their child before and many were pleasantly surprised to see that their child could be imaginative and playful:

> P_F: “Oh, and this is her idea? If anyone said to me, ‘Is Fiona creative?’, I would say no. Do you know what I mean? Because she is very not creative in other ways. She feels so comfortable, doesn't she, in the music.”

This mixture of happiness and astonishment about the child's strengths, skills and confidence became apparent in a number of statements from parents after watching video excerpts from the music therapy sessions.

5.3.7.2 Progress apparent in video excerpts

Parents often put huge effort into arranging transport, time and someone to look after siblings in order to attend the counselling sessions and particularly, as many emphasised, to see the progress of their child in music therapy. This indicates how much enjoyment and hope they gained from the video feedback. We often used the space to celebrate the child's achievements together. I had worked with a child intensely for a considerable amount of time, which enabled me to recognise and appreciate little steps towards more independence and growth. Parents seemed glad that they could share their enjoyment of these developments with me.

Regarding musical skills and motor control, we discussed that children seemed more able to follow a rhythm, that they were better able to hold a drumstick or blow a horn, or that they explored more ways of playing an instrument, for example, that they now strummed and plucked the guitar strings whereas they would only strum them in the beginning. Progress related to interaction and communication was observed by nine parents:

> P_E: “He's really in tune with what happens around him. I liked the way how he's always looking at you as well now, really waiting to see, you know, what you're going to do rather than just doing his own thing. It's such an improvement!”

Several parents were particularly pleased to watch longer excerpts during which their child remained focused and engaged. They pointed out that their child seemed less distracted and more able to participate in activities for longer periods of time. Six parents mentioned that they thought their child was more expressive during recent video excerpts than in the earlier sessions. More varied playing or singing styles, a wider range of dynamics, as well as melodic or rhythmic explorations were noticed and valued. Some parents became emotional when they talked about how the music making seemed to allow their children to find their own voice:

> P_H: "There are times where I've seen you--, where there is different sounds he is making and different rhythms that he is making which, as you say, feel more like Henry's own voice. So that's brilliant (...) It's nice (…) It's wonderful."

Children's development regarding their creativity, their playfulness or use of humour were discussed with six families. When watching the video excerpts, most comments about progress referred to increased confidence and independence on the part of the children. Parents were amazed to see that their children were able to come to the sessions without teachers supporting them, that they seemed comfortable when interacting with me, and that they even felt confident enough to take ownership of the session:

> P_M: "I suppose looking from the last video that I've seen when I came before to now, it's completely different. He's all sort of running it himself. I mean he knows what's coming and he's so much in charge of all this."

5.3.7.3 Strengths outside music therapy sessions

In the parent counselling sessions, we also talked about the children's presentation outside music therapy. In this subcategory, comments are grouped together that consider strengths of the children not directly linked to the music therapy sessions. Sometimes, watching a positive interaction in the video excerpts reminded parents of other positive moments at home that they then told me about. Seven families mentioned how well their child responded to music generally and that they thought the child had a particular aptitude for music. On the other hand, positive comments about a child's innate ability to interact and communicate well with others were rare. Similarly, parental comments that could be grouped in the subcategories 'strengths relating to self-expression', 'strengths relating to creativity, playfulness and humour', or 'strengths relating to the child's capacity to self-regulate' appeared in four counselling sessions only.

Slightly more often, parents mentioned strengths referring to cognitive skills and strengths related to skills for daily living. Six parents told me that their child was "very clever", had "a good understanding", was able to read, to write or to work independently with a computer or tablet. Others proudly shared with me that their child knew how to hoover, that they had a good sense of orientation, or that they had good self-hygiene.

5.3.7.4 Progress outside music therapy sessions

Progress of the children in music therapy sessions became apparent in the video excerpts and was noticed by the parents. Beyond that, all the 13 families observed changes in their child's behaviour at home and outside the music therapy sessions. In therapeutic interventions, positive development that translates into other settings is what is ultimately aimed for. Accordingly, parents were often thrilled to discuss and share with me their children's overall progress regarding communication, focus, self-expression, confidence, or self-regulation. Most comments (46 excerpts) from families in this subcategory referred to improved interaction and communication:

> P_G: "His speech has got phenomenally better in the last four months, phenomenally. There has been 100% improvement in his speech."

To describe the changes in their child's presentation and how they respond to people, five parents used the image of 'closed and open'. They said, for example, "Maybe before his mind was closed" (P_I), or "It's like his mind just opened for talking" (P_B). Parents noticed not only progress regarding verbal communication but also mentioned improved eye-contact, use of gestures and pointing, and reciprocal smiles. One of the most encouraging developments parents observed in their children was that they seemed to become more interested in interacting with others. Families described that their children seemed to acknowledge people more, seemed overall less isolated and more able to engage in mutual exchanges. The change in children towards wanting to be with other people, asking for shared experiences, and initiating interactions seemed to be an important aspect determining the families' quality of life:

> P_D: "I definitely feel the difference in the way that Denise is communicating, you know, she is expressing more. And the other day she said to me, 'Mama come and play with me', and I was like, 'What? Wow!'. You know, now she wants to be with me and communicate with me. Before you didn't have that wanting. For me that's the difference I'm seeing at home and that pleases me."

Five families felt that their children had also improved their focus and concentration skills. They described that the child appeared calmer and less fidgety, was more able to sit still at the dinner table or played with toys for a longer amount of time. Seven parents pointed out that the children's improved ability and readiness to express themselves was not only notable in the music therapy sessions but seemed to have generalised across different settings, including home and school:

> P_M: "I think it really is amazing how much more vocal he has become, and it's coming more and more. Also his teachers said that he's vocalising much more in the classroom and using his voice which is really good. Because when I first had him, he never made a sound, not a sound. He just used to sit with his cars lining them up and he wouldn't even move, he would just sit there and--, not a sound. Now he's the noisiest person in the house. So this is just lovely because I know what he was like to how he's now."

Changes in the child’s overall confidence and independence were attributed by some families to the positive experiences and the improved self-esteem gained in music therapy. Nine families noticed that their child was also more able to self-regulate when they felt stressed, anxious or frustrated. Some of the children started to use music, often singing, outside the sessions to self-soothe. For most parents, it was an immense relief that their child had found a socially acceptable way of dealing with and regulating difficult emotions:

> P_E: “If he's upset, he does tend to--, he has got guitars at home, so he does tend to kind of go and play them really fast and stuff, so I don’t know if that's what you do here with him. Cause I think he tends to get frustrated at times … so at those kinds of times he would get quite physical before, you know, really, he would hit people. But it doesn't seem to be as much, you know, he's definitely doing that less.”

5.3.8 Rejoicing in child’s enjoyment

Apart from enjoying their children’s progress, all parents clearly rejoiced in their children’s delight during music making. More than 50 comments from all 13 families reveal the importance of this aspect:

> P_C: “I really think music therapy's done amazing for him. I think music makes him happy. I don't know, it just makes him active, it makes him happy, it makes him--. I don't know, I can't explain it, it just--, it really is amazing, absolutely amazing. If only he could have it all the time.”

Music therapists who have gathered parents’ perceptions of being in the session with their child concluded that rejoicing in their child’s enjoyment is a common feeling (Drake, 2008; Loth, 2008; Oldfield, 2011). However, when children start school, they usually receive therapies without their parents, and families might not be able any more to participate or be involved closely in the process. Using video feedback in the counselling sessions allowed the families to still witness the joy of their child in music therapy. Parents delighted in being able to see their child’s enjoyment as becomes apparent in the following comment:

> P_M: “Oh, I look forward to the next session. I’ve been looking forward to coming and see what he’s doing because I so enjoyed watching the videos. It’s just so nice to see him finding so much fun in the music.”

The benefits of video feedback also include that the valued material can be re-watched. Handing the videos to parents at the end of the therapeutic relationship allows them to keep a memory of these happy moments and revisit them in more difficult times:

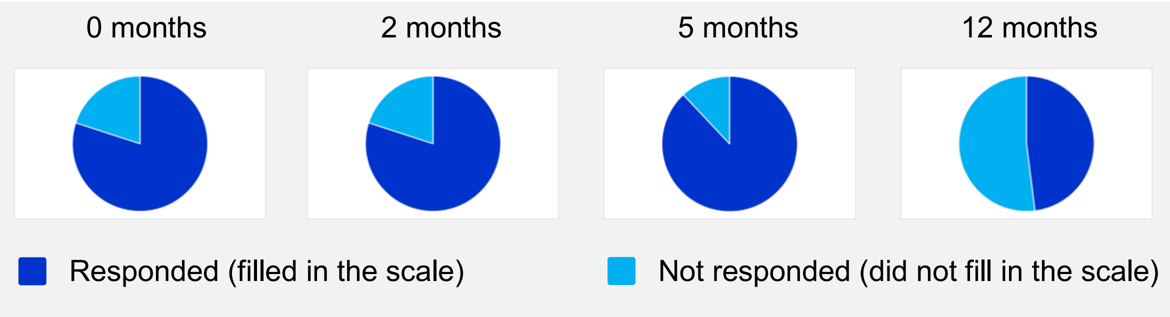
> P_J: “When you’ve finished with him, do we--, are we able to have any of this?”
> T: “Yes, I will make a DVD with all these excerpts.”
> P_J: “Really? Oh, wow!”
> T: “Yeah, I have the excerpts all here together, so you can also have them.”
> P_J: “Oh brilliant!”
> T: “It’s nice to have a memory, isn’t it?”
> P_J: “It’s nice for us because it’s nice to see that he’s doing so well in something, where he’s actually smiling and enjoying it for a period of time [voice breaks].”

Five parents specifically mentioned that they looked forward to showing the child's music therapy videos to other family members who could not be present at the counselling sessions. They explained how important it was for them to share their pride in their child's achievements and progress with their partners, other children, parents or friends.

5.4 Results: Quality of life

The quality-of-life measurement applied in this study is a one-item visual analogue scale. The scale from 0 to 100 is divided into main intervals of ten and auxiliary intervals of five. Parents were asked at baseline (0 months), mid-intervention (2 months), post-intervention (5 months), and at follow-up (12 months) to mark the number on the scale that reflected, in their estimation, the current quality of life of their child. It had been explained to them that 0 equaled the worst and 100 the best imaginable quality of life. The term 'quality of life' was not further defined. Data were collected from all 25 families to allow for a comparison of the children's quality of life between treatment groups and the control group. Response rates to this question varied at different time points. Both at baseline and at two months, 20 parents (80%) filled in the form. Slightly more parents (22/25, 88%) responded at five months. The response rate was considerably lower at 12 months (12/25, 48%).

Figure 48: Quality of life - Response rates



The follow-up assessment took place seven months after the end of both the music therapy and the parent counselling sessions, and several families seemed to have disengaged with the project by that time. This might explain the decrease in returned forms. Therefore, the results for this time point have to be interpreted with caution. Compared to the high attendance rate at parent counselling sessions, the response rates for the quality-of-life scales were overall only moderate. This reflects the mixed emotions many families expressed when they were asked to fill in the assessment scale. Parents described the scale with adjectives such as “difficult”, “horrible” or “silly”. Two parents decided to not answer the question at all because they felt that they could not or did not want to judge the quality of life of their child. The measurement tool only records a single number and does not provide further items, space for explanations or differentiations. Results are thus meaningful only to a limited extent.

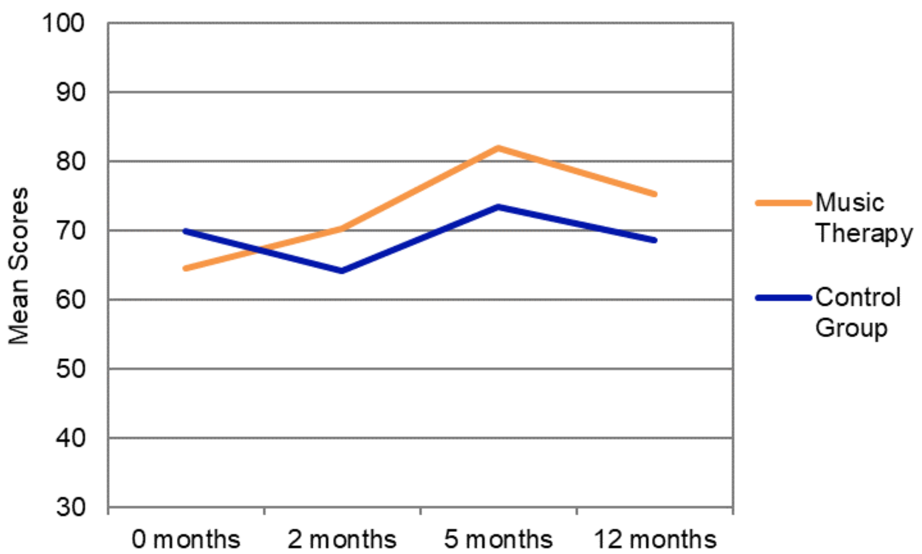
Mean scores for the four time points were calculated for all the children as well as for the subgroups, i.e. the control group, the music therapy group, the low-intensity music therapy group, and the high-intensity music therapy group. All mean scores (M) and standard deviations (SD) are listed in the following table.

Table 12: Quality of life - Mean scores

	0 months		**2 months**		**5 months**		**12 months**	
	M	(SD)	M	(SD)	M	(SD)	M	(SD)
All children	67.25	(23.1)	68.2	(18.98)	78.55	(16.29)	72	(20)
Control group	**70**	(21.68)	64.29	(12.66)	**73.56**	(13.62)	68.67	(21.03)
Music therapy	**64.5**	(24.13)	70.31	(21.33)	**82**	(17.07)	75.33	(18.32)
MT - Low	50	(25.5)	57	(20.4)	76.17	(20.58)	67.5	(22.5)
MT - High	74.17	(17.42)	78.63	(17.31)	87	(11.14)	79.25	(14.29)

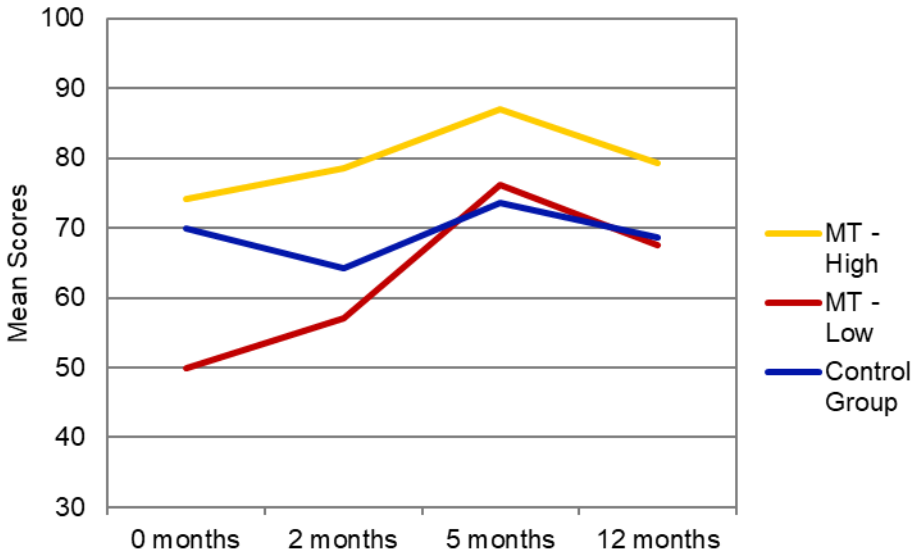
For my research, I was particularly interested in the quality of life at baseline, prior to any music therapy, in comparison to the quality of life at five months, which marked the end of the treatment for the music therapy group. The mean scores of the control group and the music therapy group at these time points are shown in bold. Mean quality-of-life scores prior to and post treatment (0 months and 5 months) were M = 70 and M = 73.56 for the control group compared to M = 64.5 and M = 82 for the music therapy group. Figure 49 depicts the mean scores for both groups at all four time points.

Figure 49: Quality of life - Mean scores (music therapy and control group)



This graph highlights the difference between the development of the mean scores for the control group and the music therapy group. Whereas the quality of life in the control group remained stable over time, the quality of life in the treatment group improved significantly. In both groups, the reported value at follow-up was lower than at five months. However, while the mean for the control group at 12 months (M = 68.67) dropped even below their baseline score (M = 70), the mean for the music therapy group at 12 months (M = 75.33) was still considerably higher than their mean prior to treatment (M = 64.5). The development of and the difference between the low-intensity and high-intensity music therapy treatment groups is illustrated in the following figure.

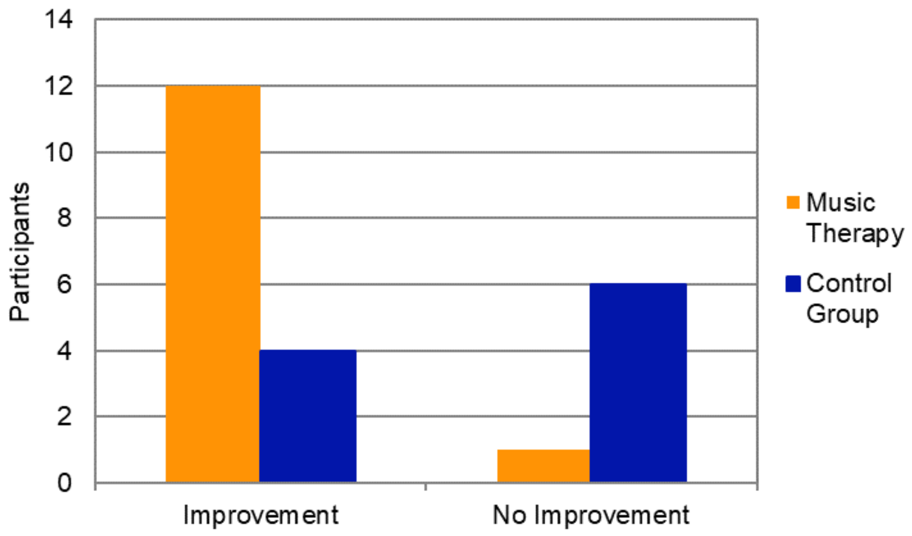
Figure 50: Quality of life - Mean scores (treatment subgroups)



Interestingly, the biggest change in mean scores can be observed in the low-intensity music therapy group, with an increase from M = 50 at baseline to M = 76.17 post-intervention. The mean scores of children in the high-intensity music therapy group improved from M = 74.17 pre-intervention to M = 87 after the five months treatment.

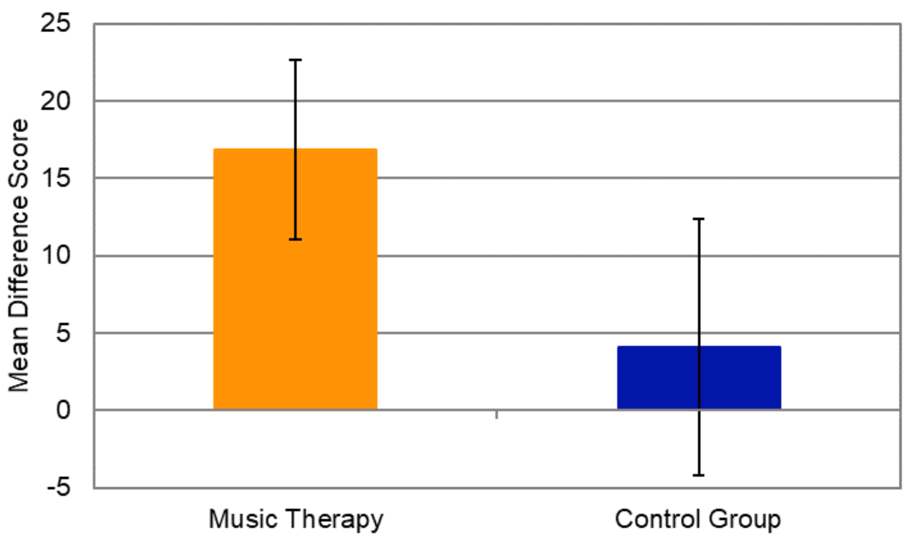
A binary analysis was undertaken to compare the proportion of children in the music therapy and the control groups whose quality-of-life score improved over the period of the five months. For three children, data were missing at either baseline or post-intervention. In these cases, an imputation with the respective mean of all subjects was undertaken (0 months, M = 67.25; 5 months, M = 78.55). The mean of the whole cohort rather than the group-specific mean was chosen to avoid bias in favour of group differences. The quality of life improved for more children in the music therapy group (12/13, 92.3%) than in the control group (4/10, 40%) as is illustrated in the following figure.

Figure 51: Quality of life - Improvement after 5 months



To investigate this further, I ran an independent-samples t-test on the difference scores. The mean changes in participants' quality of life at five months were more positive in the music therapy group (M = 16.87, SD = 5.81) than in the control group (M = 4.05, SD = 8.29). This difference was significant (mean difference 12.82, t = -2.11, df = 0.21, *p* = 0.047). Figure 52 shows the mean difference scores of both groups. The error bars, displaying the respective standard deviations, further delineate that the mean difference score of the music therapy group is positive and higher than ten, even if deviation is taken into account. On the other hand, the error bar of the control group intersects with the 0-axis, indicating that the real mean difference score of this group might be zero or even negative.

Figure 52: Quality of life - Mean difference scores



The data from the quality-of-life scales allowed us some insight into the development of participants' quality of life over time as perceived by their parents. I have compared mean scores of the treatment and the control groups, conducted a binary analysis of positive response rates, and run an independent samples t-test on the difference scores. Each of these analyses showed promising results in favour of music therapy. As the sample size was relatively small and the informative value of the measurement tool was limited, generalisation of the results is difficult. Nevertheless, the analyses suggest that music therapy has a positive effect on the quality of life of children with ASD.

5.5 Summary of the results

In this chapter I presented my research study results that were obtained from different data sets using various quantitative and qualitative methods. In the first section, baseline characteristics of the children were presented. Data of children allocated to the music therapy treatment group were similar to the baseline characteristics of the whole group in most aspects. The majority of participants were male and attended special schools. Approximately half of the children were verbal. Results of the two standardised diagnostic tests that were administered, the ADOS and the SRS, indicated that a high proportion of participants displayed severe symptoms of ASD.

The second section of this chapter focused on the results from the music therapy sessions. First, findings relating to the excerpt selection were discussed. The selection process was based on a strength-based approach informed by resilience theory. From the 229 music therapy sessions, 1,135 fragments of 30 to 180 seconds each were extracted. Depending on the activities occurring in these excerpts, they were assigned to one of the following categories: ‘hello songs’, ‘action songs’, ‘drums’, ‘guitar’, ‘objects’, ‘piano’, ‘tuned percussion’, ‘untuned percussion’, ‘wind instruments’, ‘other’, and ‘goodbye songs’. As singing or moving occurred in almost every excerpt, these behaviours did not form separate categories but were understood as integral elements of most interactions. The proportion of time spent on an activity varied between individual children, but the two subgroups of low-intensity and high-intensity treatment had very similar mean percentage scores. One quarter of all selected session excerpts could be classified as hello or goodbye songs which highlights the importance of these welcome and farewell rituals to generate positive, resilience-enhancing interactions in music therapy sessions with children with ASD.

Results of the time-sampling analysis were reported in the subsequent section. To determine which error distribution was most suitable for each of the eleven response variables, I examined the distribution of the response data using graphic assessments of goodness of fit against the Gaussian probability distribution. Five variables were well characterised by the normal distribution. For the other six variables, beta distribution was used. The model results were illustrated using tables and scatter plots. The full-null model comparison was significant for the following response variables: ‘Move’, ‘Expression’, ‘Smile’, ‘Look total’, ‘Initiate’, ‘Engaged’, and ‘Difficulty’. The continuous predictor ‘session number’ had a significant effect on all these seven response variables. While the proportion of moving, expressing, smiling, looking, initiating and being engaged increased over the course of the intervention, the proportion of difficult behaviour decreased as sessions progressed. The categorical predictor variable 'therapy intensity' only had a significant effect on the response variable 'Smile'. The categorical predictor 'verbal ability', on the other hand, was significant for 'Expression', 'Look total', 'Initiate', and 'Difficulty'. In the full-null model comparison, the response variables 'Play total', 'Vocal', 'Respond', and 'Contact total' did not yield a significant *p*-value. It is therefore not possible to draw conclusions about the effects of the test predictors on these four behaviours when using this data set and statistical model.

In an exploratory data analysis, results for the response variable 'Vocal' were investigated further. Examining the individual developments of the children showed that ten out of 13 children vocalised more often over the course of the music therapy treatment. It was pointed out that the verbal ability of children might be predictive of the responses relating to vocalising behaviour. Descriptive statistics were employed to improve the understanding of the therapist behaviours that occur during positive moments in music therapy sessions. It was notable that the frequency with which the therapist variables occurred during session excerpts did not significantly change over the course of the interventions. The therapist looked at the child, smiled, played instruments, and vocalised in more than 60% of the excerpts. Visibility of children and therapist in selected session excerpts was discussed to determine whether the quality of the video material was satisfactory. Low means of the codes 'Out' and 'T-Out' indicated that the usability and interpretability of the generated data was not compromised by limited visibility.

In addition to the time-sampling video analysis, music therapy session excerpts were analysed with the assessment tool ACTR which measures the child-therapist relationship. By exploring ACTR mean scores, I could determine whether the music therapy intervention provided children with an experience of a positive and resilience enhancing relationship. Results were first presented in time-series plots visualising the development of the ACTR scores over the course of the intervention. The data were further analysed using GLMM to allow for statistically supported conclusions about the impact of music therapy on the development of the child-therapist relationship. The full-null model comparison was significant for the variable 'ACTR score'. The quality of the child-therapist relationship as measured by the ACTR improved significantly as sessions progressed. Whereas the categorical predictor 'therapy intensity' had no significant effect on the response variable, the predictor 'verbal ability' had a significant impact on the development of the relationship.

The subsequent section of this chapter presented results generated from the thematic analysis of parent counselling sessions. Overall, the attendance of parents at counselling sessions was high, especially in the music therapy treatment subgroup. For each of the 13 families in this subgroup, the second of their three counselling sessions was transcribed and analysed. Comments from parents were coded and categorised. I identified eight key themes in the data set: (1) Exchange of information, (2) Experiences with others, (3) Impact of autism, (4) Worries about future, (5) Partnership with parents, (6) Empowering parents, (7) Celebrating strengths and progress, and (8) Rejoicing in child's enjoyment. The exchange of information focused on the development of the child, difficulties of the child, previously or currently used medication, diet and therapies, and on autism and the research study. Comments in the category 'Experiences with others' could be grouped into experiences with family members, experiences with professionals and school staff, and experiences with society and strangers. When talking about the impact of autism, parents referred to the impact on their own mental health and wellbeing, on the family and social life, and on finances and their work situation. The theme 'Worries about future' was not further divided into subcategories. A partnership with parents was sought to be achieved by talking about the setting and dates, the aims of therapy, parents' expertise and strategies, and potential future provision of music therapy or teaching. Empowerment of parents was sought by boosting parents' self-confidence, by sharing therapist's strategies, and by discussing ways of using music at home. Most comments from parents could be grouped into the key theme 'Celebrating strengths and progress'. Various strengths and signs of progress of the children became apparent in music therapy video excerpts that were watched together in the counselling sessions. Parents particularly pointed out strengths relating to musical skills, to focus and concentration, and to creativity, playfulness and humour. They primarily noticed progress relating to increased confidence and independence. Strengths and signs of progress of the children that were noticeable outside the music therapy sessions were also talked about. Parents especially mentioned progress regarding improved interaction and communication skills, enhanced self-expression, and increased ability to self-regulate in settings such as home or school. Finally, the theme 'Rejoicing in child's enjoyment' was expressed by comments referring to the observed happiness and enjoyment of the child and to the appreciation of the music therapy videos.

The next section of the results chapter focused on the quality-of-life data that were collected from 25 families at four different time points. Insight into the development of quality of life of children in the music therapy treatment group as well as of children in the control group was gained. Mean scores of the different groups were compared, a binary analysis of positive response rates was carried out, and an independent samples t-test on the difference scores was administered. Each of these analyses suggested that music therapy had a positive effect on the quality of life of children with ASD.

CHAPTER SIX
CASE STUDIES

In this chapter, two case studies are presented to illustrate processes of therapeutic change and to explore how these processes relate to different types of data and research findings. Session notes and the final music therapy reports form the basis of the case presentations. Individual time-series graphs from the video analysis are displayed. Quotes from the families' parent counselling sessions, the quality-of-life-scales data, the results of ADOS and SRS measures gathered through TIME-A, and comments from the children's teachers or TAs further inform the two case studies. The development over the course of the five-month intervention is described for one child in the low-intensity music therapy treatment group (6.1), and for one child in the high-intensity music therapy treatment group (6.2).

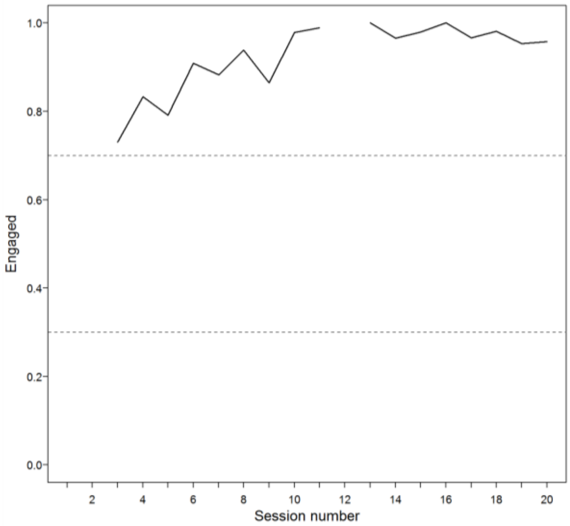
6.1 Low-intensity music therapy: Ben

Ben was four years old when his music therapy sessions started. Having been allocated to the low-intensity treatment group, he attended 20 individual music therapy sessions in his school over a period of five months. Ben was in the reception class of a special school for children with ASD. A psychologist had assessed him as being of average intelligence. He grew up bilingual and seemed to have good receptive language skills in both English and Polish. When I first met Ben, he used only few words to communicate and tended to repeat them anxiously until an adult echoed his words back to him.

His general presentation in the early music therapy sessions was that of a child driven by a nervous inner energy. He ran around the room, touched every instrument briefly, pushed over chairs and instruments, grabbed beaters and hit everything he could reach with them, including guitars and the wall. Within seconds the room was in a state of chaos and I found myself constantly reacting to prevent harm to the child and damage to the objects. In order to help Ben release his energy and channel it in a more constructive way, I placed a large drum and cymbal in front of him. He immediately hit them loudly and frantically. When I supported his drumming with simple chord progressions, played loudly but steadily from the piano, he beamed at me. Even though Ben was only able to sustain the mutual playing for a few seconds we had experienced a first meaningful musical connection.

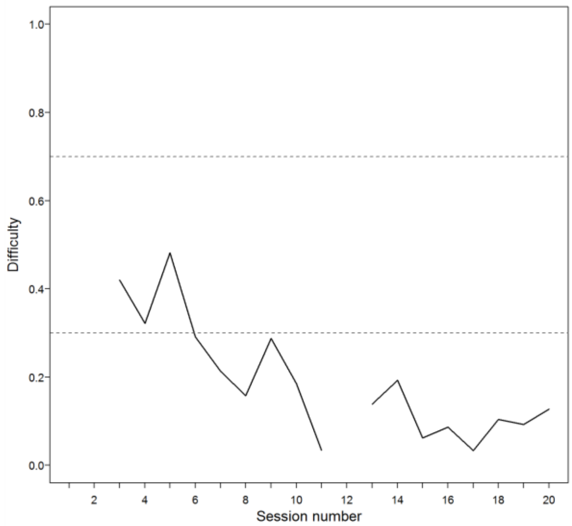
It was obvious that Ben enjoyed music making and that he was fascinated by instruments but that he needed lots of support to access them in a safe way. It proved helpful to reduce the amount of distractions in the room by removing all non-essential furniture, and by bringing a big cloth with which I covered up instruments that had been laid out openly before. These rearrangements had an immediate effect and Ben seemed more able to concentrate and to remain focused and involved. Furthermore, it was helpful to structure the sessions with well-defined activities that had a clear beginning and ending. For example, Ben responded very well to the ritual of saying ‘1-2-3-Finish’ to bring an activity to a close before moving on to the next instrument. I kept the sessions predictable with recurring elements such as a hello and a goodbye song. Ben was fond of this familiar structure and it seemed to help him to relax, concentrate and participate. The following graph shows that Ben’s level of engagement in video excerpts increased as sessions progressed and remained very high from session 10 onwards. Because of technical problems with the recording equipment, no videos from Ben’s first, second and twelfth music therapy session were available. In all the following time-series graphs for Ben, the corresponding data points are left blank.

Figure 53: Ben - Proportion of engagement



After the first few weeks, Ben was more engaged, but he appeared to be very emotional and often tearful during the sessions. Ben's expressive language skills improved immensely during this time. However, what he said in the sessions was often quite concerning. He murmured, for example, “We're not afraid of that” or “We're not crying”. He sometimes repeated “Mummy later” more than 30 times in a session and he often told me that he had a “broken leg”, a “broken arm” or another broken body part. Ben clearly experienced strong feelings and seemed to struggle to make sense of them. I was encouraged that he now felt safe enough to express some of his emotions. I started to incorporate his statements into improvised songs which Ben seemed curious about, and he added varied instrumental accompaniments. This active but playful engagement with his feelings seemed to lessen his anxiety. Ben also increasingly allowed me to calm him with soft music, nursery rhymes and simple musical games commonly used with younger children, at times when he appeared unsettled and anxious. Both his levels of anxiety and his restlessness reduced considerably as can be seen in the following graph. The plot shows Ben’s results for the response variable ‘Difficulty’ which is a combination of the codes ‘Anxiety’ and ‘Fidget’.

Figure 54: Ben - Proportion of difficult behaviour

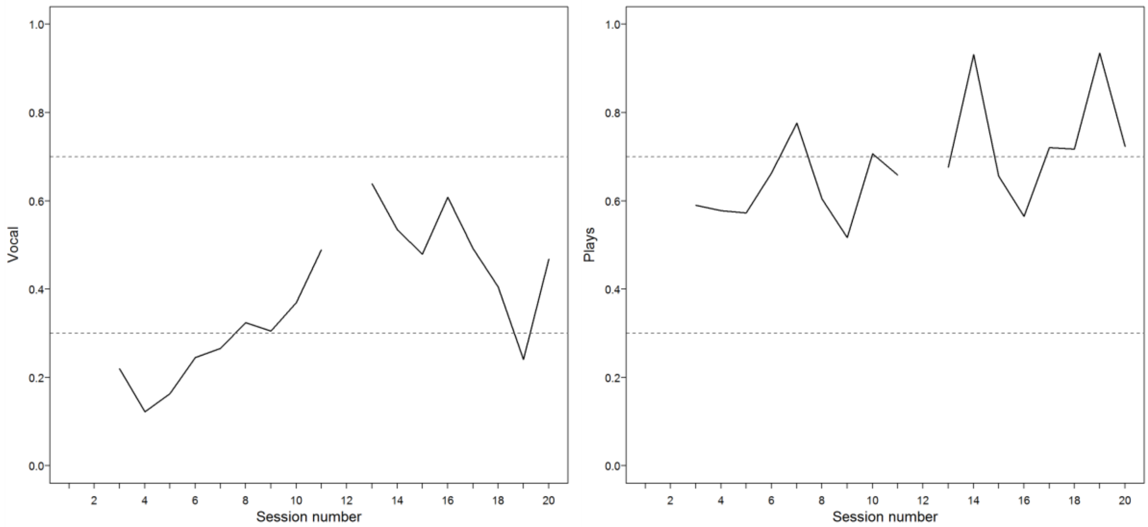


After a few sessions during which Ben played instruments to accompany the improvised songs, he also started to sing about his feelings and thoughts. He made up little songs about his daily routine and about experiences he had both at home and at school. I felt that matching his verbal, instrumental, facial and physical expressions musically had allowed Ben to listen to himself, to access feelings he had previously masked in constant activity and to express them creatively. Singing and music making seemed to help him to understand and communicate his emotions and to feel heard. Ben's increased ability to express himself verbally was also reflected by his more varied use of musical parameters. His instrumental playing now had a stronger feeling of pulse, and he experimented freely with rhythms and dynamics. When showing video excerpts from the sessions to his mother, she commented on this development:

> P_B: "Yeah, he's definitely different than before where he was like drumming and just making lots of noise. Now he's like exploring different instruments and sounds."

The quantitative video analysis does not capture this essential qualitative change in Ben's music making. Nevertheless, the fact that he expressed himself more during the sessions, especially the increase in his singing and vocalising, is represented by the following graphs.

Figure 55: Ben - Proportion of vocalising and of playing

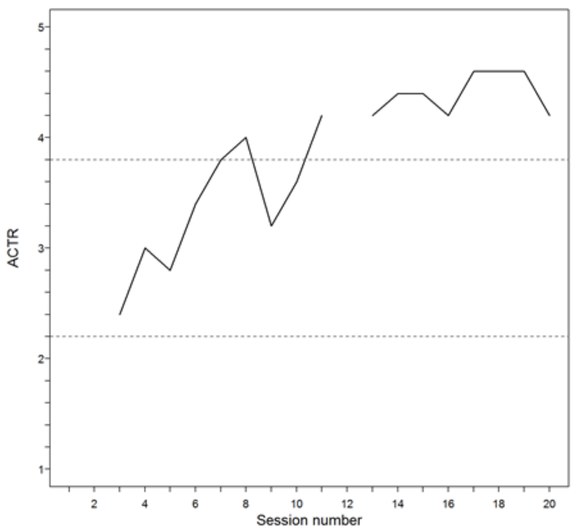


One of the most encouraging developments I could observe in the music therapy sessions was that as Ben became more able to express himself, he also became more interested in interacting with me. He seemed less isolated and more able to engage in mutual improvisations and reciprocal communication. This change was also noticed by his mother and it seemed to be an important aspect determining quality of life of the family:

> P_B: "Before was like, he was always on his own, then we catch a moment when he's, you know, when he's with us but now it's different: He's always with us, then sometimes he's forgetting about us and he is on his own. It's amazing."

Ben's improved relationship skills and especially his increased interest in being, sharing and interacting with other people is reflected by the steep increase of the scores he obtained on the tool assessing the quality of the child-therapist relationship.

Figure 56: Ben - ACTR score

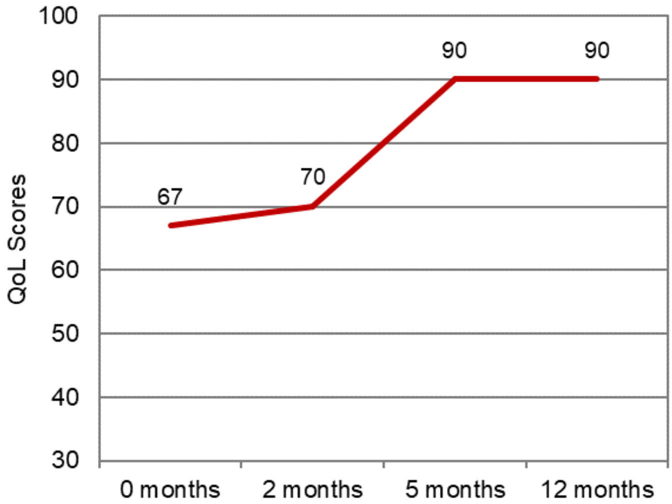


Towards the end of therapy, Ben seemed more at ease with himself and the people around him. Consequently, he became more able to try and tolerate new activities and experiences which seemed to result in an overall improved wellbeing and quality of life. In their last parent counselling session, his mother told me:

> P_B: “Before when we were singing at home he was like, ‘No, no, stop it’, so we had to stop, but now he don't mind when we're singing. Yeah, he's happy, a very happy boy now. We're doing lots of new things. He's open for new things now”.

This positive change seemed to persist after the end of treatment. In the parent-rated quality-of-life scale, Ben’s score changed dramatically from 67 pre-intervention (0 months) to 90 post-intervention (5 months). At follow-up (12 months), he still received this high score.

Figure 57: Ben - Quality of life



The primary outcome used in TIME-A was the social communication score of the ADOS. Ben was assessed with ADOS Module 1 which is administered with children who have no or very little expressive language. This module was chosen because Ben hardly used verbal language before he started the music therapy treatment. The ADOS was conducted by a blinded psychologist. Higher scores on the ADOS indicate higher symptom severity. At baseline, Ben’s score on the social communication algorithm for social affect was 14. At five months, this score had increased by five points and Ben received a score of 19. If all 29 items of the ADOS are considered, and not only the items relevant for the social affect score, Ben’s overall score amounted to 26 at baseline. At five months, the overall score added up to 30, which is an increase of 4 points compared to the baseline. This result is very disconcerting. The change in ADOS scores does not match the clinical observations of Ben’s development over the course of the music therapy intervention. Furthermore, the ADOS scores stand in stark contrast to the results of the time-sampling video analysis, the ACTR, and the quality-of-life scales.

One of the secondary outcome measures in TIME-A was the parent-rated SRS. In the SRS, Ben obtained a raw score of 103 at baseline, and a raw score of 66 after five months. Whereas the score at baseline falls into the category ‘severe range’, the score after five months corresponds with the ‘mild range’. That means that, according to the SRS, we can see significant improvement in symptom severity after five months. The discrepancy between the results of the primary and the secondary outcome is striking and will be discussed later in this chapter (6.3). The results of the SRS correspond with the feedback of his mother given in parent counselling sessions:

> P_B: “I see progress, but it's like big progress right now, on his concentration, on his focus. His speech is--, oh, it's incredible now. It's like, you know, just opened for talking”.

Ben’s progress that was noticeable in the music therapy sessions seemed to have generalised across different settings, including home and school. One of his teachers commented at five months that Ben “seems to be happier and more settled after the sessions”, and described his overall development as being “really positive. He’s doing really well.”

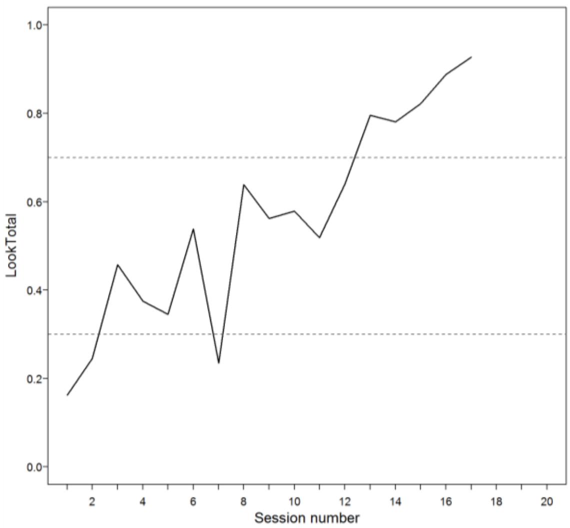
6.2 High-intensity music therapy: Isaac

Isaac had just turned five years old when I started seeing him for music therapy. He had been assigned to the high-intensity treatment group and was offered individual music therapy sessions three times a week. Isaac attended 46 sessions over a period of five months. In his mainstream primary school, Isaac was supported by a TA who provided one-to-one assistance during all school hours. This TA joined Isaac in his music therapy sessions. According to an informal assessment by a psychologist, Isaac had mild learning difficulties. When I first met Isaac, he hardly ever responded to verbal language and he only uttered a few words occasionally and without an obvious communicative intent. In school, he was mainly pacing around in the classroom while performing repetitive hand movements. He was unresponsive to staff and peers and seemed very isolated. His teachers and parents were worried about Isaac’s emotional wellbeing.

In the first four to five music therapy sessions, Isaac was constantly moving from one side to the other end of the room. He picked up instruments only to discard them seconds later while his gaze was mostly unfocused. Whereas Ben’s restlessness seemed to have come from anxiety and excessive energy, Isaac’s pacing seemed to result from a disconnection with the outside world and his own feelings. His constant movements appeared to be an attempt to shut out other people and to numb himself. His walking seemed to have no direction, and nothing could hold his attention for any prolonged time.

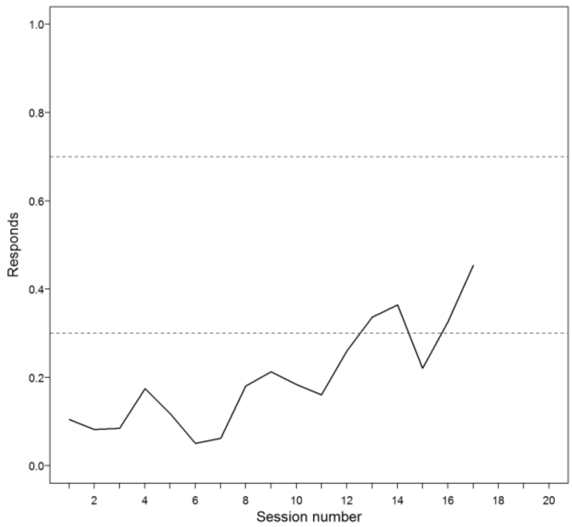
The first connection with Isaac could be established when I joined him in his walking, emphasising each step with a vocal sound. When he noticed that I copied his movements, he stopped for a few seconds and looked at me with a surprised expression. This moment of contact could be created again when I mirrored and matched his pacing, his vocal utterances and his mood on the piano or guitar, using interesting harmonies and melodies that incorporated the rhythm of his steps and the sounds he made. In this way, Isaac's expressions were reflected back to him which might have helped him to listen and to feel listened to. My imitative responses aimed to reinforce his sense of identity and self-awareness. Isaac seemed to realise and enjoy that I responded to him. He increasingly varied his vocal, facial and bodily expressions, and he smiled and looked at me when I followed him. After these initial moments of contact, Isaac quickly became more interested in interacting with me. A striking exemplification of Isaac's changing presentation is the amount of time he spent looking at me or his TA during a session. The following graph demonstrates how this behaviour changed over the course of the 17-week intervention.

Figure 58: Isaac - Proportion of looking



As I matched and mirrored Isaac's expressions most of the time, especially in the beginning, he experienced being in control of our music in a positive way. These empowering experiences allowed him to also respond to me and to follow my music or verbal requests at times. I started changing the music myself, frequently using dramatic measures, such as sudden pauses or changes in dynamic and tempo. Isaac has a great sense of humour and he responded with delight if I played in an unexpected way. Once we had established a connection through music making, he was open to new musical games or songs that I introduced and eager to participate in most activities he was presented with. He followed many of my prompts or invitations, both verbally and musically, and was one of only four children in this research project whose proportion of responding improved significantly during music therapy.

Figure 59: Isaac - Proportion of responding

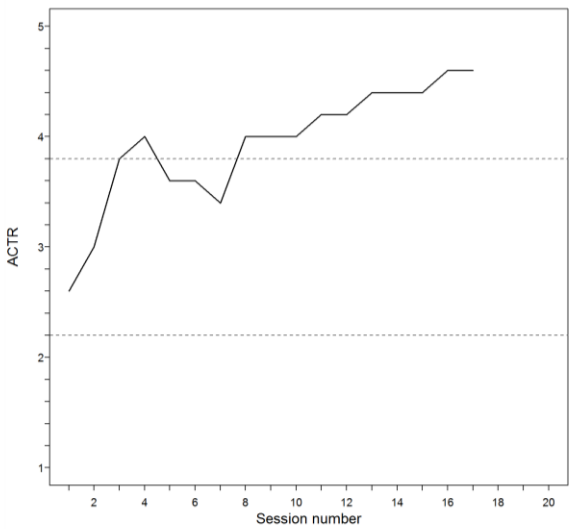


Isaac's increased awareness of and responsiveness to other people around him seemed to translate to other settings as well and it was recognised by both his parents and his teachers. This change was very important for his further development. Isaac's mother commented on it in her second counselling session:

> P_I: "I was surprised, two days ago I ask him going to bed, 'Tomorrow is music, you gonna see Miss Laura. What instruments do you use?', and he told me all the instruments. He say piano, bells, drums, even some where I don't know the name. Before he wouldn't respond. He was--, maybe before his mind was closed, now it's more open. Even now at home, we read a book and when I ask questions he answer."

Isaac's improved and more varied ways of relating to me were also picked up by the assessment tool ACTR which measured the child-therapist relationship during selected session excerpts. As intervention weeks progressed, Isaac seemed more relaxed and confident when interacting with me, more able to be both responsive and to initiate communication, and more open towards new experiences. Our relationship became more and more characterised by mutuality.

Figure 60: Isaac - ACTR score

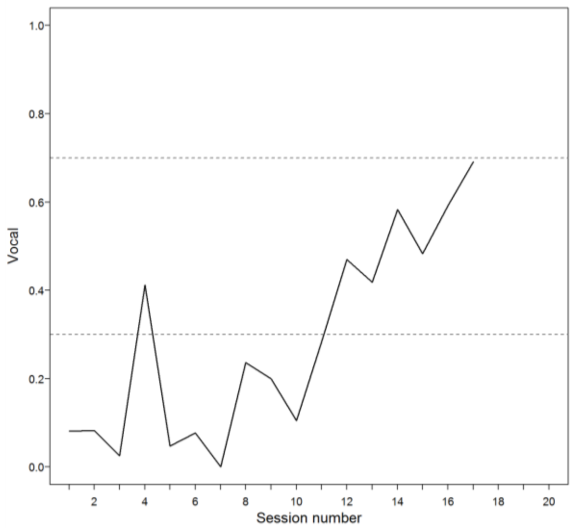


Music seemed to reach and interest Isaac in a way that verbal or visual communication did not. It was obvious from the very early sessions that Isaac enjoyed listening to music, that he was responsive to sounds and that he was highly motivated by playing instruments. Particularly the piano engaged him. He observed my playing on it carefully and copied my hand movements. He was quickly able to express himself using the piano, experimenting with various techniques. For example, he often played big cluster chords loudly and rhythmically, producing powerful music. At other times he improvised little melodies that I accompanied with chord progressions. Isaac’s parents were excited to hear about his musical skills and expressiveness on the piano and decided to buy a keyboard for him to play at home:

> P_I: “I always read the notes from the music therapy. They say he like piano, yeah, he like piano very much. Now we bought a piano, because he like it. Now he always play piano at home. He enjoys it so much all the time at home.”

When Isaac started his music therapy sessions, he did not use words to communicate with me, and he vocalised only occasionally. If he vocalised or used word approximations, he did so with a very soft voice and a monotonous intonation. Over the course of therapy, he vocalised more often, possibly as a response to my almost constant singing. I tried to incorporate every vocal expression of Isaac’s into my improvised music to show him that his vocalisations were heard and valued. As he was encouraged to use his voice, he started exploring different facets of it and he used a wider range of sounds, pitch and volume. After a few sessions, I introduced various wind instruments. Isaac seemed to enjoy playing the whistles, recorders and kazoos very much. He was especially fascinated by the sound and look of my tenor saxophone with which he usually played the reed horns enthusiastically. I noticed that Isaac was always more vocal after he had exercised breath control and the muscles around his mouth by playing horns. Therefore, the motivating and stimulating wind instruments were used in most of our sessions. The high intensity of music therapy three times a week allowed for quick progress regarding Isaac’s confidence and ability to use his voice. The following graph shows the development of his vocal expressions over the course of the treatment.

Figure 61: Isaac - Proportion of vocalising

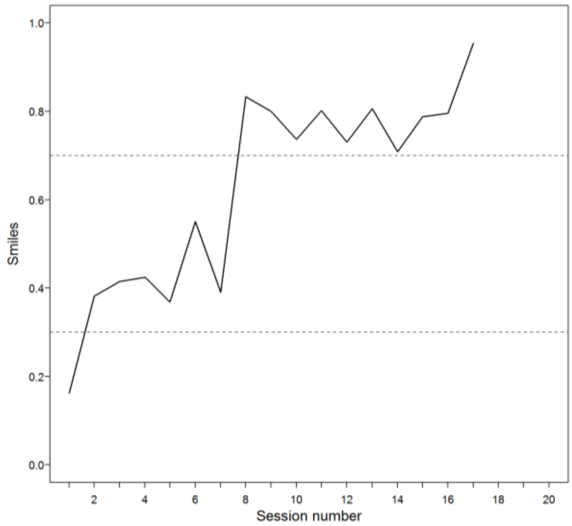


Most encouraging was the fact, that Isaac did not only vocalise more often but also in more playful, creative and interactive ways. His vocabulary increased rapidly as well. At first, he mainly copied words that I used but towards the end of therapy, Isaac used words confidently to communicate with me. He particularly enjoyed naming the colours of bells and pieces of material or filling in missing words in familiar songs. He joined in when I improvised with my voice, he sang familiar songs with me, and he even started to lead his own call-and-response songs. Outside the sessions, Isaac also started to talk more. His mother mentioned this positive development in their last parent counselling session:

> P_I: "See where he comes from. Before he can't talk, he can't do many things. Now he can talk, communicate, understand. At school he does well, before no talking, reading, writing. Now he tries and when he wants something, he can ask you. In his everyday life, he progress so much. Before I was worried, oh my god! But now I see improvement."

The high-intensity treatment sometimes felt tiring to me. As an effect of seeing the same child three times a week, my music became a bit repetitive and unimaginative in some sessions. Becoming aware of that enabled me to include more variety, playfulness and humour in the music again. However, whereas other children receiving music therapy three times a week seemed at times to similarly feel overwhelmed by the high-intensity of sessions, Isaac seemed to thrive and enjoy every moment of music making. His musicality and creativity made it easy to work with him and he often invented his own little games, songs and dances. He sometimes cheered out of enjoyment when we were playing together. When Isaac was excited, he came to me and his TA to hug us, to tell us what was happening and to share his enjoyment with us. The fact that Isaac had finally found an area that he felt he was good at helped him to build up his self-esteem and to feel proud and happy about himself. From the second week onwards, Isaac usually entered the music room with a big smile on his face and the sessions seemed to have provided a very positive and enjoyable experience for him.

Figure 62: Isaac - Proportion of smiling



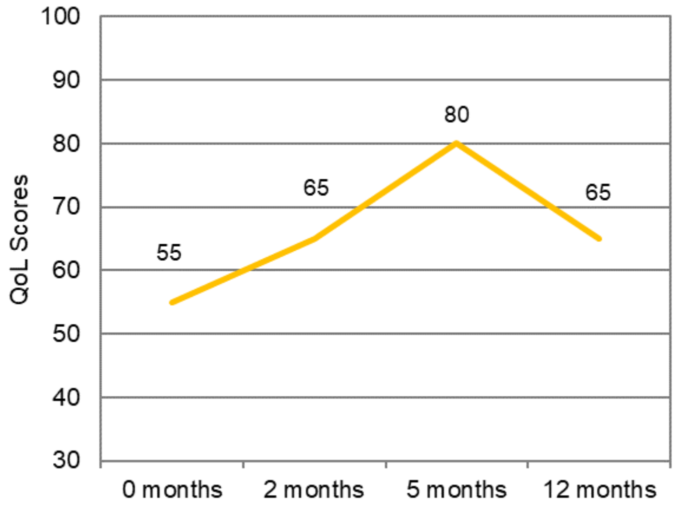
Isaac attended the music therapy sessions together with his familiar TA. She observed every session and sometimes participated in musical games. She provided Isaac with lots of reassurance and emotional support, especially during the early sessions. It was very helpful and easy working with Isaac's TA as she was always interested in discussing objectives, the directions the music therapy should take, and Isaac's progress in and outside the sessions. We shared ideas of how to implement singing and music making in his daily classroom routines. Together with another TA, she even planned a music group for Isaac and two of his peers to encourage interactions with other children. As she had known Isaac for several months before the music therapy started and continued to work with him throughout the course of the intervention, she could give a clear account of the progress she observed:

> TA_I: "I can't believe how much he changed. When I think back to the first sessions and how he was a few months ago compared to now--. It's like he is a different child. I mean, not a different child, but before he seemed so locked in and isolated. Maybe now we finally see what was always inside of him."

For TIME-A, Isaac was assessed with ADOS Module 1 which is used with children with at most single words. Higher scores reflect more obvious autistic symptoms during the assessment. At baseline, Isaac's social communication algorithm score was 15. After five months, this score had dropped to 12. When adding up all 29 ADOS symptom items rather than only those related to the diagnostic algorithm, Isaac obtained a score of 34 at baseline. This overall score reduced considerably to 21 at five months. These results accorded with the data obtained from the secondary outcome measure used in TIME-A. In the SRS filled in by parents, Isaac received a raw score of 84 at baseline, and of 56 after five months which corresponds with a change from moderate symptom severity to mild symptom severity. On the quality-of-life scale, a similarly positive development was recorded. Isaac's mother guesstimated her son's quality of life to be 55 pre-treatment, 65 mid-treatment, and

80 post-treatment. Unfortunately, the score dropped to 65 again after the music therapy sessions had ended. In a conversation, Isaac's mother explained that he missed the regular music making and that he seemed to become more isolated again. To prevent further regression and to support Isaac's development and wellbeing, I recommended that he started therapeutic piano lessons and joined a community music group for children with special needs and their parents.

Figure 63: Isaac - Quality of life



For Isaac's mother, his quality of life and emotional wellbeing was a more valued and important outcome than the symptom reduction measured by the ADOS and SRS. She cherished the video clips of Isaac's music therapy sessions and delighted in his enjoyment. Watching the session excerpts allowed her to focus on her son's abilities, on his progress and on his positive characteristics. In the following comment she articulates how meaningful it was for her to see her son experiencing and expressing joy:

> P_I: "Wow, it's amazing, he is enjoying! Music helps him to communicate, to feel--, maybe to feel happy. Sometimes before he was very sad, sometimes he wasn't comfortable, but music helps him to feel happy. I'm happy because he is happy."

6.3 Summary and discussion of case studies

In this chapter, two case studies were presented. The therapy processes of one child from the low-intensity music therapy group and of one child from the high-intensity music therapy group were described. For each child, the various types of data collected in this research study were considered and correlated. The data sources included music therapy session notes, results from the video analysis, quotes from parent counselling sessions, quality-of-life data, comments from teachers, and the scores from the diagnostic measures ADOS and SRS.

In both cases, my clinical observation, feedback from parents and teachers, the video analysis findings, the quality-of-life data, and the SRS scores were in accordance with each other and described a positive development of the child over the course of the intervention. However, the ADOS, which was used as the primary outcome measure in TIME-A, only indicated improvement for Isaac and even suggested a significant worsening of symptom severity for Ben. In order to understand and evaluate this, it is helpful to look at the differences between the two cases. At the beginning of treatment, Isaac had almost no expressive verbal language and his receptive language skills seemed below his developmental age. Ben, on the other hand, had good receptive language skills and used words to communicate. Whereas Isaac had been assessed as having an IQ ≤ 70, Ben had been assessed as being of average intelligence. It is possible that the improvement in children who are non-verbal and who have a low IQ is captured more effectively by the ADOS. Furthermore, Isaac's progress was maybe more easily quantifiable and measurable. He used more eye-contact, he responded more often to direct prompts, he vocalised more often and started to use words, and he expressed more enjoyment. The changes in Ben's behaviour were maybe more difficult to capture. He appeared less stressed and anxious, he became more able to express and manage difficult feelings, he became more able to tolerate new experiences, and he seemed more interested in interacting with other people. The limitations of quantitative measures became apparent in Ben's case as, for example, the important qualitative changes in his expressions were not picked up adequately by the video analysis or the ADOS.

An important difference between the qualitative reports, the video analysis, the quality-of-life scales, and the SRS compared with the ADOS is the amount of time the child's life is being examined. Whereas the observations of therapist, parents and teachers consider the behaviour of the child on different days over several months, the ADOS is a snapshot of the child's behaviour during 30 minutes on one particular day. With children such as Ben who have intense anxiety on certain days, the ADOS is more likely to capture results inconsistent with the overall presentation of the child compared to children whose mood is more stable. The ADOS was originally designed as a diagnostic tool rather than as a way of measuring changes and thus might not have been able to pick up some of the smaller changes. The case descriptions and the findings provided by different data sources are a reminder that it might be misleading to look at one type of information in isolation. Rather, it is important to consider different types of data and to regard the whole picture when evaluating the effectiveness of an intervention. These case studies further highlight that the effectiveness of a treatment can only be determined in a sensible and meaningful way if priorities and wishes of the people involved are taken into account. Both Ben's and Isaac's parents emphasised that they were not primarily hoping to see improvements in symptom severity but in happiness and quality of life of their children.

CHAPTER SEVEN
DISCUSSION

In this chapter, I discuss the results of my doctoral study. The first section summarises and integrates the findings from the literature review and the data analyses to answer my research questions (7.1). This is followed by a section considering the implications of my findings for clinical practice, training courses and research studies in music therapy (7.2). Limitations of my project and ideas and recommendations for future research studies are discussed in the next section (7.3).

7.1 Synthesis of findings from the literature review and the data analyses

The aim of my doctoral research was to investigate whether music therapy and parent counselling sessions enhance resilience in young children with ASD. To enable a comprehensive understanding and a thorough exploration of the complex phenomena involved, different data sets, including video recordings of music therapy sessions, transcribed parent counselling sessions, quality-of-life scales and music therapy session notes, were examined. A mixed methods design, combining quantitative and qualitative research methods, was chosen. In this section, I bring together the different findings from the literature review and the data analyses to answer the research questions that were outlined in the first chapter of this thesis:

1. What is the evidence to show that increasing resilience is a more appropriate treatment aim than symptom reduction for young children with ASD?
2. Do music therapy sessions increase behaviours indicative of resilience in young children with ASD?
3. Does different treatment intensity result in different increase or decrease of behaviours indicative of resilience?
4. Does verbal ability of children influence the increase or decrease of behaviours indicative of resilience?
5. What are the effects of parent counselling sessions offered to the families alongside music therapy sessions regarding resilience in children with ASD and their families?
6. How does quality of life of young children with ASD, as rated by their parents, develop in children receiving music therapy compared to children in a control group?

The following six sections focus on each of these research questions, bringing together all relevant findings and attempting well-founded answers.

7.1.1 What is the evidence to show that increasing resilience is a more appropriate treatment aim than symptom reduction for young children with ASD?

To find information about appropriate treatment aims for young children with ASD, a thorough literature review in the pertinent areas was conducted. The neurodevelopmental disability ASD has a high prevalence and its characteristics can cause adversity for both the affected person and their families (e.g. Brugha et al., 2012; Greeff & van der Walt, 2010). The strikingly high occurrence of comorbidities (e.g. Hudson et al., 2018; Simonoff et al., 2008) is a further reason for effective interventions. However, even though most researchers agree that early intervention is more likely to result in better outcomes (e.g. Cidav et al., 2017; Pickles et al., 2016; Zwaigenbaum et al., 2015), the promoted and applied treatment approaches vary widely (e.g. Beccerra et al., 2017; Salomone et al., 2015). Similarly, the treatment aims differ between different programmes, including reducing symptoms, improving behaviour or fostering wellbeing.

The literature review demonstrated that several intervention studies claiming significant autism symptom reduction were not pragmatic or suffered from methodological limitations so that their results could not be replicated in later studies (e.g. Anderson, 2012; Shea, 2004; Steege et al., 2007). Recent research suggests that symptom severity remains stable in most children with ASD and that symptom trajectory is unlikely to be changed by interventions (Bieleninik, Posserud et al., 2017; Gotham, Pickles, & Lord, 2012). Instead, the ability of children with ASD to adapt and to cope with their condition was shown to be significantly associated with better behavioural and emotional outcomes, which led to the recommendation that interventions should aim to increase positive adaptation (Williams et al., 2018). When discussing appropriate treatment aims, it is obligatory to also consider the perspectives and opinions of people who are themselves affected by ASD. According to a study in the UK (Pellicano et al., 2014), the autism community does not support research or interventions that change the core symptoms of the condition. Rather, individuals with ASD, the neurodiversity movement, and several practitioners argue that treatment should aim to improve quality of life, self-expression and the ability to cope (e.g. Mottron, 2017; Silberman, 2015; Straus, 2014; Turry, 2018). These intervention aims could be summarised as resilience enhancement.

The literature review highlighted that resilience publications encompass a variety of definitions. However, several scholars argue that resilience cannot be equated with the absence of a disorder or symptoms but that it refers to the attainment of strengths, wellbeing and positive experiences (e.g. Kaplan, 2013; Naglieri, LeBuffe, & Ross, 2013). Especially in the context of work with ability-diverse people, it is paramount to avoid simplified definitions of resilience as being asymptomatic or fulfilling societal norms (e.g. Hart et al., 2014; Hutcheon & Wolbring, 2013). Resilience might be better conceptualised as a dynamic process of positive adaptation (e.g. Luthar et al., 2000; Ungar, 2015; Windle et al., 2011).

In this understanding, therapy aiming to enhance resilience supports this process by fostering protective factors and applying a strength-based approach (e.g. Bekhet et al., 2012; Brooks & Goldstein, 2015; Fenwick-Smith et al., 2018).

In the creative arts therapies, a shift towards aiming for resilience promotion as opposed to symptom reduction can be observed. Scholars and practitioners of the disciplines play therapy, art therapy and dance/movement therapy have stated that their clinical practice has been informed and influenced by resilience research (e.g. Macpherson et al., 2016; Watson et al., 2014; Wengrower, 2015). In music therapy, an explicit focus on resilience enhancement has been discussed by only few researchers (Pasiali, 2012; Pasiali et al., 2018). However, many music therapists apply a strength-based approach aiming to improve quality of life and wellbeing, to strengthen the family and environment of clients, and to support the whole person as opposed to cure separate symptoms (e.g. Oldfield, 2011; Thompson, 2017; Wigram et al., 2002). Thus, music therapy is especially suitable to be conceptualised within a resilience framework. Even though fostering resilience has not been articulated often as an explicit treatment aim in the music therapy literature, a high number of clinicians and researchers seem to work towards aims that are closely linked to resilience.

The literature review provided strong evidence that clinical interventions for children with ASD should aim to enhance resilience. The potential of a shift from symptom reduction to resilience promotion has been acknowledged in recent debates in various disciplines. Fostering resilience in this client group is thought to change long-term outcomes and has thus been proposed as the most appropriate treatment aim for young children with ASD (e.g. Brooks & Goldstein, 2012; Kaboski et al., 2017; Szatmari, 2018; Williams et al., 2018).

7.1.2 Do music therapy sessions increase behaviours indicative of resilience in young children with ASD?

To answer the second question, it was important to first determine which behaviours are indicative of resilience in young children with ASD. The literature review has shown that resilience refers to positive adaptation within the context of significant adversity (e.g. Luthar et al., 2000; Masten & Obradović, 2006; Rutter, 2006). Adversity or risk factors, such as poverty or a neurodevelopmental disability, can be moderated or mitigated by protective factors. High occurrences of protective factors predict positive adaptation and are thus indicative of resilience (Shapiro, 2015). Protective factors on the internal level, the within-child factors, have been identified in longitudinal research studies and include the ability to express and regulate emotions, awareness of others, impulse control, self-efficacy, goal-directed behaviour, and reaching out to others (American Psychological Association, 2018; Brooks & Goldstein, 2015; Reivich & Shatte, 2002). In addition, having a positive relationship with a pro-social adult has been determined as the single most critical protective factor for children at risk (Luthar, 2006; Masten et al., 1990).

To find out whether music therapy sessions increase behaviours indicative of resilience in young children with ASD, these protective factors needed to be translated into observable behaviours. Scholars have recommended the use of observational data in resilience research to assess lived experiences and used skills (e.g. Fenwick-Smith et al., 2018; Liebenberg et al., 2014; Pink, 2013). In a time-sampling video analysis I then measured whether the respective behaviours increased or decreased over the course of the intervention. Eleven target behaviours were defined: 'Play total', 'Vocal', 'Move', 'Expression', 'Smile', 'Look total', 'Initiate', 'Respond', 'Engaged', 'Contact total', and 'Difficulty'. The protective factor 'ability to express emotions' was conveyed by the behaviours playing instruments, vocalising, moving expressively, self-expression, and smiling. The protective factor 'awareness of others' was translated into the behaviours looking at the other person and responding to the other person. 'Impulse control' and the 'ability to regulate emotions' were expressed by the target behaviour 'Difficulty', which was a combination of the codes 'Fidget' and 'Anxiety'. The protective factor 'self-efficacy' was represented by playing, vocalising, moving, expressing, and initiating. 'Goal-directed behaviour' was represented by the variables 'Play total', 'Vocal', 'Move', 'Expression', 'Initiate', and 'Engaged'. 'Reaching out to others' and having a positive relationship were translated into the behaviours smiling, looking, initiating, responding, and initiating physical contact with the therapist. Furthermore, a bespoke assessment tool that I developed for this research study specifically measured the quality of the child-therapist relationship and provided further data on this crucial protective factor.

The statistical analysis employed GLMM to investigate whether occurrences of these resilience-indicating behaviours changed over the course of the five-month music therapy intervention across the group of 13 children. Results of the analysis suggest that music therapy enhances the likelihood of resilience in young children with ASD. The response variables 'Move' and 'Expression' increased significantly as sessions progressed, indicating an improved ability to express emotions and to perform goal-directed behaviours. Music therapy session number had a significant positive impact on the response variable 'Look total', which signals an improved awareness of others. The occurrences of the target behaviour 'Difficulty' decreased significantly over time, showing that children used more appropriate means to control impulses and regulate emotions after having received music therapy. Session number had a significant positive effect on the response variables 'Initiate' and 'Engaged', which indicates improved self-efficacy and goal-directed behaviours. Not only do the significantly increased behaviours 'Smile', 'Look total', and 'Initiate' suggest improved relationship skills, but the significant positive results of the assessment tool ACTR supports the impression that children reached out to others more frequently as sessions progressed.

These positive results are especially exciting because children in this research study were randomly allocated to receiving music therapy. In clinical practice, children are commonly referred to music therapy because parents, teachers or other staff members believe that the child has a special liking or aptitude for music and might thus benefit from music therapy. In this doctoral research study, neither the child's and family's relationship with music nor a professional judgment of the prospect of intervention success did influence the group allocation.

The findings from the video analysis of music therapy sessions correlate with findings from the thematic analysis of parent counselling sessions. The thematic analysis generated eight key themes, including the theme 'Celebrating strengths and progress'. This theme subsumed comments from parents referring to their child's progress apparent in the music therapy video excerpts and to their child's progress apparent in other situations outside the music therapy sessions. In each of the 13 transcribed and analysed counselling sessions, parents pointed out positive development of their child. Overall, 197 text excerpts could be identified in which parents celebrated their child's progress. Progress was observed in the areas of musical skills and motor control, interaction and communication, focus and concentration, self-expression, creativity, playfulness and humour, confidence and independence, and self-regulation. These areas are closely linked to the protective factors that have been described in the literature. Improved musical skills, creativity and self-expression indicate an improved ability to express emotions. The protective factor 'awareness of others' has been enhanced by progress in interaction and communication skills. The protective factors 'emotion regulation' and 'impulse control' have been increased by progress in the areas of self-regulation, focus and concentration. Improved confidence and independence suggest improved self-efficacy and goal-directed behaviour. Finally, the protective factor 'reaching out to others' has been strengthened by progress relating to interaction, communication, focus, self-expression, and confidence.

Two case studies were presented to exemplify how music therapy sessions can increase behaviours indicative of resilience in children with ASD. My research supports findings from the literature. Even though only few studies investigated the effects of music therapy on resilience (e.g. Fancourt et al., 2016; Felsenstein, 2013; Robb et al, 2014), they all reported promising results. These studies used different research methods and explored the effects of the intervention in a variety of settings with different client groups. The transfer of findings is thus limited. However, music therapy seems generally suitable to strengthen internal protective factors that increase the likelihood for resilience. In my research, both the results from the quantitative analysis of music therapy videos and the qualitative analysis of parent counselling sessions suggest that music therapy sessions increase behaviours indicative of resilience in young children with ASD. All intrapersonal protective factors that have been outlined in the research literature were strengthened by the music therapy intervention.

7.1.3 Does different treatment intensity result in different increase or decrease of behaviours indicative of resilience?

Of the 13 children receiving music therapy for this research study, six were allocated to the low-intensity treatment group and seven were randomised to the high-intensity treatment group. Children in the low-intensity group received music therapy sessions once a week over a period of five months. Children in the high-intensity group received music therapy sessions three times a week over a period of five months. Recent resilience research supports a dosage effect (Ungar, 2015). That means that more interventions or a higher intensity of interventions lead to improved outcomes and an increased likelihood for resilience. To explore the correlation between different music therapy intensity and behaviours indicative of resilience, I included ‘treatment intensity’ as a categorical test predictor in my statistical model. Using GLMM, seven of the eleven response variables received a significant *p*-value in the full-null model comparison. For these seven variables I was thus able to draw conclusions about the effect of each predictor on the response. Only the target behaviour ‘Smile’, however, was significantly impacted by ‘treatment intensity’. Children who received music therapy three times a week expressed their enjoyment through smiling or laughing more often than children who received music therapy once a week. Smiling is a behaviour that is related to the protective factors ‘ability to express emotions’ and ‘reaching out to others and forming positive relationship’. Nevertheless, as it is the only resilience-indicating behaviour that increased as a result of high-intensity treatment, the hypothesis of a dosage effect cannot be confirmed with the data and statistical model used in my research study. In addition, the thematic analysis of parent counselling sessions did neither reveal a qualitative nor a quantitative difference between progress-related comments from parents of children in the low-intensity group and from parents of children receiving high-intensity treatment.

The findings of my study correlate with the findings of the systematic review of resilience-enhancing, primary school-based programmes conducted by Fenwick-Smith and colleagues (2018). They concluded that the length of programmes or regularity of sessions did not predict resilience outcomes. The content of the sessions and the concentration within one session seemed to be more important. As discussed in the chapters three and six of this thesis, providing music therapy sessions three times a week for the same child proved to be tiring at times for both the therapist and the child. The higher frequency of sessions might in fact have resulted sometimes in a lower intensity of interactions within the sessions. It is possible that two sessions as opposed to three sessions a week would be more manageable and thus a more effective music therapy intervention with children with ASD. It would be interesting to explore whether music therapy once a week and music therapy twice a week result in different increase or decrease of behaviours indicative of resilience in this client group.

Another thought was provided by Hart and colleagues (2014) who reviewed studies on resilience interventions with disabled children. They specified that the subgroup of children with highly complex needs responded best to high-intensity interventions. My own clinical judgment, the feedback from parents and teachers, and the observations from music therapists in the supervision group, who also worked with young children with ASD three times a week, support this proposition. In my study cohort, six of the 13 children had associated learning disabilities and complex needs. Two of the six children were allocated to the low-intensity treatment and four of the six children were allocated to the high-intensity treatment. This number of participants is too small to examine group differences and infer statistically meaningful results. In a future study with a bigger sample size, it might be worth investigating whether children with ASD and complex needs respond better to high-intensity music therapy and whether children with ASD but without complex needs respond better (or equally well) to low-intensity music therapy.

7.1.4 Does verbal ability of children influence the increase or decrease of behaviours indicative of resilience?

The verbal ability of the children was well balanced across the different subgroups in the study. To be considered verbal, children had to use at least five meaningful words in different contexts. In the treatment group, seven children were verbal while six children did not use verbal language at the beginning of the music therapy intervention. Because of the even distribution it was possible to assess whether verbal ability of children influenced the increase or decrease of behaviours indicative of resilience. 'Verbal ability' was added as a categorical predictor variable to my statistical model.

Of the seven response variables with a significant *p*-value in the full-null model comparison, four variables were significantly impacted by the predictor 'verbal ability'. These four target behaviours were 'Expression', 'Look total', 'Initiate', and 'Difficulty'. On average, verbal children were more expressive, looked at the therapist or TA more often, initiated changes more often, and displayed less difficult behaviour during music therapy than their non-verbal peers. The differences between the two groups remained stable over the course of the intervention for the variables 'Look total' and 'Initiate'. For the variables 'Expression' and 'Difficulty', the gap between the verbal and non-verbal group narrowed as sessions progressed, indicating a steeper development of the non-verbal children. In addition to these four target behaviours, the predictor 'verbal ability' had a significant effect on the quality of the child-therapist relationship as measured by the ACTR. Even though verbal children received, on average, a higher score on the ACTR compared to non-verbal children, the scores of the two groups became more similar over time.

Verbal ability of children influenced the development of ‘Expression’, ‘Look total’, ‘Initiate’, ‘Difficulty’, and ‘ACTR score’. Improvement in these behaviours suggests a higher likelihood of resilience as several intrapersonal protective factors are strengthened. Increased expressiveness indicates an improved ability to express emotions, increased time spent looking at another person indicates an improved awareness of others, and increased initiating indicates improved self-efficacy and goal-directed behaviour. Decreased occurrences of difficult, i.e. anxious or rigid, behaviours indicate an improved ability to regulate emotions and to control impulses. Increased scores on the ACTR indicate positive experiences of a supportive relationship and improved relationship skills. Verbal ability of children therefore seems to influence all the internal protective factors that were identified in the literature review.

So far, there is very little research focusing on the effects of verbal ability of children with ASD receiving music therapy. It is therefore difficult to contextualise the findings of my study. In a publication on TIME-A results (Crawford et al., 2017), detailed data on different subgroups are presented. According to these data, non-verbal children responded better to the music therapy intervention than verbal children. However, the effect was not statistically significant. Considering both the findings from my research and the findings from the TIME-A study allows us a more comprehensive understanding of the role of verbal ability in treatment response. In TIME-A, the development of children receiving music therapy was compared against children in a control group. The non-verbal children in the treatment group compared to the non-verbal children in the control group progressed more than the verbal children in the treatment group compared to the verbal children in the control group. In my research, the development of verbal children receiving music therapy was compared against non-verbal children receiving music therapy. Whereas verbal children showed more resilience-indicating behaviours throughout the intervention, the non-verbal children seemed to progress more steeply and catch up with their verbal peers in three domains (expressiveness, anxious and rigid behaviours, positive relationship with therapist). These combined observations indicate that verbal children with ASD might generally develop earlier and operate on a higher level than non-verbal children with ASD, regardless of whether they receive an intervention or not. The majority of non-verbal children might develop very little and slowly if they do not receive an appropriate intervention. That would explain why the difference between the treatment and control group was bigger in the subgroup of non-verbal children, while the verbal children scored higher than the non-verbal children within the treatment group. Being non-verbal often coincides with associated learning difficulties and more complex needs. For these children it is even more crucial that we provide early and effective intervention that allows them to develop and thrive.

7.1.5 What are the effects of parent counselling sessions offered to the families alongside music therapy sessions regarding resilience in children with ASD and their families?

The literature review revealed that the condition ASD often impacts the whole family and not only the child diagnosed (e.g. Greeff & van der Walt, 2010; Newsom & Hovanitz, 2006). Many parents of autistic children feel more stressed, depressed or anxious compared to the general population and to parents of children with other developmental problems (e.g. Baker-Ericzén et al., 2005; Schieve et al., 2007). Social support has been identified as the most important predictor of psychological and physical health in parents of children with ASD (e.g. Boyd, 2002; Gallagher & Whiteley, 2012). Furthermore, higher levels of social support and improved parental wellbeing result in better interaction patterns of parents with their children as well as in enhanced resilience in both the parents and the children (e.g. Lindsey & Barry, 2018; Okuno et al., 2011). The literature unambiguously states that treatment for children with ASD should be complemented by support for their parents. In my research, I explored the effects of parent counselling sessions offered alongside music therapy, and I investigated whether this simultaneous treatment approach promotes resilience in young children with ASD and their families.

The high attendance of parents at counselling sessions indicates that the support offered was appreciated by parents. This finding is in accordance with previous studies which showed that professional advice and social support were highly valued by families with autistic children (Greeff & van der Walt, 2010). To gain more insight into the opinions of parents, I analysed 13 counselling sessions using thematic analysis. Eight key themes could be identified: (1) Exchange of information, (2) Experiences with others, (3) Impact of autism, (4) Worries about future, (5) Partnership with parents, (6) Empowering parents, (7) Celebrating strengths and progress, and (8) Rejoicing in child's enjoyment. The first four categories show that parents used the counselling sessions to discuss their experiences, thoughts and worries. The sessions seem to have facilitated parents to tell their story which has been described as an essential feature of supportive and beneficial parent counselling (e.g. Attride-Stirling et al., 2001; Pelham & Stacey, 1999). In my study, parents reported that the diagnosis of their child had an impact on their own mental health and wellbeing, on the family and social life, and on finances and their work situation. This conforms with findings of previous research (e.g. Altiere & von Kluge, 2009). As the possibility to talk openly to a non-judgmental counsellor who listens has been found to be cathartic and beneficial for parental wellbeing (e.g. Altiere & von Kluge, 2009; Attride-Stirling et al., 2001), the first four key themes indicate that the counselling sessions provided parents with helpful and resilience-enhancing experiences.

The key theme ‘Partnership with parents’ included conversations about the setting and dates, the aims of therapy, parents’ expertise and strategies, and potential future provision of music therapy or teaching. The importance of parental involvement and of working in a partnership with parents has been emphasised by both music therapists (e.g. Horvat & O’Neill, 2008; Oldfield, 2006, 2011; Schwartzberg & Silverman, 2016) and other professionals (e.g. Bidmead et al., 2002; Nelson et al., 2000). Opinions of parents were taken seriously in the counselling sessions and their expertise informed the music therapy with their child. I believe that this approach strengthened the parents’ feelings of self-efficacy, which has been identified as one of the important predictors of resilience in family members of children with ASD (Bekhet et al., 2012). The thematic analysis suggests that parents were empowered by the counselling sessions. Boosting parents’ self-confidence, sharing therapist’s strategies, and discussing ways of using music at home were the subcategories of the sixth theme. The importance of sharing ideas with parents that they can explore outside the sessions has been highlighted in a number of music therapy research studies (e.g. Gottfried, 2017; Loth, 2008; Thompson et al., 2013). It has been shown that improving parents’ feelings of competence and self-esteem has beneficial effects on their interactions with their children and on the wellbeing and resilience of the whole family (Pickles et al., 2016; Steiner, 2011; Thompson, 2017).

An important element of the parent counselling sessions was watching selected video excerpts from their child’s music therapy sessions. The video feedback focused on the child’s strengths and provided opportunities to celebrate progress together. I chose this strength-based approach because research has discovered that parents of children with ASD do not have many possibilities to share positive views of their child even though they would enjoy and benefit from opportunities to discuss strengths and progress (Altiere & von Kluge, 2009; Steiner, 2011). Video feedback has been successfully utilised in several studies to help parents reflect on positive characteristics and developments of their child (e.g. Aldred et al., 2010; Fukkink, 2008). In the thematic analysis, a high number of parental comments could be grouped into the key theme ‘Celebrating strengths and progress’. This suggests that the strength-based approach effectively helped parents to recognise and enjoy their child’s skills and improvements both inside and outside music therapy sessions. Other music therapists have reported that parents were amazed and happy to see unexpected strengths of their child becoming apparent in sessions and translating into other settings (e.g. Jones & Oldfield, 1999; Thompson, 2017). As optimism and appreciating the child’s characteristics have been found to be predictors of resilience in parents of children with ASD (Bayat, 2007; Bekhet et al., 2012), this key theme indicates that parent counselling sessions contribute to wellbeing and resilience in the families.

In the sessions, parents frequently mentioned how much they enjoyed watching the music therapy videos and seeing their child being relaxed, playful and happy. These comments were subsumed under the key theme 'Rejoicing in child's enjoyment'. Previous research has pointed to the fact that parents are delighted to witness their child's enjoyment in music therapy (e.g. Drake, 2008; Loth, 2008; Oldfield, 2011). As research supported the statement that parents are 'only as happy as the least happy child' (Fingerman et al., 2011), this delight must not be undervalued when considering parents' mental wellbeing. Family resilience has been further supported by the fact that parents can rewatch the videos and thereby revisit the positive moments whenever they feel that this would be helpful. Overall, the findings from the thematic analysis strongly suggest that parent counselling sessions offered to the families alongside music therapy sessions enhance resilience in young children with ASD and their families.

7.1.6 How does quality of life of young children with ASD, as rated by their parents, develop in children receiving music therapy compared to children in a control group?

Improved quality of life has been identified as one of the treatment aims that people with ASD and their families find important (Pellicano et al., 2014, Silberman, 2015). Accordingly, music therapists have advocated for measuring treatment effectiveness against improved quality of life (Turry, 2018). Similarly, the World Federation of Music Therapy (2014) lists optimising quality of life as a potential music therapy outcome. Resilience and quality of life are two closely related psychological concepts, and quality of life can be regarded as one indicator for resilience (Lawford & Eiser, 2001). Several research studies use quality-of-life scales as one measure to determine the effects of interventions on resilience (e.g. Chmitorz et al., 2018; Leppin et al., 2014; Macedo et al., 2014).

In this doctoral study, parent-rated quality-of-life scales for 25 young children with ASD, including children in the music therapy treatment group and children in a control group, were collected at four different time points. Analysing these data allowed me to compare the development of participant's quality of life in the two groups. Quality-of-life mean scores of the treatment and the control groups were displayed, a binary analysis of positive response rates was conducted, and an independent samples t-test on the difference scores was carried out. Each of these statistical analyses showed promising results in favour of music therapy. Quality of life of young children with ASD, as rated by their parents, improved more in children receiving music therapy than in children in a control group. This difference was statistically significant.

These findings are supported by the thematic analysis of parent counselling sessions. The key theme 'Rejoicing in child's enjoyment' contains statements about the children's quality of life. In each of the 13 transcribed sessions, parents commented on their child's happiness and enjoyment that they observed in the music therapy videos. Ten families specifically attributed a general improvement of their child's wellbeing and quality of life to the music therapy intervention. The thematic analysis further highlights the importance and value parents ascribe to the quality of life of their children which accords with the findings from the literature review.

Previous music therapy studies using quality of life as an outcome measure showed that music therapy can improve quality of life of various client groups (e.g. McConnell et al., 2016; Thompson et al., 2013; Van Bruggen-Rufi et al., 2018). My research confirms and adds to these findings. The synthesised data of my doctoral study suggest that music therapy has a positive effect on quality of life of young children with ASD.

7.2 Implications for clinical practice, training and research

This research study focused on a client group which has received much attention in the music therapy literature (e.g. Bergmann, 2016; Oldfield, 2016). Findings from my study have implications for the clinical practice, training, and future research in the area of music therapy with children with ASD and beyond. In the following sections, I outline the relevance of my results with regard to defining and investigating treatment aims (7.2.1), to applying a family-centred intervention approach (7.2.2), to recognising the importance of welcome and farewell rituals (7.2.3), and to choosing the most suitable methodological approach (7.2.4).

7.2.1 Treatment aims

In a climate of budget cuts and restricted funding for treatment, clinicians and researchers in various disciplines are increasingly pressurised to demonstrate that the therapy offered is effective or even superior to other intervention programmes. The demand for effect studies and evidence-based practice is therefore high in music therapy. As ASD is a frequent condition with a high impact on wellbeing and health of both the children affected and family members as well as on financial resources of the society, there is great interest in finding effective treatment. Consequently, a range of interventions compete for recognition and financing. To provide quick evidence for the benefits of treatments, researchers often focus on effects that can be easily quantified and measured. Unfortunately, easily quantifiable and measurable changes are not always the changes that are most meaningful for the clients or their families.

In past research studies, treatment effectiveness has often been measured against symptom reduction. However, it is questionable whether symptom reduction is an appropriate treatment aim. The autism community, therapists and researchers suggest that clinical interventions for young children with ASD should aim instead to enhance resilience, promote wellbeing and quality of life, and support family members (e.g. Brooks & Goldstein, 2012; Mottron, 2017; Pasiali, 2012; Pellicano et al., 2014; Szatmari, 2018; Williams et al., 2018). The problem is that it is more difficult and time-consuming to adequately capture resilience-related or family-related outcomes than to measure symptom reduction. Positive adaptation and holistic development cannot be easily assessed using questionnaires or diagnostic tools. As the pressure to provide evidence is very high, the creativity and rethinking required to measure treatment effectiveness against improved resilience can appear like a drawback at first.

As a therapist, I believe it is of utmost importance to continuously question assumptions and alleged certainties. Symptom reduction in children with ASD might be socially desired and can be measured conveniently in large studies, but is it an appropriate treatment aim? Which understanding of the condition ASD, of diversity, and of normalcy does it entail? The actual aims and assessed outcomes might be similar at times when investigating symptom reduction or improved resilience. However, the perspective on the individuals and on the mandate as a therapist differ fundamentally. What *can* we aim for as music therapists? What do we *want* to aim for? What are our intervention aims when working with children with ASD? How do we decide upon these aims? Do we include the perspectives and wishes of our clients, their family members, their teachers? How do we gather the opinion of non-verbal children with a range of abilities? How much are our treatment aims influenced by expectations of the institution we work for, of the funding body, of the society, of the research community? This doctoral study has emphasised the importance of these questions and our answers, in the contexts of clinical practice, research designs, and the autism community.

7.2.2 Importance of a family-centred approach

In the music therapy literature, work with parents and families has been discussed for some time by several authors (e.g. Oldfield & Flower, 2008; Thompson et al., 2013). New publications, such as the book *Music therapy with families: Therapeutic approaches and theoretical perspectives* (Jacobsen & Thompson, 2017), indicate an increased awareness of the importance of family work. Recent years have seen some changes in our understanding of both the families and of the therapist's role. For example, many therapists strive to work in partnership with the family as opposed to applying an expert model. The partnership approach is likely to enhance the therapy process, empower family members and support the self-efficacy of parents. My research findings support these assumptions and strengthen the rationale for a family-centred music therapy practice. In line with the results from previous studies (Gottfried, 2017), this doctoral project provides further evidence that simultaneous treatment of children with ASD and their parents is a valuable alternative to joint sessions, with benefits for both the children and their families. This thesis supports previous research highlighting that family-based interventions are an absolute necessity if the therapist applies a resilience lens to the work: 'Resilience in children depends on resilience across interconnected systems in which human development unfolds, such as families' (Masten & Obradović, 2006, p. 24). The findings from the thematic analysis of parent counselling sessions show that resilience in children is highly related to resilience in their families and can be enhanced by a family-centred approach.

If improved resilience in and empowerment of family members is understood as beneficial, it seems indicated that we include corresponding outcome measures for family members when measuring treatment effectiveness. Jacobsen and Thompson (2017) pointed to the fact that this aspect is not always attended to. Even though many music therapists focus on relationships and are aware of their impact on the family system, it seems to be difficult to be explicit and open about this with families. In a way, it seems to be safer, maybe less intrusive, to develop goals primarily for the child referred to therapy. However, if we believe that the family system is important for the wellbeing of the client and if we want to work in partnership with the family, it seems ethically required to be transparent about our intentions, and explicit about the focus and goal of the intervention.

Conducting this doctoral research project made me more aware of the various dimensions, possibilities and challenges of family-centred music therapy. Which setting and treatment model is most beneficial for which family? Which roles do the therapist take when and with whom? Who decides on the treatment goals? Who is the therapy for? And who decides that? Which outcomes for which family member are considered? There are no straight answers that apply to all situations and families. Depending on the individual needs and preferences, therapists, researchers and families should discuss these questions and find the approach that is suitable for them. I believe that these aspects will become more and more important in the fast-developing field of music therapy with families. Being conscious about the opportunities and challenges of family-centred music therapy is essential for ethical and beneficial work. I thus believe that relevant questions need to be thought about and discussed openly in the music therapy community, as well as in music therapy training courses to improve clinical work and research.

7.2.3 Relevance of welcome and farewell rituals

To reduce the data for the time-sampling video analysis, I selected music therapy session excerpts. This selection process followed a strength-based approach and focused on positive moments. Exploring the activities that occurred during these selected moments yielded interesting and important results. The proportion of time spent with certain activities or on playing the different instruments varied between children. This finding was expected as I tried to respond to the different needs and preferences of individual children as opposed to following a fixed routine or educational agenda. However, welcome and farewell rituals, i.e. hello and goodbye songs, were an exception and accounted for a high proportion of selected excerpts across all the 13 children. Even though I had previously realised that greeting and goodbye songs played an important role in sessions with most children, I was surprised to find how high the proportion of excerpts falling into this category was. On average, 25% of selected excerpts included welcome or farewell rituals, which means that many significant moments occurred during these activities.

For music therapists working with children with ASD it is important to know that carefully chosen and flexibly applied hello and goodbye songs are especially well suited to generate positive and resilience-enhancing interactions in music therapy sessions with this client group. The results from the excerpt selection support the common practice in many music therapy training courses to give special attention to welcome and farewell rituals. Music therapy students benefit from practising writing and using their own hello and goodbye songs. Furthermore, this finding has implications for research employing video-analysis methods. In several microanalysis approaches, the first and last minutes of a session are discarded precisely for the reason that hello and goodbye songs or rituals might dominate the interaction (e.g. Mössler et al., 2017; Plahl, 2007). The results of my study suggest that this selection procedure excludes some of the most important moments, and that video analysis of music therapy sessions with this client group should, on the contrary, specifically include welcome and farewell rituals. Video recordings of the first and last minutes of a music therapy session with children with ASD seem to capture many significant moments.

7.2.4 Methodological approach

To conform to the standards in medical research and to the current research trends, more large-scale studies and RCTs are carried out in music therapy. Because of high participant numbers, these studies often apply quantitative methods only. It is considered best practice if measurements are administered by assessors who are blinded about the group allocation of participants. In this way, bias can be reduced. However, this procedure also holds limitations and challenges. My doctoral study highlights the importance of using various methods to generate data, including behavioural observation, qualitative analyses, and parent-rated measures. This mixed methods approach improves the accuracy of assessment of children with ASD, as it considers their behaviour across settings and time periods. Young children with ASD often display complex behaviours and struggle in formal test conditions with strangers, which might influence results. A mixed methods approach, combining both quantitative and qualitative data, allows the researcher to get a more comprehensive understanding of the processes, changes and developments.

Results from parent-rated measures are sometimes dismissed as less meaningful, because parents are not blinded to the randomisation of their child and may be biased. However, I argue that, on the contrary, this makes the parent-rated assessments especially valuable measurements. Not only do parents have the best understanding of their child, their evaluation of the treatment and their child’s development also provides us with important information about their own wellbeing. As discussed in previous chapters, ASD is likely to have an impact on the whole family and not only on the child diagnosed. Parents of children with ASD suffer more often with depression and anxiety and they experience higher levels of stress and aggravation than the general population. If parents feel that their child develops well and that their quality of life improves, they are more likely to feel less stressed themselves. This will hopefully not only affect their own mental health but also affect their interaction patterns with their child in a positive way. The perception and opinion of parents is essential when working with young children and when investigating the suitability of interventions. I thus believe that, despite potential bias, parent-rated measures are especially meaningful and should be included in effect studies.

In this doctoral project, I used GLMM as my analytical model. I explained why GLMMs are more suited to my research questions and data set than traditional statistical techniques, such as ANOVA or regression. Modelling enhances our options to understand and evaluate complex data, and to investigate relationships within data. Even though research studies in related disciplines already employ GLMMs more routinely (e.g. Andersen et al., 2106; Piek et al., 2015; Yarkiner et al., 2013), music therapy research does not make use of some of the more advanced statistical possibilities, yet. To get meaningful results and be able to draw valid conclusions, it is essential that the chosen statistical approach fits the research questions and data. However, choosing the most suitable computations requires the researcher to be aware of and understand the different options. No music therapy researcher can be expected to have a good understanding of all the developing statistical options available, but research institutes and groups need to establish partnerships with statisticians who can assist in finding the best methodological approach. The more advanced and varied the methods become, the more important good collaborations with other disciplines are. Furthermore, music therapy training courses at master's levels and certainly at doctoral levels might need to focus more on conveying a basic understanding of different statistical approaches and computing programmes.

7.3 Limitations of this study and ideas for future research

Even though I planned my doctoral study carefully, chose my research methods according to recommendations in the literature, and endeavoured to apply methods as rigorously as possible, some limitations of this research need to be noted. Some of these limitations were due to practical reasons, such as a restricted time frame, or limited resources and money. Other difficulties arose during the research process and were linked to the complexity of the phenomena I investigated. In this section, I outline the limitations, reflect on them and give recommendations of how to avoid or minimise them in future research studies. Every research project is a journey with unexpected turns, obstacles and discoveries. In my view, mistakes and difficulties are opportunities to learn and develop further. I hope that, by sharing my experiences, I can help to improve future music therapy research.

7.3.1 Small scale and risk of bias

This study included 25 young children with ASD and their families. Of this group, 13 children received music therapy. The music therapy and parent counselling sessions of these 13 participants were evaluated in the video analysis and thematic analysis. Data of all children were explored in the analysis of quality-of-life scales. In the field of music therapy, this number of participants is relatively high for a pragmatic, single-centre study. Nevertheless, compared to intervention effectiveness studies in other disciplines, my doctoral research qualifies as a small study. The narrow time frame and financial constraints did not allow me to include more children in this doctoral project. To be able to generalise findings, they need to be replicated with a larger sample size in future research studies. Furthermore, the small sample size meant that all therapy sessions were conducted by only one therapist. To be able to make assumptions about the effects of music therapy or a certain music therapy approach as opposed to music therapy delivered by a specific person, one needs to investigate effects of music therapy sessions conducted by several different therapists.

One could argue that a limitation of my study is the lack of a control group regarding the video analysis and thematic analysis. However, my research did not aim to investigate whether music therapy and parent counselling sessions are superior to another intervention regarding resilience enhancement. As demonstrated in the literature review my topic was under-researched, so it was necessary to first explore the effects of music therapy and parent counselling on resilience to see whether there were any positive effects. I ascertained that music therapy and parent counselling sessions seem to foster resilience in young children with ASD and that treatment effectiveness might be best measured against improved resilience. In future research studies, it could be informative to compare videos of music therapy sessions with videos of other intervention sessions or classroom activities regarding protective factors and the likelihood of resilience.

In my research study, I took the roles of music therapist, parent counsellor, and researcher. If one person conducts both the clinical intervention and the assessment of the effectiveness of this intervention, a high risk of bias is present. Even though I was aware of this problem from the beginning, I had no possibilities to completely avoid it. I had no financial means to employ a research assistant who could carry out the video annotation for me. Furthermore, because of consent regulations and confidentiality, it was not possible to analyse TIME-A videos of other music therapists rather than videos from my own sessions. Analysing one's own work has the benefits of understanding one's own interaction patterns and learning more about one's own therapeutic techniques that work or do not work. In addition to the practical reasons preventing me from analysing other people's work, I was also interested to explore my own approach and style, and thereby improve my abilities as a music therapist. However, I was aware that I needed to take every possible measure to minimise the risk of bias. I therefore documented all my methodological decisions and my rules for selecting video excerpts, for annotating video excerpts and for applying the quality of child-therapist relationship assessment. Manuals outlining explicit steps for each process ensured that they were comprehensible and repeatable. Inter-rater reliability tests were carried out whenever possible. To test inter-rater reliability of the video excerpt selection, the video annotation, and the ACTR rating, I employed rigorous statistical methods, such as the prevalence-adjusted, bias-adjusted kappa or the two-way random effects, absolute agreement, single measures intraclass correlation. These measures minimised the risk of bias and the subjectivity of assessments. For future research studies, it is recommendable to separate the roles of therapist and researcher while continuing to use inter-rater reliability tests at all stages of the project.

7.3.2 Weakness of assessment scales used

Because experiences of positive relationships are essential for developing resilience, I decided to measure the quality of the child-therapist relationship in the session excerpts. None of the existing relationship measurement tools was deemed suitable for my research purposes as they were either too complex and time-consuming for the scope of this study or measured concepts that were too similar to the concepts already assessed with my coding system. I thus decided to develop a new bespoke assessment tool which I called the ACTR. In an inter-rater reliability test, the scale demonstrated high reliability. However, the measure has not undergone a strict validation procedure. The psychometric properties (i.e. validity, reliability, internal consistency) need to be tested using bigger sample sizes. It has been shown that intervention research using unpublished measures is more likely to report effectiveness than research using validated scales (Marshall et al., 2000). It is therefore important to validate the ACTR to make the measure accessible and useful for future music therapy research.

I used a quality-of-life measurement in my study, as this mental-health outcome is closely linked to resilience and thus important for my research question. However, as all my study participants were also enrolled in TIME-A, the families were already burdened with a high number of questionnaires and scales that they needed to fill in for the international RCT. I therefore decided to not introduce an additional assessment tool but to use the quality-of-life measurement applied in TIME-A. This quality-of-life scale was a very simple one-item visual analogue scale with only limited informative value. Furthermore, many parents expressed their discontent with the scale. In a future study, a more elaborate assessment receiving better user acceptance should be employed to explore the effects of music therapy on quality of life of children further without causing stress for the parents.

7.3.3 Difficulties of assessing the multidimensional resilience construct

The literature review summarised the various definitions of resilience and its related concepts and presented the debates of how to measure it. There is no consensus regarding the best way of assessing resilience. While some researchers propose prospective longitudinal resilience studies, others question the possibility to assess resilience as such at all. Several intervention studies thus resort to assessing the likelihood of resilience through, for example, assessing the development of protective factors. This is the approach that I used in my study as well. As resilience is a process of adaptation, I believe that this method is not a stopgap solution but in fact the most suitable way of approaching this topic. However, future music therapy research on resilience might benefit from additional assessments, such as measuring certain biomarkers, using ecological momentary assessments, or including a number of mental-health outcomes. I have argued that the mental-health outcomes need to be chosen in a participatory and inclusive process with the study participants involved to avoid assessing outcomes that are not relevant for them.

Resilience is a multidimensional construct and therefore difficult to measure. I approached this challenge by including multiple sources of data. Risk factors and protective factors indicate the likelihood of a child becoming resilient. These factors are influential on both the internal level, the within-child factors, and the external level. My research focused mainly on the protective factors on the internal level, because these can be strengthened more easily by the intervention and assessed by video observation. However, offering parent counselling sessions to the children's families and analysing this material allowed me to gain some insight into the effects on the important external level of the family. Parents were supported and their views were taken into account. The second very important environment for children is their school. Initially, I had intended to include data gathered not only from video recordings of music therapy and parent counselling sessions, and from quality-of-life scales, but also from audio recordings of semi-structured teacher interviews. In the teacher interviews, I had planned to ask the school staff about their thoughts and perspectives, and to share ideas of how to implement music in the classrooms in a more structured way. However, when thinking carefully about how to select, prepare and analyse the material, I realised that the video recordings of music therapy and parent counselling sessions already provided a considerable amount of data. After having conducted 445 music therapy and 68 parent counselling sessions, I had collated 291 hours of video material. Collecting additional data from teachers and processing it in a thorough way turned out to be beyond the scope of this doctoral study. Therefore, I decided to focus on the music therapy and parent counselling sessions, and to adjust my research questions accordingly. As I had already recorded and documented some comments from teachers, I decided to include these in a narrative account in the case studies without analysing the data in more detail. This allowed me to capture at least some of their important insights and perspectives. I recommend that future research studies on the effects of music therapy on resilience in children take the dimension of the school environment into account in a more systematic and elaborate way. A recent doctoral study demonstrated that a collaborative approach of music therapists and teaching assistants benefits the children, their development, and the school climate (Tomlinson, 2016). In my clinical approach, I always tried to work collaboratively with school staff but not in a formalised way. Findings from resilience research and music therapy research suggest that a more conscious involvement of the school might improve both the music therapy intervention and the resilience of the children.

After having determined resilience as an appropriate treatment aim for children with ASD and their families, it is necessary to find adequate ways to measure resilience in order to evaluate treatment effectiveness. The mixed methods approach of my study was suitable for the purposes of this doctoral research. The methodological approach provided meaningful and significant findings and allowed a first insight into the effects of music therapy and parent counselling on resilience in young children with ASD and their families. However, the approach was very time-consuming. Especially the extensive video analysis of music therapy sessions required many hours of training and work. In this form, the approach does not seem suitable for future large-scale studies. Several amendments can be considered for future research:

1) I analysed one music therapy session per child per week. It might be sufficient to select less sessions and analyse less video material. However, recommendations were published for resilience research, emphasising that ‘repeated measurements at high temporal resolution’ (Kalisch et al., 2017, p. 787) are necessary to capture the dynamic processual character of adaptation and resilience. Thus, the question remains of how many videos are enough to receive meaningful results.
2) Even though I employed annotation software to assist with the video analysis, most of the annotation needed to be done manually. The fast technological progress might facilitate and accelerate the video annotation in the future. A current doctoral project in music therapy and IT engineering explores the possibilities of applying machine learning to music therapy session interpretation (Parker, 2019). These technological advancements might enable researchers in the future to analyse more video data in less time.
3) My literature review revealed that no suitable resilience scale for young and non-verbal children with ASD is available at the moment. To avoid time-consuming video analysis in future large-scale research studies on the effects of music therapy on resilience in young children with ASD, one might develop a new resilience scale for this client group. However, it remains questionable whether the positive effects of music therapy can be captured adequately by a scale or whether the character of the intervention and its benefits require more observational or qualitative methods.

7.3.4 Participation of study participants

It is important to include the views of the study participants in research. As I was interested in the effects of the music therapy intervention on resilience in children, it would have been good to gather their opinions on this subject. However, half of the children in my cohort were non-verbal and most of the other children only used a few words and might have been overburdened by answering questions for the research. Furthermore, none of the existing resilience scales is appropriate for the age range and the abilities of children in my study. I thus decided to observe their behaviour and thereby assess their responses in a very direct way. I believe that children with ASD can express themselves using music making. By analysing excerpts from their music therapy sessions, I allowed them to contribute to the research with their own (musical) voice. Nevertheless, in future studies one could explore additional ways of gathering perspectives of non-verbal and ability-diverse children through using assisted technology or specialised outcome measures. In a current doctoral project, a music therapy researcher develops a feedback tool for adolescents with severe learning disabilities (Austin, 2019). This tool or variations of it might be very helpful for future research studies and might allow researchers to include the invaluable perspectives of the music therapy clients.

CHAPTER EIGHT
CONCLUSION

The aim of this doctoral research was to investigate whether music therapy and parent counselling sessions enhance resilience in young children with ASD. I have demonstrated the relevance of this gap in knowledge and proposed six subquestions to approach it. Using a mixed methods design, I analysed various data sources, including video recordings of music therapy sessions, transcribed parent counselling sessions, and data from scales measuring quality of life of participants at different time points. The findings from a thorough literature review and from the different data analyses were combined and discussed to answer the research questions.

The literature review provided strong evidence that increasing resilience is a more appropriate treatment aim than symptom reduction for young children with ASD. Findings from the quantitative and qualitative analyses suggest that music therapy sessions increase behaviours indicative of resilience in this client group. Intrapersonal protective resilience factors, such as the ability to express and regulate emotions, awareness of others, impulse control, self-efficacy, goal-directed behaviour, and reaching out to others, were strengthened by music therapy. In my study cohort, different treatment intensity did not result in statistically significant differences regarding the increase or decrease of behaviours indicative of resilience. However, I suggested that future research studies with more participants investigate whether the subgroup of children with ASD and complex needs respond better to high-intensity music therapy. The video analysis showed that while verbal children displayed more resilience-indicating behaviours throughout the music therapy intervention, the non-verbal children progressed more steeply. This indicates that music therapy is an effective early intervention for the group of non-verbal children with ASD, which is more difficult to reach with other interventions. The findings from the thematic analysis suggest that parent counselling sessions offered to the families alongside music therapy sessions enhance resilience in young children with ASD and their families. Parents highlighted that resilience-indicating child behaviours increased both inside and outside music therapy sessions. They enjoyed watching their child succeed in music therapy, and they reported feeling empowered and strengthened by the simultaneous treatment approach. Both the results from the parent-rated quality-of-life scales and the thematic analysis of parent counselling sessions suggest that music therapy has a positive effect on quality of life of young children with ASD. Considering all these findings, one can conclude that music therapy and parent counselling sessions enhance resilience in young children with ASD.

I have indicated that this study provides only preliminary evidence. It is necessary to replicate findings in larger-scale studies and to further explore the effects of the intervention on resilience in this client group. I have made several recommendations for future research studies, including separating the roles of therapist and researcher, using inter-rater reliability tests, applying validated and user-friendly assessment tools, measuring relevant biomarkers, involving the school environment in a systematic manner, and considering the perspectives of study participants at all stages of the research project. I have pointed out that my methodological approach, though suitable for my study, needs to be amended for research with a bigger sample size. Nevertheless, I would like to suggest that the model and the statistical cutting-edge methods that were used in this doctoral study are adopted and developed in future music therapy research. I have demonstrated that these methods help to advance the discipline by extending and refining our possibilities to organise, analyse and understand the data collected. I have also discussed the necessity to consult experts from other fields and to collaborate with statisticians for a well-informed decision regarding suitable methods. As the available research methods become more complex and advanced, liaising with other researchers becomes more and more essential.

This doctoral research was motivated by my clinical experience and the resulting belief that music therapy can make a significant difference in the lives of children with ASD and their families. After having spent so much time analysing and contextualising the various data sets and results, I feel I have learned invaluable information about children with ASD, their families, their strengths and resources, and their responses to music therapy. Our interactions with clients in music therapy is always shaped by underlying, maybe unconscious assumptions about their condition. It is therefore important that we constantly question our understanding of autism, listen to autistic people and follow the latest research. For a long time, treatment effectiveness was measured against symptom reduction in children with ASD. This implies that a cure of autism is possible and that a 'normalisation' of children with ASD and their behaviour is desirable. The autism community and a growing number of practitioners and researchers question and reject this view. My doctoral study has convinced me that it is better to measure treatment effectiveness by looking at improved resilience in children with ASD. This implies that autism is a form of human variability and neurodiversity, and that children with ASD need not be changed but need to be strengthened. My strongest realisation from this research is that we should think carefully about our intervention aims and be open and explicit about them. In clinical practice, intervention aims influence our therapeutic approach and our relationship with our clients and their families. In research and effect studies, we can only measure what we set out to measure. It is of utmost importance that we ask the right questions that are relevant for our clients and their families. The findings from this study suggest that resilience enhancement is one priority for the work with children with ASD and their families, and that music therapy is a suitable intervention to achieve this aim.

REFERENCES

Aarts, M. (2000). *Marte Meo Grundbok* [Marte Meo handbook]. Harderweijk, Netherlands: Aarts Production.

Abbeduto, L., Seltzer, M. M., Shattuck, P., Krauss, M. W., Orsmond, G., & Murphy, M. M. (2004). Psychological well-being and coping in mothers of youths with autism, Down syndrome, or fragile X syndrome. *American Journal on Mental Retardation, 109*(3), 237-254.

Abbott, E. A. (2016). Reviewing the literature. In B. L. Wheeler, & K. Murphy (Eds.), *Music therapy research* (3rd ed) (pp. 56-65). Dallas, TX: Barcelona Publishers.

Accordino, R., Comer, R., & Heller, W. B. (2007). Searching for music's potential: A critical examination of research on music therapy with individuals with autism. *Research in Autism Spectrum Disorders, 1*(1), 101-115.

Ackerman, S., Schoenbrun, S., Hudac, C., & Bernier, R. (2017). Interactive effects of prenatal antidepressant exposure and likely gene disrupting mutations on the severity of autism spectrum disorder. *Journal of Autism and Developmental Disorders, 47*(11), 3489-3496.

Ahern, N. R., Kiehl, E. M., Sole, M. L., & Byers, J. (2006). A review of instruments measuring resilience*. Issues in Comprehensive Pediatric Nursing, 29*(2), 103-125.

Aigen, K. (2005). *Music-centred music therapy.* Gilsum, NH: Barcelona Publishers.

Aigen, K. (2008). An analysis of qualitative music therapy research reports 1987 – 2006: Articles and book chapters. *The Arts in Psychotherapy, 35*(4), 251-261.

Aigen, K. (2014). Music-centred dimensions of Nordoff-Robbins music therapy. *Music Therapy Perspectives, 32*(1), 18-29.

Albanesi, H. (2017). Encountering disability studies in the social sciences. *The Social Science Journal, 54*(1), 1-3.

Aldinger, K. A., Lane, C. J., Veenstra-VanderWeele, J. & Levitt, P. (2015). Patterns of risk for multiple co-occurring medical conditions replicate across distinct cohorts of children with autism spectrum disorder. *Autism Research, 8*(6), 771-781.

Aldred, C., Green, J., Howlin, P., LeCouteur, A., Slonims, V., Barron, S., & PACT therapists (2010). Pre-school autism communication trial (PACT): Intervention procedure. *The Lancet (supplement), 375*(9732), s1-s20.

Altiere, M. J., & von Kluge, S. (2009). Searching for acceptance: Challenges encountered while raising a child with autism. *Journal of Intellectual and Developmental Disability, 34*(2), 142-152.

Alvin, J. (1978). *Music therapy for the autistic child.* London, England: Oxford University Press.

Alvord, M. K., & Grados, J. J. (2005). Enhancing resilience in children: A proactive approach. *Professional Psychology: Research and Practice, 36*(3), 238–245.

American Music Therapy Association (2019). *About music therapy & AMTA: What is music therapy?* Retrieved on January 10, 2019 from https://www.musictherapy.org/about/musictherapy/

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

American Psychological Association (2017). *Ethical principles of psychologists and code of conduct.* (2002, amended June 1, 2010 and January 1, 2017). Retrieved on March 16, 2018 from http://www.apa.org/ethics/code/index.aspx

American Psychological Association (2018). *The road to resilience.* Retrieved on March 16, 2018 from http://www.apa.org/helpcenter/road-resilience.aspx

Andersen, L., Magidson, J., O'Cleirigh, C., Remmert, J., Kagee, A., Leaver, M., … Joska, J. (2016). A pilot study of a nurse-delivered cognitive behavioral therapy intervention (Ziphamandla) for adherence and depression in HIV in South Africa. *Journal of Health Psychology, 23*(6), 776-787.

Anderson, C. (2012). *Floortime and pivotal response training*. Retrieved on April 21, 2018 from https://iancommunity.org/cs/Bens_simplex_community/floortime_and_prt

Annesley, L., Crociani, S., Davidson, B., & Vaz, A. (2015). The saxophone. In A. Oldfield, J. Tomlinson, & D. Loombe (Eds.), *Flute, accordion or clarinet? Using the characteristics of our instruments in music therapy* (pp. 265-286). London, England: Jessica Kingsley Publishers.

Anthony, E. J. & Cohler, B. J. (Eds.). (1987). *The invulnerable child*. New York, NY: Guilford Press.

Arezina, C. H. (2011). *The effect of interactive music therapy on joint attention skills in preschool children with autism spectrum disorder* (Master's thesis). University of Kansas, Lawrence, KS.

Aumann, K., & Hart, A. (2009). *Helping children with complex needs bounce back: Resilient therapy for parents and professionals*. London, England: Jessica Kingsley Publishers.

Austin, V. (2019, January). *Expanding the clinical picture: What can adolescents with severe learning disabilities feedback about their experience in individual music therapy and why is this important?* Paper presented at the PhD seminar of the

Cambridge Institute for Music Therapy Research, Anglia Ruskin University, Cambridge, England.

Autism Speaks (2010). *How is autism treated?* Retrieved on April 21, 2018 from https://www.autismspeaks.org/sites/default/files/documents/100-day-kit/treatment_version_2_0.pdf

Attride-Stirling, J., Davis, H., Markless, G., Selare, I., & Day, C. (2001). Someone to talk to who'll listen: Addressing the psychosocial needs of children and families. *Journal of Community and Applied Social Psychology, 11*(3), 179-191.

Baio, J., Wiggins, L., Christensen, D. L., Maenner, M. J., Daniels, J., Warren, Z., … Dowling, N. F. (2018). Prevalence of autism spectrum disorder among children aged 8 years — autism and developmental disabilities monitoring network, 11 sites, United States, 2014. *Morbidity and Mortality Weekly Report. Surveillance Summaries, 67*(6), 1–23.

Baird, G., Simonoff, E., Pickles, A., Chandler, S., Loucas, T., Meldrum, D., & Charman, T. (2006). Prevalence of disorders of the autism spectrum in a population cohort of children in South Thames: The special needs and autism project (SNAP). *The Lancet, 368*(9531), 210-215.

Baker, F. A. (2016). Software used in data analysis of interpretivist research. In B. L. Wheeler, & K. Murphy (Eds.), *Music therapy research* (3rd ed) (pp. 281-290). Dallas, TX: Barcelona Publishers.

Baker-Ericzén, M. J., Brookman-Frazee, L., & Stahmer, A. (2005). Stress levels and adaptability in parents of toddlers with and without autism spectrum disorders. *Research and Practice for Persons with Severe Disabilities, 30*(4), 194-204.

Baker-Ericzén, M. J., Stahmer, A. C., & Burns, A. (2007). Child demographics associated with outcomes in a community-based pivotal response training program. *Journal of Positive Behavior Interventions, 9*(1), 52-60.

Baron-Cohen, S. (2017). Editorial perspective: Neurodiversity - a revolutionary concept for autism and psychiatry. *Journal of Child Psychology and Psychiatry, 58*(6), 744-747.

Baron-Cohen, S., Lombardo, M. V., Auyeung, B., Ashwin, E., Chakrabarti, B., & Knickmeyer, R. (2011). Why are autism spectrum conditions more prevalent in males? *PLOS Biology, 9*(6), e1001081.

Baron-Cohen, S., Scott, F. J., Allison, C., Williams, J., Bolton, P., Matthews, F. E., & Brayne, C. (2009). Prevalence of autism-spectrum conditions: UK school-based population study. *The British Journal of Psychiatry, 194*(6), 500-509.

Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language 68*(3), 255-278.

Barry, P., O'Callaghan, C., Wheeler, G., & Grocke, D. (2010). Music therapy CD creation for initial pediatric radiation therapy: A mixed methods analysis. *Journal of Music Therapy, 47*(3), 233-263.

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*(1), 1-48.

Bayat, M. (2007). Evidence of resilience in families of children with autism. *Journal of Intellectual Disability Research, 51*(9), 702-714.

Becerra, T. A., Massolo, M. L., Yau, V. M., Owen-Smith, A. A., Lynch, F. L., Crawford, P. M., … Croen, L. A. (2017). A survey of parents with children on the autism spectrum: Experience with services and treatments. *The Permanente Journal*, *21*, 16–24.

Bekhet, A. K., Johnson, N. L., & Zauszniewski, J. A. (2012). Resilience in family members of persons with autism spectrum disorder: A review of the literature. *Issues in Mental Health Nursing, 33*(10), 650-656.

Benenzon, R. (1982). *Music therapy in child psychosis*. Springfield, IL: Charles C. Thomas.

Berger, D. (2002). *Music therapy, sensory integration and the autistic child*. London, England: Jessica Kingsley Publishers.

Bergmann, T. (2016). Music therapy for people with autism spectrum disorder. In J. Edwards (Ed.), *The Oxford handbook of music therapy* (pp. 186-209). Oxford, England: Oxford University Press.

Bergmann, T. (2018). TIME-A: Ist Musiktherapie bei Autismus Zeit- und Geldverschwendung? [TIME-A: Is music therapy for autism a waste of time and money?]. *Musiktherapeutische Umschau, 39*(1), 5-11.

Bettelheim, B. (1967). *The empty fortress: Infantile autism and the birth of the self*. Oxford, England: Free Press of Glencoe.

Bhatara, A., Quintin, E.-M., Fombonne, E., & Levitin, D. J. (2013). Early sensitivity to sound and musical preferences and enjoyment in adolescents with autism spectrum disorders. *Psychomusicology: Music, Mind, and Brain, 23*(2), 100-108.

Bidmead, C., Davis, H., & Day, C. (2002). Partnership working: What does it really mean? *Community Practitioner, 75(7)*, 256-259.

Bieleninik, Ł., Geretsegger, M., Mössler, K., Assmus, J., Thompson, G., Gattino, G., … Gold, C. (2017). Effectiveness of improvisational music therapy versus enhanced standard care for children with autism spectrum disorder: The TIME-A randomized controlled trial. *JAMA, 318*(6), 525-535.

Bieleninik, Ł., Posserud, M.-B., Geretsegger, M., Thompson, G., Elefant, C., & Gold, C. (2017). Tracing the temporal stability of autism spectrum diagnosis and severity as measured by the Autism Diagnostic Observation Schedule: A systematic review and meta-analysis. *PLOS ONE, 12*(9), e0183160.

Blauth, L. K. (2017). Improving mental health in families with autistic children: Benefits of using video feedback in parent counselling sessions offered alongside music therapy. *Health Psychology Report, 5*(2), 138-150.

Block, J. H., & Block, J. (1980). The role of ego-control and ego resiliency in the organization of behaviour. In W. A. Collins (Ed.), *Minnesota symposium on child psychology* (pp. 39-101). Hillsdale, NJ: Lawrence Erlbaum Associated.

Block, J., & Kremen, A. M. (1996). IQ and ego-resiliency: Conceptual and empirical connections and separateness. *Journal of Personality and Social Psychology, 70*(2), 349-361.

Bonanno, G. A, & Diminich, E. D. (2013). Annual research review: Positive adjustment to adversity trajectories of minimal-impact resilience and emergent resilience. *Journal of Child Psychology and Psychiatry, 54*(4), 378–401.

Bonanno, G. A., Romero, S. A., & Klein, S. I. (2015). The temporal elements of psychological resilience: An integrative framework for the study of individuals, families, and communities. *Psychological Inquiry: An International Journal for the Advancement of Psychological Theory, 26*(2), 139-169.

Bonde, L. O. (2007). Using multiple methods in music therapy health care research: Reflections on using multiple methods in a research project about receptive music therapy with cancer survivors. In J. Edwards (Ed.), *Music: Promoting health and creating community in healthcare contexts* (pp. 105-122). Newcastle, England: Cambridge Scholars Publishing.

Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*. Thousand Oaks, CA: Sage.

Boyd, B. A. (2002). Examining the relationship between stress and lack of social support in mothers of children with autism. *Focus on Autism and other Developmental Disabilities, 17*(4), 209-215.

Bowlby, J. (1988). *A secure base: Clinical applications of attachment theory.* London, England: Routledge.

Bradt, J., Burns, D. S., & Creswell, J. W. (2013). Mixed methods research in music therapy research. *Journal of Music Therapy, 50*(2), 123-148.

Bradt, J., Potvin, N., Kesslick, A., Shim, M., Radl, D., Shriver, E., Gracely, E. J., & Komarnicky-Kocher, L. T. (2015). The impact of music therapy versus music medicine on psychological outcomes and pain in cancer patients: A mixed methods study. *Supportive Care in Cancer, 23*(5), 1261-1271.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2). 77-101.

Brauns, A. (2004). *Buntschatten und Fledermäuse: Mein Leben in einer anderen Welt* [Coloured shadows and bats: My life in a different world]. München, Germany: Goldmann.

Brooks, R., & Goldstein, S. (2001). *Raising resilient children*. New York, NY: McGraw-Hill.

Brooks, R., & Goldstein, S. (2012). *Raising resilient children with autism spectrum disorders: Strategies for maximizing their strengths, coping with adversity, and developing a social mindset.* New York, NY: McGraw-Hill.

Brooks, R., & Goldstein, S. (2015). The power of mindsets: Guideposts for a resilience-based treatment approach. In D. A. Crenshaw, R. Brooks, & S. Goldstein (Eds.), *Play therapy interventions to enhance resilience* (pp. 3-31). New York, NY: Guildford Press.

Brownell, M. D. (2002). Musically adapted social stories to modify behaviors in students with autism: Four case studies. *Journal of Music Therapy, 39*(2), 117-144.

Brugha, T., Cooper, S. A., McManus, S., Purdon, S., Scott, F. J., Spiers, N., & Tyrer, F. (2012). *Estimating the prevalence of autism spectrum conditions in adults: Extending the 2007 adult psychiatric morbidity survey.* Leeds, England: The NHS Information Centre.

Bruscia, K. E. (Ed.). (2011). *Case examples of music therapy for autism and Rett syndrome.* Gilsum, NH: Barcelona Publishers.

Bruscia, K. E. (2014). *Defining music therapy* (3rd ed.). Gilsum, NH: Barcelona Publishers.

Buday, E. M. (1995). The effects of signed and spoken words taught with music on sign and speech imitation by children with autism. *Journal of Music Therapy, 32*(3), 189–202.

Buescher, A. V., Cidav, Z., Knapp, M., & Mandell, D. S. (2014). Costs of autism spectrum disorders in the United Kingdom and the United States. *JAMA Pediatrics, 168*(8), 721-728.

Bull, R. (2008). Autism and the family: Group music therapy with mothers and children. In A. Oldfield, & C. Flower (Eds.), *Music therapy with children and their families* (pp. 71-87). London, England: Jessica Kingsley Publishers.

Burlingham, D., Goldberger, A., & Lussier, A. (1955). Simultaneous analysis of mother and child. *The Psychoanalytic Study of the Child, 10*(1), 165-186.

Burns, D. S., & Masko, M. K. (2016). Combining interpretivist with objectivist methods in explanatory sequential designs. In B. L. Wheeler, & K. Murphy (Eds.), *Music therapy research* (3rd ed.) (pp. 599-607). Dallas, TX: Barcelona Publishers.

Byrt, T., Bishop, J., & Carlin, J. B. (1993). Bias, prevalence and kappa. *Journal of Clinical Epidemiology, 46*(5), 423–429.

Carnevali, L., Koenig, J., Sgoifo, A., & Ottaviani, C. (2018). Autonomic and brain morphological predictors of stress resilience. *Frontiers in Neuroscience*, *12*, 228.

Carpente, J. (2009). *Contributions of Nordoff-Robbins music therapy within the developmental, individual-difference, relationship-based (DIR®)/Floortime™ framework to the treatment of children with autism: Four case studies* (Doctoral dissertation). Temple University, Philadelphia, PA.

Carpente, J. A. (2011). Addressing core features of autism: Integrating Nordoff-Robbins music therapy within the developmental, individual-difference, relationship-based (DIR®)/Floortime™ model. In A. Meadows (Ed.), *Developments in music therapy practice: Case study perspectives* (pp. 134-149). Gilsum, NH: Barcelona Publishers.

Cicchetti, D. (2010). Resilience under conditions of extreme stress: A multilevel perspective. *World Psychiatry*, *9*(3), 145–154.

Cidav, Z., Munson, J., Estes, A., Dawson, G., Rogers, S., & Mandell, D. (2017). Cost offset associated with early start denver model for children with autism. *Journal of the American Academy of Child and Adolescent Psychiatry, 56*(9), 777-783.

Chazan, S. E. (2003). *Simultaneous treatment of parent and child*. London, England: Jessica Kingsley Publishers.

Chen, R. J., Kelly, G., Sengupta, A., Heydendael, W., Nicholas, B., Beltrami, S., … Bhatnagar, S. (2015). MicroRNAs as biomarkers of resilience or vulnerability to stress. *Neuroscience, 305*, 36-48.

Chmitorz, A., Kunzler, A., Helmreich, I., Tüscher, O., Kalisch, R., Kubiak, T., Wessa, M., & Lieb, K. (2018). Intervention studies to foster resilience: A systematic review and proposal for a resilience framework in future intervention studies. *Clinical Psychology Review, 59*, 78-100.

Cohen, J. (2013). Creating a positive school climate: A foundation for resilience. In S. Goldstein, & R. Brooks (Eds.), *Handbook of resilience in children* (2nd ed.) (pp. 411-423). New York, NY: Springer.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385-396.

Coholic, D., Eys, M., & Lougheed, S. (2012). Investigating the effectiveness of an arts-based and mindfulness-based group program for the improvement of resilience in children in need. *Journal of Child and Family Studies, 21*(5), 833–844.

Connor, K. M., & Davidson, J. R. T. (2003). Development of a new resilience scale: The Connor-Davidson resilience scale (CD-RISC). *Depression and Anxiety, 18*(2), 71-82.

Connor, K. M., Davidson, J. R. T., & Lee, L. C. (2003). Spirituality, resilience, and anger in survivors of violent trauma: A community survey. *Journal of Traumatic Stress, 16*(5), 487-494.

Constantine, N. A., & Benard, B. (2001). *California healthy kids survey resilience assessment module: Technical report*. Berkeley, CA: Public Health Institute.

Constantino, J. N., & Gruber, C. P. (2005). *Social responsiveness scale: Manual*. Los Angeles, CA: Western Psychological Services.

Cook, E. L., & Silverman, M. J. (2013). Effects of music therapy on spirituality with patients on a medical oncology/hematology unit: A mixed-methods approach. *Arts in Psychotherapy, 40*(2), 239-244.

Cornwall Council (2018). *Video interaction guidance service*. Retrieved on April 19, 2018 from https://www.cornwall.gov.uk/education-and-learning/schools-and-colleges/special-educational-needs-file/information-advice-and-support/council-services/childrens-psychology-service/educational-psychology/video-interaction-guidance-service/

Cosden, M., Koegel, L. K., Koegel, R. L., Greenwell, A., & Klein, E. (2006). Strength-based assessment for children with autism spectrum disorders. *Research and Practice for Persons with Severe Disabilities, 31*(2), 134–143.

Coury, D. L., Ashwood, P., Fasano, A., Fuchs, G., Geraghty, M., Kaul, A., … Jones, N. E. (2012). Gastrointestinal conditions in children with autism spectrum disorder: Developing a research agenda. *Pediatrics, 130*(Supplement 2), s160-s168.

Craig, J. A., & Ozga-Lawn, M. (2013). *Pamphlet architecture 32: Resilience*. New York, NY: Princeton Architectural Press.

Crawford, M. J., Gold, C., Odell-Miller, H., Thana, L., Faber, S., Assmus, J., … Hassiotis, A. (2017). International multicentre randomised controlled trial of improvisational music therapy for children with autism spectrum disorder: TIME-A study. *Health Technology Assessment, 21*(59), 1-40.

Crenshaw, D. A., Brooks, R., & Goldstein, S. (Eds.). (2015). *Play therapy interventions to enhance resilience*. New York, NY: Guildford Press.

Creswell, J. W., Klassen, A. C., Plano Clark, V. L., & Smith, K. C. (2011). *Best practices for mixed methods research in the health sciences.* Washington, DC: National Institutions of Health.

Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research* (2nd ed.). Thousand Oaks, CA: Sage.

Dabrowska, A., & Pisula, E. (2010). Parenting stress and coping styles in mothers and fathers of pre-school children with autism and Down syndrome. *Journal of Intellectual Disability Research, 54*(3), 266-280.

Dahiru, T. (2008). *P* – value, a true test of statistical significance? A cautionary note. *Annals of Ibadan Postgraduate Medicine*, *6*(1), 21–26.

Daigneault, I., Dion, J., Hébert, M., Mcduff, P., & Collin-Vézina, D. (2013). Psychometric properties of the child and youth resilience measure (CYRM-28) among samples of French Canadian youth. *Child Abuse and Neglect*, 37(2-3), 160-171.

Daskalakis, N. P., Cohen, H., Nievergelt, C. M., Baker, D. G., Buxbaum, J. D., Russo, S. J., & Yehuda, R. (2016). New translational perspectives for blood-based biomarkers of PTSD: From glucocorticoid to immune mediators of stress susceptibility. *Experimental Neurology*, *284*(Pt B), 133–140.

Davis, H. (1993). *Counselling parents of children with chronic illness or disability*. Leicester, England: BPS Books.

Davis, M. (2016). *The effect of music therapy on joint attention skills in children with autism spectrum disorder* (Master's thesis). University of Kansas, Lawrence, KA.

Davis, N. O., & Carter, A. S. (2008). Parenting stress in mothers and fathers of toddlers with autism spectrum disorders: Association with child characteristics. *Journal of Autism and Developmental Disorders, 38*(7), 1278-1291.

Dawson, G. (2008). Early behavioral intervention, brain plasticity, and the prevention of autism spectrum disorder. *Development and Psychopathology, 20*(3), 775-803.

Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., Donaldson, A., & Varley, J. (2010). Randomized, controlled trial of an intervention for toddlers with autism: The early start denver model. *Pediatrics*, *125*(1), e17–e23.

Dawson, G., Jones, E. J., Merkle, K., Venema, K., Lowy, R., Faja, S., … Webb, S. J. (2012). Early behavioral intervention is associated with normalized brain activity in young children with autism. *Journal of the American Academy of Child and Adolescent Psychiatry, 51*(11), 1150-1159.

Dean, M., Harwood, R., & Kasari, C. (2017). The art of camouflage: Gender differences in the social behaviors of girls and boys with autism spectrum disorder. *Autism*, *21*(6), 678-689.

De Backer, J., & Wigram, T. (2007). Analysis of notated music examples selected from improvisations of psychotic patients. In T. Wosch, & T. Wigram (Eds.), *Microanalysis in music therapy: Methods, techniques and applications for clinicians, researchers, educators and students* (pp. 120-133). London, England: Jessica Kingsley Publishers.

Dickerson, M. S., Calhoun, S. L., Baweja, R., & Mahr, F. (2015). Suicide ideation and attempts in children with psychiatric disorders and typical development. *Crisis, 36*(1), 55-60.

Dobson, A. J, & Barnett, A. G. (2008). *An introduction to generalized linear models* (3rd ed.). Boca Raton, FL: Chapman and Hall/CRC.

Drake, T. (2008). Back to basics: Community-based music therapy for vulnerable young children and their parents. In A. Oldfield, & C. Flower (Eds.), *Music therapy with children and their families* (pp. 37-51). London, England: Jessica Kingsley Publishers.

Dray, J., Bowman, J., Campbell, E., Freund, M., Wolfenden, L., Hodder, R. K., … Wiggers, J. (2017). Systematic review of universal resilience-focused interventions targeting child and adolescent mental health in the school setting. *Journal of the American Academy of Child and Adolescent Psychiatry, 56*(10), 813–824.

Durkin, M. S., Maenner, M. J., Meaney, F. J., Levy, S. E., DiGuiseppi, C., Nicholas, J. S., … Schieve, L. A. (2010). Socioeconomic inequality in the prevalence of autism spectrum disorder: Evidence from a U.S. cross-sectional study. *PLOS ONE, 5*(7), e11551.

Dworzynski, K., Ronald, A., Bolton, P., & Happé, F. (2012). How different are girls and boys above and below the diagnostic threshold for autism spectrum disorders? *Journal of the American Academy of Child and Adolescent Psychiatry, 51*(8), 788-797.

Edgerton, C. L. (1994). The effect of improvisational music therapy on the communicative behaviors of autistic children. *Journal of Music Therapy, 31*(1), 31-62.

Epstein, M. H. (2004). *Behavioral and emotional rating scale, second edition: Examiner's manual*. Austin, TX: PRO-ED.

Epstein, M. H., & Sharma, H. M. (1998). *Behavioral and emotional rating scale: A strength based approach to assessment*. Austin, TX: PRO-ED.

Estes, A., Munson, J., Dawson, G., Koehler, E., Zhou, X. H., & Abbott, R. (2009). Parenting stress and psychological functioning among mothers of preschool children with autism and developmental delay. *Autism, 13*(4), 375-387.

Estes, A., Munson, J., Rogers, S. J., Greenson, J., Winter, J., & Dawson, G. (2015). Long-term outcomes of early intervention in 6-year-old children with autism spectrum disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 54*(7), 580-587.

Euper, J. A. (1968). Early infantile autism. In E. T. Gaston (Ed.), *Music in therapy* (pp. 181-190). New York, NY: MacMillan Publishing Company.

Evans, R., & Plumridge, G. (2007). Inclusion, social networks and resilience: Strategies, practices and outcomes for disabled children and their families. *Social Policy and Society, 6*(2), 231–241.

Fancourt, D., Perkins, R., Ascenso, S., Carvalho, L. A., Steptoe, A., & Williamon, A. (2016). Effects of group drumming interventions on anxiety, depression, social resilience and inflammatory immune response among mental health service users. *PLOS ONE, 11*(3), e0151136.

Farmer, K. J. (2003). *The effect of music vs. nonmusic paired with gestures on spontaneous verbal and nonverbal communication skills of children with autism ages 1-5* (Master's thesis). Florida State University, Tallahassee, FL.

Feinstein, A. (2010). *A history of autism: Conversations with the pioneers*. Hoboken, NJ: Wiley-Blackwell.

Felsenstein, R. (2013). From uprooting to replanting: On post-trauma group music therapy for pre-school children. *Nordic Journal of Music Therapy, 22*(1), 69-85.

Fenwick-Smith, A., Dahlberg, E. E., & Thompson, S. C. (2018). Systematic review of resilience-enhancing, universal, primary school-based mental health promotion programs. *BMC Psychology*, *6*, 30.

Fergusson, D. M., & Horwood, J. L. (2003). Resilience to childhood adversity: Results of a 21-year study. In S. S. Luthar (Ed.), *Resilience and vulnerability: Adaptation in the context of childhood adversities* (pp. 130-155). New York, NY: Cambridge University Press.

Field, M. (2015). Ecological momentary assessment: New insights and opportunities. *Addiction, 110*(6), 1043–1044.

Fingerman, K. L., Cheng, Y., Birditt, K., & Zarit, S. (2012). Only as happy as the least happy child: Multiple grown children's problems and successes and middle-aged parents' well-being. *The Journals of Gerontology, Series B, Psychological Sciences and Social Sciences*, *67*(2), 184-193.

Finnigan, E., & Starr, E. (2010). Increasing social responsiveness in a child with autism: A comparison of music and non-music interventions. *Autism, 14*(4), 321-348.

Forstmeier, W., & Schielzeth, H. (2011). Cryptic multiple hypotheses testing in linear models: Overestimated effect sizes and the winner's curse. *Behavioral Ecology and Sociobiology 65*(1), 47-55.

Foss-Feig, J. H., McPartland, J. C., Anticevic, A., & Wolf, J. (2016). Re-conceptualizing ASD within a dimensional framework: Positive, negative, and cognitive feature clusters. *Journal of Autism and Developmental Disorders, 46*(1), 342-351.

Friborg, O., Hjemdal, O., Rosenvinge, J. H., & Martinussen, M. (2003). A new rating scale for adult resilience: What are the central protective resources behind healthy adjustment? *International Journal of Methods in Psychiatric Research, 12*(2), 65-76.

Fukkink, R. G. (2008). Video feedback in widescreen: A meta-analysis of family programs. *Clinical Psychology Review, 28*(6), 904-916.

Furnham, A., & Buck, C. (2003). A comparison of lay-beliefs about autism and obsessive-compulsive disorder. *International Journal of Social Psychiatry, 49*(4), 287-307.

Gallagher, S., & Whiteley, J. (2012). Social support is associated with blood pressure responses in parents caring for children with developmental disabilities. *Research in Developmental Disabilities, 33*(6), 2099-2105.

Gattino, G. S., Riesgo, R. D. S., Longo, D., Leite, J. C., & Faccini, L. S. (2011). Effects of relational music therapy on communication of children with autism: A randomized controlled study. *Nordic Journal of Music Therapy, 20*(2), 142-154.

Geretsegger, M., Elefant, C., Mössler, K. A., & Gold, C. (2014). Music therapy for people with autism spectrum disorder. *Cochrane Database of Systematic Reviews*, Issue 6, Art. No.: CD004381.

Geretsegger, M., Holck, U., Carpente, J. A., Elefant, C., Kim, J., & Gold, C. (2015). Common characteristics of improvisational approaches in music therapy for children with autism spectrum disorder: Developing treatment guidelines. *Journal of Music Therapy, 52(2)*, 258-281.

Geretsegger, M., Holck, U., & Gold, C. (2012). Randomised controlled trial of music therapy's effectiveness for children with autism spectrum disorders (TIME-A): Study protocol. *BMC Pediatrics, 12*(1), 2-27.

Gold, C. (2017). *Statement from Dr. Christian Gold, Principal Investigator of the TIME-A study published in JAMA, for the American Music Therapy Association, September 2017*. Retrieved on November 27, 2018 from https://uni.no/media/manual_upload/AMTA_statement_CG_on_TIME-A.pdf

Gold, C., Wigram, T., & Elefant, C. (2006). Music therapy for autistic spectrum disorder. *Cochrane Database of Systematic Reviews*, Issue 2, Art. No.: CD004381.

Goldstein, S., & Brooks, R. (Eds.) (2013). *Handbook of resilience in children* (2nd ed). New York, NY: Springer.

Gomez, L. (1997). *An introduction to object relations.* London, England: Free Association Books.

Gotham, K., Pickles, A., & Lord, C. (2012). Trajectories of autism severity in children using standardized ADOS scores. *Pediatrics, 130*(5), e1278-e1284.

Gottfried, T. (2017). Music-oriented counselling model for parents of children with autism spectrum disorder. In S. L. Jacobsen, & G. Thompson (Eds.), *Music therapy with families: Therapeutic approaches and theoretical perspectives* (pp. 116-134). London, England: Jessica Kingsley Publishers.

Grandin, T. (1995). *Thinking in pictures: And other reports from my life with autism*. New York, NY: Doubleday.

Grandin, T. (2012). *Different not less: Inspiring stories of achievement and successful employment from adults with autism, Asperger's, and ADHD*. Arlington, TX: Future Horizons.

Gray, D. E. (1995). Lay conceptions of autism: Parents' explanatory models. *Medical Anthropology, 16*(2), 99-118.

Gray, D. E. (2006). Coping over time: The parents of children with autism. *Journal of Intellectual Disability Research, 50*(Pt 12), 970-976.

Greeff, A. P., & Van der Walt, K. (2010). Resilience in families with an autistic child. *Education and Training in Autism and Developmental Disabilities, 45*(3), 347-355.

Green, J., Charman, T., McConachie, H., Aldred, C., Slonims, V., Howlin, P., … Pickles, A., and the PACT Consortium (2010). Parent-mediated communication-focused treatment in children with autism (PACT): A randomised controlled trial. *The Lancet, 375*(9732), 2152–2160.

Green, J., Charman, T., Pickles, A., Wan, M. W., Elsabbagh, M., Slonims, V., … Johnson, M. H., and the BASIS Team (2015). Parent-mediated intervention versus no intervention for infants at high risk of autism: A parallel, single-blind, randomised trial. *The Lancet Psychiatry, 2*(2), 133-140.

Green, V. A., Pituch, K. A., Itchon, J., Choi, A., O'Reilly, M., & Sigafoos, J. (2006). Internet survey of treatments used by parents of children with autism. *Research in Developmental Disabilities, 27*(1), 70-84.

Greenspan, S. I., & Wieder, S. (2007). The developmental individual-difference, relationship-based (DIR/Floortime) model approach to autism spectrum disorders. In E. Hollander, & E. Anagnostou (Eds.), *Clinical manual for the treatment of autism* (pp. 179-209). Arlington, VA: American Psychiatric Publishing.

Gresham, F. M., & MacMillan, D. L. (1998). Early intervention project: Can its claims be substantiated and its effects replicated? *Journal of Autism and Developmental Disorders, 28*(1), 5-13.

Grogan, K., & Knak, D. (2002). A children's group: An exploration of the framework necessary for therapeutic work. In A. Davies, & E. Richards (Eds.), *Music therapy and group work: Sound company* (pp. 202-215). London, England: Jessica Kingsley Publishers.

Guest, G., MacQueen, K., & Namey, E. (2012). *Applied thematic analysis*. Los Angeles, CA: Sage.

Hallgren, K. A. (2012). Computing inter-rater reliability for observational data: An overview and tutorial. *Tutorials in Quantitative Methods for Psychology, 8*(1), 23-34.

Harris, H., Israeli, D., Minshew, N., Bonneh, Y., Heeger, D. J., Behrmann, M., & Sagi, D. (2015). Perceptual learning in autism: Over-specificity and possible remedies. *Nature Neuroscience, 18*(11), 1574-1576.

Hart, A., Heaver, B., Brunnberg, E., Sandberg, A., Macpherson, H., Coombe, S., & Kourkoutas, E. (2014). Resilience-building with disabled children and young people: A review and critique of the academic evidence base. *International Journal of Child, Youth and Family Studies, 5*(3), 394-422.

Hartley, S. L., & Sikora, D. M. (2009). Sex differences in autism spectrum disorder: An examination of developmental functioning, autistic symptoms, and coexisting behavior problems in toddlers. *Journal of Autism and Developmental Disorders, 39*(12), 1715-1722.

Heaton, P. (2005). Interval and contour processing in autism. *Journal of Autism and Developmental Disorders, 35*(6), 787-793.

Higashida, N. (2013). *The reason I jump: One boy's voice from the silence of autism*. London, England: Sceptre.

Hjemdal, O., Friborg, O., Stiles, T. C., Martinussen, M., & Rosenvinge, J. (2006). A new rating scale for adolescent resilience: Grasping the central protective resources behind healthy development. *Measurement and Evaluation in Counseling and Development, 39*(2), 84-96.

Holbrook, S. J., Schmitt, R. J., Adam, T. C., & Brooks, A. J. (2016). Coral reef resilience, tipping points and the strength of herbivory. *Scientific Reports, 6*, Article number: 35817.

Holck, U. (2004). Interaction themes in music therapy: Definition and delimitation. *Nordic Journal of Music Therapy, 13*(1), 3-19.

Holck, U. (2007). An ethnographic descriptive approach to video microanalysis. In T. Wosch, & T. Wigram (Eds.), *Microanalysis in music therapy: Methods, techniques and applications for clinicians, researchers, educators and students* (pp. 29-40). London, England: Jessica Kingsley Publishers.

Holck, U., Oldfield, A., & Plahl, C. (2005). Video microanalysis in music therapy research: A research workshop. In D. Aldridge, J. Fachner, & J. Erkkilä (Eds.), *Many faces of music therapy: Proceedings of the 6th European music therapy congress, June 16-20, 2004, Jyväskylä, Finland*.

Holcomb-McCoy, C. (2009). *Cultural considerations in parent consultation* (ACAPCD – 25). Alexandria, VA: American Counseling Association.

Hollander, F. M., & Juhrs, P. D. (1974). Orff-Schulwerk: An effective treatment tool with autistic children. *Journal of Music Therapy, 11*(1), 1-12.

Holm, J. E., & Holroyd, K. A. (1992). The daily hassles scale (revised): Does it measure stress or symptoms? *Behavioral Assessment, 14*(3-4), 465-482.

Holmes, J., Oldfield, A., & Polichroniadis, M. (Eds.) (2011). *Creating change for complex children and their families: A multi-disciplinary approach to multi-family work*. London, England: Jessica Kingsley Publishers.

Holmes, T. H., & Rahe, R. H. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research, 11*(2), 213–218.

Horner, R. H., Carr, E. G., Strain, P. S., Todd, A. W., & Reed, H. K. (2002). Problem behavior interventions for young children with autism: A research synthesis. *Journal of Autism and Developmental Disorders, 32*(5), 423-446.

Horvat, J., & O'Neill, N. (2008). 'Who is the therapy for?': Involving a parent or carer in their child's music therapy. In A. Oldfield, & C. Flower (Eds.), *Music therapy with children and their families* (pp. 89-102). London, England: Jessica Kingsley Publishers.

Hoskyns, S. (2013). *Enabling the curious practitioner: Perceptions on the integration of research and practice in the education of music therapy students at master's level* (Doctoral dissertation). Massey & Victoria Universities, Wellington, New Zealand.

Hoskyns, S. (2016). Thematic analysis. In B. L. Wheeler, & K. Murphy (Eds.), *Music therapy research* (3rd ed) (pp. 563-569). Dallas, TX: Barcelona Publishers.

Howard, J. S., Sparkman, C. R., Cohen, H. G., Green, G., & Stanislaw, H. (2005). A comparison of intensive behavior analytic and eclectic treatments for young children with autism. *Research in Developmental Disabilities, 26*(4), 359-383.

Hudson, C. C., Hall, L., & Harkness, K. L. (2018). Prevalence of depressive disorders in individuals with autism spectrum disorder: A meta-analysis. *Journal of Abnormal Child Psychology, 47*(1), 165-175.

Humpal, M., & Kern, P. (2012). Evidence-based practice for young children with autism spectrum disorders: Implications for music therapy. In P. Kern, & M. Humpal (Eds.), *Early childhood music therapy and autism spectrum disorders: Developing potential in young children and their families* (pp. 39-57). London, England: Jessica Kingsley Publishers.

Hutcheon, E., & Wolbring, G. (2013). Deconstructing the resilience concept using an ableism lens: Implications for people with diverse abilities. *Dilemata, International Journal of Applied Ethics, 5*(11), 235–252.

Hyman, S. L, Stewart, P. A., Foley, J., Cain, U., Peck, R., Morris, D. D., Wang, H., & Smith, T. (2015). The gluten-free/casein-free diet: A double-blind challenge trial in children with autism. *Journal of Autism and Developmental Disorders, 46*(1), 205-220.

Ikuno, R. (1999). Henry's transition through music. In J. Hibben (Ed.), *Inside music therapy: Client experiences* (pp. 251-264). Gilsum, NH: Barcelona Publishers.

Jacobsen, S. L. (2017). Child protection: Music therapy with families and emotionally neglected children. In S. L. Jacobsen, & G. Thompson (Eds.), *Music therapy with families: Therapeutic approaches and theoretical perspectives* (pp. 199-220). London, England: Jessica Kingsley Publishers.

Jacobsen, S. L., & Thompson, G. (2017). *Music therapy with families: Therapeutic approaches and theoretical perspectives.* London, England: Jessica Kingsley Publishers.

Jones, A., & Oldfield, A. (1999). Sharing sessions with John. In J. Hibben (Ed.), *Inside music therapy: Client experiences* (pp. 165-171). Gilsum, NH: Barcelona Publishers.

Joyce, S., Shand, F., Tighe, J., Laurent, S. J., Bryant, R. A., & Harvey, S. B. (2018). Road to resilience: A systematic review and meta-analysis of resilience training programmes and interventions. *BMJ Open*, *8*(6), e017858.

Juffer, F., Bakermans-Kranenburg, M. J., & Van Ijzendoorn, M. H. (Eds.) (2008). *Promoting positive parenting: An attachment-based intervention*. New York, NY: Taylor Francis.

Kaboski, J., McDonnell, C. G., & Valentino, K. (2017). Resilience and autism spectrum disorder: Applying developmental psychopathology to optimal outcome. *Review Journal of Autism and Developmental Disorder, 4*(3), 175-189.

Kaenampornpan, P. (2015). *The inclusion of the family members as primary carers in music therapy sessions with children in a special education centre: How does this help the child and the carer?* (Doctoral dissertation). Anglia Ruskin University, Cambridge, England.

Kalisch, R., Müller, M. B., & Tüscher, O. (2015). A conceptual framework for the neurobiological study of resilience. *Behavioral and Brain Sciences*, 38, e92.

Kalisch, R., Baker, D. G., Basten, U., Boks, M. P., Bonanno, G. A., Brummelman, E., … Kleim, B. (2017). The resilience framework as a strategy to combat stress-related disorders. *Nature Human Behaviour, 1*, 784-790.

Kaplan, H. B. (1999). Toward an understanding of resilience: A critical review of definitions and models. In M. D. Glantz, & J. L. Johnson (Eds.), *Resilience and development: Positive life adaptations* (pp. 17-84). Dordrecht, Netherlands: Kluwer Academic Publishers.

Kaplan, H. B. (2013). Reconceptualizing resilience. In S. Goldstein, & R. Brooks (Eds.), *Handbook of resilience in children* (2nd ed) (pp. 39-55). New York, NY: Springer.

Kapp, S. K., Gillespie-Lynch, K., Sherman, L. E., & Hutman, T. (2013). Deficit, difference, or both? Autism and neurodiversity. *Developmental Psychology, 49*(1), 59-71.

Kasari, C., Gulsrud, A. C., Wong, C., Kwon, S., & Locke, J. (2010). Randomized controlled caregiver mediated joint engagement intervention for toddlers with autism. *Journal of Autism and Developmental Disorders, 40*(9), 1045–1056.

Kashdan, T. B., Ferssizidis, P., Collins, R. L., & Muraven, M. (2010). Emotion differentiation as resilience against excessive alcohol use: An ecological momentary assessment in underage social drinkers. *Psychological Science, 21*(9), 1341–1347.

Kedar, I. (2012). *Ido in autismland: Climbing out of autism's silent prison.* Place of publication not identified: Sharon Kedar.

Kern, P., & Aldridge, D. (2006). Using embedded music therapy interventions to support outdoor play of young children with autism in an inclusive community-based child care program. *Journal of Music Therapy, 43*(4), 270-294.

Kern, P., Rivera, N., Chandler, A., & Humpal, M. (2013). Music therapy services for individuals with autism spectrum disorder: A survey of clinical practices and training needs. *Journal of Music Therapy, 50*(4), 274-303.

Kern, P., Wakeford, L., & Aldridge, D. (2007). Improving the performance of a young child with autism during self-care tasks using embedded song interventions: A case study. *Music Therapy Perspectives, 25*(1), 43-51.

Kern, P., Wolery, M., & Aldridge, D. (2007). Use of songs to promote independence in morning greeting routines for young children with autism. *Journal of Autism and Developmental Disorders, 37*(7), 1264-1271.

Khanna, R., Madhavan, S. S., Smith, M. J., Patrick, J. H., Tworek, C., & Becker-Cottrill, B. (2011). Assessment of health-related quality of life among primary caregivers of children with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *41*(9) 1214-1227.

Kim, D., Volk, H., Girirajan, S., Pendergrass, S., Hall, M. A., Verma, S. S., … Selleck, S. B. (2017). The joint effect of air pollution exposure and copy number variation on risk for autism. *Autism Research, 10*(9), 1470-1480.

Kim, J., Wigram, T., & Gold, C. (2008). The effects of improvisational music therapy on joint attention behaviors in autistic children: A randomized controlled study. *Journal of Autism and Developmental Disorders, 38*(9), 1758-1766.

Kleim, B., Wysokowsky, J., Schmid, N., Seifritz, E., & Rasch, B. (2016). Effects of sleep after experimental trauma on intrusive emotional memories. *Sleep*, *39*(12), 2125–2132.

Koegel, L. K., Koegel, R. L., Ashbaugh, K., & Bradshaw, J. (2014). The importance of early identification and intervention for children with or at risk for autism spectrum disorders. *International Journal of Speech-Language Pathology, 16*(1), 50-56.

Koegel, R. L., Bradshaw, J. L, Ashbaugh, K., & Koegel, L. K. (2014). Improving question-asking initiations in young children with autism using pivotal response treatment. *Journal of Autism and Developmental Disorders, 44*(4), 816-827.

Koegel, R. L., & Koegel, L. K. (2006). *Pivotal response treatments for autism: Communication, social, and academic development*. Baltimore, MD: Paul H Brookes Publishing.

Koegel, R. L., Koegel, L. K., & McNerney, E. K. (2001). Pivotal areas in intervention for autism. *Journal of Clinical Child Psychology, 30*(1), 19-32.

Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine, 15*, 155-163.

Kowal-Summek, L. (2016). *Musiktherapie und Autismus: Zur Anwendung ausgewählter Methoden der Leiborientierten Musiktherapie* [Music therapy and autism: Applications of selected methods of body oriented music therapy] (2nd ed). Wiesbaden, Germany: Springer Verlag.

LaGasse, A. (2014). Effects of a music therapy group intervention on enhancing social skills in children with autism. *Journal of Music Therapy, 51*(3), 250-275.

Lai, M. C., Lombardo, M. V., Ruigrok, A. N., Chakrabarti, B., Auyeung, B., Szatmari, P., Happé, F., & Baron-Cohen, S. (2017). Quantifying and exploring camouflaging in men and women with autism. *Autism, 21*(6), 690-702.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159–174.

Landis-Shack, N., Heinz, A. J., & Bonn-Miller, M. O. (2017). Music therapy for posttraumatic stress in adults: A theoretical review. *Psychomusicology*, *27*(4), 334–342.

Lapadat, J. C., & Lindsay, A. C. (1999). Transcription in research and practice: From standardization of technique to interpretive positionings. *Qualitative Inquiry, 5*(1), 64-86.

Lawford, J., & Eiser, C. (2001). Exploring links between the concepts of quality of life and resilience. *Pediatric Rehabilitation, 4*(4), 209-216.

LeBuffe, P. A., & Naglieri, J. A. (2012). *The Devereux early childhood assessment for preschoolers, second edition (DECA-P2): Assessment, technical manual, and user's guide.* Lewisville, NC: Kaplan.

LeBuffe, P. A., Shapiro, V. B., & Naglieri, J. A. (2009). *The Devereux student strengths assessment (DESSA).* Lewisville, NC: Kaplan.

Lecavalier, L., Leone, S., & Wiltz, L. J. (2006). The impact of behaviour problems on caregiver stress in young people with autism spectrum disorders. *Journal of Intellectual Disability Research, 50*(Pt 3), 172–183.

Lecourt, E. (1991). Off-beat music therapy: A psychoanalytic approach to autism. In K. E. Bruscia (Ed.), *Case studies in music therapy* (pp. 73-98). Gilsum, NH: Barcelona Publishers.

Lee, J. (2013). Maternal stress, well-being, and impaired sleep in mothers of children with developmental disabilities: A literature review. *Research in Developmental Disabilities, 34*(11), 4255-4273.

Leppin, A. L., Bora, P. R., Tilburt, J. C., Gionfriddo, M. R., Zeballos-Palacios, C., Dulohery, M. M., … Montori, V. M. (2014). The efficacy of resiliency training programs: A systematic review and meta-analysis of randomized trials. *PLOS ONE, 9*(10), e111420.

Letwin, L., & Silverman, M. J. (2017). No between-group difference but tendencies for patient support: A pilot study of a resilience-focused music therapy protocol for adults on a medical oncology/hematology unit. *The Arts in Psychotherapy, 55*, 116-125.

Levinge, A. (2015). *The music of being*. London, England: Jessica Kingsley Publishers.

Liebenberg, L., Ungar, M., & Theron, L. (2014). Using video observation and photo elicitation interviews to understand obscured processes in the lives of youth resilience. *Childhood, 21*(4), 532-547.

Liebenberg, L., Ungar, M., & Van de Vijver, F. R. R. (2012). Validation of the child and youth resilience measure-28 (CYRM-28) among Canadian youth with complex needs. *Research on Social Work Practice, 22*(2), 219-226.

Lim, H. A. (2010). Effect of developmental speech and language training through music on speech production in children with autism spectrum disorders. *Journal of Music Therapy, 47*(1), 2-26.

Lim, H. A. (2012). *Developmental speech-language training through music for children with autism spectrum disorders: Theory and clinical applications*. London, England: Jessica Kingsley Publishers.

Lim, H. A., & Draper, E. (2011). The effects of music therapy incorporated with applied behaviour analysis verbal behaviour approach for children with autism spectrum disorders. *Journal of Music Therapy, 48*(4), 532-550.

Lindenfelser, K. J., Hense, C., & McFerran, K. (2012). Music therapy in pediatric palliative care: Family-centred care to enhance quality of life. *American Journal of Hospice and Palliative Care, 29*(3), 219-226.

Lindsey, R. A., & Barry, T. D. (2018). Protective factors against distress for caregivers of a child with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 48*(4), 1092-1107.

Loomes, R., Hull, L., & Mandy, W. P. L. (2017). What is the male-to-female ratio in autism spectrum disorder? A systematic review and meta-analysis. *Journal of the American Academy of Child and Adolescent Psychiatry, 56*(6), 466-474.

Loth, H. (2008). Music therapy groups for families with a learning-disabled toddler: Bridging some gaps. In A. Oldfield, & C. Flower (Eds.), *Music therapy with children and their families* (pp. 53-69). London, England: Jessica Kingsley Publishers.

Loth, H. (2014). *An investigation into the relevance of gamelan music to the practice of music therapy* (Doctoral dissertation). Anglia Ruskin University, Cambridge, England.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*(1), 3-9.

Lovell, B., Moss, M., & Wetherell, M. (2012a). The psychosocial, endocrine and immune consequences of caring for a child with autism or ADHD. *Psychoneuroendocrinology*, *37*(4), 534-542.

Lovell, B., Moss, M., & Wetherell, M. (2012b). With a little help from my friends: Psychological, endocrine and health corollaries of social support in parental caregivers of children with autism or ADHD. *Research in Developmental Disabilities, 33*(2), 682-687.

Luthar, S. S. (1993). Annotation: Methodological and conceptual issues in research on childhood resilience. *Journal of Child Psychology and Psychiatry, 34*(4), 441-453.

Luthar, S. S. (2006). Resilience in development: A synthesis of research across five decades. In D. Cicchetti, & D. J. Cohen (Eds.), *Developmental psychopathology: Risk, disorder, and adaptation* (2nd ed, Vol 3) (pp. 739-795). Hoboken, NJ: Wiley.

Luthar, S. S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. *Child Development*, *71*(3), 543–562.

Luthar, S. S., & Zelazo, L. B. (2003). Research on resilience: An integrative review. In S. S. Luthar (Ed.), *Resilience and vulnerability: Adaptation in the context of childhood adversities* (pp. 510-549). Cambridge, England: Cambridge University Press.

Lyons, D. M., Buckmaster, C. L., & Schatzberg, A. F. (2018). Learning to actively cope with stress in female mice. *Psychoneuroendocrinology, 96*, 78-83.

Macedo, T., Wilheim, L., Goncalves, R., Coutinho, E. S. F., Vilete, L., Figueira, I., & Ventura, P. (2014). Building resilience for future adversity: A systematic review of interventions in non-clinical samples of adults. *BMC Psychiatry, 14*(1), 227-234.

Macpherson, H., Hart, A., & Heaver, B. (2016). Building resilience through group visual arts activities: Findings from a scoping study with young people who experience mental health complexities and/or learning difficulties. *Journal of Social Work, 16*(5), 541–560.

Mahlberg, M. (1973). Music therapy in the treatment of an autistic child. *Journal of Music Therapy, 10*(4), 189-193.

Malchiodi, C. A. (2015). Calm, connection, and confidence: Using art therapy to enhance resilience in traumatized children. In D. A. Crenshaw, R. Brooks, & S. Goldstein (Eds.), *Play therapy intervention to enhance resilience* (pp. 126-145). New York, NY: Guilford Press.

Malloch, S. (1999). Mothers and infants and communicative musicality. *Musicae Scientiae, 3*(Suppl 1), 29-57.

Malloch, S., & Trevarthen, C. (2009). *Communicative musicality: Exploring the basis of human companionship*. Oxford, England: Oxford University Press.

Mancini, A. D., & Bonanno, G. A. (2009). Predictors and parameters of resilience to loss: Toward an individual differences model. *Journal of Personality, 77*(6), 1805-1832.

Manning, J., & Kunkel, A. (2014). *Researching interpersonal relationships: Qualitative methods, studies and analysis.* Thousand Oaks, CA: Sage.

Marshall, M., Lockwood, A., Bradley, C., Adams, C., Joy, C., & Fenton, M. (2000). Unpublished rating scales: A major source of bias in randomised controlled trials of treatments for schizophrenia. *The British Journal of Psychiatry, 176*, 249-252.

Martin, L. K. (2012). Applied behaviour analysis: Introduction and practical application in music therapy for young children with autism spectrum disorders. In P. Kern, & M. Humpal (Eds.), *Early childhood music therapy and autism spectrum disorders: Developing potential in young children and their families* (pp. 101-116). London, England: Jessica Kingsley Publishers.

Martin, P. A. (2015). Cultural awareness in two UK counselling psychology settings: Initial training and supervision. *The European Journal of Counselling Psychology, 3*(2), 99-112.

Masten, A. S. (2001). Ordinary magic: Resilience processes in development. *American Psychologist, 56*(3), 227-238.

Masten, A. S. (2011). Resilience in children threatened by extreme adversity: Frameworks for research, practice, and translational synergy. *Development and Psychopathology, 23*(2), 493-506.

Masten, A. S., Best, K. M., & Garmezy, N. (1990). Resilience and development: Contributions from the study of children who overcome adversity. *Development and Psychopathology, 2*(4), 425-444.

Masten, A. S., & Obradović, J. (2006). Competence and resilience in development. In B. M. Lester, A. S. Masten, & B. McEwen (Eds.), *Annals of the New York Academy of Sciences: Resilience in Children*, Vol. 1094 (pp. 13-27). Boston, MA: Blackwell.

MAXQDA (2018). *Software for qualitative data analysis 1989-2018.* Berlin, Germany: VERBI-Software-Consult-Sozialforschung GmbH.

Maxwell, J. A. (2016). Expanding the history and range of mixed methods research. *Journal of Mixed Methods Research, 10*(1), 12-27.

May, D. (2006). Time-limited play therapy to enhance resiliency in children. In C. E. Schaefer, & H. G. Kaduson (Eds.), *Contemporary play therapy: Theory, research, and practice* (pp. 293-306). New York, NY: Guildford Press.

McConnell, T., Graham-Wisener, L., Regan, J., McKeown, M., Kirkwood, J., Hughes, N., … Porter, S. (2016). Evaluation of the effectiveness of music therapy in improving the quality of life of palliative care patients: A randomised controlled pilot and feasibility study. *BMJ Supportive and Palliative Care, 6*(3), 398.

McCullagh, P., & Nelder, J. A. (1989). *Generalized linear models* (2nd ed.). London, England: Chapman and Hall.

McEwen, B. S. (2016). In pursuit of resilience: Stress, epigenetics, and brain plasticity. *Annals of the New York Academy of Sciences, 1373*(1), 56–64.

McGraw, K. O, & Wong, S. P. (1996). Forming inferences about some intraclass correlation coefficients. *Psychological Methods, 1*(1), 30–46.

Mehl, M. R. (2017). The electronically activated recorder (EAR): A method for the naturalistic observation of daily social behavior. *Current Directions in Psychological Science, 26*(2), 184-190.

Mohammadzaheri, F., Koegel, L. K., Rezaei, M., & Bakhshi, E. (2015). A randomized clinical trial comparison between pivotal response treatment (PRT) and adult-driven applied behavior analysis (ABA) intervention on disruptive behaviors in public school children with autism. *Journal of Autism and Developmental Disorders, 45*(9), 2899-2907.

Molnar-Szakacs, I., & Heaton, P. (2012). Music: A unique window into the world of autism. *Annals of the New York Academy of Sciences, 1252,* 318–324

Montes, G., & Halterman, J. S. (2007). Psychological functioning and coping among mothers of children with autism: A population-based study. *Pediatrics*, *119*(5), 1040-1046.

Morse, J. M. (1991). Approaches to qualitative-quantitative methodological triangulation. *Nursing Research, 40*(2), 120-123.

Mössler, K., Gold, C., Aßmus, J., Schumacher, K., Calvet, C., Reimer, S. ... Schmid, W. (2017). The therapeutic relationship as predictor of change in music therapy with young children with autism spectrum disorder. *Journal of Autism and Developmental Disorders,* 1-15.

Mottron, L. (2017). Should we change targets and methods of early intervention in autism, in favor of a strengths-based education? *European Child & Adolescent Psychiatry, 26*(7), 815-825.

Mukhopadhyay, T. R. (2003). *The mind tree: A miraculous child breaks the silence of autism*. New York, NY: Arcade Publishing.

Mundry, R. (2014). Statistical issues and assumptions of phylogenetic generalized least squares. In L. Z. Garamszegi (Ed.), *Modern phylogenetic comparative methods and their application in evolutionary biology* (pp. 131-153). Berlin, Germany: Springer.

Mundry, R. (2017). From nonparametric tests to mixed models: A brief overview of statistical tools frequently used in comparative psychology. In J. Call, G. M. Burghardt, I. M. Pepperberg, C. T. Snowdon, & T. Zentall (Eds.), *APA handbook of comparative psychology, volume 1: Basic concepts, methods, neural substrate, and behaviour.* Washington, D.C.: American Psychological Association.

Mundy, P., Sullivan, L., & Mastergeorge, A. M. (2009). A parallel and distributed-processing model of joint attention, social cognition and autism. *Autism Research, 2*(1), 2-21.

Naber, F. B., Swinkels, S. H., Buitelaar, J. K., Bakermans-Kranenburg, M. J., van IJzendoorn, M. H., Dietz, C., van Daalen, E., & van Engeland, H. (2007). Attachment in toddlers with autism and other developmental disorders. *Journal of Autism and Developmental Disorders, 37*(6), 1123-1138.

Naglieri, J. A., LeBuffe, P. A., & Ross, K. M. (2013). Measuring resilience in children: From theory to practice. In S. Goldstein, & R. Brooks (Eds.), *Handbook of resilience in children* (2nd ed.) (pp. 241-259). New York, NY: Springer.

Naglieri, J. A., LeBuffe, P. A., & Shapiro, V. B. (2013). Assessment of social-emotional competencies related to resilience. In S. Goldstein, & R. Brooks (Eds.), *Handbook of resilience in children* (2nd ed.) (pp. 261-272). New York, NY: Springer.

National Autism Center (2009). *National standards report: Addressing the need for evidence-based practice guidelines for autism spectrum disorders*. Randolph, MA: National Autism Center.

Nelson, G., Amio, J. L., Prilleltensky, I., & Nickels, P. (2000). Partnerships for implementing school and community prevention programs. *Journal of Educational and Psychological Consultation, 11*(1), 121-145.

Newsom, C., & Hovanitz, C. A. (2006). Autistic spectrum disorders. In E. J. Mash, & R. A. Barkley (Eds.), *Treatment of childhood disorders* (3rd ed.) (pp. 455-511). New York, NY: Guilford Press.

NICE: National Institute for Health and Care Excellence (2013). *Autism spectrum disorder in under 19s: Support and management; NICE clinical guideline 170*. Retrieved on April 27, 2018 from https://www.nice.org.uk/guidance/cg170/resources/autism-spectrum-disorder-in-under-19s-support-and-management-pdf-35109745515205

Nickerson, A. B. (2007). The use and importance of strength-based assessment. *School Psychology Forum, 2*(1), 15-25.

Nilsson, M. (2006). To be the sole therapist: Children and parents in simultaneous psychotherapy. *Journal of Infant, Child, and Adolescent Psychotherapy, 5*(2), 206-225.

Nordoff, P., & Robbins, C. (1965). Improvised music for autistic children. *Music Journal, 23*(8), 39-67.

Nordoff, P., & Robbins, C. (1968). Clinical experiences with autistic children. In E. T. Gaston (Ed.), *Music in therapy* (pp. 191–193). New York, NY: Macmillan.

Nordoff, P., & Robbins, C. (1977). *Creative music therapy*. New York, NY: John Day.

Northamptonshire County Council (2018). Targeted mental health in schools (TaMHS). Retrieved on April 19, 2018 from http://www3.northamptonshire.gov.uk/councilservices/children-families-education/schools-and-education/information-for-school-staff/pupil-support-and-inclusion/Pages/targeted-mental-health-in-schools.aspx

Ockelford, A. (2013). *Music, language and autism*. London, England: Jessica Kingsley Publishers.

Okuno, H., Nagai, T., Sakai, S., Mohri, I., Yamamoto, T., Yoshizaki, A., … Taniike, M. (2011). Effectiveness of modified parent training for mothers of children with pervasive developmental disorder on parental confidence and children's behavior. *Brain and Development, 33*(2), 152–160.

Oldfield, A. (1995). Communicating through music: The balance between following and initiating. In T. Wigram, R. West, & B. Saperston (Eds.), *The art and science of music therapy: A handbook* (pp. 226-237). Amsterdam, Netherlands: Harwood Academic Publishers.

Oldfield, A. (2004). *Music therapy with children on the autistic spectrum: Approaches derived from clinical practice and research* (Doctoral dissertation). Anglia Ruskin University, Cambridge, England.

Oldfield, A. (2006). *Interactive music therapy - a positive approach: Music therapy at a child development centre.* London, England: Jessica Kingsley Publishers.

Oldfield, A. (2008). Working in partnership and supporting parents: Music therapy for pre-school children and their parents at a child development centre. In A. Oldfield, & C. Flower (Eds.), *Music therapy with children and their families* (pp. 19-36). London, England: Jessica Kingsley Publishers.

Oldfield, A. (2011). Parents' perceptions of being in music therapy sessions with their children: What is our role as music therapists with parents? In J. Edwards (Ed.), *Music therapy and parent-infant bonding* (pp. 58-72). Oxford, England: Oxford University Press.

Oldfield, A. (2016). The future of music therapy for persons with autism spectrum disorder. In C. Dileo (Ed.), *Envisioning the future of music therapy* (pp. 96-103). Retrieved on November 26, 2018 from https://www.temple.edu/boyer/academicprograms/music-therapy/documents/ENVISIONING_THE_FUTURE.pdf

Oldfield, A. (2017). Music therapy with families in a psychiatric children's unit. In S. L. Jacobsen, & G. Thompson (Eds.), *Music therapy with families: Therapeutic approaches and theoretical perspectives* (pp. 72-91). London, England: Jessica Kingsley Publishers.

Oldfield, A., Blauth, L., Finnemann, J., & Casey, Ó. (2019). Clinical trials…: Are music therapists deluding themselves? In H. Dunn, E. Coombes, E. Maclean, H. Mottram, & J. Nugent (Eds.), *Music therapy and autism across the lifespan: A spectrum of approaches.* London, England: Jessica Kingsley Publishers.

Oldfield, A., & Bunce, L. (2001). 'Mummy can play too...': Short-term music therapy with mothers and young children. *British Journal of Music Therapy, 15*(1), 27-36.

Oldfield, A. & Flower, C. (2008). *Music therapy with children and their families*. London, England: Jessica Kingsley Publishers.

Oren, D. (2011). Psychodynamic parenthood therapy: A model for therapeutic work with parents and parenthood. *Clinical Child Psychology and Psychiatry, 17*(4), 553-570.

Osório, C., Probert, T., Jones, E., Young, A. H., & Robbins, I. (2017). Adapting to stress: Understanding the neurobiology of resilience. *Behavioural Medicine, 43*(4), 307–322.

Ouellet-Morin, I., Laurin, M., Robitaille, M. P., Brendgen, M., Lupien, S. J., Boivin, M., & Vitaro, F. (2016). Validation of an adapted procedure to collect hair for cortisol determination in adolescents. *Psychoneuroendocrinology, 70*, 58-62.

Pajareya, K., & Nopmaneejumruslers, K. (2011). A pilot randomized controlled trial of DIR/Floortime parent training intervention for pre-school children with autistic spectrum disorders. *Autism, 15*(5), 563-577.

Palmer, N., Beam, A., Agniel, D., Eran, A, Manrai, A., Spettell, C., … Kohane, I. (2017). Association of sex with recurrence of autism spectrum disorder among siblings. *JAMA Pediatrics, 171*(11), 1107-1112.

Paniagua, F. A. (2014). *Assessing and treating culturally diverse clients: A practical guide* (4th ed.). Los Angeles, CA: Sage.

Papousek, M. (1996). Intuitive parenting: A hidden source of musical stimulation in infancy. In I. Deliege, & J. Sloboda (Eds.), *Musical beginnings: Origins and development of musical competence* (pp. 88-112). Oxford, England: Oxford University Press.

Parker, K. J., Buckmaster, C. L., Schatzberg, A. F., & Lyons, D. M. (2004). Prospective investigation of stress inoculation in young monkeys. *Archives of General Psychiatry*, *61*(9), 933–941.

Parker, R. (2019, January). *What just happened? The application of machine learning to music therapy session interpretation.* Paper presented at the PhD seminar of the Cambridge Institute for Music Therapy Research, Anglia Ruskin University, Cambridge, England.

Pasiali, V. (2004). The use of prescriptive therapeutic songs in a home-based environment to promote social skills acquisition by children with autism: Three case studies. *Music Therapy Perspectives, 22*(1), 11-20.

Pasiali, V. (2010). *Family-based music therapy: Fostering child resilience and promoting parental self-efficacy through shared musical experiences* (Doctoral dissertation). Michigan State University, East Lansing, MI.

Pasiali, V. (2012). Resilience, music therapy, and human adaptation: Nurturing young children and families. *Nordic Journal of Music Therapy, 21*(1), 36-56.

Pasiali, V. (2017). Families and children at risk. In S. L. Jacobsen, & G. Thompson (Eds.), *Music therapy with families: Therapeutic approaches and theoretical perspectives* (pp. 221-246). London, England: Jessica Kingsley Publishers.

Pasiali, V., Schoolmeesters, L., & Engen, R. (2018). Mapping resilience: Analyses of measures and suggested uses in music therapy. *Approaches: An Interdisciplinary Journal of Music Therapy, 10*(1), 18-42.

Patterson, J. (2002). Integrating family resilience and family stress theory. *Journal of Marriage and Family, 64*(2), 349-360.

Pavlicevic, M. (1995). Interpersonal processes in clinical improvisation: Towards a subjectively objective systematic definition. In T. Wigram, B. Saperston, & R. West (Eds.), *The art and science of music therapy: A handbook* (pp. 167-178). Chur, Switzerland: Harwood Academic Publishers.

Pavlicevic, M. (2005). *Music therapy in context: Music, meaning and relationship.* London, England: Jessica Kingsley Publishers.

Pelham, G., & Stacey, J. (1999). *Counselling skills for creative arts therapists*. Bodmin, England: Worth Publishing.

Pellicano, E., Dinsmore, A., & Charman, T. (2014). What should autism research focus upon? Community views and priorities from the United Kingdom. *Autism, 18*(7), 756-770.

Pickles, A., Le Couteur, A., Leadbitter, K., Salomone, E., Cole-Fletcher, R., Tobin, H., … Green, J. (2016). Parent-mediated social communication therapy for young children with autism (PACT): Long-term follow-up of a randomised controlled trial. *The Lancet, 388*(10059)*,* 2501-2509.

Piek, J. P., Kane, R., Rigoli, D., McLaren, S., Roberts, C. M., Rooney, R., … Straker, L. (2015). Does the animal fun program improve social-emotional and behavioural outcomes in children aged 4-6 years? *Human Movement Science, 43*, 155-163.

Pink, S. (2013). *Doing visual ethnography* (3rd ed.). London, England: Sage.

Plahl, C. (2007). Microanalysis of preverbal communication in music therapy. In T. Wosch, & T. Wigram (Eds.), *Microanalysis in music therapy: Methods, techniques and applications for clinicians, researchers, educators and students* (pp. 41-53). London, England: Jessica Kingsley Publishers.

Plumb, J. C. (2011). *The impact of social support and family resilience on parental stress in families with a child diagnosed with an autism spectrum disorder* (Doctoral dissertation). University of Pennsylvania, Philadelphia, PA.

Poslawsky, I. E., Naber, F. B., Bakermans-Kranenburg, M. J., van Daalen, E., van Engeland, H., & van Ijzendoorn, M. H. (2015). Video-feedback intervention to promote positive parenting adapted to autism (VIPP-AUTI): A randomized controlled trial. *Autism, 19*(5), 588-603.

Potvin, N., Bradt, J., & Ghetti, C. (2018). A theoretical model of resource-oriented music therapy with informal hospice caregivers during pre-bereavement. *Journal of Music Therapy, 55*(1), 27-61.

Potvin, N., Bradt, J., & Kesslick, A. (2015). Expanding perspective on symptom management in cancer care. *Journal of Music Therapy, 52*(1), 135-167.

Prince-Embury, S. (2007). *Resiliency scales for children and adolescents: A profile of personal strengths*. San Antonio, TX: Harcourt Assessment.

Purewal Boparai, S. K., Au, V., Koita, K., Oh, D. L., Briner, S., Burke Harris, N., & Bucci, M. (2018). Ameliorating the biological impacts of childhood adversity: A review of intervention programs. *Child Abuse and Neglect*, 81, 82-105.

Raglio, A., Gnesi, M., Monti, M. C., Oasi, O., Gianotti, M., Attardo, L., … Imbriani M. (2017) The music therapy session assessment scale (MT-SAS): Validation of a new tool for music therapy process evaluation. *Clinical Psychology and Psychotherapy, 24*(6), O1547‑O1561.

Rainone, N., Chiodi, A., Lanzillo, R., Magri, V., Napolitano, A., Brescia Morra, V., Valerio, P., & Freda, M. F. (2017). Affective disorders and health-related quality of life (HRQoL) in adolescents and young adults with multiple sclerosis (MS): The moderating role of resilience. *Quality of Life Research, 26*(3), 727-736.

Rao, S. M., & Gagie, B. (2006). Learning through seeing and doing: Visual supports for children with autism. *TEACHING Exceptional Children, 38*(6), 26-33.

R Core Team (2018). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. Available from https://www.R-project.org/

Reivich, K., & Shatte, A. (2002). *The resilience factor: Seven essential skills for overcoming life's inevitable obstacles*. New York, NY: Broadway Books.

Reschke-Hernández, A. E. (2011). History of music therapy treatment interventions for children with autism. *Journal of Music Therapy, 48*(2), 169-207.

Resilience Research Centre (2016). *The child and youth resilience measure (CYRM) child version: User's manual research*. Retrieved on April, 21 2018 from http://www.resilienceresearch.org/files/CYRM/Child%20-%20CYRM%20Manual.pdf

Reyes, J. A., Elias, M. J., Parker, S. J., & Rosenblatt, J. L. (2013). Promoting educational equity in disadvantaged youth: The role of resilience and social-emotional learning. In S. Goldstein, & R. Brooks (Eds.), *Handbook of resilience in children* (2nd ed.) (pp. 349-370). New York, NY: Springer.

Ridder, H. M. (2007). Microanalysis on selected video clips with focus on communicative response in music therapy. In T. Wosch, & T. Wigram (Eds.), *Microanalysis in music therapy: Methods, techniques and applications for clinicians, researchers, educators and students* (pp. 54-66). London, England: Jessica Kingsley Publishers.

Riessman, C. K. (1993). *Narrative analysis*. Newbury Park, CA: Sage.

Rimmele, R. (2017). *Videograph: The software for coding and analysis of video content*. Retrieved on May 16, 2017 from http://www.dervideograph.de/enhtmStart.html

Robb, S. L., Burns, D. S., Stegenga, K. A., Haut, P. R., Monahan, P. O., Meza, J., … Haase, J. E. (2014). Randomized clinical trial of therapeutic music video intervention for resilience outcomes in adolescents/young adults undergoing hematopoietic stem cell transplant: A report from the children's oncology group. *Cancer, 120*(6), 909–917.

Robbins, C. (1993). The creative processes are universal. In M. Heal, & T. Wigram (Eds.), *Music therapy in health and education* (pp. 7-25). London, England: Jessica Kingsley Publishers.

Roberts, C. A., Hunter, J., & Cheng, A. L. (2017). Resilience in families of children with autism and sleep problems using mixed methods. *Journal of Pediatric Nursing, 37*, e2-e9.

Robertson, I. T., Cooper, C. L., Sarkar, M., & Curran, T. (2015). Resilience training in the workplace from 2003 to 2014: A systematic review. *Journal of Occupational and Organizational Psychology, 88*(3), 533‐562.

Rogers, C. (1951). *Client-centered therapy: Its current practice, implications and theory*. London, England: Constable.

Rogers, C. (1961). *On becoming a person: A therapist's view of psychotherapy*. London, England: Constable.

Rogers, S. J., & Dawson, G. (2010). *Early start denver model for young children with autism: Promoting language, learning, and engagement*. New York, NY: The Guilford Press.

Roghanchi, M., Mohamad, A. R., Mey, S. C., Momeni, K. M., & Golmohamadian, M. (2013). The effect of integrating rational emotive behavior therapy and art therapy on self-esteem and resilience. *The Arts in Psychotherapy, 40*(2), 179–184.

Rolf, J. E. (1999). Resilience: An interview with Norman Garmezy. In M. D. Glantz, & J. L. Johnson (Eds.), *Longitudinal research in the social and behavioral sciences. Resilience and development: Positive life adaptations* (pp. 5-14). Dordrecht, Netherlands: Kluwer Academic Publishers.

Romerhaus, B. J. (1968). Clinical experiences with hospitalized early-childhood schizophrenic children in music therapy. In E. T. Gaston (Ed.), *Music in therapy* (pp. 193-195). New York, NY: MacMillan Publishing Company.

Rossignol, D. A. (2009). Novel and emerging treatments for autism spectrum disorders: A systematic review. *Annals of Clinical Psychiatry, 21*(4), 213–236.

Roulston, K. (2001). Data analysis and 'theorizing as ideology'. *Qualitative Research, 1*(3), 279-302.

Runswick-Cole, K., & Goodley, D. (2013). Resilience: A disability studies and community psychology approach. *Social and Personality Psychology Compass, 7*(2), 67–78.

Russ, S. W. (2004). *Play in child development and psychotherapy: Toward empirically supported practice*. Mahwah, NJ: Erlbaum.

Rutgers, A., Bakermans-Kranenburg, M. J., Van Ijzendoorn, M. H., & van Berckelaer-Onnes, I. A. (2004). Autism and attachment: A meta-analytic review. *Journal of Child Psychology and Psychiatry, 45*(6), 1123-1134.

Rutter, M. (2006). Implications of resilience concepts for scientific understanding. In B. M. Lester, A. S. Masten, & B. McEwen (Eds.), *Annals of the New York Academy of Sciences: Resilience in Children*, Vol. 1094 (pp. 1-12). Boston, MA: Blackwell.

Ryan, J. B., Hughes, E. M., Katsiyannis, A., McDaniel, M., & Sprinkle, C. (2011). Research-based educational practices for students with autism spectrum disorders. *TEACHING Exceptional Children, 43*(3), 56 – 64.

Saleebey, D. (2008). The strengths perspective: Putting possibility and hope to work in our practice. In K. M. Sowers, C. N. Dulmus, & B. W. White (Eds.), *Comprehensive handbook of social work and social welfare: Vol. 1. The profession of social work* (pp. 123-142). Hoboken, NJ: Wiley.

Salomone, E., Beranová, S., Bonnet-Brilhault, F., Lauritsen, M. B., Budisteanu, M., Buitelaar, J., ... Charman, T. (2015). Use of early intervention for young children with autism spectrum disorder across Europe. *Autism, 20*(2), 233-249.

Sanders, J., Munford, R., Thimasarn-Anwar, T., & Liebenberg, L. (2017). Validation of the child and youth resilience measure (CYRM-28) on a sample of at-risk New Zealand youth. *Research on Social Work Practice, 27*(7), 1-19.

Saperston, B. (1973). The use of music in establishing communication with an autistic mentally retarded child. *Journal of Music Therapy, 10*(4), 184-188.

Schielzeth, H., & Forstmeier, W. (2009). Conclusions beyond support: Overconfident estimates in mixed models. *Behavioral Ecology, 20*(2), 416-420.

Schieve, L. A., Blumberg, S. J., Rice, C, Visser, S. N., & Boyle, C. (2007). The relationship between autism and parenting stress. *Pediatrics, 119*(S1), 114-121.

Schoon, I. (2006). *Risk and resilience: Adaptations in changing times*. New York, NY: Cambridge University Press.

Schreier, M. (2014). Qualitative content analysis. In U. Flick (Ed.), *The SAGE handbook of qualitative data analysis* (pp. 170-183). Thousand Oaks, CA: Sage.

Schumacher, K., & Calvet-Kruppa, C. (1999). The AQR: An analysis system to evaluate the quality of relationship during music therapy. *Nordic Journal of Music Therapy, 8*(2), 188–191.

Schumacher, K., & Calvet, C. (2007). The “AQR-instrument” (assessment of the quality of relationship): An observation instrument to assess the quality of a relationship. In T. Wosch, & T. Wigram (Eds.), *Microanalysis in music therapy: Methods, techniques and applications for clinicians, researchers, educators and students* (pp. 79-91). London, England: Jessica Kingsley Publishers.

Schwartzberg, E. T., & Silverman, M. J. (2017). Parent perceptions of music therapy in an on-campus clinic for children with autism spectrum disorder. *Musicae Scientiae, 21*(1), 98-112.

Seligman, M. E. P. (1995). *The optimistic child*. Boston, MA: Houghton Mifflin.

Seymour, J. W. (2010). Resiliency-based approaches and the healing process in play therapy. In D. A. Crenshaw (Ed.), *Reverence in healing: Honoring strengths without trivializing suffering* (pp. 71-84). Lanham, MD: Jason Aronson.

Seymour, J. W. (2015). Resilience-enhancing factors in play therapy. In D. A. Crenshaw, R. Brooks, & S. Goldstein (Eds.), *Play therapy intervention to enhance resilience* (pp. 32-50). New York, NY: Guilford Press.

Shapiro, V. B. (2015). Resilience: Have we not gone far enough? A response to Larry E. Davis. *Social Work Research, 39*(1), 7-10.

Sharda, M., Midha, R., Malik, S., Mukerji, S., & Singh, N. C. (2015). Fronto-temporal connectivity is preserved during sung but not spoken word listening, across the autism spectrum. *Autism Research, 8*(2), 174-186.

Shea, V. (2004). A perspective on the research literature related to early intensive behavioral intervention (Lovaas) for young children with autism. *Autism, 8*(4), 349-367.

Sherwin, A. C. (1953). Reactions to music of autistic (schizophrenic) children. *American Journal of Psychiatry, 109*(11), 823-831.

Shim, M., Johnson, R. B., Gasson, S., Goodill, S., Jermyn, R., & Bradt, J. (2017). A model of dance/movement therapy for resilience-building in people living with chronic pain. *European Journal of Integrative Medicine, 9*, 27-40.

Shrout, P. E, & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin, 86*(2), 420–428.

Siegel, M., & Gabriels, R. L. (2014). Psychiatric hospital treatment of children with autism and serious behavioral disturbance. *Child and Adolescent Psychiatric Clinics of North America, 23*(1), 125-142.

Silberman, S. (2015). *NeuroTribes: The legacy of autism and the future of neurodiversity.* New York, NY: Penguin Random House LLC.

Siman-Tov, A., & Kaniel, S. (2011). Stress and personal resource as predictors of the adjustment of parents to autistic children: A multivariate model. *Journal of Autism and Developmental Disorders, 41*(7), 879-890.

Simonoff, E., Pickles, A., Charman, T., Chandler, S., Loucas, T., & Baird, G. (2008). Psychiatric disorders in children with autism spectrum disorders: Prevalence, comorbidity, and associated factors in a population-derived sample. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*(8), 921-929.

Simpson, K., & Keen, D. (2011). Music interventions for children with autism: Narrative review of the literature. *Journal of Autism and Developmental Disorders, 41*(11), 1507-1514.

Sinha, R., Lacadie, C. M., Constable, R. T., & Seo, D. (2016). Dynamic neural activity during stress signals resilient coping. *Proceedings of the National Academy of Sciences of the United States of America*, *113*(31), 8837–8842.

Skinner, B. F. (1953). *Science and human behavior*. New York, NY: Macmillan.

Slavich, G. M., & Epel, E. S. (2010). *The stress and adversity inventory (STRAIN): An automated system for assessing cumulative stress exposure*. Los Angeles, CA: University of California.

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: Assessing the ability to bounce back. *International Journal of Behavioural Medicine, 15*(3), 194-200.

Society for Disability Studies (2016). *What is disability studies?* Retrieved on April 19, 2018 from https://disstudies.org/index.php/about-sds/what-is-disability-studies/

Solomon, M., Miller, M., Taylor, S. L., Hinshaw, S. P., & Carter, C. S. (2012). Autism symptoms and internalizing psychopathology in girls and boys with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 42*(1), 48-59.

Solomon, R., Necheles, J., Ferch, C., & Bruckman, D. (2007). Pilot study of a parent training program for young children with autism: The PLAY project home consultation program. *Autism, 11*(3), 205-224.

Spence, S. J., & Schneider, M. T. (2009). The role of epilepsy and epileptiform EEGs in autism spectrum disorders. *Pediatric Research, 65*(6), 599-606.

Steege, M. W., Mace, F. C., Perry, L., & Longenecker, H. (2007). Applied behavior analysis: Beyond discrete trial teaching. *Psychology in the Schools, 44*(1), 91-99.

Steiner (2011). A strength-based approach to parent education for children with autism. *Journal of Positive Behavior Interventions, 13*(3), 178–190.

Stepney, S. A. (2017). *Art therapy with students at risk: Fostering resilience and growth through self-expression* (3rd ed.). Springfield, IL: Charles C. Thomas Publisher.

Stern, D. N. (1985). *The interpersonal world of the infant: A view from psychoanalysis and developmental psychology.* New York, NY: Karnac.

Stevens, E., & Clark, F. (1969). Music therapy in the treatment of autistic children. *Journal of Music Therapy, 6*(4), 98-104.

Straus, J. (2014). Music therapy and autism: A view from disability studies. *Voices: A World Forum for Music Therapy, 14*(3).

Szatmari, P. (2018). Risk and resilience in autism spectrum disorder: A missed translational opportunity? *Developmental Medicine and Child Neurology, 60*(3), 225-229.

Taylor, J. (2015). *Liturgical dance: A dance/movement therapy treatment modality to build resilience* (Master's thesis). Sarah Lawrence College, Bronxville, NY.

Thaut, M. H. (1984). A music therapy treatment model for autistic children. *Music Therapy Perspectives, 1*(4), 7-13.

The National Autistic Society (2018). *Our position on the causes of autism*. Retrieved on February 28, 2018 from https://www.autism.org.uk/get-involved/media-centre/position-statements/causes.aspx#

Theron, L. (2006). Critique of an intervention programme to promote resilience among learners with specific learning difficulties. *South African Journal of Education, 26*(2), 199–214.

Thomas, A., & Hunter, B. (2003). *The effect of music therapy on communication skills of children ages 2-3 with autism: A pilot study*. Minneapolis, MN: Proceedings of the American Music Therapy Association Conference.

Thompson, B. (Producer), & Thompson, M. (Director). (2017). *Operation syncopation* [Documentary movie]. England: Anglia Ruskin University.

Thompson, G. (2012). *Making a connection: Randomised controlled trial of family centred music therapy for young children with autism spectrum disorder* (Doctoral thesis). The University of Melbourne, Melbourne, Australia.

Thompson, G. A. (2017). Long-term perspectives of family quality of life following music therapy with young children on the autism spectrum: A phenomenological study. *Journal of Music Therapy, 54*(4), 432-459.

Thompson, G. A., McFerran, K. S., & Gold, C. (2013). Family-centred music therapy to promote social engagement in young children with autism spectrum disorder: A randomized controlled study. *Child: Care, Health and Development, 40*(6), 840–852.

Thorpe, K. E, Zwarenstein, M., Oxman, A. D, Treweek, S., Furberg, C. D, Altman, D. G, … Chalkidou, K. (2009). A pragmatic-explanatory continuum indicator summary (PRECIS): A tool to help trial designers. *Journal of Clinical Epidemiology, 62*(5), 464–475.

Toigo, D. A. (1992). Autism: Integrating a personal perspective with music therapy practice. *Music Therapy Perspectives, 10*(1)*,* 13-20.

Tomlinson, J. (2016). *Music therapist collaboration with teaching assistants for facilitating verbal development in young children with special needs* (Doctoral dissertation). Anglia Ruskin University, Cambridge, England.

Trull, T. J., & Ebner-Priemer, U. (2014). The role of ambulatory assessment in psychological science. *Current Directions in Psychological Science, 23*(6), 466‐470.

Turry, A. (2018). Response to effects of improvisational music therapy vs. enhanced standard care on symptom severity among children with autism spectrum disorder: The TIME-A randomized clinical trial. *Nordic Journal of Music Therapy, 27*(1), 87-89.

Tyrer, P. (2014). A comparison of DSM and ICD classifications of mental disorder. *Advances in Psychiatric Treatment, 20*(4), 280–285.

Ungar, M. (2004). A constructionist discourse on resilience. *Youth and Society, 35*(3), 341-365.

Ungar, M. (2008). Resilience across cultures. *British Journal of Social Work, 38*(2), 218-235.

Ungar, M. (2015). Practitioner review: Diagnosing childhood resilience – a systemic approach to the diagnosis of adaptation in adverse social and physical ecologies. *Journal of Child Psychology and Psychiatry, 56*(1), 4-17.

Ungar, M., & Liebenberg, L. (2011). Assessing resilience across cultures using mixed methods: Construction of the child and youth resilience measure. *Journal of Mixed Methods Research, 5*(2), 126-149.

Uni Research (2016). *Trial of improvisational music therapy's effectiveness for children with autism (TIME-A)*. Retrieved on May 29, 2016 from https://uni.no/en/uni-health/gamut/trial-of-improvisational-music-therapys-effectiveness-for-children-with-autism-time-a/

Van Bruggen-Rufi, M., Vink, A., Achterberg, W., & Roos, R. (2018). Improving quality of life in patients with Huntingdon's disease through music therapy: A qualitative explorative study using focus group discussions. *Nordic Journal of Music Therapy, 27*(1), 44-66.

Vanhove, A. J., Herian, M. N., Perez, A. L. U., Harms, P. D., & Lester, P. B. (2015). Can resilience be developed at work? A meta-analytic review of resilience-building programme effectiveness. *Journal of Occupational and Organizational Psychology, 89*(2), 278‐307.

Veatch, O. J., Sutcliffe, J. S., Warren, Z. E., Keenan, B. T., Potter, M. H., & Malow, B. A. (2017). Shorter sleep duration is associated with social impairment and comorbidities in ASD. *Autism Research, 10*(7), 1221-1238.

VicHealth (2015). *Interventions to build resilience among young people: A literature review*. Melbourne, Australia: Victorian Health Promotion Foundation.

Wagner, G. (2007). The Benenzon model of music therapy. *Nordic Journal of Music Therapy, 16*(2), 146-147.

Wagnild, G. M., & Young, H. M. (1993). Development and psychometric evaluation of the resilience scale. *Journal of Nursing Measurement, 1*(2), 165-178.

Walsh, F. (2003). Family resilience: A framework for clinical practice. *Family Process, 42*(1), 1-18.

Watson, C. C., Rich, B. A., Sanchez, L., O'Brien, K., & Alvord, M. K. (2014). Preliminary study of resilience-based group therapy for improving the functioning of anxious children. *Child and Youth Care Forum, 43*(3), 269-286.

Wengrower, H. (2015). Widening our lens: The implications of resilience for the professional identity and practice of dance movement therapists. *Body, Movement and Dance in Psychotherapy: An International Journal for Theory, Research and Practice, 10*(3), 153-168.

Werner, E. E., & Smith, R. S. (1982). *Vulnerable but invincible: A study of resilient children*. New York, NY: McGraw-Hill.

Wessells, M. G. (2015). Commentary: A social environment approach to promotive and protective practice in childhood resilience – reflections on Ungar (2014). *Journal of Child Psychology and Psychiatry, 56*(1), 18-20.

Wheeler, D., Williams, K., Seida, J., & Ospina, M. (2008). The Cochrane library and autism spectrum disorder: An overview of reviews. *Evidence-Based Child Health, 3*(1), 3-15.

Whipple, J. (2004). Music in intervention for children and adolescents with autism: A meta-analysis. *Journal of Music Therapy, 41*(2), 90–106.

Whipple, J. (2012). Music therapy as an effective treatment with autism spectrum disorders in early childhood: A meta-analysis. In P. Kern, & M. Humpal (Eds.), *Early childhood music therapy and autism spectrum disorders: Developing potential in young children and their families* (pp. 59-76). London, England: Jessica Kingsley Publishers.

Wieder, S., & Greenspan, S. I. (2003). Climbing the symbolic ladder in the DIR model through floor time/interactive play. *Autism, 7*(4), 425-435.

Wigram, T. (2007). Event-based analysis of improvisations using the improvisation assessment profiles (IAPs). In T. Wosch, & T. Wigram (Eds.), *Microanalysis in music therapy: Methods, techniques and applications for clinicians, researchers, educators and students* (pp. 120-133). London, England: Jessica Kingsley Publishers.

Wigram, T., & Elefant, C. (2009). Therapeutic dialogues in music: Nurturing musicality of communication in children with autistic spectrum disorder and Rett syndrome. In S. Malloch, & C. Trevarthen (Eds.), *Communicative musicality* (pp. 423–446). Oxford, England: Oxford University Press.

Wigram, T., & Gold, C. (2006). Music therapy in the assessment and treatment of autistic spectrum disorder: Clinical application and research evidence. *Child: Care, Health, and Development, 32*(5), 535–542.

Wigram, T., Pedersen, I. N., & Bonde, L. O. (2002). *A comprehensive guide to music therapy: Theory, clinical practice, research and training.* London, England: Jessica Kingsley Publishers.

Williams, D. (1996). *Autism: An inside-out approach*. London, England: Jessica Kingsley Publishers.

Williams, D. L., Siegel, M., Mazefsky, C. A., & Autism and Developmental Disorders Inpatient Research Collaborative (ADDIRC). (2018). Problem behaviors in autism spectrum disorder: Association with verbal ability and adapting/coping skills. *Journal of Autism and Developmental Disorders, 48*(11), 3668-3677.

Wimpory, D., Chadwick, P., & Nash, S. (1995). Brief report: Music interaction therapy for children with autism: An evaluative case study with two-year follow-up. *Journal of Autism and Developmental Disorders, 25*(5), 541-552.

Windle, G., Bennett, K. M., & Noyes, J. (2011). A methodological review of resilience measurement scales. *Health and Quality of Life Outcomes, 9*, 8-25.

Windle, G., Markland, D. A., & Woods, B. (2008). Examination of a theoretical model of psychological resilience in older age. *Aging and Mental Health*, 12(3), 285-292.

Wingate, M., Kirby, R. S., Pettygrove, S., Cunniff, C., Schulz, E., Ghosh, T., … Wright, V. (2014). Prevalence of autism spectrum disorder among children aged 8 years: Autism and developmental disabilities monitoring network, 11 sites, United States, 2010. *Morbidity and Mortality Weekly Report. Surveillance Summaries, 63*(2), 1-21.

Winnicott, D. W. (2005). *Playing and Reality.* 1971. London, England: Routledge.

World Federation of Music Therapy (2014). *About WFMT: What is music therapy?* Retrieved on December 13, 2015 from http://www.wfmt.info/WFMT/About_WFMT.html

World Health Organization (2018). *ICD-11: International Classification of Diseases 11th Revision.* Retrieved on February 28, 2018 from https://icd.who.int/

Wright, M. O., Masten, A. S., & Narayan, A. J. (2013). Resilience processes in development: Four waves of research on positive adaptation in the context of adversity. In S. Goldstein, & R. Brooks (Eds.), *Handbook of resilience in children* (2nd ed.) (pp. 15-37). New York, NY: Springer.

Yarkiner, Z., Hunter, G., O'Neil, & de Lusignan, S. (2013). Applications of mixed models for investigating progression of chronic disease in a longitudinal dataset of patient records from general practice. *Journal of Biometrics and Biostatistics, S9*: 001.

Yirmiya, N., & Shaked, M. (2005). Psychiatric disorders in parents of children with autism: A meta-analysis. *Journal of Child Psychology and Psychiatry, 46*(1), 69-83.

Young, A., Green, E., & Rogers, K. (2008). Resilience and deaf children: A literature review. *Deafness Education International, 10*(1), 40-55.

Zhou, T. (2015). Resilience – within the changing world: 1st EADMT Conference. *Body, Movement and Dance in Psychotherapy: An International Journal for Theory, Research and Practice, 10*(3), 181-185.

Zwaigenbaum, L., Bauman, M. L., Choueiri, R., Kasari, C., Carter, A., Granpeesheh, D., … Natowicz, M. R. (2015). Early intervention for children with autism spectrum disorder under 3 years of age: Recommendations for practice and research. *Pediatrics, 136*(Supplement 1), S1-S9.

APPENDIX

Appendix 4.3 Consent form

cambridgeshire music

Cambridgeshire County Council

Laura Bruecker

Consent for Video / Writing

Please delete any of the following you do NOT want to give permission for:

I agree to my child's videos being used for the following purposes:

1. For video analysis in a PhD to gain better understanding of music therapy processes.
2. For music therapy training, teaching purposes and music therapy conferences.
3. To show in interviews or to groups of professionals to demonstrate music therapy techniques or approaches.

I agree to my child being written about for the following purposes (when writing about the work, names and identifying details will be changed):

1. To include in a music therapy PhD.
2. To include in a professional journal.
3. To include in a text book.

I agree to transcriptions of our conversations being used for the following purposes (when writing about the work, names and identifying details will be changed):

1. To include in a music therapy PhD.
2. To include in a professional journal.
3. To include in a text book.

I agree to excerpts from our conversations being used for the following purpose:

1. To show in interviews or to groups of professionals to demonstrate the benefits of video feedback.

Name of child:
(print)..**DOB:**..............................

Name of carer: (print)..

Date:...

Signature:...

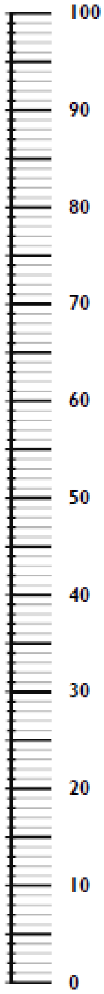
Therapist's name: (print)..

Appendix 4.5 Quality-of-life scale - Blank form

Here you can see a scale (rather like a thermometer) on which you can state how high or low the quality of life is – the best quality of life you can imagine is marked 100 and the worst quality of life you can imagine is marked 0.

Please indicate on this scale how good or bad **your child's quality of life** is today, in your opinion. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your child's quality of life is today.

Best imaginable
quality of life



Your child's quality of life today

Worst imaginable
quality of life

TIME-A | adapted from EuroQol Group, 1990 CODE: ______ RESPONDENT: ______ DATE: ______ TIMEPOINT: ______

Appendix 4.6.1 Selection criteria for music therapy session excerpts

1. Choose 4 or 5 excerpts per video
2. These should be, in your opinion, the ‘best’ moments in the therapy sessions according to the individual clinical aims related to resilience
3. Each excerpt should be 0:30 - 2:30 minutes long
4. The intervals have to be 10 seconds, i.e. start and finish an excerpt at 1:10, 1:20, 1:30 etc. and not at 1:13, 1:27 or 1:51
5. Face (frontal or profile) of child must be visible most of the time
6. Excerpt must include music making

Appendix 4.6.2 Transcribed parent counselling session

Explanations and abbreviations:

- T = Therapist
- P1 and P2 = Parents
- (T: yeah), (P1: uh-huh), (P2: mhm) = Affirmative noises and fillers, such as uh-huh, yeah, etc., made by any of the speakers while another person speaks, are transcribed in brackets
- [laughs] = Emotional non-verbal utterances that support or elucidate statement, such as laughter, nods or sighs, are transcribed in square brackets
- HE = Words with a special emphasis are capitalised
- We-we = Stutters and repeated words are marked by a hyphen
- -- = Discontinuations of words or sentences are marked by a double hyphen
- // =Speech overlaps are marked by a double slash. The start of an interjection is indicated by //.
- (…) = Pauses are indicated by suspension marks in parentheses, corresponding to the pause length from one second (.) to three seconds (…).

T: It's good to see you again.

P1: Yes, nice to see you, too.

P2: You too.

T: Yeah. Um, how is life at the moment? How is everything at home?

P2: About the same [laughs].

T: Yeah?

P1: Yeah, it's okay.

- Teacher enters room. -

Teacher: Knock, knock. Can I just get some milk please?

- Small talk with teacher who gets milk. -

T: I was told that the room should be free for this hour.

P1: Yeah, that's okay, that's fine.

- Small talk with teacher. Teacher leaves room. -

T: So, most things are as usual, nothing//

P2: //Not much of a change, no.

P1: No.

T: How was the Easter break? Was that a difficult transition this time?

P2: Um//

P1: //No, I don't think so, I don't really think it was particularly difficult.

P2: Well, yeah, he-he never likes coming to school on a Monday (T:mhm) if he's had a weekend off (T: yeah) and obviously it accentuates it when it's been longer (T: mhm). Tha-that's how it is.

P1: Of course, yes, yes.

P2: Mondays-mondays are always a problem but, you know, (T: mhm) that's how it is (T: mhm).

P1: But during the weekend he was fine, (P2: mhm) wasn't he? (P2: Mhm) Yeah (P2: yes). He's losing, um, his baby teeth, um, (T: uh-huh) over--, since we last saw you (T: yeah) and it's an ongoing process, and so I think that's interfered (T: mhm, mhm), um, with a lot of things. Um, this is really difficult to tell--, you can imagine when he's losing them and getting the new ones in, but--. It's hard to communicate if he's uncomfortable or not (T: uh-huh, mhm), you know, to pick a part (T: mhm). But other than that, yes--. We've, um, we've been doing more of what you suggested (T: mhm), um, so I--, we did before but we are making more time to use the instruments that he's got (T: mhm, mhm) at home and to mimic the sounds that he's making (T: yeah). That's one thing I took away from our last conversation (T: mhm, mhm). So I've been focusing more on that and it seems to be--, he seems to enjoy it and it does seem to create moments where we're in the moment together (T: yeah), so that's really nice.

T: So, something for you to enjoy as well, [P1 nods heavily] a positive time.

P1: Yeah, exactly. Cause he doesn't easy--, I don't think he finds it easy to share, (T: uh-huh), share moments (T: yeah). Um, and somebody came to our house recently and-and we were looking at the various pictures we have with Henry and one of them happens to be him out in the snow, which he really enjoyed, but he's looking at the camera, he's really sharing that moment (T: mhm), so it reminded me--. Cause I was describing that we had this picture of him because, um, uh, that was a treasured moment (T: yeah) because they're not--, they're not--, um, they only come at times (T: uh-huh, mhm), not so often. And so I think sometimes the music is something--, or the sounds, when we're making sounds--, is a more reliable way to get those moments (T: mhm, mhm), I think, something that he's more able to share.

T: Yeah. And did you notice any-any difference, um, in how he reacts to the instruments now that you use them more often with him? Did you notice, for example, any kind of--, um, that he shows you that he knows what's about to come, a positive moment, a positive experience? Is there any//

P1: //I-I don't know but he initiates it.

T: Oh, he initiates it?

P1: Yeah.

T: Oh that's great, yeah, that's a really clear sign of him//

P1: //Yeah, I think I noticed that (T: yeah). And he seems to have therefore confidence in that-that we will--, um, confidence and he initiates it and it's something he clearly is asking for but he also seems to have confidence (T: uh-huh, yeah) in knowing that we can do that, so I think that's nice (T: yeah). Cause it's sometimes difficult--, a lot of times difficult to create situations that we share (T: uh-huh) together. We do a lot of things together but to actually create something that HE is creating (T: mhm), rather than something that I'M initiating (T: yeah) and I'm trying to join him in and that sort of thing (T: mhm). So I think that's nice.

T: Yeah, that sounds really good that he is taking the initiative to do something that seems to become his//

P1: //Yeah, that's nice.

T: That he's really sharing. Mhm, mhm, and are you both enjoying that or--?

P2: Well, he does it more-more with her to be honest (T: uh-huh). But he-he has always accessed his musical things.

T: Uh-huh, yeah.

P1: But he has mostly, um--. I just think that's the sort of progress forward that he is sort of--, he has accessed musical things but he has tended to do them on his own (T: mhm), and he was never really including--, I would try and join in (T: mhm) but I think what I do is I try and join in as opposed to follow him what he was doing and therefore communication is-is, I feel, is a little bit more open now (T: uh-huh), because he's sort of sharing that moment as opposed to we're just sitting in the same space doing music (T: yeah, mhm). So I certainly like that better.

T: Mhm, yeah. Also for us in the therapy lots of things have changed (P1: mhm) and have developed since the last time we met.

P1: Oh good!

T: So we had 26 sessions now//

P1: //Uh-huh, I've been wondering.

T: which is about halfway through.

P2: Okay.

T: Yeah, so we will continue until, um, maybe a week before the summer holidays start [P1 and P2 nod]. Especially, I would say the first 20 sessions were a very clear progress like that [makes an upward movement with arm], (P1: uh-huh), amazing (P1: right). I would say at the moment it's a little bit like a plateau (P1: uh-huh) that we have reached. So, um, something very common that I notice with most of the children this happens after approximately 20, 30 sessions (P1: mhm), that they seem to have kind of taken things on board as much as they could in that time (P1: yeah). And for me it feels a little bit as if he has taken himself a little bit out of the active communication (P1: right) and sits a little bit back, more back (P1: mhm) but I wouldn't say he's passive (P1: mhm). He's listening very actively (P1: mhm) and I-I very clearly feel that he's, um, he's not going back in terms of isolating himself [P1 and P2 nod], he's more taking a step back, processing what has happened and what is happening, that's how I would describe what's happening at the moment (P1: right) with us. Would you be interested to see//some of the videos?//

P1: //Yes//

P2: Yeah!

P1: Yes absolutely, absolutely [all laugh].

T: I can see that, yeah. So, I just put some-some excerpts together again to show you various things. Is that good with the light?

P2: Yeah, is fine, yeah, yeah, that's fine.

T: Yeah, so//

P1: //Oh I forg--, one thing I want to say is his dancing, my dancing, my terrible dancing [laughs]. But he's--, we've always done it but he--, he's been kind of equivocal, um, about it at times (T: mhm) and so--, and I do think he enjoys it more (T: mhm, great, yeah). It's just--, AND he initiates it whereas before kind of I did most of the initiation

(T: uh-huh) and we he had fun while we were doing it. But, uh, now he--, um, he-he initiates it (T: yeah) and that’s really great (T: mhm, yeah). It’s all that, the--, um, uh, both in the making of sounds and, um, uh, sharing sounds together which is communication, but also the dancing that he initiates it, he WANTS me to be part of that (T: uh-huh). We did a lot of that before but I kind of invaded his world [laughs], now I sort of feel like he’s, he’s enjoying it more and-and more asking for it (T: yeah) and asking for it as something to do together (T: uh-huh) as opposed to just putting up with me [laughs].

T: Wow, that sounds wonderful! I think, yeah, the great thing about dancing is that--, one thing is to show kind of his enjoyment of moving, of being alive and his energy (P1: mhm, mhm), but also you share this kind of fluid movement that you have with another person (P1: yes) and that’s very//

P1: //And what you were saying that’s what rang a bell in my head. Sometimes there are just moments where he-he watches (T: uh-huh) and now you know where you can sort of take each other’s hands and spin round (T: uh-huh) and spin back (T: yeah) and we’ve been able to do that together and we never would have been able to do that before (T: mhm). A little step, he sort of takes more looks and then changes and so on like that rather than-- (T: yeah), before I was feeling like I was invading his world, you know, he would//

T: //It’s nicer for you as well to have the feeling that--, like you’re saying, invading his world is not really (P1: no) a thing that you want to do

P1: No exactly (T: mhm), exactly. Thank you, I just wanted to say, those are the things that you sometimes forget but now that we talk about it, it’s so important.

T: Yeah, that’s good. Um, I wanted to show you this particular video. We always start the session with our hello song which is always me on the guitar and, um, he wouldn’t in the beginning--, he was very careful watching me what I was doing and in this one I ask him to sit down and he comes immediately (P1: mhm) and listens to the song and then joins in the playing and that’s, um, what happens now all the time which is, I think, amazing (P1: yes).

- Watch video excerpt: Hello song [P1 and P2 smile], **P1:** His smile! -

T: Yeah, so I think that’s a big change.

P1: Isn’t it! Yeah!

T: He’s coming to sit with me (P1: yes), and really sharing with me, sharing the instrument, sharing the song (P1: yeah). I mean he//

P1: //And his attention when watching you (T: yeah) while being able to sit and to watch (T: yeah) and to allow you to play and be part of that (T: mhm). Really good concentration, really good looking, wasn’t it (P2: yeah), really good looking! So he’s really in that moment which is--, it’s lovely! And then, um, and then to explore and some really nice movements and sounds.

T: Yeah, the nice thing is his creative exploring (P1: yes!), he isn’t only copying what I do, strumming but he goes along the strings, he plucks them (P1: yes), and he-his excitement, yeah, I think that’s//

P1: //And that smile in the end! (T: Yeah) He was really enjoying that, yeah, that's lovely. That's--, the confidence as well is just (T: yeah), I feel is significantly improved, isn't it?

T: Mhm, I mean obviously he knows me by now (P1: uh-huh), and he knows the situation (P1: yes), he knows the structure and so when I ask him now to sit down, I think it was very clear that he wasn't scared that anything would happen (P1: no) that he isn't prepared for (P1: yeah), yeah, so it's something he's familiar with (P1: uh-huh) and it's good that this gives him the space to explore and be free, yeah.

P1: But I think we talked about it last time because I was saying about his confidence--, I don't think you can be creative unless you are in a place of confidence (T: exactly, yeah). And I think maybe that's also with us at home with the dancing and the music (T: mhm). There is a greater sort of confidence now about what is happening and what we're going to do (T: yeah) and then he can be more creative.

T: Mhm, yeah. Um, I remember that I showed you last time some video excerpts with him playing the bells, he's doing that here as well, you can't see them [all laugh] but you have seen them before (P1: yes). But, yeah, it's just, again, it's nice music that we're doing together, he's very much in the situation and it's just a lovely moment I think.

- Watch video excerpt: Bells, **T:** And you can see that he's playing them, [P1 and P2 smile] -

T: What I wanted to say about the last one, um, it's really a calm moment (P1: mhm) of us being together and the musical phrases that he initiates are really coming back, it's a clear musical structure (P1: right) which is repeated [sings phrase].

P1: Yes, I thought, yes, yes.

T: So he was initiating that phrase (P1: mhm) and also then I mirrored that back (P1: mhm) when I played it back, he played--, it was difficult to see because you couldn't see the bells but you could see the arm movements, he was always playing at the time when the phrase was coming to an end, so [sings beginning of phrase] and then he played [sings end of phrase] (P1: right). So, he was responding to the phrase.

P1: Yeah, yes. I don't know enough but it sounded right if that makes sense.

T: Yeah, it's kind of a musical conversation (P1: yes), that I start something, and he responds with something.

P2: Yeah, that makes sense.

P1: Isn't that interesting, because he covers his ears for so many sounds (T: uh-huh, mhm) and it must be pitch as well as loudness (T: yeah) because that's what we find and yet he doesn't with the musical instruments.

T: He does sometimes in the sessions (P1: does he?), yeah, and, um, sometimes I have the feeling it's because of things being loud (P1: uh-huh) and he covers them but he doesn't seem to be really afraid of the volume (P1: mhm), but mostly it feels to me as if it's just a sensory exploration as well, like he's doing this [moves hands in front of ears] (P1: oh right, yes) to see how the sound changes//

P1: //Changes. How interesting.

T: Mhm, yeah. He's playing the horns here, very lively, a very different moment in the session, and again in terms of musical things that developed, in the middle of our playing we stop and vocalise and I think the blowing, um, the blowing instruments really encourage vocalisation because you use the breath (P1: yeah), the mouth. So he vocalises and then after that we start again and kind of close the whole musical structure. So he has a real feeling of musical concepts I would say.

- Watch video excerpt: Horn, [P1 and P2 laugh] -

P1: Right, that was great! And looking at this reminds me since we last met he's whistling (T: uh-huh, yeah). And there's a real song he's developing (T: uh-huh), it's starting off with just one sound (T: mhm) and it's starting to change. I can't whistle, I just can't whistle at all, um, but he is and the phrases are getting longer (T: uh-huh, mhm) and he's really exploring it.

T: Yeah. He-he seems to really enjoy playing the blowing instruments (P1: mhm), so that's something that really seems to, yeah, match with his current needs really.

P1: Yeah, we don't have a horn, we have whistles, but I think he obviously prefers the horns to the whistle. He picks it up, the whistle, but he doesn't tend to favour it (T: uh-huh), he tends to put it back down again (T: mhm). So with all whistles that we've got he's not too keen on, so he started--, it looks like a whistle, it's sort of recorder that we have at home (T: yeah), um, uh, little plastic things, so he's just whistling himself now (T: mhm) [P1 and T laugh]. Maybe we should get a horn [to P2 who nods]. They are simple to get, aren't they? We should try, cause that was lovely.

T: Mhm. But it's great that he's whistleing at home (P1: yeah). I think all this, the whistleing, the vocalising, the singing, that's all coming now. What is also developing now is his language in the sessions (P1: really?). Yeah, we always say, when we finish something--, I always encourage him to do this, I think I mentioned that last time, '1-2-3-Finish' with all activities. So we don't just put instruments away but we always make a clear ending, "Okay, we finish with that now", and he's used to me initiating this phrase, "Let's say 1, we play, let's say 2, we play, and then let's play 3 and then finish" (P1: uh-huh). So, he has whistles here (P1: mhm) in that moment, so I say to him "We have to finish" (P: uh-huh) and, um, well—

- Watch video excerpt: 1-2-3-Finish, [P1 smiles] -

P2: Wow, he said the numbers, okay. That's a good--, a good idea maybe.

T: Yeah, and that's something that's really happening often now (P1: good, good) that he's using these words (P2: yeah) with me, saying these numbers (P1: mhm) or saying finish or//

P1: //Which is good because this is something he struggles with (T: yeah) and I struggle-we struggle with. Cause it is the transitions and that (T: mhm), when there is something really pleasurable or something really got his attention, to have a nice ending to something (T: yeah), because otherwise you just--, both of us, um, will just remember the difficulty at the end (T: mhm, mhm). Isn't it great when you have a really positive interaction (T: yeah), particularly communication (T: yeah, yeah), that then ends on a positive (T: uh-huh), not the struggle you have at the end. We're trying to find a way to resolve.

T: Yeah. I mean this happens of course with us as well (P1: mhm) that for example he doesn't want to leave the room (P1: yes) or he doesn't want to finish an activity. What I just always do when these things happen with him, after that I talk about how nice it was (P1: yes). So that even (P1: yeah) if there was a struggle, on the way back

I will say, “Do you remember (P1: yes), we did this and this and I remember this was really good”, so that there is the feeling of positivity (P1: yeah) after that and thinking back of the good things (P1: mhm, yeah). Um, that’s him dancing [all laugh], just a wonderful moment.

- Watch video excerpt: Dancing to piano -

P1: You are so skilled to follow his movements with your music.

T: Sometimes it works (P1: mhm), sometimes I feel that I can follow him (P1: yes). So I always try to put some moments like this in our sessions (P1: uh-huh), so that he has free time (P1: yes, yeah). And then often after that he comes to me to the piano (P1: uh-huh) and we play a little bit together and, yeah, I just really like this music that we do together.

- Watch video excerpt: Piano together -

T: So, I think these moments are really precious. It’s like a musical piece that he creates.

P1: Yes, yeah. His concentration, even though he’s not always looking at the piano, he’s there because the rest of him is still (T: mhm), and Henry is not still [laughs] mostly (T: mhm). So he’s really in that moment (T: mhm) which is (…) lovely.

T: Um, this is a very different moment again, um, a very playful one, a humorous one. He does, as most children with autism, like spinning objects (P1: mhm, uh-huh), so when we have the cymbal he often starts spinning it and I thought at one point, because it’s quite difficult to divert him from that (P1: uh-huh), and I thought, okay, rather than getting into a kind of struggle (P1: yes) or fight now, let’s see how he reacts if I incorporate that into a game (P1: yeah). And he really has a good sense of humour [P1 smiles] and he’s, um, yeah, it’s developing into a nice game.

- Watch video excerpt: Cymbal game, [all laugh], **P1:** Good game! -

T: And very good eye contact in the end.

P1: Yeah (P2: yeah), oh yes [laughs], it was a very shared moment, wasn’t it (T: mhm), it was great!

T: Oh yeah, (..), um, talking about his vocalisations--, I think this is one of the really fascinating moments where he’s-he’s using his voice, encouraged by music.

- Watch video excerpt: Vocalising to chime bars, **P1:** His smile! [smiles] -

P1: Lots of different sounds (T: yeah). He really--, I thought they were not involuntary (T: mhm), he was thinking of the sounds that he was going to make and changing them.

T: Mhm, yeah, and when I said in the beginning, um, that he’s now often taking his time out a little bit (P1: uh-huh), and I think in this one you could really see that doesn’t mean he isn’t there (P1: mhm), so for example in the middle of this moment that we had, he was just listening but he was really listening [P1 nods], he was there, he was smiling at the end and then waiting for his time to come back (P1: mhm), it was really, again, a musical phrase. Maybe I play an instrument like these wooden chime bars and he listens or watches me (P1: mhm) and then maybe a session later he comes and play with me as well [P1 and P2 nod]. This happened with the guitar, with the piano, this one. And he plays them again in a very concentrated way.

- Watch video excerpt: Chime bars -

T: And that’s how we end sessions, always with the djembe drum. I sing a goodbye song and, yeah, like you said, sometimes it’s difficult for him to finish (P1: mhm), so I don’t insist that much as I do in the hello song for him to sit down on the chair (P1: yeah). So I have the same arrangement with two chairs (P1: mhm), so that’s always how we start and end but--, it often happens that he’s--, for the hello song he’s fine, he sits down (P1: mhm), does everything, for the goodbye song he often doesn’t (P1: yeah), but chooses, for example here, he’s sitting on the floor first (P1: mhm) and then that’s maybe him being a little younger again, instead of sitting on the chair, he’s sitting down, he doesn’t want to finish. But I feel as soon as we do the music then together on the drum he’s fine again (P1: yeah), he participates once we start (P1: uh-huh).

- Watch video excerpt: Goodbye song, [all laugh] -

P1: That was really great! Lovely eye contact (T: uh-huh). And it’s normal that he doesn’t want it to end (T: yeah) but he got you to prolong it just a little bit [laughs], didn’t he (T: mhm, mhm). But that was really nice (T: yeah) because he was saying, kind of, can we do this together.

T: Yeah, and in a very appropriate way (P1: yes), taking my hands (P2: yes) and showing me, “I want to do the drum roll again” (P1: yes, exactly). And this has become a sort of pattern for us now, the way how we end (P1: yeah). I sing the goodbye song and he has time to process (P1: yes), and then we have the fun bit in the end.

P1: Yeah. (…) No that’s lovely.

T: When you see that, um, is there anything else that you want to ask about or that you want to say, anything that came to your mind, maybe you didn’t understand or you thought that was strange or--

P2: I thought this, just from watching it all, which is not really related to music-to music at all, sometimes he wears the belt, sometimes he doesn’t (T: uh-huh). And I was intrigued, do they put the belt on him because he has a difficult day and then do you find when he’s got the belt on, he’s not as responsive to you or not? Or is it just a totally random thing? Cause there’s no--, I noticed that about 40% of the time he’s got the belt on (T: yeah) and the other time he hasn’t. Obviously someone decides he needs to have the belt on that day (T: uh-huh, yeah). Is that just a random thing that just depends on sort of who is looking after him or do you find it makes a difference? Is it--, are they having a more difficult day with him and then you find that as well?

T: Um, what I--, so often I come to the classroom to pick him up (P2: mhm) and then we might have a small chat about how his day has been so far (P2: mhm), and then if he has the belt on the teachers often say things to me like, “He’s very active today (P1: mhm, P2: okay), he’s very lively or he has difficulties to sit down today”, and that’s why//

P2: //Right. And that’s why they put it on//

T: //they decide to put the belt on// (P2: okay) to help him to settle (P1: mhm, P2: right). I have the feeling that in the music it doesn’t really make a difference (P2: okay). So sometimes, um, when he comes with the belt, it isn’t really--, it’s often quite loose, so if he doesn’t want it he can push it down (P2: okay). And he sometimes does it in the music and it doesn’t really make him more active in the music (P2: okay). Because I think that’s a really--, for him that’s a different situation (P1: mhm), it’s a different environment, a different--, and he is not only ALLOWED but also ENCOURAGED to move around (P1: mhm, P2: mhm, yeah, yeah) in the music, so I think the belt is not really necessary with us in the sessions. But I don't--, if he has it on and the teachers think it's useful for him on the day I don't do anything, I don't put it off, I don't say anything against it (P1: yes, yeah).

P2: And the sessions aren't any different, you don't find the sessions any different?

T: I mean the sessions are--, of course, they are different every time I see him (P2: yeah) but not really in relation (P2: okay) to the belt, that's what I (P2: right) experience, yeah. Also sometimes it's, and that's quite common not only with Henry, I experience that with other children as well, that for example teachers say he has a very difficult day today and then the music session is great (P1: uh-huh, P2: okay) or the other way round (P2: okay, P1: yeah). Maybe they say, "Oh today he was really participating" (P1: yeah), and then I feel in the music session he seems to be quite distant (P1: uh-huh, P2: okay). So yeah, it's not always related (P2: okay).

P1: That's really what we find at home, it's hard to-to--, often times it's hard to follow through. The expectations of how he's going to be (T: yeah), it's not-not, uh, not always in synchrony with what--, how he presents.

T: Mhm, I think that it's--, it sometimes makes sense that he's different to the other environment because it's maybe a space where he can have the other--. For example, if he's very lively outside (P1: uh-huh) then maybe he enjoys using the music for some more calm moments (P1 and 2: mhm) and to have a more relaxing time (P1: uh-huh), and the other way round. If he feels he has to sit down a lot during the day (P1: uh-huh) and has to concentrate a lot then he might be very active and energetic in the sessions (mhm). And maybe it's similar at home, that if school is feeling, "Today he was really hyper" (P1: yes, that's right), and then he comes home and he can maybe finally relax.

P1: Yeah, I think--, yes that resonates with me because sometimes we read in the book and then we see how he is (T: mhm), and there seems to be quite a juxtaposition between the two (T: yeah). No that resonates.

T: Yeah. (…) So if there is nothing that you would like to add in terms of aims I would just continue working with him in that way (P2: mhm) or--

P1: Is there anything--, because I'm so new to music therapy, is there any aims that you would find with other children you would be putting in?

T: You mean that I haven't focused on yet (P1: YES) but I would (yeah). I think one thing that I want to explore with him a bit more (P1: mhm) in the next weeks is to encourage his playful side more (P1 and 2: mhm), so maybe more age-appropriate games and musical songs (P1: uh-huh). For example, when you ask about other children, I would--, I often play action songs with other children (P1: mhm), and I haven't done that with Henry yet (P1: mhm), because I had the feeling that for him other things were more important. He didn't show a particular interest (P1: yes) in doing these things (P1: yes), but I think maybe now it is the right moment to introduce some more humorous and playful activities (P1: uh-huh) for us to do together. Because, as I said in the cymbal game, he really has a good sense of humour (P1: yes) and he enjoys laughing together (P1: yeah) and this side wasn't very prominent yet in the music therapy with us (P1: uh-huh). So that would be something. And another thing that, um, just happened recently, I think this week only, oh no the week before, last week was the first time that he, um, went to the drum set (P1: uh-huh). He went to the big drum set and played it with like proper drum sticks (P1: wow) and I played piano music to it and our music sounded, like, very professional [all laugh]. So he plays the drums in all the different ways (P1: wow), trying different things (P1: okay) and then--, I say that also because we have this distance, me sitting at the piano, he's sitting at the drums (P1: uh-huh) and still have the connection which is quite (P1: yes) remarkable (P1: yeah), so that's a recent development that I want to (P1: yeah) concentrate on as well.

P2: So obviously we got lots of toy instruments. Is there any benefit in us getting any proper instruments at any point? Or do you just want to focus with what you're doing really and not us trying to do it badly.

P1: Excuse me! [laughs]

T: No no, there is never a reason why you shouldn't (P2: okay) play with him! And of course you can get another instrument if you want but//

P1: //Yes, we got a piano.

P2: We've got a piano, we've got a proper electric organ, but they are the only sort of adult (T: yeah) things we've got. Oh, he's--, we've got lots of other things but they're children toys basically.

P1: They are all plastic yeah.

P2: But mostly you are using proper instruments apart from the bells, which are also probably proper instruments, you know, you are using proper instruments on the whole.

P1: The wooden, um, it's not a xylophone--

T: The chime bars.

P1: The chime bars, that's a lovely tone (T: yeah). We should get something like that because I think that's a very nice, very different (T: uh-huh) and-and, sorry cause you know the right words to it, but a sort of low, soft (T: uh-huh), deep sound (T: yeah, yeah), isn't it? A lot of things--, it's different. I really liked that (T: yeah) and he obviously likes that sound as well because lots of sounds he doesn't like (T: mhm). That was nice to see. Yeah.

T: Yeah, I mean with instruments, I would always think about--, because these instruments are very expensive (P1: mhm, mhm). So if you have a piano and you have lots of good toy instruments, I don't know, maybe that's enough (P2: okay), but if you are interested in getting other instruments, go for it [laughs].

P2: But we're interested whether it's going to be of help and use to him (T: mhm). Because at the time, you know, cause I have no interest in playing them or something, you know, but if it's going to be of use and help to him we obviously, we would get them (T: mhm). That's the thing.

T: Yeah. With most instruments I would say probably the most important thing is to play them with him. So there is probably--, if you offer him an instrument he probably wouldn't use it straight away (P2: no, no), but, yeah, he would need someone who does it with him (P2: yes). I mean, sometimes after seeing children for music therapy I think with the parents together if there was an interest in the child getting some therapeutic teaching (P1: uh-huh) so that could be something//

P1: //Yes, I wondered about that.

T: Yeah, that's something that we could think about towards the end, seeing if there is a particular instrument that he always (P1: yes, P2: okay) seems to be (P1: yes) drawn to (P2: yeah).

P1: Yes, cause he'll need to be interested in whatever (T: yeah). No that's certainly ultimately one of my aims (T: mhm), I was hoping that if he-if he--, if it resonated with him and if he found an instrument, lots of instruments, but if he particularly found an instrument and then invest (T: uh-huh, yeah) in some teaching for him (T: uh-huh) cause I think//

T: //and there are good-there are good music therapists who are teachers as well and who do--, or teachers who have a therapeutic background and who teach an instrument with the knowledge of the child's needs, and the knowledge of//

P1: //Yes, yeah, because it wouldn't be normal--, like for instance he would get a piano teacher who didn't have a background in therapy, because Henry wouldn't be able to follow it and--

T: But he definitely has everything he needs to be able to learn an instrument, so I think that//

P1: //That would be really great. Yeah, so I guess that would be our aim, if you find that then we will keep going on at home. If you find that there is an instrument that he gravitates to (T: yeah) we would really like to know that and then pursue that with him (T: uh-huh, yeah). Because I think that would be a really fantastic thing (T: uh-huh). And he's always seemed to me to have an interest, a genuine interest in music because he would listen to my mum on the piano since when he was very young, something that he seemed to connect with (T: mhm), so I think that would be--. We want to, uh, give him the opportunity to express himself and to enjoy something (T: yeah), and it would be delightful if it was music, it would be fantastic! Yes, but if he gravitates to an instrument (T: yeah) that would be really one of the really great outcomes I think (T: yeah), and then we could see to continue that and see if he would take that on (T: uh-huh). Great, that's really good news actually, cause I thought--, we had thought previously, in years previous about whether he would have the scope to--. Because unfortunately none of us play an instrument ourselves (T: mhm), and we were sort of grabbling with the idea how we could find somebody that could help him explore (T: uh-huh) that side, cause you are limited when you can't play. I-I play, I enjoy when we make sounds together (T: uh-huh), but I have no intrinsic knowledge or capabilities in music and so it's very limited in that way.

T: But, um, what I said last time as well, the most important thing is that you play with him, that you enjoy it. You don't have to be a musician. You are interested in Henry, you are his mother, and that's all you need, that's enough (P1: yeah). Just enjoy the music together.

P1: Yeah, thank you. But if you find something that he really gravitates to we would be really like--, and we would like to take that further.

T: Uh-huh, yeah, good.

P1: Thank you very much for showing us the videos! It's so lovely to see Henry really--, the difference even in what you showed us last time, so interesting and the difference that we can see on here (T: mhm), of his involvement and his interaction, it's all there. It's great to see, isn't it? (P2: Mhm, yeah). It's really great to see (T:

mhm). And it's also, it's nice to take these times out, because when you asked us when we first arrived with the changes and there is so many challenges (T: uh-huh) every day that you can--, we can sometimes get lost (T: uh-huh) in the challenges of every day (T: mhm). And we try always to take moments out, to enjoy those moments of positivity (T: mhm) and creativeness and progress that he is having, getting really to know Henry (T: yes), Henry interacting with us. But you can sometimes feel overwhelmed with the day-to-day things.

T: Because it is very tiring as well (P1: Yes, it is). And then finding the energy to celebrate the good things--, it's not always easy.

P1: Yes, sometimes the first things that come to mind are the things we keep looking for as opposed to things that we are enjoying (T: uh-huh) and isn't the life all like that, a list of to do things [laughs] (T: yeah). But he does, I would say, that we've been thinking about all this, he is whistling, we have much more moments when HE is asking for the dancing (T: mhm) and he is asking, and they last longer (T: mhm), and there seems to be more of a connection rather than playing side by side (T: yeah), then we follow and just as you can show on-on-on there. And I think with his-with his sounds--. But I think I'm more in tune with his sounds now (T: uh-huh), in tune with him (T: mhm), listening for the patterns in his sounds and how they are changing (T: mhm). I think I see more than I've seen before. Because he's been making so many sounds all of his life but, uh, being more in tune about those sounds.

T: Uh-huh, yeah, I think he has a real--, a really clear own voice (P1: mhm), in terms of the vocal sounds he is making they have a distinct character (P1: yes), that's Henry.

P1: Yes, I think I appreciate that much more (T: mhm) and I think I appreciate it more so I'm more attuned to it (T: mhm), but also I think he's also--, I also think he is trying more out (T: uh-huh, uh-huh). There is different patterns, there is different sounds (T: mhm) that sound much more like--, cause he can sometimes make sounds which I think is his way of actually dampening down things around him (T: yeah). But there are times where I've seen you--, where there is different sounds he is making and different rhythms that he is making (T: mhm, mhm) which is, as you say, FEEL more like Henry's own voice (T: yeah, uh-huh). So that's brilliant (..), it's nice (..), it's wonderful.

T: At the end of the therapy when we finish, I will make a DVD with all these excerpts so//

P1: //Lovely, thank you.

P2: Thank you, that's great.

T: Yeah, so that you can take it home. Um, I'm sorry that I have to ask you now if you could possibly fill in some forms. These are the same forms that you were asked to do in the beginning. I think Johanna, the psychologist (P1: right) probably should have done. I don't know if you have time now or if you want to--

P1: I was just going to say I need to rush unfortunately. I apologise, I double-booked myself.

T: Yeah do you want to take them home?

P1: Yes, yeah and send them back, yeah.

P2: How soon do you need them back?

T: Oh, you can take your time. At some point next week (P2: okay). This one is about his treatment, if he's getting any other treatment, but that's only within the last two months (P1: okay) or any medication and if there is anything you don't want to fill in you don't have to (P1: yeah). Fill in as much as you want to. And then this one you probably did in the beginning as well, it's a questionnaire, it's called the social responsiveness scale. You have numbers 1 to 4--

P2: You filled them in last time, didn't you? (P1: Yes) So basically you do them again (P1: yeah, that's fine), otherwise it will be very inconsistent, isn't it. Basically.

P1: Yes that's fine.

T: And then, yeah, this one is a really difficult one to fill in.

P1: Yes, I remember it. You got asked this last time on the phone as well (P2: Oh, yeah?), and you talked to me, you remember?

P2: Yes, oh god. So that should be fun.

P1: So you can do them. Yeah, we decided on the phone we were having a disagreement [all laugh]. Remember the disagreement about his quality of life. We were having a discussion because of the-of the values we were giving were slightly different (T: mhm). Well, we found a middle ground.

T: It is a very difficult (P1: it is) question, yeah, and I mean I think everyone is aware that a number given on one day isn't really showing-- (P2: yeah), but yeah, that's the research.

P2: That's fine.

P1: That's fine. And thank you very much, thank you very much.

P2: And next time we have the meeting, if we haven't got back within a couple of days it means we haven't got the request (T: yeah, okay). So we do reply back very quickly with most things, so I don't know how long it has been since you sent it out?

T: It was a week, so don't worry.

P2: A week. We never got it.

T: No, I thought I just hear//

P2: //If we haven't replied within a few days it means we haven't received it.

T: Yeah (P2: okay?). No worries [all laugh]. Thank you for coming today. And in July, when we finish with the music therapy, we will meet again if that's okay.

P2: Lovely. Okay.

P1: That would be lovely.

P2: Thank you so much.

P1: Yeah, thank you so much. I really appreciate everything you are doing.

Appendix 4.7.1.2 ACTR rating form

a) Blank form

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1																				
2																				
3																				
4																				
5																				
Ø																				

b) Completed ACTR forms for all children

Arjun

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	3	3	2	3	3	3	3	4	4	3	3	4	3	4	4	4	4	4	4	x
2	2	3	2	3	3	4	2	2	3	4	4	4	4	4	4	5	4	4	4	x
3	3	3	3	2	3	3	3	3	3	3	3	4	3	3	4	4	4	4	4	x
4	3	3	3	2	3	3	3	3	3	3	3	3	4	4	4	4	4	3	4	x
5	3	3	4	3	3	3	3	3	3	x	4	3	3	4	3	4	4	4	4	x
Ø	**2.8**	**3**	**2.8**	**2.6**	**3**	**3.2**	**2.8**	**3**	**3.2**	**3.2**	**3.4**	**3.6**	**3.4**	**3.8**	**3.8**	**4.2**	**4**	**3.8**	**4**	x

Ben

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	x	x	3	3	2	3	3	4	3	4	4	x	4	5	4	5	5	5	4	5
2	x	x	2	3	3	3	5	4	3	3	5	x	4	4	5	4	4	4	4	4
3	x	x	2	3	3	3	4	4	3	4	3	x	4	4	4	4	4	4	5	3
4	x	x	3	4	3	4	3	4	3	4	5	x	4	4	4	4	5	5	5	4
5	x	x	2	2	3	4	4	4	4	3	4	x	5	5	5	4	5	5	5	5
Ø	x	x	**2.4**	**3**	**2.8**	**3.4**	**3.8**	**4**	**3.2**	**3.6**	**4.2**	x	**4.2**	**4.4**	**4.4**	**4.2**	**4.6**	**4.6**	**4.6**	**4.2**

Charlie

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	x	3	3	4	3	3	3	4	3	3	3	x	4	4	3	4	4	4	4	4
2	x	2	3	2	3	3	4	4	4	3	4	x	3	4	4	4	4	5	4	4
3	x	4	3	4	3	4	4	5	4	3	3	x	4	3	5	4	4	4	4	4
4	x	3	3	3	4	4	4	4	5	3	4	x	4	4	5	4	5	4	4	4
5	x	3	2	3	4	x	5	4	3	x	4	x	3	4	4	x	4	4	4	4
Ø	x	**3**	**2.8**	**3.2**	**3.4**	**3.5**	**4**	**4.2**	**3.8**	**3**	**3.6**	x	**3.6**	**3.8**	**4.2**	**4**	**4.2**	**4.2**	**4**	**4**

Denise

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	2	3	3	4	3	3	4	4	3	x	4	5	4	4	4	4	5	5	4	x
2	3	3	3	3	4	3	4	4	4	x	4	5	5	5	5	5	5	5	5	x
3	3	4	4	3	4	3	4	4	4	x	5	4	5	5	5	5	5	4	5	x
4	3	3	3	4	5	4	4	5	5	x	5	5	5	5	5	5	5	5	5	x
5	3	3	4	4	4	x	4	4	4	x	4	4	4	5	5	5	5	5	4	x
Ø	**2.8**	**3.2**	**3.4**	**3.6**	**4**	**3.2**	**4**	**4.2**	**4**	x	**4.4**	**4.6**	**4.6**	**4.8**	**4.8**	**4.8**	**5**	**4.8**	**4.6**	x

Eric

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	2	4	4	4	4	5	5	5	5	5	5	5	4	4	5	4	5	5	x	x
2	3	3	4	4	4	5	4	4	4	5	5	4	4	5	4	5	5	4	x	x
3	3	4	4	5	5	5	5	4	5	4	5	5	5	5	5	5	5	5	x	x
4	3	3	4	4	4	4	4	5	5	5	5	5	4	4	5	5	5	5	x	x
5	3	4	3	4	5	4	4	5	5	5	5	5	5	x	5	5	5	4	x	x
Ø	**2.8**	**3.6**	**3.8**	**4.2**	**4.4**	**4.6**	**4.4**	**4.6**	**4.8**	**4.8**	**5**	**4.8**	**4.4**	**4.5**	**4.8**	**4.8**	**5**	**4.6**	x	x

Fiona

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	2	2	2	3	3	4	4	4	4	5	4	5	5	4	5	4	x	x	x	x
2	3	1	3	3	3	5	4	4	5	4	4	5	5	5	4	4	x	x	x	x
3	3	1	4	2	4	4	5	3	4	4	4	5	4	5	4	5	x	x	x	x
4	2	2	2	4	4	5	3	4	4	4	4	5	5	4	5	4	x	x	x	x
5	x	x	3	4	4	4	4	4	4	4	4	4	3	4	4	5	x	x	x	x
Ø	**2.5**	**1.5**	**2.8**	**3,2**	**3,6**	**4,4**	**4**	**4**	**4,2**	**4,2**	**4**	**4,8**	**4,4**	**4,4**	**4,4**	**4,4**	x	x	x	x

Ghalib

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	2	2	3	4	3	3	3	4	4	5	5	4	4	4	4	5	4	4	5	x
2	4	3	3	3	4	4	4	3	4	5	4	4	5	4	4	5	5	5	5	x
3	3	2	2	3	3	3	4	4	5	4	5	5	4	5	4	5	5	4	4	x
4	2	2	2	4	3	4	3	4	4	4	5	5	4	5	4	5	5	5	3	x
5	x	x	3	4	3	3	3	3	4	5	4	5	4	5	3	4	5	5	4	x
Ø	**2.8**	**2.2**	**2.6**	**3.6**	**3.2**	**3.4**	**3.4**	**3.6**	**4.2**	**4.6**	**4.6**	**4.6**	**4.2**	**4.6**	**3.8**	**4.8**	**4.8**	**4.6**	**4.2**	x

Henry

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	2	2	2	4	3	4	4	4	4	4	4	5	4	5	4	4	4	4	4	x
2	3	3	3	4	4	3	4	3	4	4	4	3	4	5	5	5	5	5	4	x
3	2	3	2	3	4	4	4	4	4	3	4	4	4	5	5	5	5	4	5	x
4	3	3	3	3	3	4	4	3	4	4	5	4	3	5	4	4	5	5	4	x
5	3	3	3	4	3	4	4	5	4	4	x	5	5	3	4	5	4	5	4	x
Ø	**2.6**	**2.8**	**2.6**	**3.6**	**3.4**	**3.8**	**4**	**3.8**	**4**	**3.8**	**4.2**	**4.2**	**4**	**4.6**	**4.4**	**4.6**	**4.6**	**4.6**	**4.2**	x

Isaac

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	3	3	4	4	4	4	3	4	4	4	4	4	4	5	4	4	4	x	x	x
2	3	3	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	x	x	x
3	2	3	5	4	4	4	4	5	4	4	4	4	5	5	4	5	5	x	x	x
4	2	4	3	4	3	3	3	4	4	4	5	4	5	4	5	5	5	x	x	x
5	3	2	3	4	3	3	3	3	4	4	4	4	4	4	5	5	5	x	x	x
Ø	**2.6**	**3**	**3.8**	**4**	**3.6**	**3.6**	**3.4**	**4**	**4**	**4**	**4.2**	**4.2**	**4.4**	**4.4**	**4.4**	**4.6**	**4.6**	x	x	x

Jahnu

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	x	3	2	4	4	2	3	4	3	3	4	x	4	4	5	4	5	5	5	4
2	x	3	2	3	2	3	3	4	4	4	3	x	4	5	5	5	5	5	4	5
3	x	3	3	3	3	2	3	3	4	4	4	x	4	4	4	5	5	5	5	4
4	x	3	3	3	3	3	3	4	4	4	4	x	4	4	4	4	4	5	5	3
5	x	2	4	3	4	4	4	4	4	5	4	x	5	5	5	5	5	5	x	5
Ø	x	**2.8**	**2.8**	**3.2**	**3.2**	**2.8**	**3.2**	**3.8**	**3.8**	**4**	**3.8**	x	**4.2**	**4.4**	**4.6**	**4.6**	**4.8**	**5**	**4.8**	**4.2**

Kyle

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	3	2	2	2	3	3	3	4	4	4	5	5	5	4	4	4	x	x	x	x
2	3	2	2	3	3	3	4	4	5	4	4	5	5	4	4	4	x	x	x	x
3	2	2	2	4	4	4	3	4	4	4	5	4	5	4	4	4	x	x	x	x
4	2	1	3	3	4	4	4	3	4	5	4	4	4	3	4	5	x	x	x	x
5	1	x	2	4	3	3	4	4	5	5	5	5	5	5	5	5	x	x	x	x
Ø	**2.2**	**1.8**	**2.2**	**3.2**	**3.4**	**3.4**	**3.6**	**3.8**	**4.4**	**4.4**	**4.6**	**4.6**	**4.8**	**4**	**4.2**	**4.4**	x	x	x	x

Leanne

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	2	2	2	3	3	2	3	2	3	4	4	3	4	4	4	4	x	x	x	x
2	2	3	2	4	4	2	3	4	4	4	4	4	4	4	4	5	x	x	x	x
3	3	3	3	3	2	3	4	3	4	5	5	5	4	4	4	4	x	x	x	x
4	3	3	3	3	3	3	4	3	4	5	4	4	4	4	5	5	x	x	x	x
5	x	3	3	3	2	3	3	3	5	3	4	3	5	5	5	5	x	x	x	x
Ø	**2.5**	**2.8**	**2.6**	**3.2**	**2.8**	**2.6**	**3.4**	**3**	**4**	**4.2**	**4.2**	**3.8**	**4.2**	**4.2**	**4.4**	**4.6**	x	x	x	x

Malik

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	3	3	3	3	3	4	4	4	4	x	4	4	3	x	4	4	5	5	4	5
2	3	3	3	3	4	3	3	3	4	x	5	4	3	x	3	5	4	4	4	5
3	2	4	3	3	3	3	3	4	4	x	4	3	4	x	4	4	4	5	5	5
4	3	3	3	3	4	4	4	4	3	x	4	3	4	x	4	4	5	5	4	3
5	2	4	3	4	4	x	5	5	5	x	5	4	5	x	5	4	5	5	5	5
Ø	**2.6**	**3.4**	**3**	**3.2**	**3.6**	**3.5**	**3.8**	**4**	**4**	x	**4.4**	**3.6**	**3.8**	x	**4**	**4.2**	**4.6**	**4.8**	**4.4**	**4.6**

Appendix 4.7.1.3 R script

```
p="Laura's project"

install.packages("Matrix")
install.packages("glmmTMB")
install.packages("lme4")
library(glmmTMB)
library(lme4)          # for fitting LMM
library(car)           # for Variance Inflation Factor

# this code assumes that each session for each child is saved as a
separate text file and that each text-file has the same number of
columns and each column has the same name and that files are saved
in the form "name_session.txt"

## 1. Compile all datasets
datasets=list.files("D:/Laura/Documents/PhD/Video Analysis/R/Data",
pattern=".txt")        # create a vector with the names of all the
files in that folder
length(datasets)       # 229 files in that folder
datasets

c.names=c("childID", "sessionID", "excerptID", "observationID",
"uniqueID", "begin", "end", "Plays", "AsstPlay", "Vocal", "Moves",
"Talks", "Object", "Smiles", "Looks", "LooksTA", "Initiate",
"Responds", "Engaged", "Contact", "ContactTA", "Fidgets", "Anxiety",
"Out",
    "TPlays", "TVocal", "TMoves", "TTalks", "TObject", "TSmiles",
"TLooks", "TInitiat", "TName", "TPraise", "TContact", "TOut",
"TAPlays", "TATalks", "TAMoves", "TAObject", "TASmiles", "TAName",
"TAPraise", "TAContac")

orig.data=c()
for(i in 1:length(datasets)){     # the loop is indexed by 'i'(so
loop is repeated 229 times)
    xx=read.table(file=paste(c("D:/Laura/Documents/PhD/Video
Analysis/R/Data/", datasets[i]), collapse=""), header=T,
comment.char="", as.is=T, quote="", fill=T, sep="\t")
colnames(xx)=gsub(x=colnames(xx), pattern="Control",
replacement="Anxiety", fixed=T)
    xx[is.na(xx)]=0
# add general info to the dataset, e.g. child name, session ID etc.
    yy=datasets[i]
    yy=gsub(x=yy, pattern=".txt", replacement="", fixed=T)
    xx$childID=strsplit(yy, split="_", fixed=T)[[1]][1]
    xx$sessionID=strsplit(yy, split="_", fixed=T)[[1]][2]
    xx$sessionID=as.numeric(gsub(x=xx$sessionID, pattern="session",
replacement="", fixed=T))

xx$excerptID=cumsum(xx$begin=="00:00:00")
xx$observationID=NA
    for (j in 1:length(unique(xx$excerptID))){ # start another loop
this time with index 'j': for each unique 'excerptID'

xx$observationID[xx$excerptID==j]=1:length(xx$observationID[xx$excer
ptID==j])
        }
    xx$uniqueID=paste(xx$childID, xx$sessionID, xx$excerptID,
xx$observationID, sep="_")      # each datapoint gets a unique ID,
helpful to check for errors
    xx.c.names=colnames(xx)
    xx.c.missing=setdiff(c.names, xx.c.names)
```

```
    for(j in 1:length(xx.c.missing)){
        zz=cbind(xx, rep(NA, times=nrow(xx)))
        colnames(zz)[ncol(zz)]=xx.c.missing[j]
        xx=zz
    }

    xx=xx[c.names]
    orig.data=rbind(orig.data, xx)
}

str(orig.data)
# 23141 obs. of  44 variables (37 behaviour observation variables
and 7 general info variables such as childID)

## check for errors
        # 1. look for error in "Plays"
        # unique(orig.data$Plays)
        # xx=subset(orig.data, Plays=="00:00:00")
            # error in Denise session 15, corrected in excel
manually

        # 2. look for error in "Contact"
        # xx=subset(orig.data, Contact==2)
            # error in Fiona, corrected in excel manually

        # 3. look for error in "Anxiety"
        # xx=subset(orig.data, is.na(Anxiety))
        # table(xx$childID, xx$sessionID)

        # 4. look for error in "TObject"
        # unique(orig.data$TObject)
        # xx=subset(orig.data, TObject=="00:00:00")
            # error in Henry session 17, corrected in excel manually


## save original.data as a separate object
str(orig.data)                        # 23141 obs. of 44 variables
summary(orig.data)

xdata=orig.data            # continue working with xdata, so in case
of mistakes the original data is safe in the object 'orig.data'
table(xdata$childID, xdata$sessionID)
write.table(table(xdata$childID, xdata$sessionID),
file="D:/Laura/Documents/PhD/Video
Analysis/R/Outputs/Excerpt_length_per_child_session.out",
    row.names=T, col.names=T, sep="\t", quote=F)


## 2. Data cleansing
# 2.1 Deal with 'Out' observation
table(xdata$Out)            # 245 Out observations

xdata$Smiles[xdata$Smiles==0 & xdata$Out==1]=NA
table(xdata$Smiles, xdata$Out, useNA="always")

xdata$Looks[xdata$Looks==0 & xdata$Out==1]=NA
table(xdata$Looks, xdata$Out, useNA="always")

# 2.2 Add columns that combine specifc behaviors
table(xdata$Plays, xdata$AsstPlay, useNA="always")
xdata$PlayTotal=NA
xdata$PlayTotal[xdata$Plays==0 & is.na(xdata$AsstPlay)]=0
xdata$PlayTotal[xdata$Plays==1 & is.na(xdata$AsstPlay)]=1
xdata$PlayTotal[xdata$Plays==0 & xdata$AsstPlay==0]=0
```

```
xdata$PlayTotal[xdata$Plays==1 & xdata$AsstPlay==0]=1
xdata$PlayTotal[xdata$Plays==1 & xdata$AsstPlay==1]=1
xdata$PlayTotal[xdata$Plays==0 & xdata$AsstPlay==1]=1
table(xdata$PlayTotal, useNA="always")

table(xdata$Looks, xdata$LooksTA, useNA="always")
xdata$LookTotal=NA
xdata$LookTotal[xdata$Looks==0 & is.na(xdata$LooksTA)]=0
xdata$LookTotal[xdata$Looks==1 & is.na(xdata$LooksTA)]=1
xdata$LookTotal[xdata$Looks==0 & xdata$LooksTA==0]=0
xdata$LookTotal[xdata$Looks==1 & xdata$LooksTA==0]=1
xdata$LookTotal[xdata$Looks==1 & xdata$LooksTA==1]=1
xdata$LookTotal[xdata$Looks==0 & xdata$LooksTA==1]=1
table(xdata$LookTotal, useNA="always")

table(xdata$Contact, xdata$ContactTA, useNA="always")
xdata$ContactTotal=NA
xdata$ContactTotal[xdata$Contact==0 & is.na(xdata$ContactTA)]=0
xdata$ContactTotal[xdata$Contact==1 & is.na(xdata$ContactTA)]=1
xdata$ContactTotal[xdata$Contact==0 & xdata$ContactTA==0]=0
xdata$ContactTotal[xdata$Contact==1 & xdata$ContactTA==0]=1
xdata$ContactTotal[xdata$Contact==1 & xdata$ContactTA==1]=1
xdata$ContactTotal[xdata$Contact==0 & xdata$ContactTA==1]=1
table(xdata$ContactTotal, useNA="always")

xdata$Expression=0
xdata$Expression[xdata$Plays==1 | xdata$AsstPlay==1 | xdata$Talk==1
| xdata$Vocal==1 | xdata$Move==1 | xdata$Object==1]=1
xdata$Expression[is.na(xdata$Plays) & is.na(xdata$AsstPlay) &
is.na(xdata$Talk) & is.na(xdata$Vocal) & is.na(xdata$Move) &
is.na(xdata$Object)]=NA
table(xdata$Expression, useNA="always")

xdata$Difficulty=0
xdata$Difficulty[xdata$Fidget==1 | xdata$Anxiety==1]=1
xdata$Difficulty[is.na(xdata$Fidget) & is.na(xdata$Anxiety)]=NA
table(xdata$Difficulty, useNA="always")

# 2.3 Add therapy intensity and verbal ability
children=sort(unique(xdata$childID))
children
# "Arjun" "Ben" "Charlie" "Denise" "Eric" "Fiona"  "Ghalib"  "Henry"
"Isaac" "Jahnu" "Kyle" "Leanne" "Malik"

transl=data.frame(cbind(children,
    c("1", "1", "3", "1", "3", "1", "1", "3", "3", "3", "1", "3",
"3"),
    c("0", "1", "0", "1", "1", "1", "1", "0", "1", "1", "0", "0",
"0")))
colnames(transl)[2]="TType"
colnames(transl)[3]="verbal"
transl[, 1:3]=lapply(transl[, 1:3], as.character)
transl

xdata$TType=NA
xdata$verbal=NA
for (i in 1:nrow(transl)){
    xdata$TType[xdata$childID==transl$children[i]]=transl$TType[i]
    xdata$verbal[xdata$childID==transl$children[i]]=transl$verbal[i]
}
table(xdata$childID, xdata$TType, useNA="always")
table(xdata$childID, xdata$verbal, useNA="always")
write.table(table(xdata$childID, xdata$TType, useNA="always"),
file="D:/Laura/Documents/PhD/Video
```

```
Analysis/R/Outputs/Frequency_table_childID_TType.out", row.names=T,
col.names=T, sep="\t", quote=F)
write.table(table(xdata$childID, xdata$verbal, useNA="always"),
file="D:/Laura/Documents/PhD/Video
Analysis/R/Outputs/Frequency_table_childID_verbal.out", row.names=T,
col.names=T, sep="\t", quote=F)

## 3. Deriving %-behaviour observation per child and session and
target variable
sessions=unique(xdata$sessionID)
sessions=sort(sessions)
children=unique(xdata$childID)
children

target.var=c("Plays", "AsstPlay", "Vocal", "Moves", "Talks",
"Object", "Smiles", "Looks", "LooksTA", "Initiate", "Responds",
"Engaged", "Contact", "ContactTA", "Fidgets", "Anxiety", "Out",
"TPlays", "TVocal",
    "TMoves", "TTalks", "TObject", "TSmiles", "TLooks", "TInitiat",
"TName", "TPraise", "TContact", "TOut", "TAPlays", "TATalks",
"TAMoves", "TAObject", "TASmiles", "TAName", "TAPraise", "TAContac",
"PlayTotal",
    "LookTotal", "ContactTotal", "Expression", "Difficulty")
target.var

hea.perc=matrix(, nrow=length(sessions)*length(children),
ncol=length(target.var))
res.perc=data.frame(res.perc)
str(res.perc)
colnames(res.perc)=target.var
rownames(res.perc)=paste(rep(children, times=length(sessions)),
rep(sessions, eac=length(children)), sep="_")
res.perc=cbind(res.perc, rep(children, times=length(sessions)),
rep(sessions, eac=length(children)))
colnames(res.perc)[ncol(res.perc)-1]="childID"
res.perc$childID=as.character(res.perc$childID)
colnames(res.perc)[ncol(res.perc)]="sessionID"
res.perc=res.perc[order(res.perc$childID, res.perc$sessionID), ]

for (i in 1:length(children)){               # first loop through
children

    for (j in 1:length(sessions)){           # then loop through
sessions

        for (k in 1:length(target.var)){     # then loop through
columns

            res.perc[paste(children[i], sessions[j], sep="_"),
target.var[k]]=
                as.numeric(sum(xdata[xdata$childID==children[i] &
xdata$sessionID==sessions[j], target.var[k]],
na.rm=T)/length(xdata[xdata$childID==children[i] &
xdata$sessionID==sessions[j], target.var[k]]))
            }
# calculate the percentage the behaviour was observed (sum divided
by length)
        }
    }
str(res.perc)

res.perc$TType=NA
res.perc$verbal=NA
for (i in 1:nrow(transl)){
```

```
res.perc$TType[res.perc$childID==transl$children[i]]=transl$TType[i]

res.perc$verbal[res.perc$childID==transl$children[i]]=transl$verbal[
i]
}
table(res.perc$childID, res.perc$TType, useNA="always")
table(res.perc$childID, res.perc$verbal, useNA="always")

head(res.perc, 20)
summary(res.perc)
write.table(res.perc, file="D:/Laura/Documents/PhD/Video
Analysis/R/Outputs/Percentage_variables_per_child_session.out",
row.names=T, col.names=T, sep="\t", quote=F)


## 4. Plotting time-series for each child and variable
str(res.perc)
table(res.perc$sessionID, res.perc$childID)      # 13 children
length(target.var)                               # 40 variables

target.var=c("Plays", "AsstPlay", "Vocal", "Moves", "Talks",
"Object", "Smiles", "Looks", "LooksTA", "Initiate", "Responds",
"Engaged", "Contact", "ContactTA", "Fidgets", "Anxiety", "Out",
"TPlays", "TVocal",
    "TMoves", "TTalks", "TObject", "TSmiles", "TLooks", "TInitiat",
"TName", "TPraise", "TContact", "TOut", "TAPlays", "TATalks",
"TAMoves", "TAObject", "TASmiles", "TAName", "TAPraise", "TAContac",
"PlayTotal",
    "LookTotal", "ContactTotal", "Expression", "Difficulty")


for (i in 1:length(children)){ # first loop through children

    for (k in 1:length(target.var)){    # then loop through
variables

        png(filename=paste("D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Prop_behavior_", children[i], "_", target.var[k],
".png", sep=""),
            height=15, width=15,
            unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)

        par(mar=c(2.3, 2.4, 2.5, 0.2), mgp=c(1.2, 0.3, 0))

        plot(1:20, res.perc[res.perc$childID==children[i],
target.var[k]],      # x-axis goes from 1:20 sessions, y-axis has
the % value of the target variable
            type="l",
            ylim=c(0,1),
            tcl=-0.25,
            las=1,
            ylab="",
            xaxt="n", xlab="Session number", main=children[i],
font.main=1,
            cex.axis=0.7, cex.lab=0.9,
            lwd=1.5)
        axis(at=seq(from=1, to=19, by=2), labels=FALSE, side=1,
cex.axis=0.7, tcl=-0.25)
        axis(at=seq(from=2, to=20, by=2), labels=seq(from=2, to=20,
by=2), side=1, cex.axis=0.7, tcl=-0.25)
        segments(x0=0, y0=0.3, x1=21, lty=2, col="gray30", lwd=0.8)
        segments(x0=0, y0=0.7, x1=21, lty=2, col="gray30", lwd=0.8)
```

```
        mtext(text=target.var[k], side=2, line=1.5, at=0.5, srt=90,
cex=0.9)
        dev.off()
    }
}


## 5. Models

library(lme4)

# a) First check distribution of response data
str(res.perc)
vars.to.plot=c("PlayTotal", "Vocal", "Moves", "Expression",
"Smiles", "LookTotal", "Initiate", "Responds", "Engaged",
"ContactTotal", "Difficulty", "sessionID")
for (i in 1:length(vars.to.plot)){
    png(filename=paste("D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Data_distribution/", vars.to.plot[i], ".png",
sep=""), height=10, width=10, unit="cm", pointsize=12, bg="white",
res=250, type="windows", restoreConsole=TRUE)
    par(mar=c(2.0, 2.4, 2.0, 0.2), mgp=c(1.2, 0.3, 0))
    hist(res.perc[, vars.to.plot[i]], xlab="", las=1,
main=vars.to.plot[i], tcl=-0.25, cex.lab=0.8, cex.axis=0.7,
cex.main=0.9)
    dev.off()
}

## Response is restricted to range between 0 and 1 which means that
a Gaussian distribution might not be appropriate, because the fitted
response could get values outside of that range
## There might be an excess number of 0's which is often a problem
in model fitting

## => Run full models to check
    # number of 0's and 1's
    # range of fitted values (should be between 0 and 1)
    # distribution of residuals

# b) Prepare model predictors and random effect
res.perc$TType=as.factor(res.perc$TType)
res.perc$verbal=as.factor(res.perc$verbal)
colnames(res.perc)[44]="sessionNr"
res.perc$childID=as.factor(res.perc$childID)
str(res.perc)

# c) fit models
    # i) create subset of data needed for response
    # ii) remove all entries with NAs
    # iii) z-transform covariate sessionNr (mean=0, SD=1)


## 5.1 Play Total

# i)
data.PlayTot=res.perc[, c("PlayTotal", "sessionNr", "TType",
"verbal", "childID")]
# ii)
data.PlayTot=data.PlayTot[complete.cases(data.PlayTot), ]
str(data.PlayTot)
# iii)
round(mean(data.PlayTot$sessionNr), 3)             # 9.856856
round(sd(data.PlayTot$sessionNr), 3)               # 5.406
data.PlayTot$z.sessionNr=as.vector(scale(data.PlayTot$sessionNr))
```

```
summary(data.PlayTot)
sd(data.PlayTot$z.sessionNr)
range(data.PlayTot$PlayTotal) # 0.01923077 0.94166667 => no 0s and
1s

# Full model
full.plays=lmer(PlayTotal ~ z.sessionNr + I(z.sessionNr^2) + TType +
verbal +                 # response and test predictors
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),              # random effects: 1 = random intercept,
'sessionNr + I(sessionNr^2) | childID' defines random slope for
sessionNr^2 in child ID, '|' means that the correlation between
random intercept and random slope is included
                                data=data.PlayTot, REML=F)
range(fitted(full.plays))           # 0.3238119 0.9290695 => this
looks good, no values predicted outside the 0-1 range

# model assumptions
diagnostics.plot(full.plays)        # but residuals for low values
very large in qq-plot
ranef.diagn.plot(full.plays)        # not normally distributed

# save diagnostics plot
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Plays_diagnostics_plot.png", height=10, width=10,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
diagnostics.plot(full.plays)
dev.off()

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Plays_diagnostics_plot_random.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
ranef.diagn.plot(full.plays)
dev.off()

# multicollinearity
library(car)
x.full.plays=lm(PlayTotal ~ z.sessionNr + I(z.sessionNr^2) + TType +
verbal,    data=data.PlayTot)
vif(x.full.plays)

# Null model:
null.plays=lmer(PlayTotal ~ 1 +
# all test predictors   removed
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.PlayTot, REML=F)

# Full-null model comparison
fn.compare.plays=anova(null.plays, full.plays, test="Chisq")
fn.compare.plays
# P-value: 0.1483  => no significant difference between full and
null model

# model results
print(summary(null.plays), corr=F)
print(summary(full.plays), corr=F)
round(summary(full.plays)$coefficients, 3)
summary(full.plays)$varcor
round(ranef(full.plays)$childID, 3)
full.plays.p=as.data.frame(drop1(full.plays, test="Chisq"))
```

```
# save model results
write.table(round(summary(null.plays)$coefficients, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Play_null.out", row.names=T, col.names=T, sep="\t", quote=F)
write.table(round(summary(full.plays)$coefficients, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Play_full_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(summary(full.plays)$varcor,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Play_full_RE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(ranef(full.plays)$childID, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Play_full_RS.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(full.plays.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Play_full_p.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(fn.compare.plays, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Play_full_null_compar.out", row.names=T,
col.names=T, sep="\t", quote=F)

# full model confidence interval
boot.full.play=confint.merMod(object=full.plays)
boot.full.play=boot.glmm.pred(model.res=full.plays, excl.warnings=T,
nboots=1000, level=0.95)
round(boot.full.play$ci.estimates, 3)
write.table(boot.full.play$ci.estimates,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Play_full_CI.out", row.names=T, col.names=T, sep="\t",
quote=F)

# plot
png(filename=" D:/Laura/Documents/PhD/Video
Analysis/R/Plots/PlayTot_raw_data.png", height=15, width=15,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.PlayTot$z.sessionNr, data.PlayTot$PlayTotal, ylim=c(0, 1),
las=1, xaxt="n", xlab="Session number", ylab="", pch=19)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
mtext(text="Play Total", side=2, line=2, at=0.5, srt=90, cex=1)
dev.off()



## 5.2 Look Total
str(res.perc)

data.LookTot=res.perc[, c("LookTotal", "sessionNr", "TType",
"verbal", "childID")]              # i)
data.LookTot=data.LookTot[complete.cases(data.LookTot), ]        #
ii)
str(data.LookTot)

data.LookTot$z.sessionNr=as.vector(scale(data.LookTot$sessionNr))#
iii)
summary(data.LookTot)
range(data.LookTot$LookTotal)       # 0.04237288 0.92727273 => no 0s
and 1s
```

```
full.look=lmer(LookTotal ~ z.sessionNr + I(z.sessionNr^2) + TType +
verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.LookTot, REML=F)
range(fitted(full.look))            # 0.01864816 0.85316883 => no
values predicted outside the 0-1 range
diagnostics.plot(full.look)         # residuals only for smallest
value is a bit larger
ranef.diagn.plot(full.look)         # not really normally
distributed, but not too bad either

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Look_diagnostics_plot.png", height=10, width=10,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
diagnostics.plot(full.look)
dev.off()
png(filename="F:/Lauras_projekt/Model
results/Look_diagnostics_plot_random.png", height=10, width=10,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
ranef.diagn.plot(full.look)
dev.off()

library(car)
x.full.look=lm(LookTotal ~ z.sessionNr + I(z.sessionNr^2) + TType +
verbal, data=data.LookTot)
vif(x.full.look)

null.look=lmer(LookTotal ~ 1 +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.LookTot, REML=F)
fn.compare.look=anova(null.look, full.look, test="Chisq")
fn.compare.look
# P-value: 0.000684 => significant difference between full and null
model

write.table(round(summary(null.look)$coefficients, 3), file="
D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Look_null.out", row.names=T, col.names=T, sep="\t", quote=F)
write.table(fn.compare.look, file=" D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Look_full_null_compar.out", row.names=T,
col.names=T, sep="\t", quote=F)

# inference full model
round(summary(full.look)$coefficients, 3)
# fixed effects
full.look.p=as.data.frame(drop1(full.look, test="Chisq"))
round(full.look.p, 3)
                 # Df      AIC   LRT Pr(Chi)
# <none>           NA -287.664    NA      NA
# z.sessionNr       1 -283.537 6.127   0.013
# I(z.sessionNr^2)  1 -286.828 2.836   0.092
# TType             1 -289.455 0.209   0.647
# verbal            1 -282.532 7.132   0.008

write.table(round(summary(full.look)$coefficients, 3), file=
"D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Look_full_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(summary(full.look)$varcor,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
```

```
results/Look_full_RE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(ranef(full.look)$childID, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Look_full_RS.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(full.look.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Look_full_p.out", row.names=T, col.names=T, sep="\t",
quote=F)

# full model stability
stab.full.look=glmm.model.stab(model.res=full.look)
stab.full.look$summary
write.table(stab.full.look$summary, file="F:/Lauras_projekt/Model
results/Look_full_stability.out", row.names=T, col.names=T,
sep="\t", quote=F)

# full model confidence interval
boot.full.look=confint.merMod(object=full.look)
write.table(boot.full.look, file="F:/Lauras_projekt/Model
results/Look_full_CI.out", row.names=T, col.names=T, sep="\t",
quote=F)

# reduced model
    # => squared term not significant (p=0.092), not possible to
infer effect of linear term
    # => run reduced model not including the squared term

red.look=lmer(LookTotal ~ z.sessionNr + TType + verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.LookTot, REML=F)
range(fitted(red.look))
# 0.04542774 0.88841627
round(summary(red.look)$coefficients, 3)
# fixed effects
red.look.p=as.data.frame(drop1(red.look, test="Chisq"))
round(red.look.p, 3)
            # Df       AIC    LRT Pr(Chi)
# <none>       NA -286.828     NA      NA
# z.sessionNr  1 -280.968 7.861   0.005
# TType        1 -288.520 0.308   0.579
# verbal       1 -281.924 6.904   0.009
write.table(round(summary(red.look)$coefficients, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Look_red_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(summary(red.look)$varcor,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Look_red_RE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(ranef(red.look)$childID, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Look_red_RS.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(red.look.p, 3), file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Look_red_p.out", row.names=T, col.names=T,
sep="\t", quote=F)

# red model stability
stab.red.look=glmm.model.stab(model.res=red.look)
stab.red.look$summary
```

```
write.table(stab.red.look$summary,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Look_red_stability.out", row.names=T, col.names=T, sep="\t",
quote=F)

# red model confidence interval
boot.red.look=confint.merMod(object=red.look)
write.table(boot.red.look, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Look_red_CI.out", row.names=T, col.names=T,
sep="\t", quote=F)


## Plot result for Look Total for reduced model
data.LookTot$verbal
as.numeric(data.LookTot$verbal)
x.lab.1=seq(from=2, to=20, by=2)
x.at.1=(x.lab.1-
mean(data.LookTot$sessionNr))/sd(data.LookTot$sessionNr)
x.lab.2=seq(from=1, to=19, by=2)
x.at.2=(x.lab.2-
mean(data.LookTot$sessionNr))/sd(data.LookTot$sessionNr)

# Therapy intensity was not significant, but still had an effect.
For plotting, we centre the predictor, to show it at the average of
low/high intensity.
ttype.code=as.numeric(data.LookTot$TType==levels(data.LookTot$TType)
[2])
ttype.code=ttype.code-mean(ttype.code)
plot.red.look=lmer(LookTotal ~ z.sessionNr + ttype.code + verbal +
(1 + z.sessionNr + I(z.sessionNr^2) | childID), data=data.LookTot,
REML=F)
est.plot.red.look=summary(plot.red.look)$coefficients[, "Estimate"]

cols=c("gray40", "red")

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Look_result_plot_red_model.png", height=15,
width=15, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.LookTot$z.sessionNr, data.LookTot$LookTotal, ylim=c(0,1),
las=1,
    xaxt="n", xlab="Session number", ylab="Look Total",
    col=cols[as.numeric(data.LookTot$verbal)], pch=19)
legend("topleft", legend=c("verbal", "non-verbal"), col=c("red",
"gray40"), pch=19, cex=0.9)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
abline(a=est.plot.red.look["(Intercept)"],
b=est.plot.red.look["z.sessionNr"], lwd=2, lty=1, col="gray40")#
non-verbal
abline(a=est.plot.red.look["(Intercept)"]+est.plot.red.look["verbal1
"], b=est.plot.red.look["z.sessionNr"], lwd=2, lty=1, col="red")    #
verbal
dev.off()


## 5.3 Contact Total - Beta distribution
str(res.perc)

data.ConTot=res.perc[, c("ContactTotal", "sessionNr", "TType",
"verbal", "childID")]
data.ConTot=data.ConTot[complete.cases(data.ConTot), ]
str(data.ConTot)
```

```

data.ConTot$z.sessionNr=as.vector(scale(data.ConTot$sessionNr))
summary(data.ConTot)
range(data.ConTot$ContactTotal)      # 0.0000 0.5625

transf.par=0.000001
data.ConTot$tr.ContactTotal=data.ConTot$ContactTotal*(1-
transf.par*2)+transf.par
table(data.ConTot$tr.ContactTotal)

# full model

    ## NOTE: full model did not converge when the correlation
between random intercept and slope was included, so the interaction
was excluded

full.con=glmmTMB(tr.ContactTotal ~ z.sessionNr + I(z.sessionNr^2) +
TType + verbal +
                                 (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),                        # correlation between random
intercept and slope excluded (i.e., || instead of |)
                                 data=data.ConTot,
family=list(family="beta", link="logit"))

null.con=glmmTMB(tr.ContactTotal ~ 1 +
                                 (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),                         # correlation between random
intercept and slope excluded (i.e., || instead of |)
                                 data=data.ConTot,
family=list(family="beta", link="logit"))

fn.compare.con=anova(null.con, full.con, test="Chisq")
fn.compare.con
# P-value: 0.2094 => not-significant
write.table(round(summary(full.con)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Contact_beta_full_FE.out", row.names=T, col.names=T,
sep="\t", quote=F)

full.con.b.p=as.data.frame(drop1(full.con, test="Chisq"))
round(full.con.b.p, 3)
write.table(round(full.con.b.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Contact_beta_full_p.out", row.names=T, col.names=T,
sep="\t", quote=F)

# full model confidence interval
boot.full.con.b=confint(object=full.con)
write.table(boot.full.con.b, file="G:/Lauras_projekt/Model
results/Contact_beta_full_CI.out", row.names=T, col.names=T,
sep="\t", quote=F)

# Plot
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Contact_raw_data.png", height=15, width=15,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.ConTot$z.sessionNr, data.ConTot$ContactTotal, ylim=c(0,
1), las=1, xaxt="n", xlab="Session number", ylab="", pch=19)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
mtext(text="Contact Total", side=2, line=2, at=0.5, srt=90, cex=1)
dev.off()
```

```
## 5.4 Initiate
str(res.perc)

data.Initiate=res.perc[, c("Initiate", "sessionNr", "TType",
"verbal", "childID")]
data.Initiate=data.Initiate[complete.cases(data.Initiate), ]
str(data.Initiate)

data.Initiate$z.sessionNr=as.vector(scale(data.Initiate$sessionNr))
summary(data.Initiate)
range(data.Initiate$Initiate)          # 0.01785714 0.41666667

full.Initiate=lmer(Initiate ~ z.sessionNr + I(z.sessionNr^2) + TType
+ verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Initiate, REML=F)

# diagnostics
range(fitted(full.Initiate))                # 0.03595003 0.29599762
diagnostics.plot(full.Initiate)
ranef.diagn.plot(full.Initiate)

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Initiate_diagnostics_plot.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
diagnostics.plot(full.Initiate)
dev.off()
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Initiate_diagnostics_plot_random.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
ranef.diagn.plot(full.Initiate)
dev.off()

library(car)
x.full.Initiate=lm(Initiate ~ z.sessionNr + I(z.sessionNr^2) + TType
+ verbal,  data=data.Initiate)
vif(x.full.Initiate)

null.Initiate=lmer(Initiate ~ 1 +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Initiate, REML=F)
fn.compare.Initiate=anova(null.Initiate, full.Initiate,
test="Chisq")
fn.compare.Initiate
# P-value: 1.242e-05 => significant difference between full and null
model
write.table(round(summary(null.Initiate)$coefficients, 3),
file="D:/Lauras_projekt/Model results/Initiate_null.out",
row.names=T, col.names=T, sep="\t", quote=F)
write.table(fn.compare.Initiate, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Initiate_full_null_compar.out",
row.names=T, col.names=T, sep="\t", quote=F)

# inference full model
round(summary(full.Initiate)$coefficients, 3)
# fixed effects
full.Initiate.p=as.data.frame(drop1(full.Initiate, test="Chisq"))
round(full.Initiate.p, 3)
```

```
                  # Df      AIC    LRT Pr(Chi)
# <none>            NA -689.996     NA      NA
# z.sessionNr        1 -675.010 16.986   0.000
# I(z.sessionNr^2)   1 -682.483  9.513   0.002
# TType              1 -690.436  1.561   0.212
# verbal             1 -682.870  9.127   0.003
write.table(round(summary(full.Initiate)$coefficients, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Initiate_full_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(summary(full.Initiate)$varcor,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Initiate_full_RE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(ranef(full.Initiate)$childID, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Initiate_full_RS.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(full.Initiate.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Initiate_full_p.out", row.names=T, col.names=T, sep="\t",
quote=F)

# full model stability
stab.full.Initiate=glmm.model.stab(model.res=full.Initiate)
stab.full.Initiate$summary
write.table(stab.full.Initiate$summary,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Initiate_full_stability.out", row.names=T, col.names=T,
sep="\t", quote=F)

# full model confidence interval
boot.full.Initiate=confint.merMod(object=full.Initiate)
write.table(boot.full.Initiate, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Initiate_full_CI.out", row.names=T,
col.names=T, sep="\t", quote=F)

# Plot
x.lab.1=seq(from=2, to=20, by=2)
x.at.1=(x.lab.1-
mean(data.Initiate$sessionNr))/sd(data.Initiate$sessionNr)
x.lab.2=seq(from=1, to=19, by=2)
x.at.2=(x.lab.2-
mean(data.Initiate$sessionNr))/sd(data.Initiate$sessionNr)

ttype.code=as.numeric(data.Initiate$TType==levels(data.Initiate$TTyp
e)[2])
ttype.code=ttype.code-mean(ttype.code)
plot.full.Initiate=lmer(Initiate ~ z.sessionNr + I(z.sessionNr^2) +
ttype.code + verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Initiate, REML=F)
est.plot.full.Initiate=summary(plot.full.Initiate)$coefficients[,
"Estimate"]
x.vals=seq(from=min(data.Initiate$z.sessionNr),
to=max(data.Initiate$z.sessionNr), length.out=100)
y.vals.non=est.plot.full.Initiate["(Intercept)"]+est.plot.full.Initi
ate["z.sessionNr"]*x.vals+est.plot.full.Initiate["I(z.sessionNr^2)"]
*x.vals^2
y.vals.verb=est.plot.full.Initiate["(Intercept)"]+est.plot.full.Init
iate["verbal1"]+est.plot.full.Initiate["z.sessionNr"]*x.vals+est.plo
t.full.Initiate["I(z.sessionNr^2)"]*x.vals^2
```

```
cols=c("gray40", "red")

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Initiate_result_plot_full_model.png", height=15,
width=15, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.Initiate$z.sessionNr, data.Initiate$Initiate, ylim=c(0,
1), las=1,
    xaxt="n", xlab="Session number", ylab="Initiate",
    col=cols[as.numeric(data.Initiate$verbal)], pch=19)
legend("topright", legend=c("verbal", "non-verbal"), col=c("red",
"gray40"), pch=19)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
lines(x=x.vals, y=y.vals.non, lwd=2, lty=1, col="gray40")
lines(x=x.vals, y=y.vals.verb, lwd=2, lty=1, col="red")
dev.off()


## 5.5 Respond
str(res.perc)

data.Responds=res.perc[, c("Responds", "sessionNr", "TType",
"verbal", "childID")]
data.Responds=data.Responds[complete.cases(data.Responds), ]
str(data.Responds)

data.Responds$z.sessionNr=as.vector(scale(data.Responds$sessionNr))
summary(data.Responds)
range(data.Responds$Responds)           # 0.01785714 0.41666667

full.Responds=lmer(Responds ~ z.sessionNr + I(z.sessionNr^2) + TType
+ verbal +
                                 (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                 data=data.Responds, REML=F)

range(fitted(full.Responds))             # 0.03595003 0.29599762
diagnostics.plot(full.Responds)
ranef.diagn.plot(full.Responds)

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Responds_diagnostics_plot.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
diagnostics.plot(full.Responds)
dev.off()
png(filename="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Responds_diagnostics_plot_random.png", height=10, width=10,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
ranef.diagn.plot(full.Responds)
dev.off()

library(car)
x.full.Responds=lm(Responds ~ z.sessionNr + I(z.sessionNr^2) + TType
+ verbal,  data=data.Responds)
vif(x.full.Responds)

null.Responds=lmer(Responds ~ 1 +
                                 (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                 data=data.Responds, REML=F)
```

```
fn.compare.Responds=anova(null.Responds, full.Responds,
test="Chisq")
fn.compare.Responds
# P-value: 0.0883 => not significant

write.table(round(summary(null.Responds)$coefficients, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Responds_null.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(summary(full.Responds)$coefficients, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Responds_full.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(fn.compare.Responds, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Responds_full_null_compar.out",
row.names=T, col.names=T, sep="\t", quote=F)

full.Responds.p=as.data.frame(drop1(full.Responds, test="Chisq"))
write.table(round(full.Responds.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Responds_full_p.out", row.names=T, col.names=T, sep="\t",
quote=F)

# full model confidence interval
boot.full.Responds=boot.glmm.pred(model.res=full.Responds,
excl.warnings=T, nboots=1000, level=0.95)
round(boot.full.Responds$ci.estimates, 3)
write.table(boot.full.Responds$ci.estimates,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Responds_full_CI.out", row.names=T, col.names=T, sep="\t",
quote=F)

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Responds_raw_data.png", height=15, width=15,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.Responds$z.sessionNr, data.Responds$Responds, ylim=c(0,
1), las=1,
    xaxt="n", xlab="Session number", ylab="Respond", pch=19)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
dev.off()


## 5.6 Smile
str(res.perc)

data.Smiles=res.perc[, c("Smiles", "sessionNr", "TType", "verbal",
"childID")]
data.Smiles=data.Smiles[complete.cases(data.Smiles), ]
str(data.Smiles)

data.Smiles$z.sessionNr=as.vector(scale(data.Smiles$sessionNr))
summary(data.Smiles)
range(data.Smiles$Smiles)                # 0.0000000 0.9821429

full.Smiles=lmer(Smiles ~ z.sessionNr + I(z.sessionNr^2) + TType +
verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Smiles, REML=F)

range(fitted(full.Smiles))               # 0.0565329 0.7974566
```

```
diagnostics.plot(full.Smiles)
ranef.diagn.plot(full.Smiles)

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Smiles_diagnostics_plot.png", height=10, width=10,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
diagnostics.plot(full.Smiles)
dev.off()
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Smiles_diagnostics_plot_random.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
ranef.diagn.plot(full.Smiles)
dev.off()

library(car)
x.full.Smiles=lm(Smiles ~ z.sessionNr + I(z.sessionNr^2) + TType +
verbal,  data=data.Smiles)
vif(x.full.Smiles)

null.Smiles=lmer(Smiles ~ 1 +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Smiles, REML=F)
fn.compare.Smiles=anova(null.Smiles, full.Smiles, test="Chisq")
fn.compare.Smiles
# P-value: 2.567e-06 => significant difference between full and null
model

write.table(round(summary(null.Smiles)$coefficients, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Smiles_null.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(fn.compare.Smiles, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Smiles_full_null_compar.out", row.names=T,
col.names=T, sep="\t", quote=F)

round(summary(full.Smiles)$coefficients, 3)
full.Smiles.p=as.data.frame(drop1(full.Smiles, test="Chisq"))
round(full.Smiles.p, 3)
                 # Df      AIC    LRT  Pr(Chi)
# <none>           NA -192.286     NA       NA
# z.sessionNr       1 -174.103 20.183    0.000
# I(z.sessionNr^2)  1 -190.473  3.813    0.051
# TType             1 -183.220 11.065    0.001
# verbal            1 -192.912  1.374    0.241

write.table(round(summary(full.Smiles)$coefficients, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Smiles_full_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(summary(full.Smiles)$varcor,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Smiles_full_RE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(ranef(full.Smiles)$childID, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Smiles_full_RS.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(full.Smiles.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Smiles_full_p.out", row.names=T, col.names=T, sep="\t",
quote=F)
```

```
# full model stability
stab.full.Smiles=glmm.model.stab(model.res=full.Smiles)
stab.full.Smiles$summary
write.table(stab.full.Smiles$summary,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Smiles_full_stability.out", row.names=T, col.names=T,
sep="\t", quote=F)

# full model confidence interval
boot.full.Smiles=confint.merMod(object=full.Smiles)
write.table(boot.full.Smiles, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Smiles_full_CI.out", row.names=T,
col.names=T, sep="\t", quote=F)

# reduced/final model
red.Smiles=lmer(Smiles ~ z.sessionNr + TType + verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Smiles, REML=F)
range(fitted(red.Smiles))                              # 0.0668137
0.8106904
round(summary(red.Smiles)$coefficients, 3)
red.Smiles.p=as.data.frame(drop1(red.Smiles, test="Chisq"))
round(red.Smiles.p, 3)
            # Df      AIC    LRT Pr(Chi)
# <none>       NA -190.473     NA      NA
# z.sessionNr  1 -175.226 17.246   0.000
# TType        1 -181.552 10.921   0.001
# verbal       1 -191.041  1.432   0.231

write.table(round(summary(red.Smiles)$coefficients, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Smiles_red_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(summary(red.Smiles)$varcor,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Smiles_red_RE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(ranef(red.Smiles)$childID, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Smiles_red_RS.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(red.Smiles.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Smiles_red_p.out", row.names=T, col.names=T, sep="\t",
quote=F)

# red model stability
stab.red.Smiles=glmm.model.stab(model.res=red.Smiles)
stab.red.Smiles$summary
write.table(stab.red.Smiles$summary,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Smiles_red_stability.out", row.names=T, col.names=T,
sep="\t", quote=F)

# red model confidence interval
boot.red.Smiles=confint.merMod(object=red.Smiles)
boot.red.Smiles.2=boot.glmm.pred(model.res=red.Smiles,
excl.warnings=T, nboots=1000, level=0.95)
round(boot.red.Smiles.2$ci.estimates, 3)
write.table(boot.red.Smiles.2$ci.estimates,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
```

```
results/Smiles_red_CI.out", row.names=T, col.names=T, sep="\t",
quote=F)

# plot for final (reduced) model
x.lab.1=seq(from=2, to=20, by=2)
x.at.1=(x.lab.1-
mean(data.Smiles$sessionNr))/sd(data.Smiles$sessionNr)
x.lab.2=seq(from=1, to=19, by=2)
x.at.2=(x.lab.2-
mean(data.Smiles$sessionNr))/sd(data.Smiles$sessionNr)

# Verbal ability was not significant, but still had an effect. For
plotting, we centre the predictor to show it at the average of
verbal/non-verbal.
verbal.code=as.numeric(data.Smiles$verbal==levels(data.Smiles$verbal
)[2])
verbal.code=verbal.code-mean(verbal.code)
plot.red.Smiles=lmer(Smiles ~ z.sessionNr + TType + verbal.code + (1
+ z.sessionNr + I(z.sessionNr^2) | childID), data=data.Smiles,
REML=F)
est.plot.red.Smiles=summary(plot.red.Smiles)$coefficients[,
"Estimate"]

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Smiles_result_plot_red_model.png", height=15,
width=15, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.Smiles$z.sessionNr, data.Smiles$Smiles, ylim=c(0, 1),
las=1,
    xaxt="n", xlab="Session number", ylab="Smile",
    col=as.numeric(data.Smiles$TType)+2, pch=19)
legend("topleft", legend=c("high-intensity therapy", "low-intensity
therapy"), col=c(4,3), pch=19, cex=0.9)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
abline(a=est.plot.red.Smiles["(Intercept)"],
b=est.plot.red.Smiles["z.sessionNr"], lwd=2, lty=1, col="green")#
non-verb
abline(a=est.plot.red.Smiles["(Intercept)"]+est.plot.red.Smiles["TTy
pe3"], b=est.plot.red.Smiles["z.sessionNr"], lwd=2, lty=1,
col="blue")  # verbal
dev.off()


## 5.7 ACTR index
ACTR.data=read.table(file="D:/Laura/Documents/PhD/Video
Analysis/R/Original_data/ACTR_Table.txt", header=T, row.names=1,
comment.char="", as.is=T, quote="", fill=T, sep="\t")
str(ACTR.data)
head(ACTR.data)
summary(ACTR.data)
hist(ACTR.data$ACTR)
colnames(ACTR.data)[3]="sessionNr"
ACTR.data$TType=as.factor(ACTR.data$TType)
ACTR.data$verbal=as.factor(ACTR.data$verbal)
ACTR.data$childID=as.factor(ACTR.data$childID)
str(ACTR.data)

# plot of raw data for each child
for (i in 1:length(children)){             # first loop through
children
```

```
    png(filename=paste("D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Prop_behavior_", children[i], "_ACTR", ".png",
sep=""),
        height=15, width=15,
        unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)

    par(mar=c(2.3, 2.4, 2.5, 0.2), mgp=c(1.2, 0.3, 0))

    plot(1:20, ACTR.data[ACTR.data$childID==children[i], 1],
            type="l",
            ylim=c(1,5),
            tcl=-0.25,
            las=1,
            ylab="",
            xaxt="n", xlab="Session number", main=children[i],
font.main=1,
            cex.axis=0.7, cex.lab=0.9,
            lwd=1.5)
        axis(at=seq(from=1, to=19, by=2), labels=FALSE, side=1,
cex.axis=0.7, tcl=-0.25)
        axis(at=seq(from=2, to=20, by=2), labels=seq(from=2, to=20,
by=2), side=1, cex.axis=0.7, tcl=-0.25)
        axis(at=seq(from=1, to=5, by=0.2), labels=FALSE, side=2,
cex.axis=0.7, tcl=-0.25)

        segments(x0=0, y0=2.2, x1=21, lty=2, col="gray30", lwd=0.8)
        segments(x0=0, y0=3.8, x1=21, lty=2, col="gray30", lwd=0.8)
        mtext(text="ACTR", side=2, line=1.5, at=3, srt=90, cex=0.9)
        dev.off()
    }

data.ACTR=ACTR.data[, c("ACTR", "sessionNr", "TType", "verbal",
"childID")]
data.ACTR=data.ACTR[complete.cases(data.ACTR), ]
str(data.ACTR)

data.ACTR$z.sessionNr=as.vector(scale(data.ACTR$sessionNr))
summary(data.ACTR)
range(data.ACTR$ACTR)                        # 1.6  5.0

# 5.7.1 Gaussian distribution
full.ACTR=lmer(ACTR ~ z.sessionNr + I(z.sessionNr^2) + TType +
verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.ACTR, REML=F)

range(fitted(full.ACTR))                     # 1.919584 4.888555
diagnostics.plot(full.ACTR)
ranef.diagn.plot(full.ACTR)

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/ACTR_diagnostics_plot.png", height=10, width=10,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
diagnostics.plot(full.ACTR)
dev.off()
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/ACTR_diagnostics_plot_random.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
ranef.diagn.plot(full.ACTR)
dev.off()
```

```
library(car)
x.full.ACTR=lm(ACTR ~ z.sessionNr + I(z.sessionNr^2) + TType +
verbal,  data=data.ACTR)
vif(x.full.ACTR)

null.ACTR=lmer(ACTR ~ 1 +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.ACTR, REML=F)
fn.compare.ACTR=anova(null.ACTR, full.ACTR, test="Chisq")
fn.compare.ACTR
# P-value: 1.213e-09 => significant difference between full and null
model
write.table(round(summary(null.ACTR)$coefficients, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/ACTR_null.out", row.names=T, col.names=T, sep="\t", quote=F)
write.table(fn.compare.ACTR, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/ACTR_full_null_compar.out", row.names=T,
col.names=T, sep="\t", quote=F)

round(summary(full.ACTR)$coefficients, 3)
full.ACTR.p=as.data.frame(drop1(full.ACTR, test="Chisq"))
round(full.ACTR.p, 3)
                 # Df     AIC    LRT Pr(Chi)
# <none>           NA 151.622     NA      NA
# z.sessionNr       1 188.935 39.313   0.000
# I(z.sessionNr^2)  1 163.065 13.443   0.000
# TType             1 153.686  4.064   0.044
# verbal            1 157.952  8.330   0.004

write.table(round(summary(full.ACTR)$coefficients, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/ACTR_full_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(summary(full.ACTR)$varcor,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/ACTR_full_RE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(ranef(full.ACTR)$childID, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/ACTR_full_RS.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(full.ACTR.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/ACTR_full_p.out", row.names=T, col.names=T, sep="\t",
quote=F)

# full model stability
stab.full.ACTR=glmm.model.stab(model.res=full.ACTR)
stab.full.ACTR$summary
write.table(stab.full.ACTR$summary,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/ACTR_full_stability.out", row.names=T, col.names=T,
sep="\t", quote=F)

# full model confidence interval
boot.full.ACTR=confint.merMod(object=full.ACTR)
write.table(boot.full.ACTR, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/ACTR_full_CI.out", row.names=T,
col.names=T, sep="\t", quote=F)

# 5.7.2 Beta distribution
data.ACTR$tr.ACTR=(data.ACTR$ACTR-1)/4
```

```
summary(data.ACTR)

transf.par=0.000001
data.ACTR$tr.ACTR=data.ACTR$tr.ACTR*(1-transf.par*2)+transf.par
table(data.ACTR$tr.ACTR)

full.ACTR.b=glmmTMB(tr.ACTR ~ z.sessionNr + I(z.sessionNr^2) + TType
+ verbal +
                                  (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                  data=data.ACTR,
family=list(family="beta", link="logit"))

null.ACTR.b=glmmTMB(tr.ACTR ~ 1 +
                                  (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                  data=data.ACTR,
family=list(family="beta", link="logit"))

fn.compare.ACTR.b=anova(null.ACTR.b, full.ACTR.b, test="Chisq")
fn.compare.ACTR.b
# P-value: 3.266e-07 => significant difference between full and null
model

write.table(round(summary(null.ACTR.b)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/ACTR_beta_null.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(fn.compare.ACTR.b, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/ACTR_beta_full_null_compar.out",
row.names=T, col.names=T, sep="\t", quote=F)

round(summary(full.ACTR.b)$coefficients$cond, 3)
full.ACTR.b.p=as.data.frame(drop1(full.ACTR.b, test="Chisq"))
round(full.ACTR.b.p, 3)
write.table(round(summary(full.ACTR.b)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/ACTR_beta_full_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(full.ACTR.b.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/ACTR_beta_full_p.out", row.names=T, col.names=T, sep="\t",
quote=F)

# full model confidence interval
boot.full.ACTR.b=confint(object=full.ACTR.b)
write.table(boot.full.ACTR.b, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/ACTR_beta_full_CI.out", row.names=T,
col.names=T, sep="\t", quote=F)

# reduced/final model
red.ACTR.b=glmmTMB(tr.ACTR ~ z.sessionNr + TType + verbal +
                                  (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                  data=data.ACTR,
family=list(family="beta", link="logit"))

round(summary(red.ACTR.b)$coefficients$cond, 3)
red.ACTR.b.p=as.data.frame(drop1(red.ACTR.b, test="Chisq"))
round(red.ACTR.b.p, 3)
write.table(round(summary(red.ACTR.b)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/ACTR_beta_red_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
```

```
write.table(round(red.ACTR.b.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/ACTR_beta_red_p.out", row.names=T, col.names=T, sep="\t",
quote=F)

# red model confidence interval
boot.red.ACTR.b=confint(object=red.ACTR.b)
write.table(boot.red.ACTR.b, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/ACTR_beta_red_CI.out", row.names=T,
col.names=T, sep="\t", quote=F)

# plot for final (reduced) model
ttype.code=as.numeric(data.ACTR$TType==levels(data.ACTR$TType)[2])
ttype.code=ttype.code-mean(ttype.code)
plot.red.ACTR.b=glmmTMB(tr.ACTR ~ z.sessionNr + ttype.code + verbal
+
                                  (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                  data=data.ACTR,
family=list(family="beta", link="logit"))
est.plot.red.ACTR.b=summary(plot.red.ACTR.b)$coefficients$cond[,
"Estimate"]

# results are in logit space, so estimates need to be converted to
linear space
x.vals=seq(from=min(data.ACTR$z.sessionNr),
to=max(data.ACTR$z.sessionNr), length.out=100)
LP.non=est.plot.red.ACTR.b["(Intercept)"]+est.plot.red.ACTR.b["z.ses
sionNr"]*x.vals
LP.verb=est.plot.red.ACTR.b["(Intercept)"]+est.plot.red.ACTR.b["verb
al1"]+est.plot.red.ACTR.b["z.sessionNr"]*x.vals
y.vals.non=(exp(LP.non))/(1+exp(LP.non))
y.vals.verb=exp(LP.verb)/(1+exp(LP.verb))

y.lab.1=seq(from=1, to=5, by=1)
y.at.1=(y.lab.1-1)/4
y.lab.2=seq(from=1, to=5, by=0.2)
y.at.2=(y.lab.2-1)/4

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/ACTR_beta_result_plot_red_model.png", height=15,
width=15, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.ACTR$z.sessionNr, data.ACTR$tr.ACTR, las=1, ylim=c(0, 1),
    xaxt="n", yaxt="n", xlab="Session number", ylab="ACTR",
    col=as.numeric(data.ACTR$verbal), pch=19)
legend("bottomright", legend=c("verbal", "non-verbal"), col=c(2,1),
pch=19)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
axis(at=y.at.1, labels=y.lab.1, side=2, las=1)
axis(at=y.at.2, labels=FALSE, side=2)
lines(x=x.vals, y=y.vals.non, lwd=2, lty=1, col="black")
lines(x=x.vals, y=y.vals.verb, lwd=2, lty=1, col="red")
dev.off()


## 5.8 Vocal
data.Vocal=res.perc[, c("Vocal", "sessionNr", "TType", "verbal",
"childID")]
data.Vocal=data.Vocal[complete.cases(data.Vocal), ]
str(data.Vocal)
data.Vocal$z.sessionNr=as.vector(scale(data.Vocal$sessionNr))
```

```
summary(data.Vocal)
range(data.Vocal$Vocal)                  # 0.0000000 0.7446809

# 5.8.1 Gaussian
full.Vocal=lmer(Vocal ~ z.sessionNr + I(z.sessionNr^2) + TType +
verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Vocal, REML=F)

range(fitted(full.Vocal))                       # 0.007867882
0.618439289
diagnostics.plot(full.Vocal)
ranef.diagn.plot(full.Vocal)
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Vocal_diagnostics_plot.png", height=10, width=10,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
diagnostics.plot(full.Vocal)
dev.off()
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Vocal_diagnostics_plot_random.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
ranef.diagn.plot(full.Vocal)
dev.off()

null.Vocal=lmer(Vocal ~ 1 +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Vocal, REML=F)
fn.compare.Vocal=anova(null.Vocal, full.Vocal, test="Chisq")
# p-value: 0.01179 => significant difference between full and null
model

write.table(fn.compare.Vocal, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Vocal_normal_full_null_compar.out",
row.names=T, col.names=T, sep="\t", quote=F)

# 5.8.2 Beta
transf.par=0.000001
data.Vocal$tr.Vocal=data.Vocal$Vocal*(1-transf.par*2)+transf.par
table(data.Vocal$tr.Vocal)

# full model
full.Vocal.b=glmmTMB(tr.Vocal ~ z.sessionNr + I(z.sessionNr^2) +
TType + verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Vocal,
family=list(family="beta", link="logit"))
summary(full.Vocal.b)

null.Vocal.b=glmmTMB(tr.Vocal ~ 1 +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Vocal,
family=list(family="beta", link="logit"))
summary(null.Vocal.b)

fn.compare.Vocal.b=anova(null.Vocal.b, full.Vocal.b, test="Chisq")
fn.compare.Vocal.b
# p-value: 0.05633 => not-significant
```

```
write.table(fn.compare.Vocal.b, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Vocal_beta_full_null_compar.out",
row.names=T, col.names=T, sep="\t", quote=F)

round(summary(full.Vocal.b)$coefficients$cond, 3)
full.Vocal.b.p=as.data.frame(drop1(full.Vocal.b, test="Chisq"))
round(full.Vocal.b.p, 3)
write.table(round(summary(full.Vocal.b)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Vocal_beta_full_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(full.Vocal.b.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Vocal_beta_full_p.out", row.names=T, col.names=T, sep="\t",
quote=F)

# full model confidence interval
boot.full.Vocal.b=confint(object=full.Vocal.b)
write.table(boot.full.Vocal.b, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Vocal_beta_full_CI.out", row.names=T,
col.names=T, sep="\t", quote=F)

# Plot
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Vocal_raw_data.png", height=15, width=15,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.Vocal$z.sessionNr, data.Vocal$Vocal, ylim=c(0, 1), las=1,
xaxt="n", xlab="Session number", ylab="", pch=19)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
mtext(text="Vocal", side=2, line=2, at=0.5, srt=90, cex=1)
dev.off()

# check random effects
summary(full.Vocal.b)$varcor
round(ranef(full.Vocal.b)[[1]]$childID, 3)
write.table(summary(full.Vocal.b)$varcor,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Vocal_beta_full_RE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(ranef(full.Vocal.b)[[1]]$childID, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Vocal_beta_full_RS.out", row.names=T, col.names=T, sep="\t",
quote=F)


## 5.9 Move
data.Moves=res.perc[, c("Moves", "sessionNr", "TType", "verbal",
"childID")]
data.Moves=data.Moves[complete.cases(data.Moves), ]
str(data.Moves)
data.Moves$z.sessionNr=as.vector(scale(data.Moves$sessionNr))
summary(data.Moves)
range(data.Moves$Moves)               # 0.0 0.5

# 5.9.1 Gaussian
full.Moves=lmer(Moves ~ z.sessionNr + I(z.sessionNr^2) + TType +
verbal +
                                 (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                 data=data.Moves, REML=F)
```

```
range(fitted(full.Moves))                    # 0.003360086 0.395455749
diagnostics.plot(full.Moves)
ranef.diagn.plot(full.Moves)
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Moves_diagnostics_plot.png", height=10, width=10,
unit="cm", pointsize=12, bg="white", res=250, type="windows",
restoreConsole=TRUE)
diagnostics.plot(full.Moves)
dev.off()
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Moves_diagnostics_plot_random.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
ranef.diagn.plot(full.Moves)
dev.off()

# 5.9.2 Beta distribution
transf.par=0.000001
data.Moves$tr.Moves=data.Moves$Moves*(1-transf.par*2)+transf.par
table(data.Moves$tr.Moves)

# full model
full.Moves.b=glmmTMB(tr.Moves ~ z.sessionNr + I(z.sessionNr^2) +
TType + verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                data=data.Moves,
family=list(family="beta", link="logit"))

null.Moves.b=glmmTMB(tr.Moves ~ 1 +
                                (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                data=data.Moves,
family=list(family="beta", link="logit"))

fn.compare.Moves.b=anova(null.Moves.b, full.Moves.b, test="Chisq")
fn.compare.Moves.b
# p-value: 0.01033 => significant difference between full and null
model

round(summary(full.Moves.b)$coefficients$cond, 3)
full.Moves.b.p=as.data.frame(drop1(full.Moves.b, test="Chisq"))
round(full.Moves.b.p, 3)
write.table(round(summary(full.Moves.b)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Moves_beta_full_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(full.Moves.b.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Moves_beta_full_p.out", row.names=T, col.names=T, sep="\t",
quote=F)

# full model confidence interval
boot.full.Moves.b=confint(object=full.Moves.b)
write.table(boot.full.Moves.b, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Moves_beta_full_CI.out", row.names=T,
col.names=T, sep="\t", quote=F)

# reduced/final model
red.Moves.b=glmmTMB(tr.Moves ~ z.sessionNr + TType + verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                data=data.Moves,
family=list(family="beta", link="logit"))
```

```
round(summary(red.Moves.b)$coefficients$cond, 3)
red.Moves.b.p=as.data.frame(drop1(red.Moves.b, test="Chisq"))
round(red.Moves.b.p, 3)
write.table(round(summary(red.Moves.b)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Moves_beta_red_FE.out", row.names=T, col.names=T, sep="\t",
quote=F)
write.table(round(red.Moves.b.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Moves_beta_red_p.out", row.names=T, col.names=T, sep="\t",
quote=F)

# red model confidence interval
    boot.red.Moves.b=confint(object=red.Moves.b)
    write.table(boot.red.Moves.b, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Moves_beta_red_CI.out", row.names=T,
col.names=T, sep="\t", quote=F)

# plot for final (reduced) model
ttype.code=as.numeric(data.Moves$TType==levels(data.Moves$TType)[2])
ttype.code=ttype.code-mean(ttype.code)
verbal.code=as.numeric(data.Moves$verbal==levels(data.Moves$verbal)[
2])
verbal.code=verbal.code-mean(verbal.code)
plot.red.Moves.b=glmmTMB(tr.Moves ~ z.sessionNr + ttype.code +
verbal.code +
                                 (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                 data=data.Moves,
family=list(family="beta", link="logit"))
est.plot.red.Moves.b=summary(plot.red.Moves.b)$coefficients$cond[,
"Estimate"]

x.vals=seq(from=min(data.Moves$z.sessionNr),
to=max(data.Moves$z.sessionNr), length.out=100)
LP=est.plot.red.Moves.b["(Intercept)"]+est.plot.red.Moves.b["z.sessi
onNr"]*x.vals
y.vals=(exp(LP))/(1+exp(LP))

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Moves_beta_result_plot_red_model.png", height=15,
width=15, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.Moves$z.sessionNr, data.Moves$tr.Moves, las=1,
ylim=c(0,1),
    xaxt="n", xlab="Session number", ylab="Move", pch=19)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
lines(x=x.vals, y=y.vals, lwd=2, lty=1, col="black")
dev.off()

# check random effects
summary(full.Moves.b)$varcor
round(ranef(full.Moves.b)[[1]]$childID, 3)
write.table(round(ranef(full.Moves.b)[[1]]$childID, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Moves_beta_full_RS.out", row.names=T, col.names=T, sep="\t",
quote=F)


## 5.10 Expression
```

```
data.Expression=res.perc[, c("Expression", "sessionNr", "TType",
"verbal", "childID")]
data.Expression=data.Expression[complete.cases(data.Expression), ]
str(data.Expression)
data.Expression$z.sessionNr=as.vector(scale(data.Expression$sessionN
r))
summary(data.Expression)
range(data.Expression$Expression)                # 0.03846154
0.99166667

# 5.10.1 Gaussian
full.Expression=lmer(Expression ~ z.sessionNr + I(z.sessionNr^2) +
TType + verbal +
                                 (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                 data=data.Expression, REML=F)

range(fitted(full.Expression))               # 0.5420326 0.9522973
diagnostics.plot(full.Expression)
ranef.diagn.plot(full.Expression)
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Expression_diagnostics_plot.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
diagnostics.plot(full.Expression)
dev.off()
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Expression_diagnostics_plot_random.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
ranef.diagn.plot(full.Expression)
dev.off()

# 5.10.2 Beta
transf.par=0.000001
data.Expression$tr.Expression=data.Expression$Expression*(1-
transf.par*2)+transf.par
table(data.Expression$tr.Expression)

# full model
full.Expression.b=glmmTMB(tr.Expression ~ z.sessionNr +
I(z.sessionNr^2) + TType + verbal +
                                 (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                 data=data.Expression,
family=list(family="beta", link="logit"))

null.Expression.b=glmmTMB(tr.Expression ~ 1 +
                                 (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                 data=data.Expression,
family=list(family="beta", link="logit"))

fn.compare.Expression.b=anova(null.Expression.b, full.Expression.b,
test="Chisq")
fn.compare.Expression.b
# p-value: 0.002519 => significant difference between full and null
model

round(summary(full.Expression.b)$coefficients$cond, 3)
full.Expression.b.p=as.data.frame(drop1(full.Expression.b,
test="Chisq"))
round(full.Expression.b.p, 3)
```

```
write.table(round(summary(full.Expression.b)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Expression_beta_full_FE.out", row.names=T, col.names=T,
sep="\t", quote=F)
write.table(round(full.Expression.b.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Expression_beta_full_p.out", row.names=T, col.names=T,
sep="\t", quote=F)

# full model confidence interval
boot.full.Expression.b=confint(object=full.Expression.b)
write.table(boot.full.Expression.b,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Expression_beta_full_CI.out", row.names=T, col.names=T,
sep="\t", quote=F)

# reduced/final model
red.Expression.b=glmmTMB(tr.Expression ~ z.sessionNr + TType +
verbal +
                                  (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                  data=data.Expression,
family=list(family="beta", link="logit"))

round(summary(red.Expression.b)$coefficients$cond, 3)
red.Expression.b.p=as.data.frame(drop1(red.Expression.b,
test="Chisq"))
round(red.Expression.b.p, 3)
write.table(round(summary(red.Expression.b)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Expression_beta_red_FE.out", row.names=T, col.names=T,
sep="\t", quote=F)
write.table(round(red.Expression.b.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Expression_beta_red_p.out", row.names=T, col.names=T,
sep="\t", quote=F)

# red model confidence interval
boot.red.Expression.b=confint(object=red.Expression.b)
write.table(boot.red.Expression.b,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Expression_beta_red_CI.out", row.names=T, col.names=T,
sep="\t", quote=F)

# plot for final (reduced) model
ttype.code=as.numeric(data.Expression$TType==levels(data.Expression$
TType)[2])
ttype.code=ttype.code-mean(ttype.code)
plot.red.Expression.b=glmmTMB(tr.Expression ~ z.sessionNr +
ttype.code + verbal +
                                  (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                  data=data.Expression,
family=list(family="beta", link="logit"))
est.plot.red.Expression.b=summary(plot.red.Expression.b)$coefficient
s$cond[, "Estimate"]

x.vals=seq(from=min(data.Expression$z.sessionNr),
to=max(data.Expression$z.sessionNr), length.out=100)
LP.non=est.plot.red.Expression.b["(Intercept)"]+est.plot.red.Express
ion.b["z.sessionNr"]*x.vals
LP.verb=est.plot.red.Expression.b["(Intercept)"]+est.plot.red.Expres
sion.b["verbal1"]+est.plot.red.Expression.b["z.sessionNr"]*x.vals
y.vals.non=(exp(LP.non))/(1+exp(LP.non))
```

```
y.vals.verb=exp(LP.verb)/(1+exp(LP.verb))

cols=c("gray40", "red")

png(filename="D:/Laura/Documents/PhD/R/Expression_beta_result_plot_r
ed_model.png", height=15, width=15, unit="cm", pointsize=12,
bg="white", res=250, type="windows", restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.Expression$z.sessionNr, data.Expression$tr.Expression,
las=1,
    xaxt="n", xlab="Session number", ylab="Expression",
    col=cols[as.numeric(data.Expression$verbal)], pch=19)
legend("bottomright", legend=c("verbal", "non-verbal"), col=c("red",
"gray40"), pch=19)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
lines(x=x.vals, y=y.vals.non, lwd=2, lty=1, col="gray40")
lines(x=x.vals, y=y.vals.verb, lwd=2, lty=1, col="red")
dev.off()


## 5.11 Engaged
data.Engaged=res.perc[, c("Engaged", "sessionNr", "TType", "verbal",
"childID")]
data.Engaged=data.Engaged[complete.cases(data.Engaged), ]
str(data.Engaged)
data.Engaged$z.sessionNr=as.vector(scale(data.Engaged$sessionNr))
summary(data.Engaged)
range(data.Engaged$Engaged)              # 0.5384615 1.0000000

# 5.11.1 Gaussian
full.Engaged=lmer(Engaged ~ z.sessionNr + I(z.sessionNr^2) + TType +
verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Engaged, REML=F)

range(fitted(full.Engaged))       # 0.7088016 1.0091385 => values
predicted outside of range 0-1

# 5.11.2 Beta
transf.par=0.000001
data.Engaged$tr.Engaged=data.Engaged$Engaged*(1-
transf.par*2)+transf.par
table(data.Engaged$tr.Engaged)

# full model
full.Engaged.b=glmmTMB(tr.Engaged ~ z.sessionNr + I(z.sessionNr^2) +
TType + verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                data=data.Engaged,
family=list(family="beta", link="logit"))

null.Engaged.b=glmmTMB(tr.Engaged ~ 1 +
                                (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                data=data.Engaged,
family=list(family="beta", link="logit"))

fn.compare.Engaged.b=anova(null.Engaged.b, full.Engaged.b,
test="Chisq")
fn.compare.Engaged.b
```

```
# p-value: 2.529e-06 *** => significant difference between full and
null model

round(summary(full.Engaged.b)$coefficients$cond, 3)
full.Engaged.b.p=as.data.frame(drop1(full.Engaged.b, test="Chisq"))
round(full.Engaged.b.p, 3)
write.table(round(summary(full.Engaged.b)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Engaged_beta_full_FE.out", row.names=T, col.names=T,
sep="\t", quote=F)
write.table(round(full.Engaged.b.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Engaged_beta_full_p.out", row.names=T, col.names=T,
sep="\t", quote=F)

# full model confidence interval
boot.full.Engaged.b=confint(object=full.Engaged.b)
write.table(boot.full.Engaged.b, file="D:/Laura/Documents/PhD/Video
Analysis/R/Model results/Engaged_beta_full_CI.out", row.names=T,
col.names=T, sep="\t", quote=F)

# plot for full model
ttype.code=as.numeric(data.Engaged$TType==levels(data.Engaged$TType)
[2])
ttype.code=ttype.code-mean(ttype.code)
verbal.code=as.numeric(data.Engaged$verbal==levels(data.Engaged$verb
al)[2])
verbal.code=verbal.code-mean(verbal.code)
plot.red.Engaged.b=glmmTMB(tr.Engaged ~ z.sessionNr +
I(z.sessionNr^2) + ttype.code + verbal.code +
                                (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                data=data.Engaged,
family=list(family="beta", link="logit"))
est.plot.red.Engaged.b=summary(plot.red.Engaged.b)$coefficients$cond
[, "Estimate"]

x.vals=seq(from=min(data.Engaged$z.sessionNr),
to=max(data.Engaged$z.sessionNr), length.out=100)
LP=est.plot.red.Engaged.b["(Intercept)"]+est.plot.red.Engaged.b["z.s
essionNr"]*x.vals+est.plot.red.Engaged.b["I(z.sessionNr^2)"]*x.vals^
2
y.vals=(exp(LP))/(1+exp(LP))

png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Engaged_beta_result_plot_full_model.png",
height=15, width=15, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.Engaged$z.sessionNr, data.Engaged$tr.Engaged, las=1,
ylim=c(0,1),
    xaxt="n", xlab="Session number", ylab="Engaged", pch=19)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
lines(x=x.vals, y=y.vals, lwd=2, lty=1, col="black")
dev.off()


## 5.12 Difficulty
data.Difficulty=res.perc[, c("Difficulty", "sessionNr", "TType",
"verbal", "childID")]
data.Difficulty=data.Difficulty[complete.cases(data.Difficulty), ]
str(data.Difficulty)
```

```
data.Difficulty$z.sessionNr=as.vector(scale(data.Difficulty$sessionN
r))
summary(data.Difficulty)
range(data.Difficulty$Difficulty)            # 0 1

# 5.12.1 Gaussian
full.Difficulty=lmer(Difficulty ~ z.sessionNr + I(z.sessionNr^2) +
TType + verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
| childID),
                                data=data.Difficulty, REML=F)

range(fitted(full.Difficulty))               # 0.001698345
0.809787642
diagnostics.plot(full.Difficulty)
ranef.diagn.plot(full.Difficulty)
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Difficulty_diagnostics_plot.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
diagnostics.plot(full.Difficulty)
dev.off()
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Difficulty_diagnostics_plot_random.png", height=10,
width=10, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
ranef.diagn.plot(full.Difficulty)
dev.off()

# 5.12.2 Beta
transf.par=0.000001
data.Difficulty$tr.Difficulty=data.Difficulty$Difficulty*(1-
transf.par*2)+transf.par
table(data.Difficulty$tr.Difficulty)

# full model
full.Difficulty.b=glmmTMB(tr.Difficulty ~ z.sessionNr +
I(z.sessionNr^2) + TType + verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                data=data.Difficulty,
family=list(family="beta", link="logit"))

null.Difficulty.b=glmmTMB(tr.Difficulty ~ 1 +
                                (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                data=data.Difficulty,
family=list(family="beta", link="logit"))

fn.compare.Difficulty.b=anova(null.Difficulty.b, full.Difficulty.b,
test="Chisq")
fn.compare.Difficulty.b
# p-value: 6.673e-05 *** => significant difference between full and
null model

round(summary(full.Difficulty.b)$coefficients$cond, 3)
full.Difficulty.b.p=as.data.frame(drop1(full.Difficulty.b,
test="Chisq"))
round(full.Difficulty.b.p, 3)
write.table(round(summary(full.Difficulty.b)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Difficulty_beta_full_FE.out", row.names=T, col.names=T,
sep="\t", quote=F)
```

```
write.table(round(full.Difficulty.b.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Difficulty_beta_full_p.out", row.names=T, col.names=T,
sep="\t", quote=F)

# full model confidence interval
boot.full.Difficulty.b=confint(object=full.Difficulty.b)
write.table(boot.full.Difficulty.b,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Difficulty_beta_full_CI.out", row.names=T, col.names=T,
sep="\t", quote=F)

# reduced/final model
red.Difficulty.b=glmmTMB(tr.Difficulty ~ z.sessionNr + TType +
verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                data=data.Difficulty,
family=list(family="beta", link="logit"))

round(summary(red.Difficulty.b)$coefficients$cond, 3)
red.Difficulty.b.p=as.data.frame(drop1(red.Difficulty.b,
test="Chisq"))
round(red.Difficulty.b.p, 3)
write.table(round(summary(red.Difficulty.b)$coefficients$cond, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Difficulty_beta_red_FE.out", row.names=T, col.names=T,
sep="\t", quote=F)
write.table(round(red.Difficulty.b.p, 3),
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Difficulty_beta_red_p.out", row.names=T, col.names=T,
sep="\t", quote=F)

# red model confidence interval
boot.red.Difficulty.b=confint(object=red.Difficulty.b)
write.table(boot.red.Difficulty.b,
file="D:/Laura/Documents/PhD/Video Analysis/R/Model
results/Difficulty_beta_red_CI.out", row.names=T, col.names=T,
sep="\t", quote=F)

# plot for final (reduced) model
ttype.code=as.numeric(data.Difficulty$TType==levels(data.Difficulty$
TType)[2])
ttype.code=ttype.code-mean(ttype.code)
plot.red.Difficulty.b=glmmTMB(tr.Difficulty ~ z.sessionNr +
ttype.code + verbal +
                                (1 + z.sessionNr + I(z.sessionNr^2)
|| childID),
                                data=data.Difficulty,
family=list(family="beta", link="logit"))
est.plot.red.Difficulty.b=summary(plot.red.Difficulty.b)$coefficient
s$cond[, "Estimate"]

x.vals=seq(from=min(data.Difficulty$z.sessionNr),
to=max(data.Difficulty$z.sessionNr), length.out=100)
LP.non=est.plot.red.Difficulty.b["(Intercept)"]+est.plot.red.Difficu
lty.b["z.sessionNr"]*x.vals
LP.verb=est.plot.red.Difficulty.b["(Intercept)"]+est.plot.red.Diffic
ulty.b["verbal1"]+est.plot.red.Difficulty.b["z.sessionNr"]*x.vals
y.vals.non=(exp(LP.non))/(1+exp(LP.non))
y.vals.verb=exp(LP.verb)/(1+exp(LP.verb))

cols=c("gray40", "red")
```

```
png(filename="D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Difficulty_beta_result_plot_red_model.png",
height=15, width=15, unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
par(mar=c(3,3,0.2,0.2), mgp=c(1.7,0.5,0), tcl=-0.25)
plot(data.Difficulty$z.sessionNr, data.Difficulty$tr.Difficulty,
las=1,
    xaxt="n", xlab="Session number", ylab="Difficulty",
    col=cols[as.numeric(data.Difficulty$verbal)], pch=19)
legend("topright", legend=c("verbal", "non-verbal"), col=c("red",
"gray40"), pch=19)
axis(at=x.at.1, labels=x.lab.1, side=1)
axis(at=x.at.2, labels=FALSE, side=1)
lines(x=x.vals, y=y.vals.non, lwd=2, lty=1, col="gray40")
lines(x=x.vals, y=y.vals.verb, lwd=2, lty=1, col="red")
dev.off()


## 6. Plot therapist variables
(for each variable one summary graph across all children and
sessions)
str(res.perc)
colnames(res.perc)

target.var=c("TPlays", "TVocal", "TMoves", "TTalks", "TObject",
"TSmiles", "TLooks", "TInitiat", "TName", "TPraise", "TContact",
"TOut")
length(target.var)

for (k in 1:length(target.var)){
png(filename=paste("D:/Laura/Documents/PhD/Video
Analysis/R/Plots/Therapist_prop_behavior_", target.var[k], ".png",
sep=""),
            height=15, width=15,
            unit="cm", pointsize=12, bg="white", res=250,
type="windows", restoreConsole=TRUE)
        par(mar=c(2.3, 2.4, 0.2, 0.2), mgp=c(1.2, 0.3, 0))
        plot(1, 1, type="n", xlim=c(0,20), ylim=c(0,1),
            tcl=-0.25, las=1, ylab="", xaxt="n", xlab="Session
number", cex.axis=0.7, cex.lab=0.9)
        for (m in 1:20){
            xx1=sum(!is.na(res.perc[res.perc$sessionNr==m,
target.var[k]]))
            points(rep(m, times=xx1),
res.perc[res.perc$sessionNr==m,
target.var[k]][!is.na(res.perc[res.perc$sessionNr==m,
target.var[k]])], pch=19, col=grey(level=0.25, alpha=0.5))
            }
        axis(at=seq(from=1, to=19, by=2), labels=FALSE, side=1,
cex.axis=0.7, tcl=-0.25)
        axis(at=seq(from=2, to=20, by=2), labels=seq(from=2, to=20,
by=2), side=1, cex.axis=0.7, tcl=-0.25)
        segments(x0=0, y0=0.3, x1=21, lty=2, col="gray30", lwd=0.8)
        segments(x0=0, y0=0.7, x1=21, lty=2, col="gray30", lwd=0.8)
        mtext(text=target.var[k], side=2, line=1.5, at=0.5, srt=90,
cex=0.9)
        dev.off()
}


# save.image("D:/Laura/Documents/PhD/Video
Analysis/R/Scripts/20181001.RData")
#                                   load("D:/Laura/Documents/PhD/Video
Analysis/R/Scripts/20181001.RData")
```

Appendix 5.2.2.1 Diagnostic test results for all response variables

Figure Appendix 1: Diagnostics 'ACTR score'

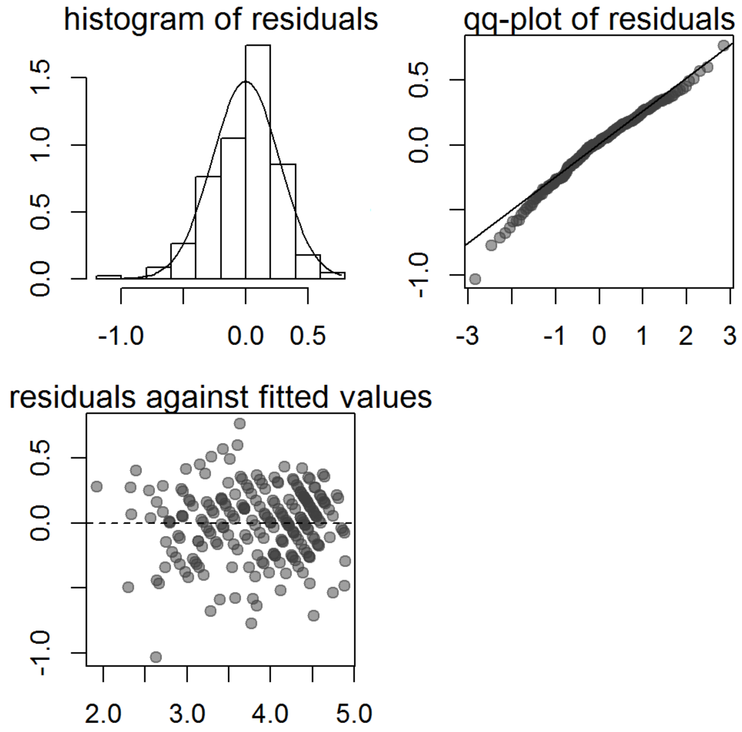


Figure Appendix 2: Diagnostics 'Difficulty'

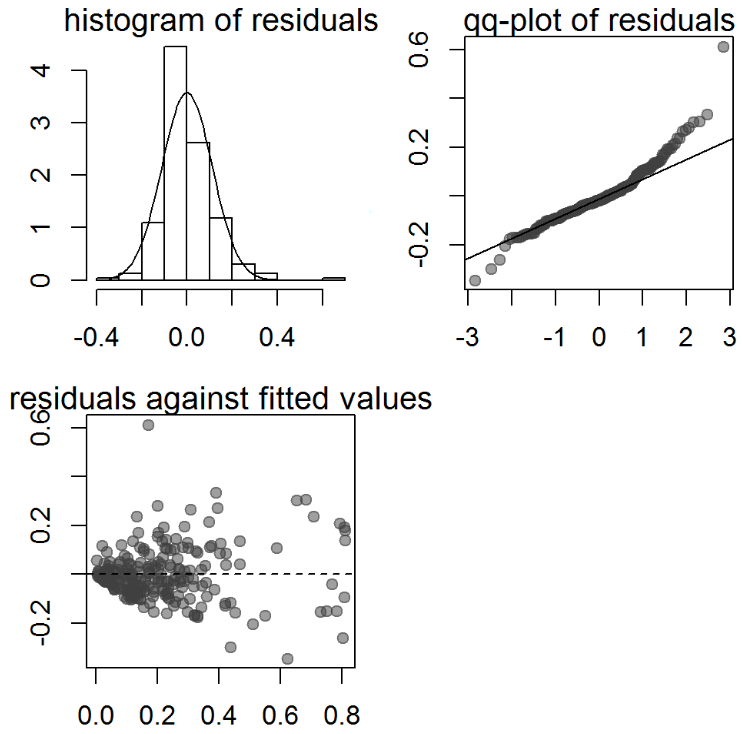


Figure Appendix 3: Diagnostics 'Expression'

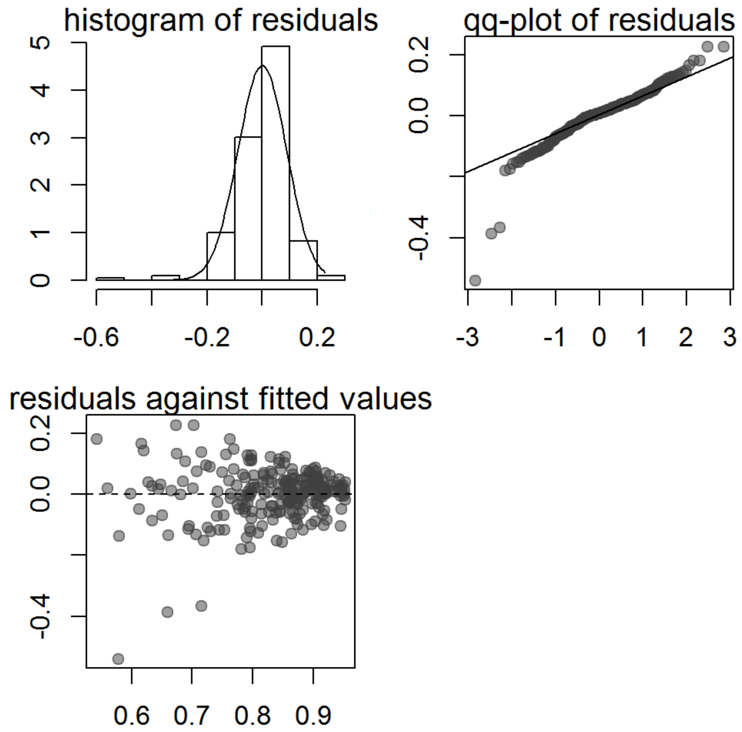


Figure Appendix 4: Diagnostics 'Initiate'

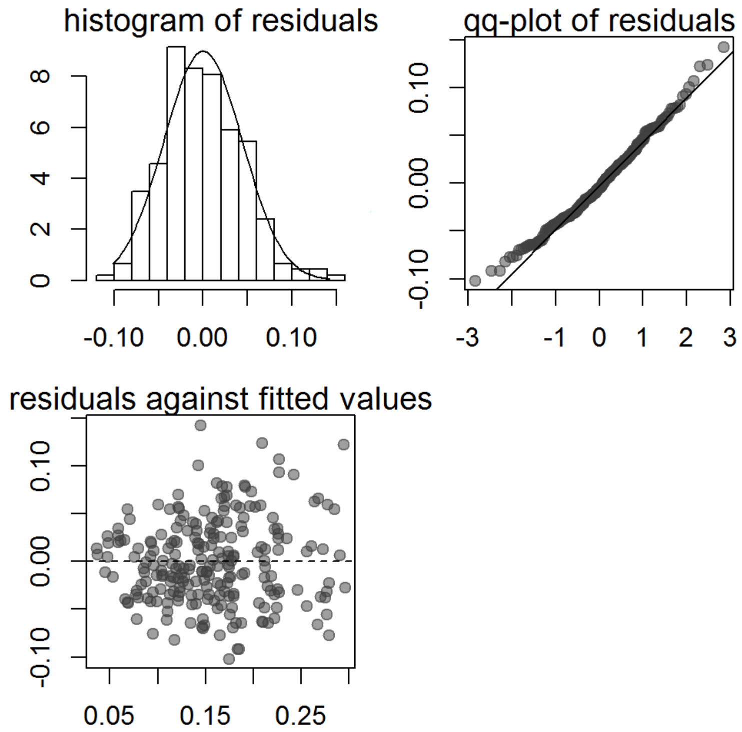


Figure Appendix 5: Diagnostics 'Look total'

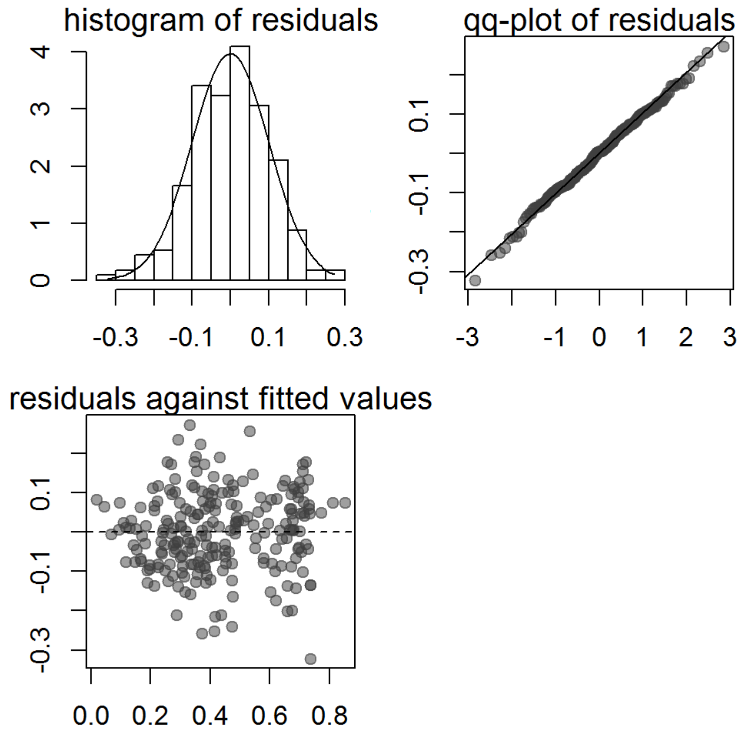


Figure Appendix 6: Diagnostics 'Move'

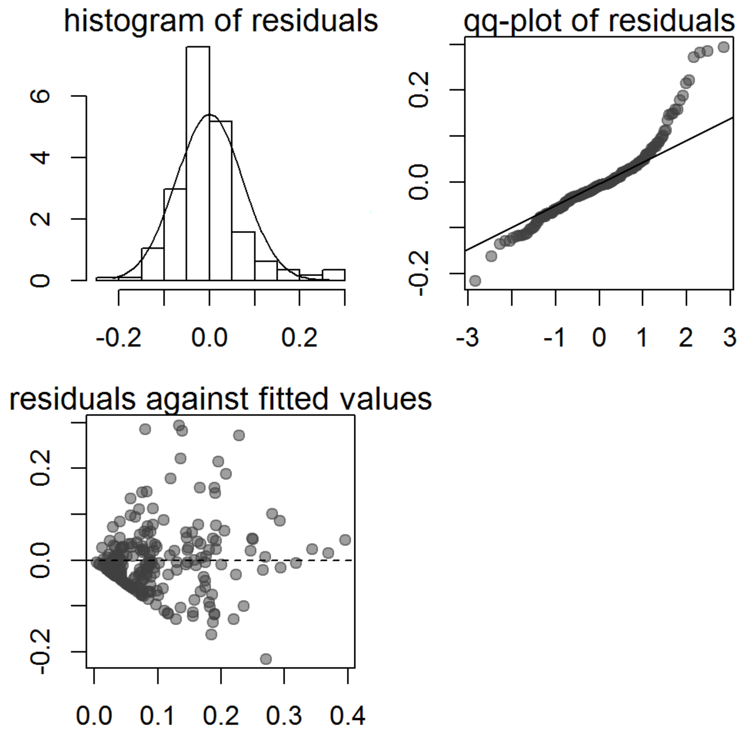


Figure Appendix 7: Diagnostics 'Play total'

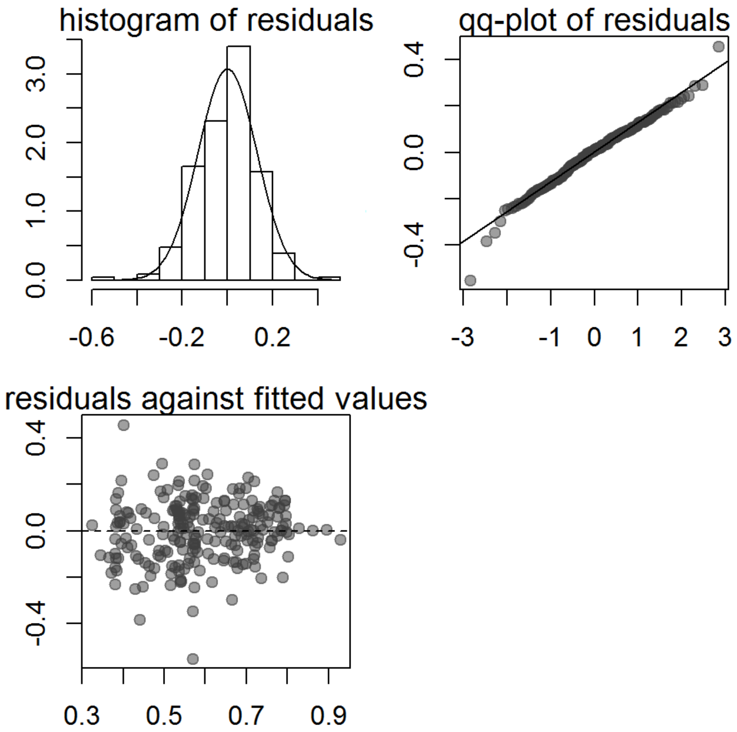


Figure Appendix 8: Diagnostics 'Respond'

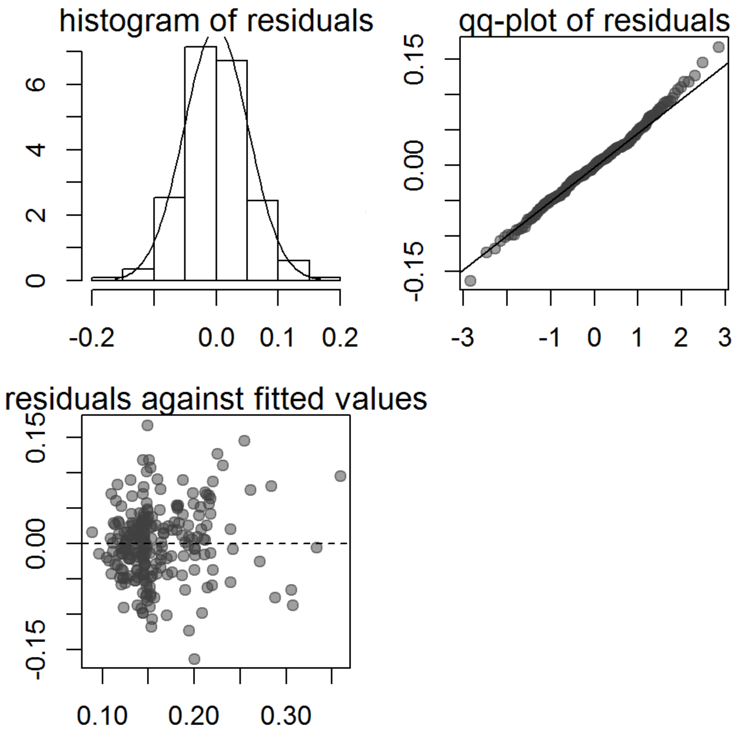


Figure Appendix 9: Diagnostics 'Smile'

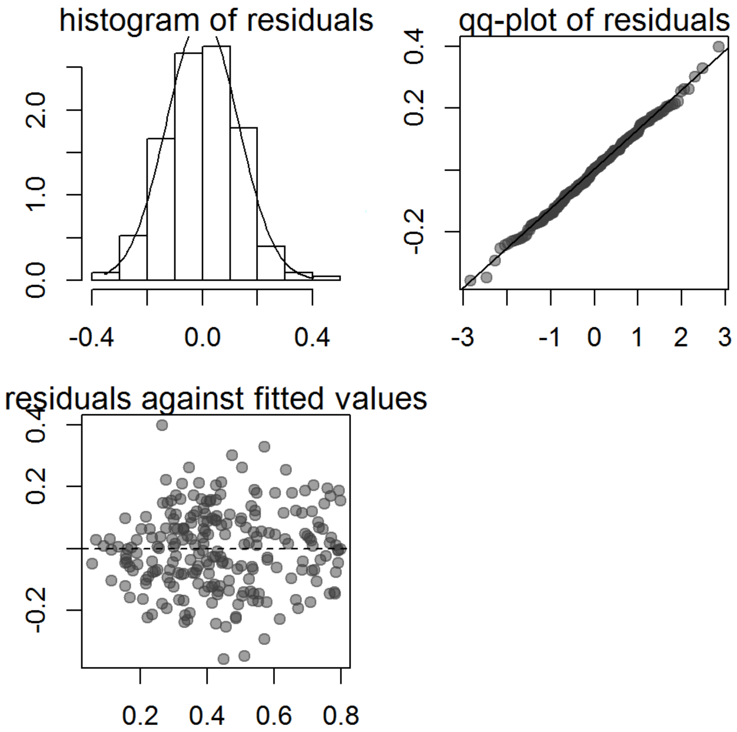
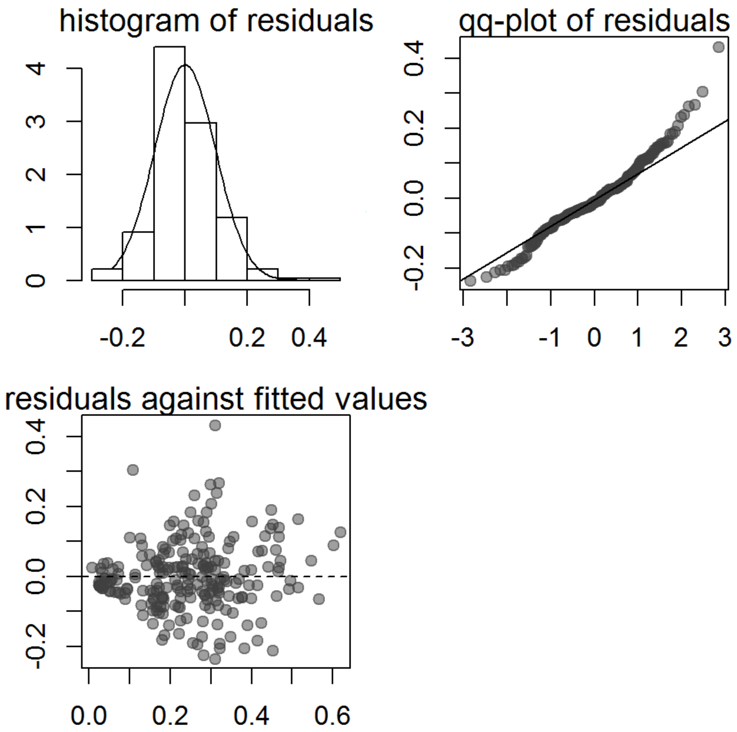
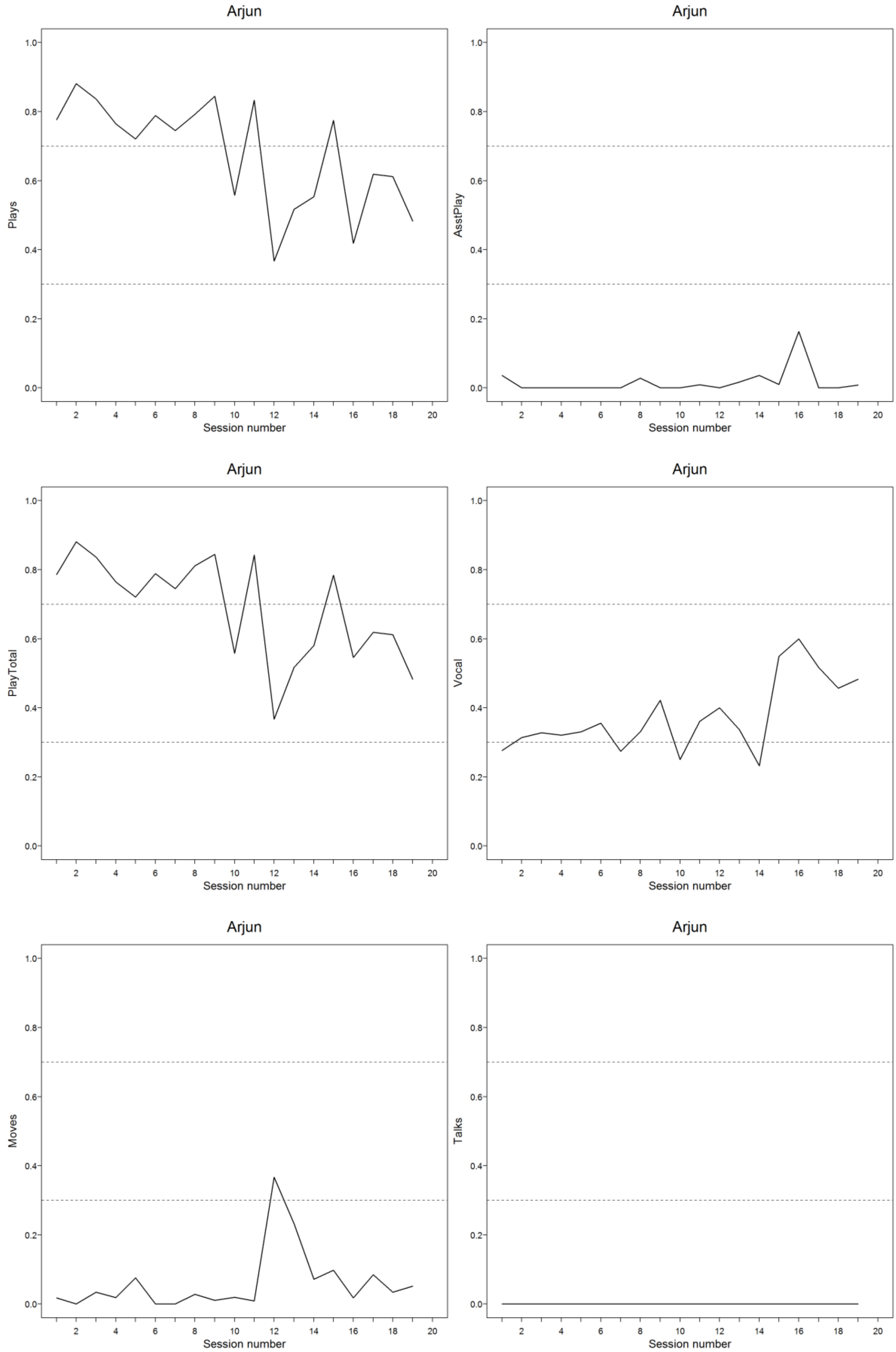


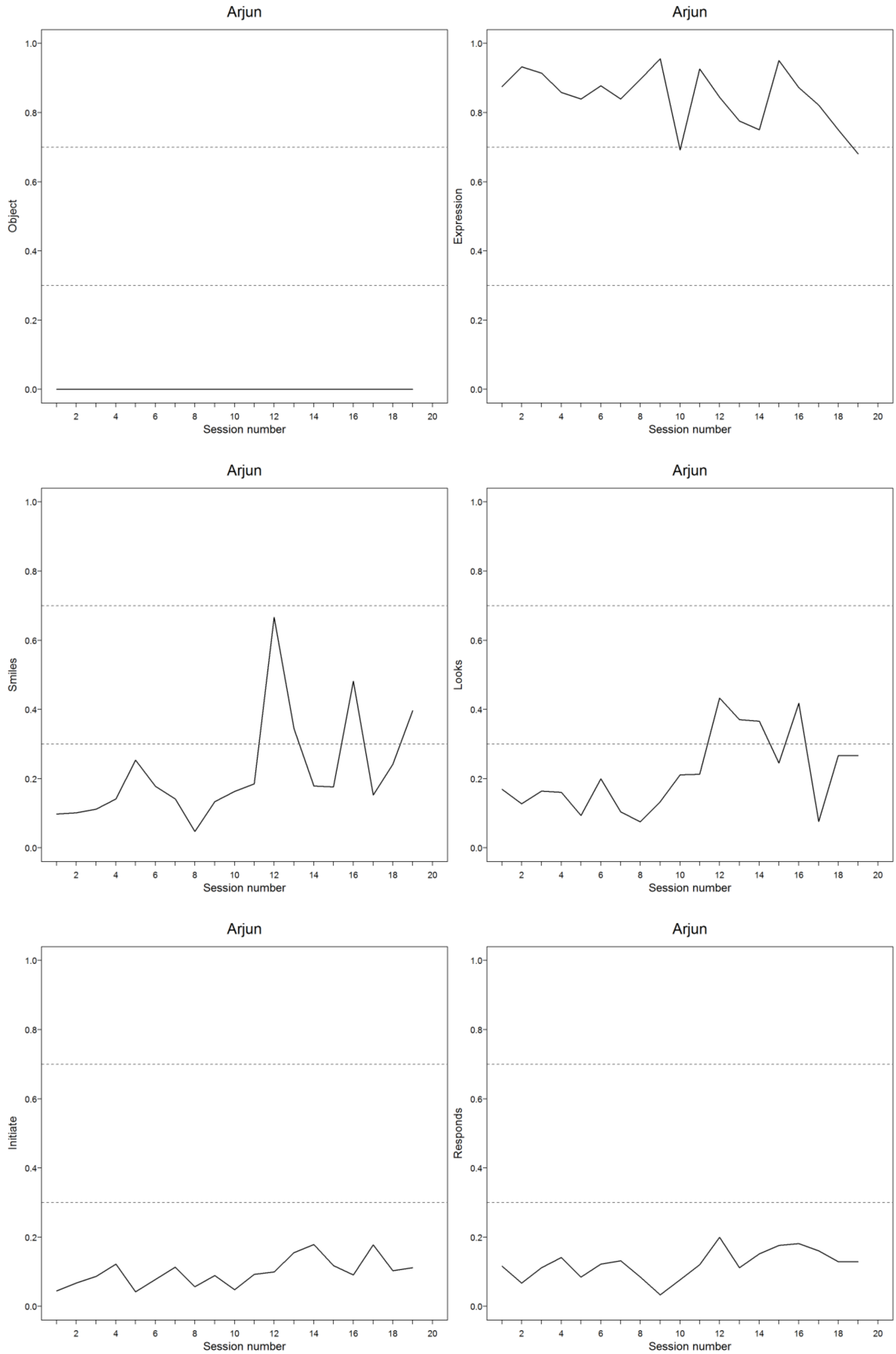
Figure Appendix 10: Diagnostics 'Vocal'

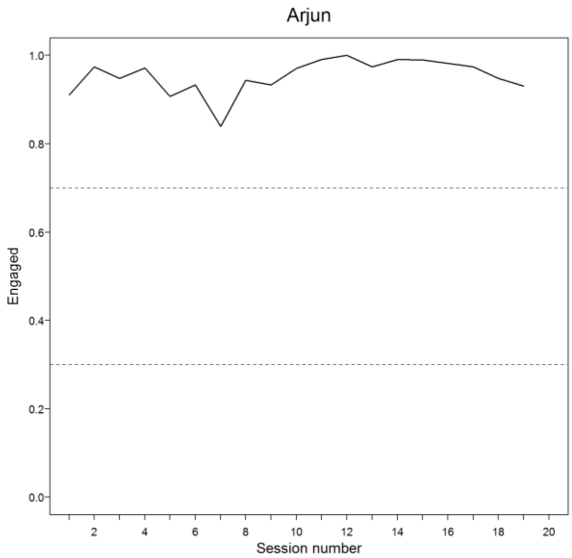


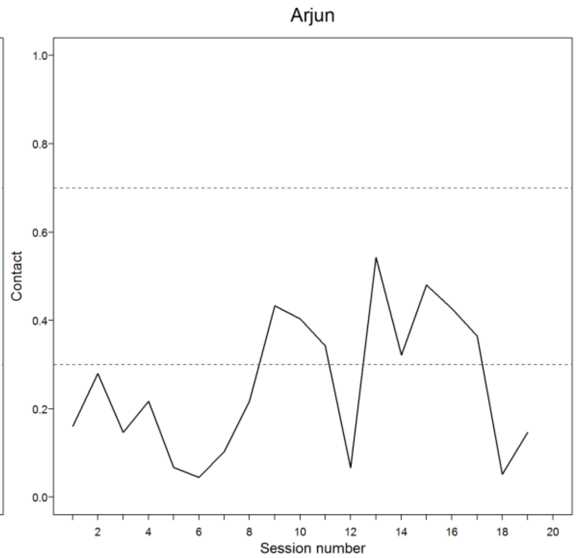
Appendix 5.2.2.3 Time-series graphs for all children and variables

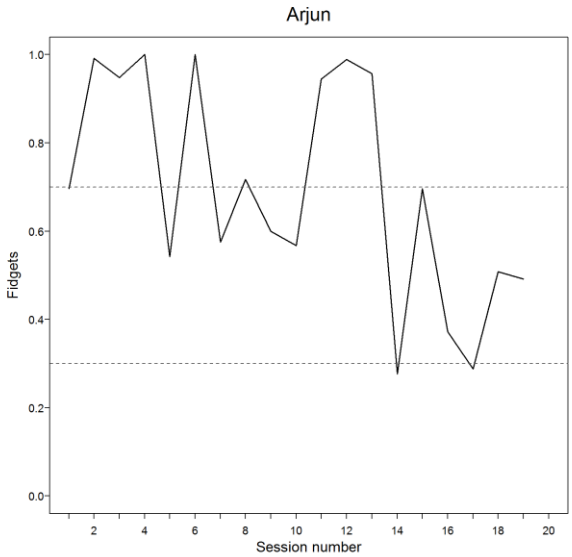
Figure Appendix 11: Variables Arjun

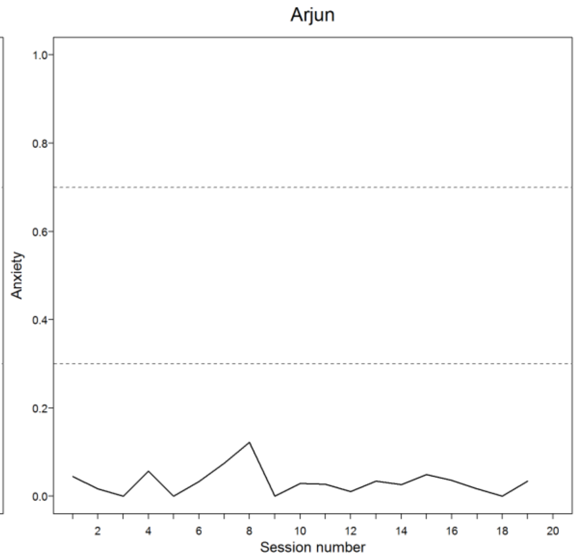


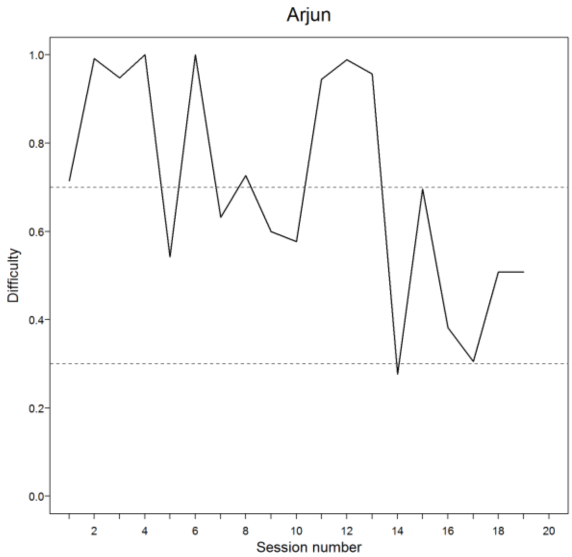

Arjun
Object
Session number
Arjun
Expression
Session number
Arjun
Smiles
Session number
Arjun
Looks
Session number
Arjun
Initiate
Session number
Arjun
Responds
Session number


Arjun
Engaged
Session number


Arjun
Contact
Session number


Arjun
Fidgets
Session number


Arjun
Anxiety
Session number


Arjun
Difficulty
Session number

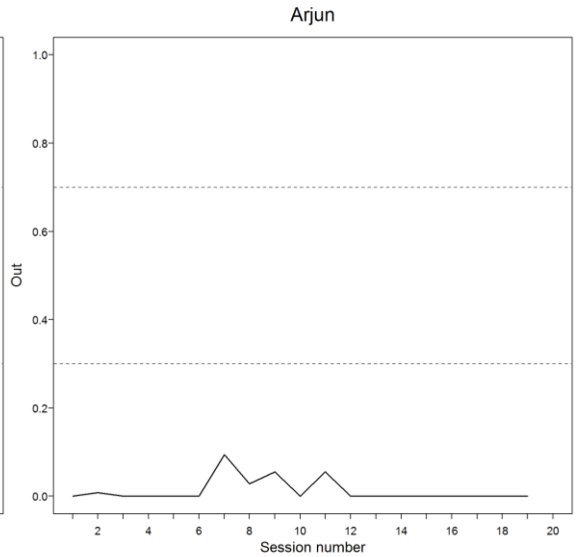
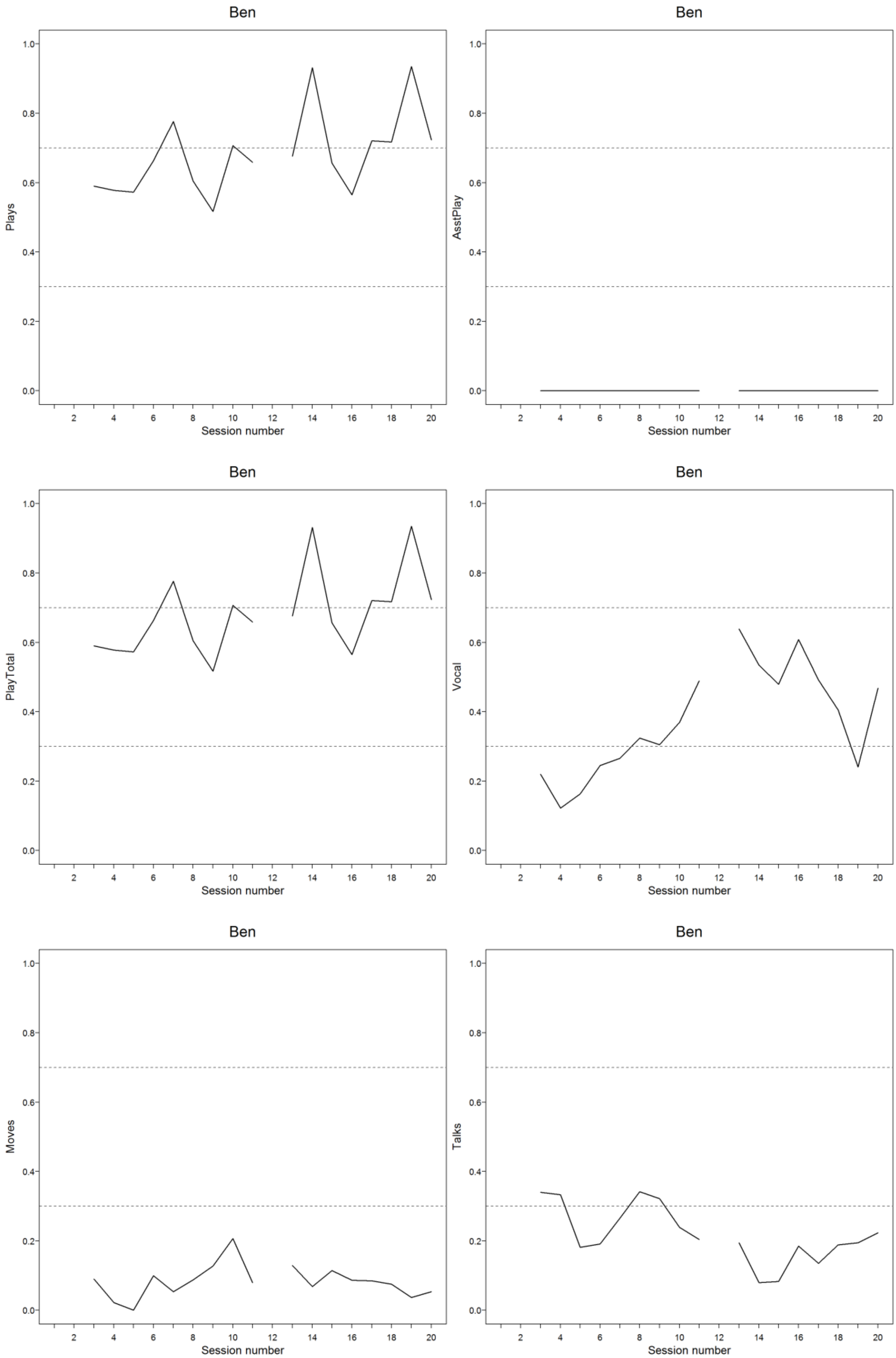
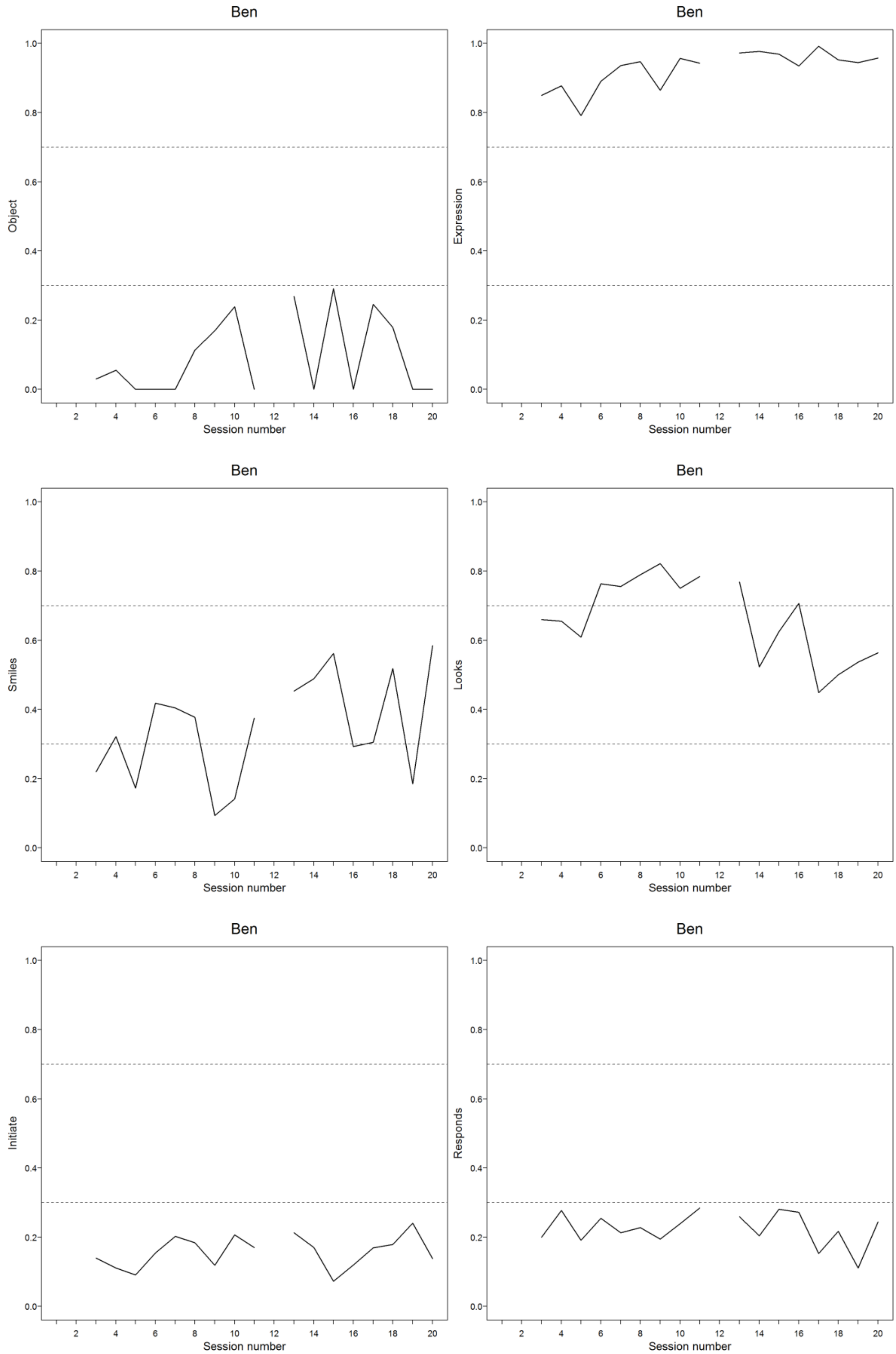

Arjun
Out
Session number

Figure Appendix 12: Variables Ben




Ben
Object
Session number
Ben
Expression
Session number
Ben
Smiles
Session number
Ben
Looks
Session number
Ben
Initiate
Session number
Ben
Responds
Session number

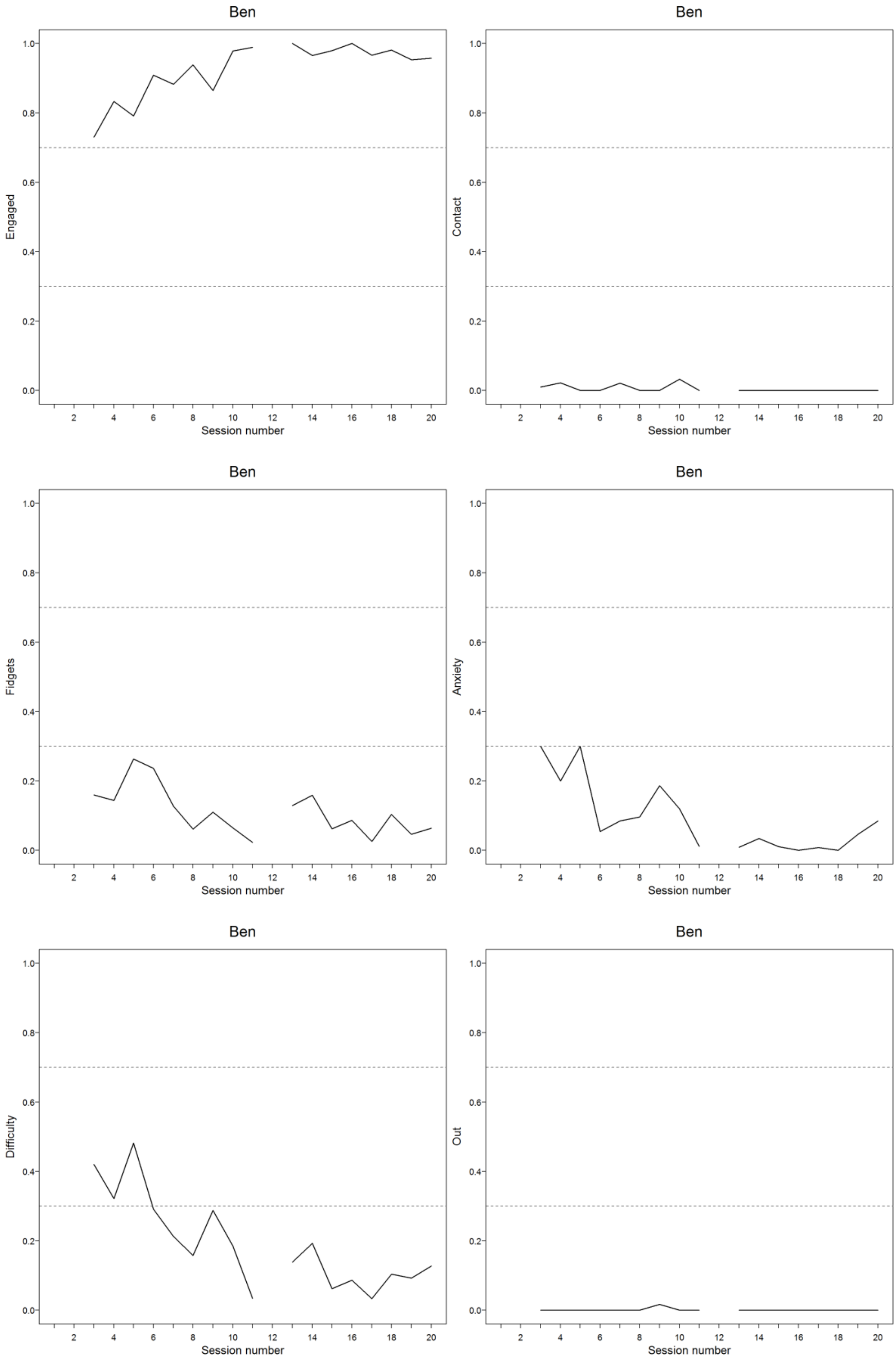
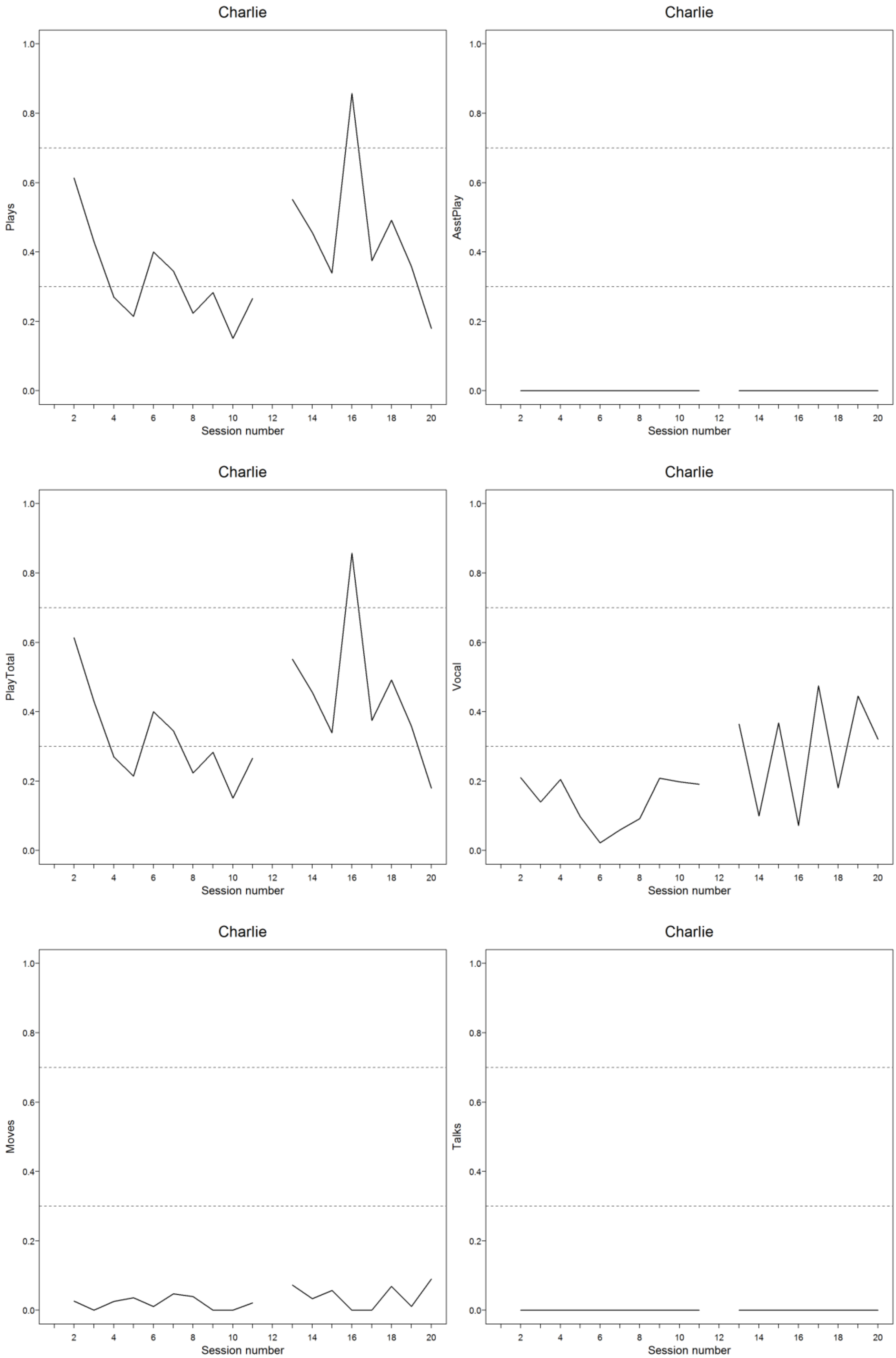
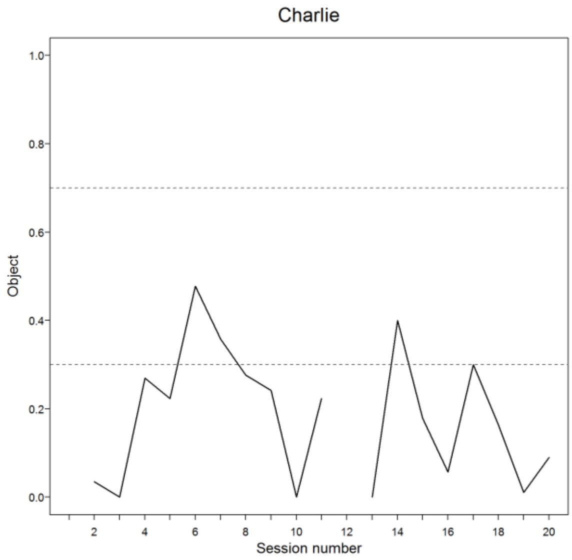
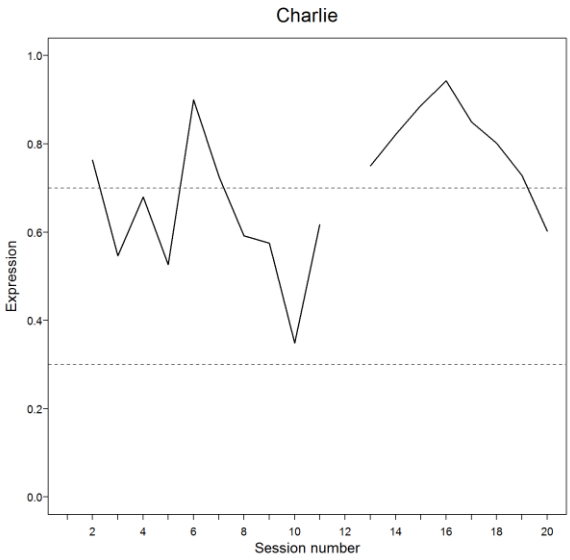
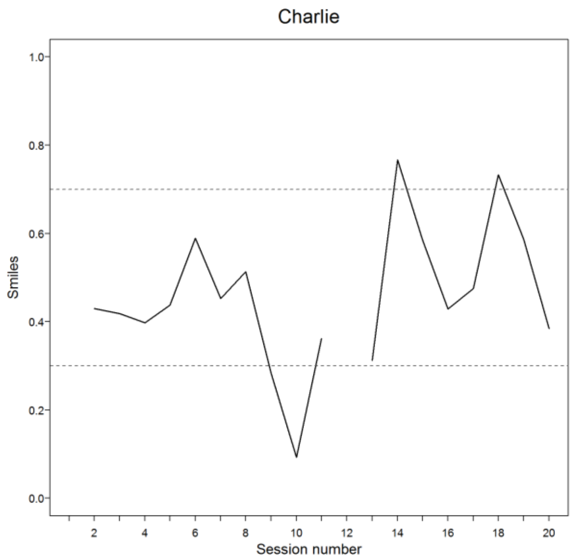

Ben
Engaged
Session number
Ben
Contact
Session number
Ben
Fidgets
Session number
Ben
Anxiety
Session number
Ben
Difficulty
Session number
Ben
Out
Session number

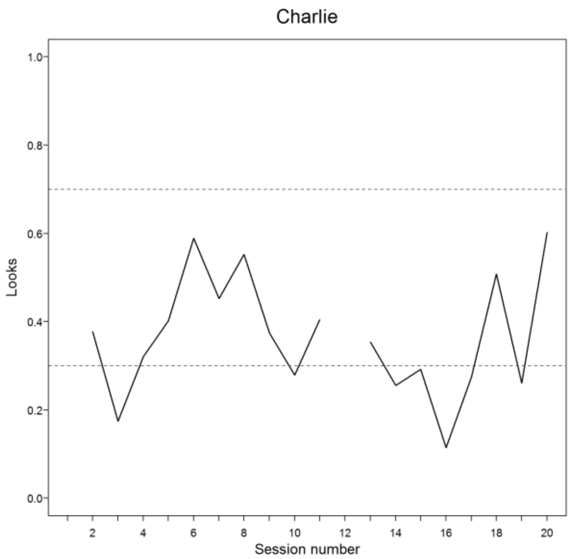
Figure Appendix 13: Variables Charlie

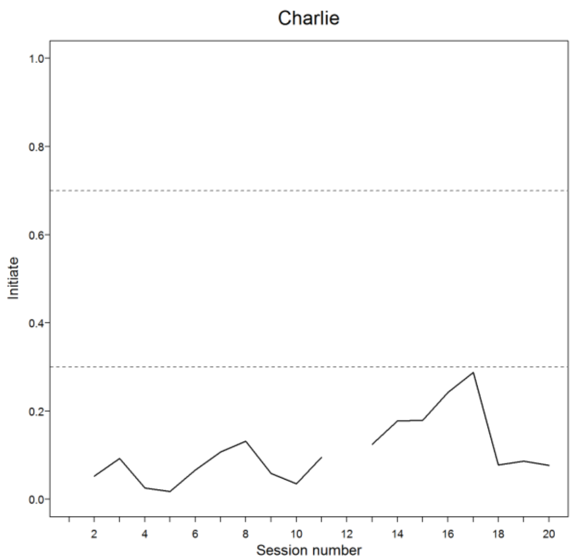


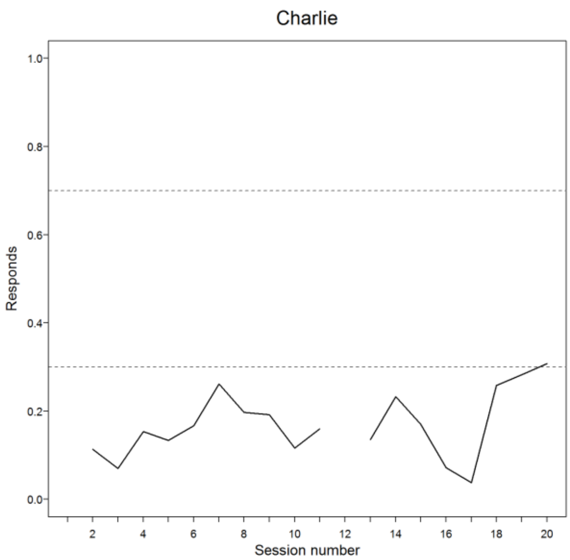

Charlie
Object
Session number

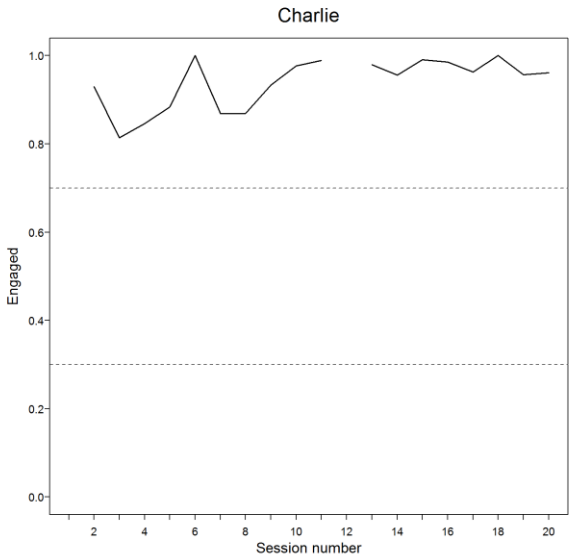

Charlie
Expression
Session number

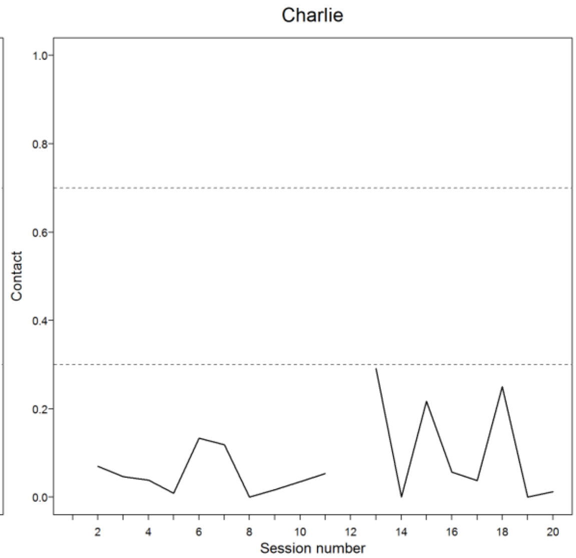

Charlie
Smiles
Session number

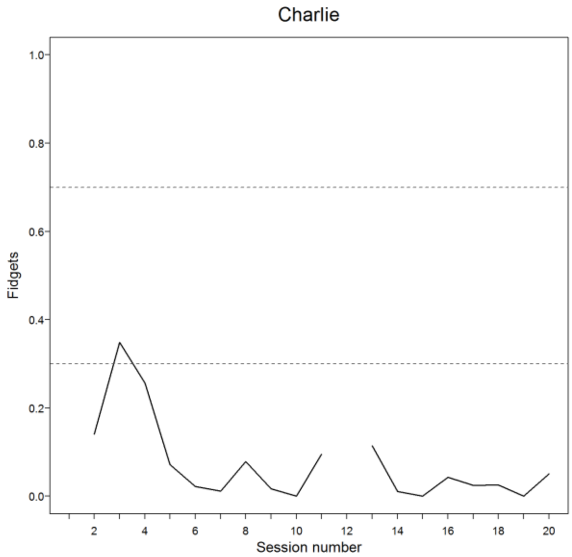

Charlie
Looks
Session number

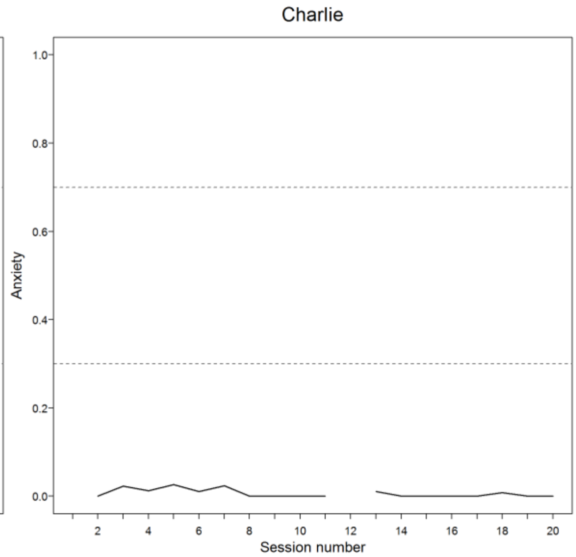

Charlie
Initiate
Session number

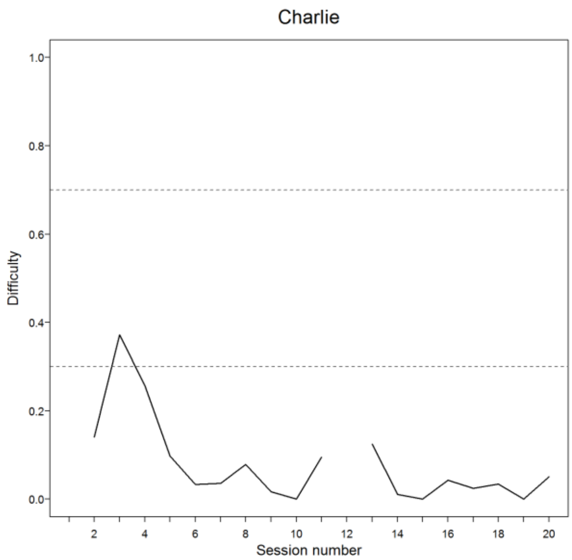

Charlie
Responds
Session number


Charlie
Engaged
0.0
0.2
0.4
0.6
0.8
1.0
2 4 6 8 10 12 14 16 18 20
Session number


Charlie
Contact
0.0
0.2
0.4
0.6
0.8
1.0
2 4 6 8 10 12 14 16 18 20
Session number


Charlie
Fidgets
0.0
0.2
0.4
0.6
0.8
1.0
2 4 6 8 10 12 14 16 18 20
Session number


Charlie
Anxiety
0.0
0.2
0.4
0.6
0.8
1.0
2 4 6 8 10 12 14 16 18 20
Session number


Charlie
Difficulty
0.0
0.2
0.4
0.6
0.8
1.0
2 4 6 8 10 12 14 16 18 20
Session number

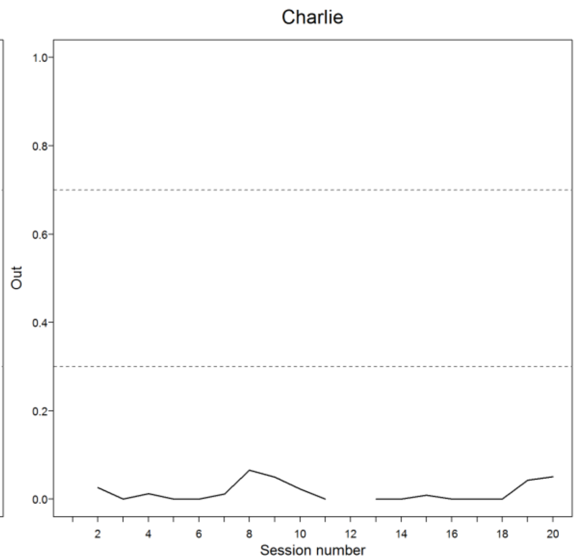
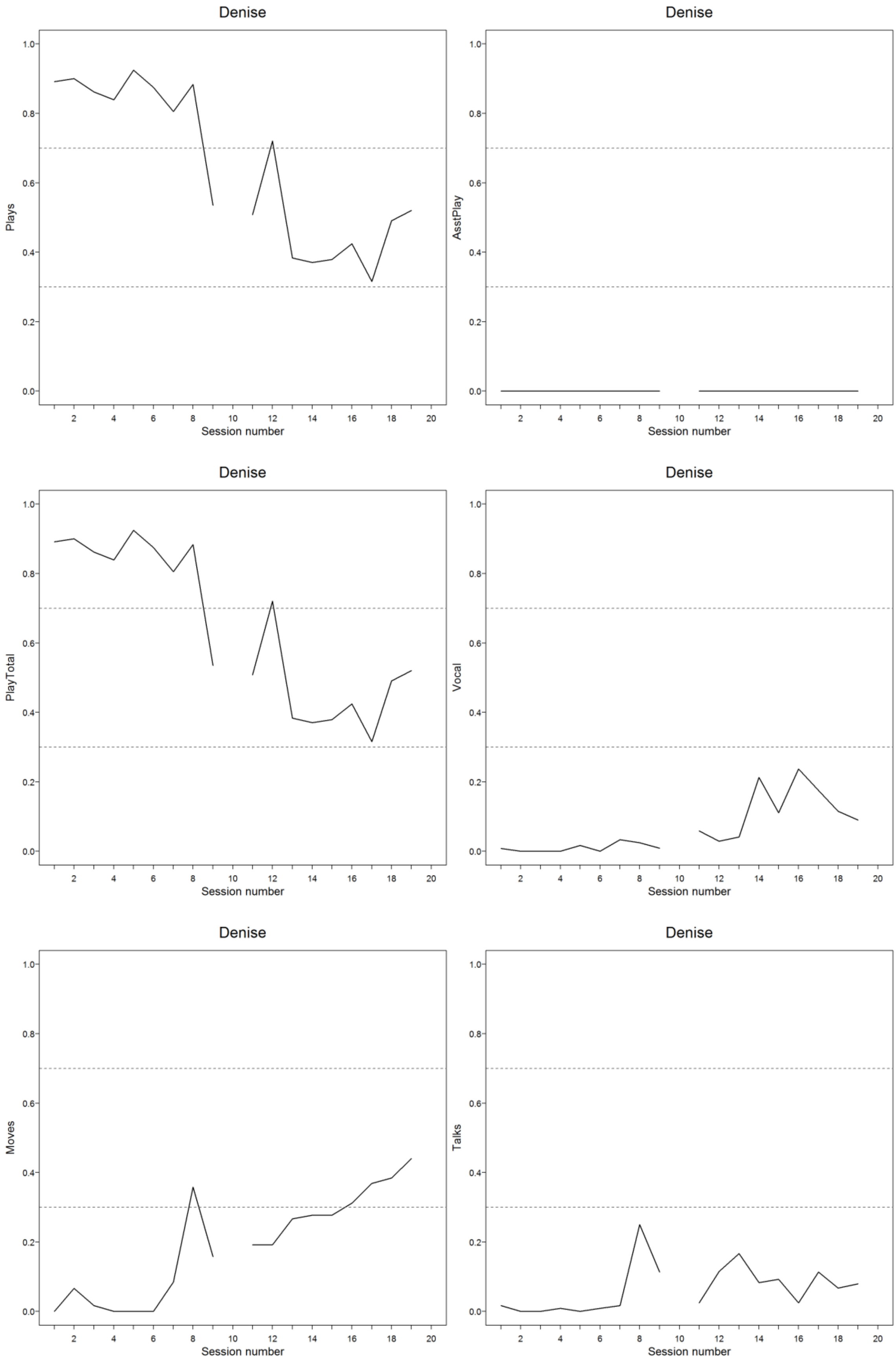
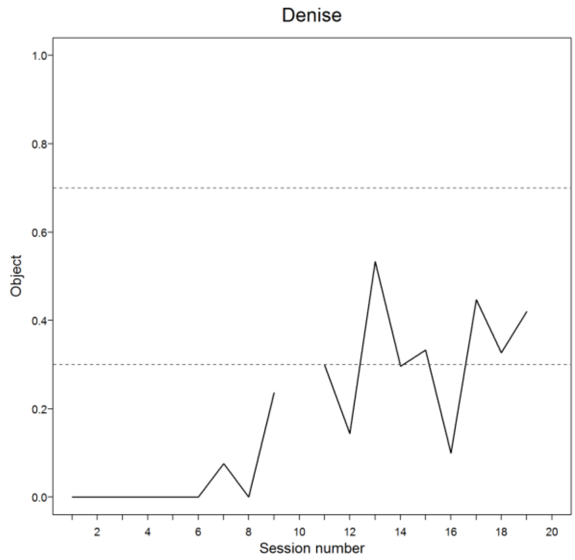
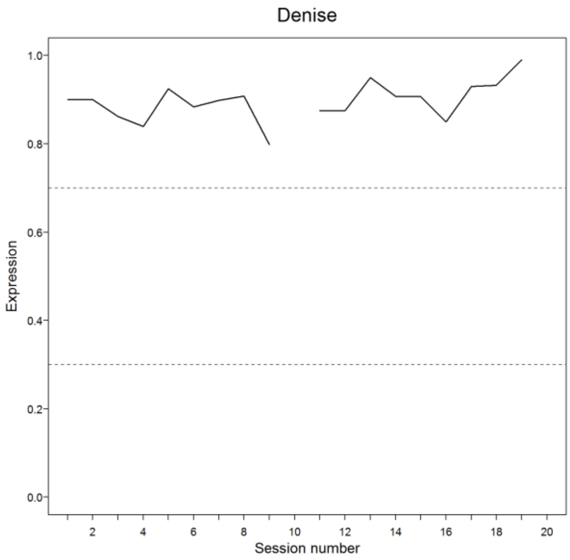
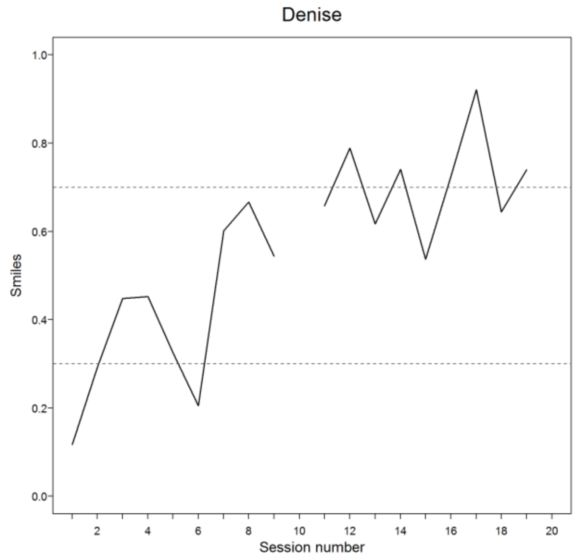

Charlie
Out
0.0
0.2
0.4
0.6
0.8
1.0
2 4 6 8 10 12 14 16 18 20
Session number

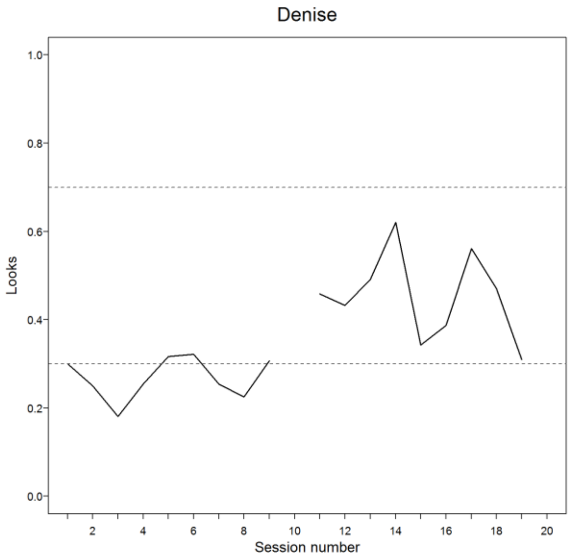
Figure Appendix 14: Variables Denise

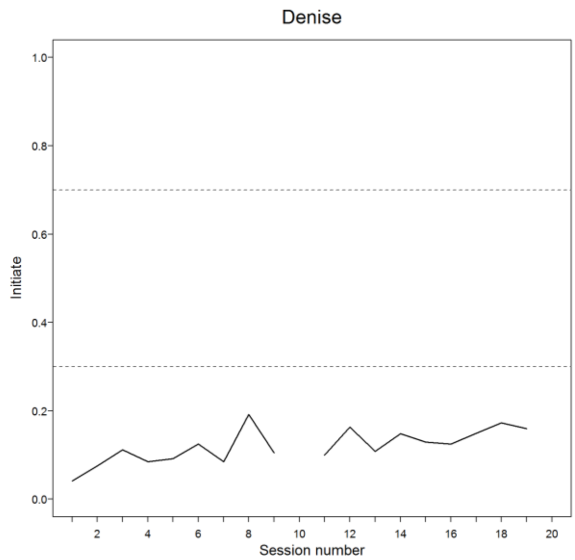


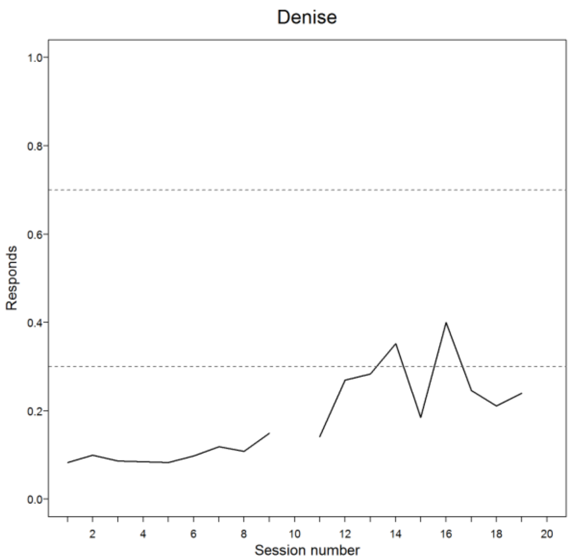

Denise
Object
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

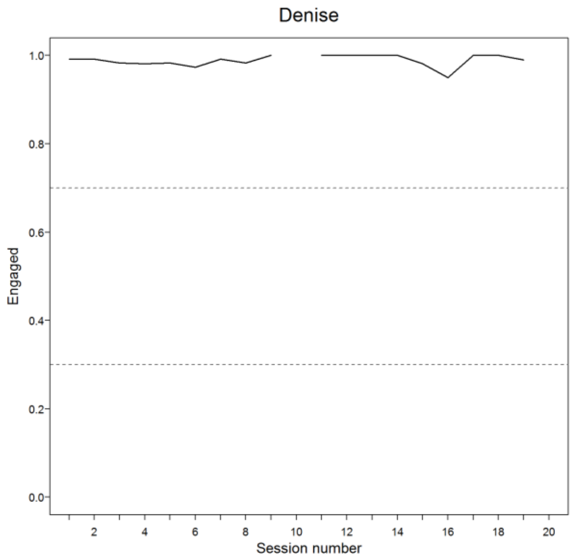

Denise
Expression
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

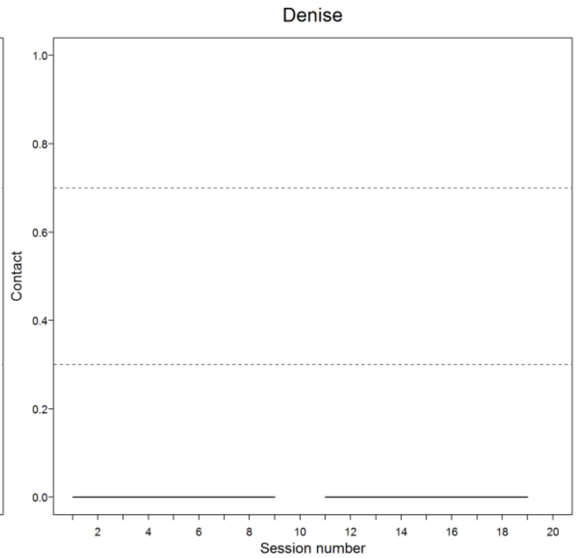

Denise
Smiles
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

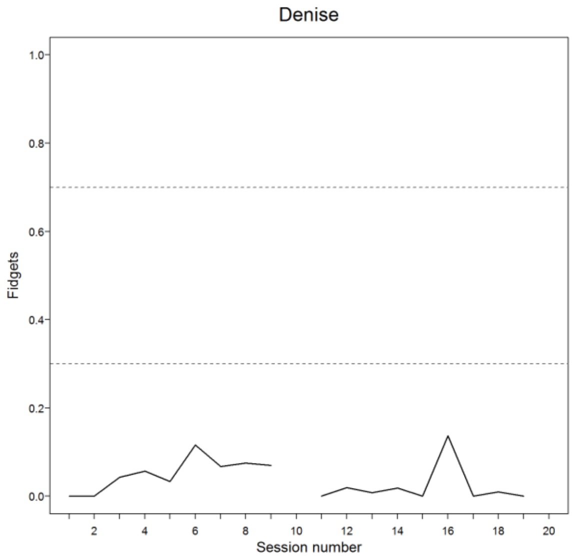

Denise
Looks
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

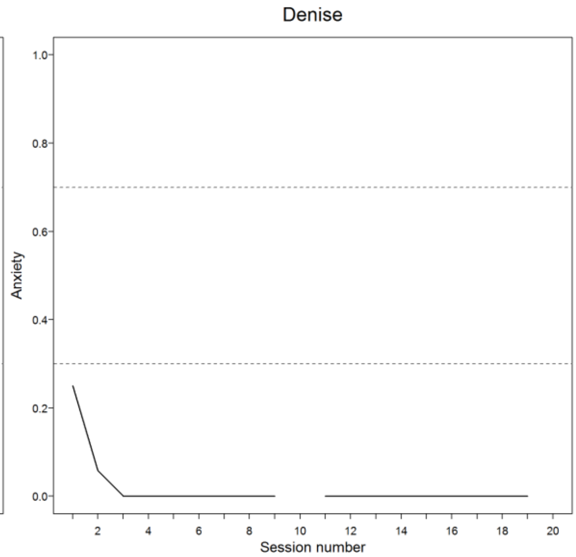

Denise
Initiate
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

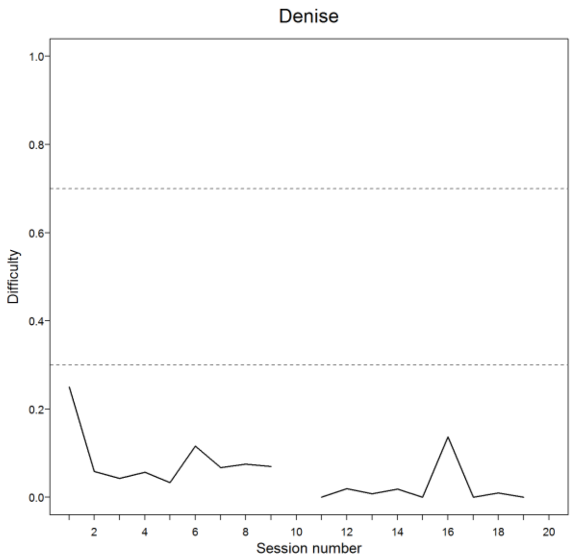

Denise
Responds
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Denise
Engaged
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number


Denise
Contact
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number


Denise
Fidgets
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number


Denise
Anxiety
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number


Denise
Difficulty
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number

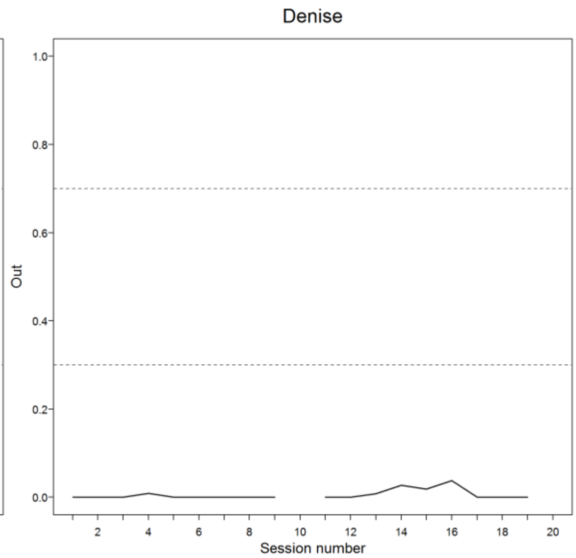
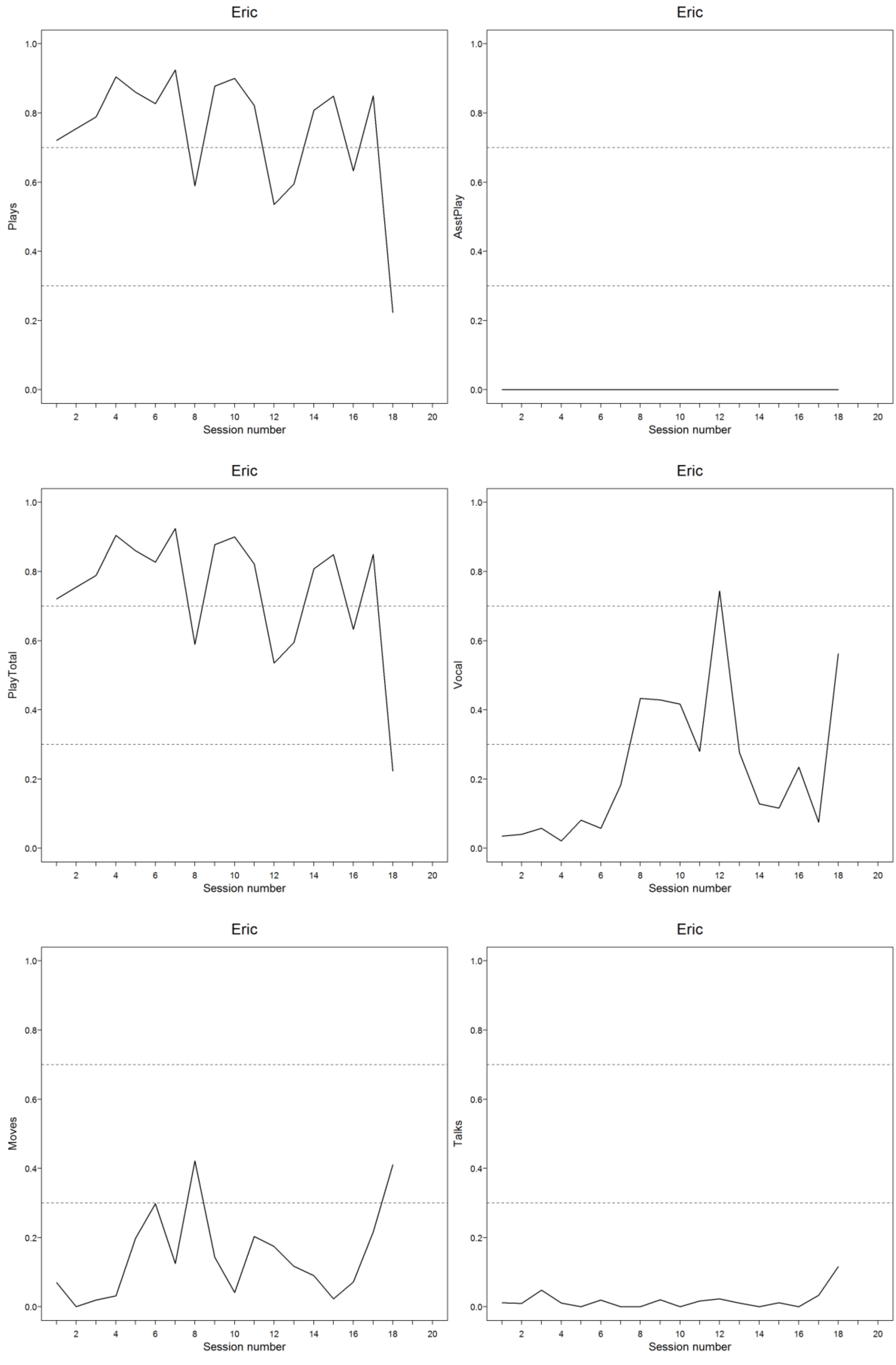
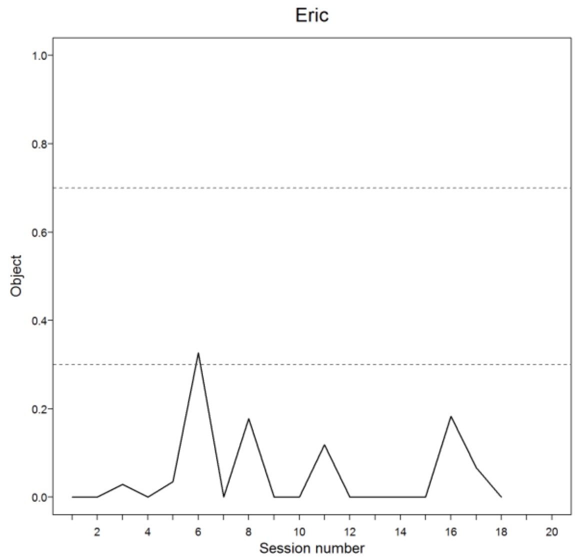
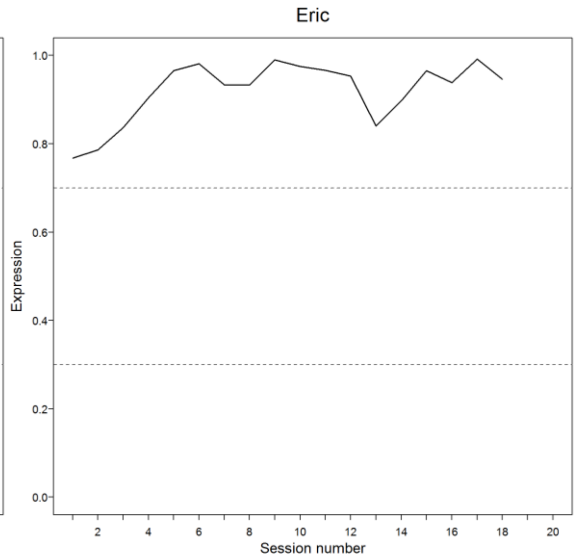
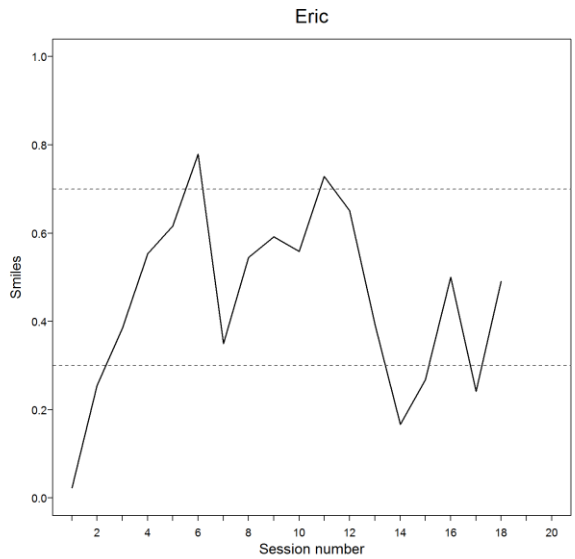

Denise
Out
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number

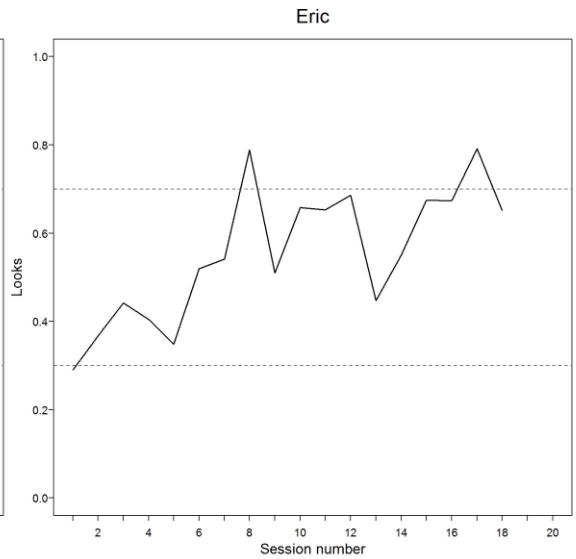
Figure Appendix 15: Variables Eric

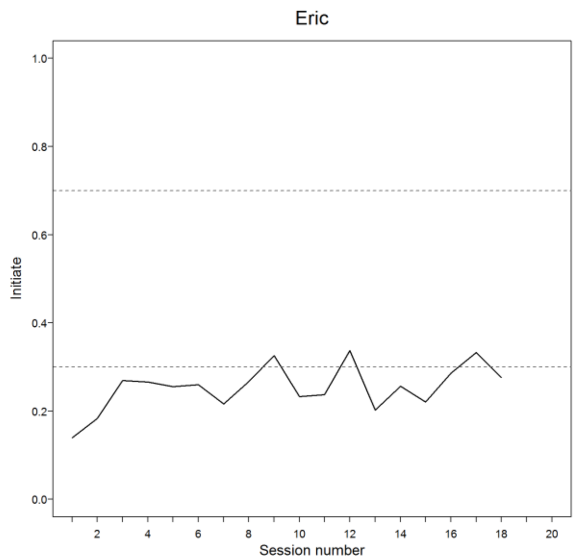


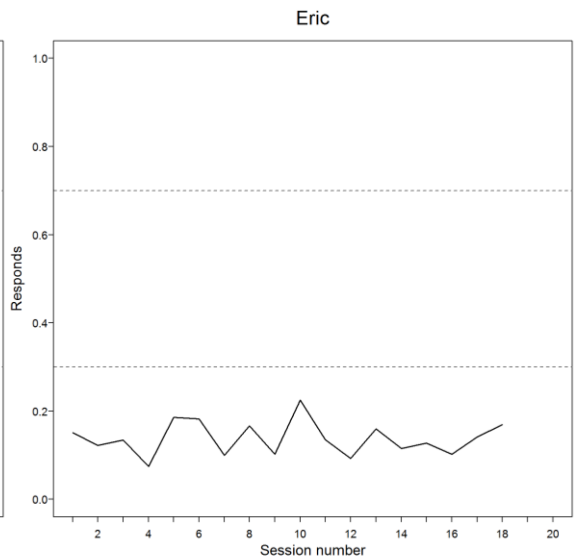

Eric
Object
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

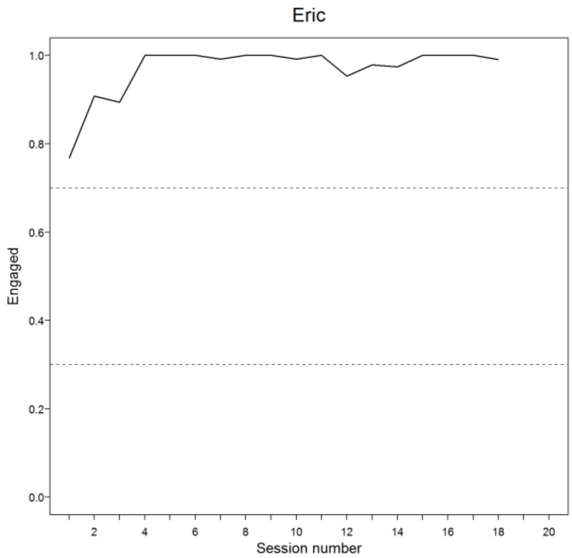

Eric
Expression
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

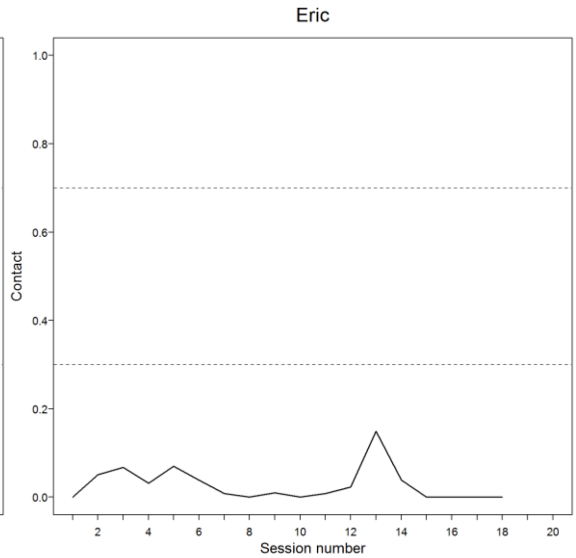

Eric
Smiles
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

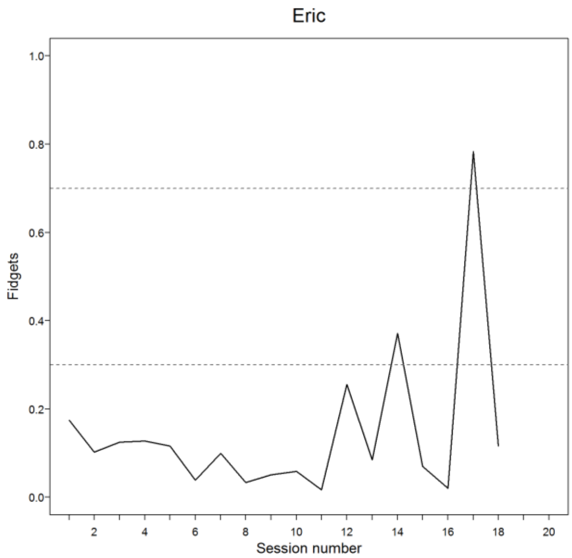

Eric
Looks
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

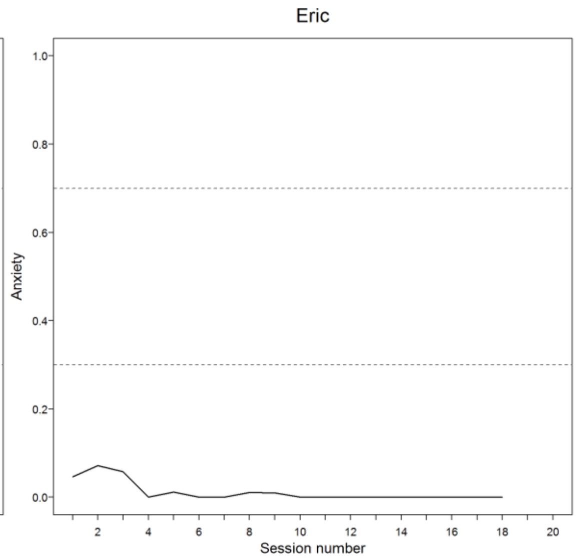

Eric
Initiate
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

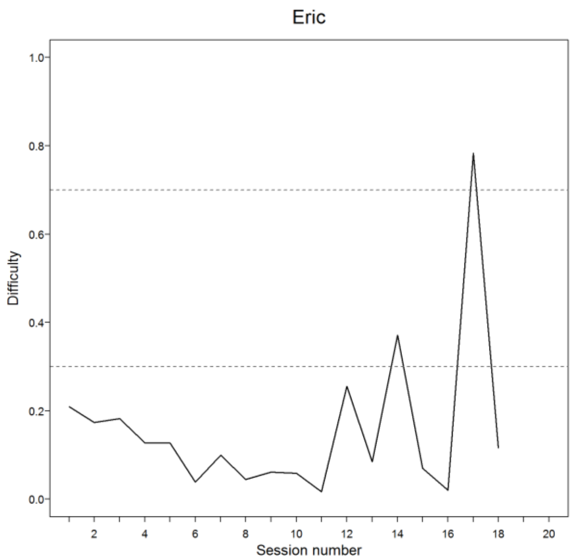

Eric
Responds
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Eric
Engaged
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Eric
Contact
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Eric
Fidgets
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Eric
Anxiety
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Eric
Difficulty
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

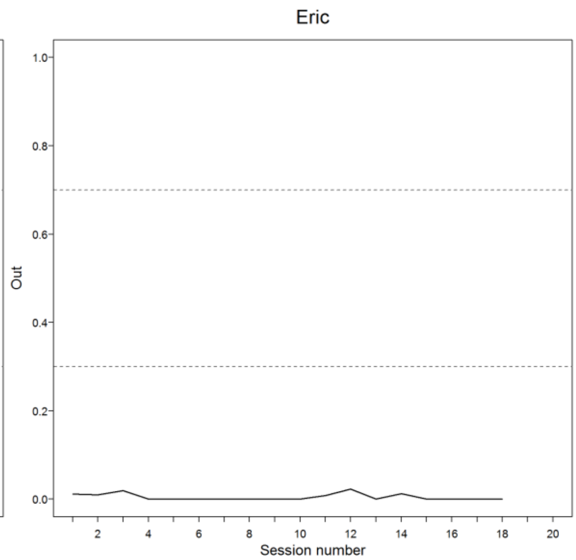
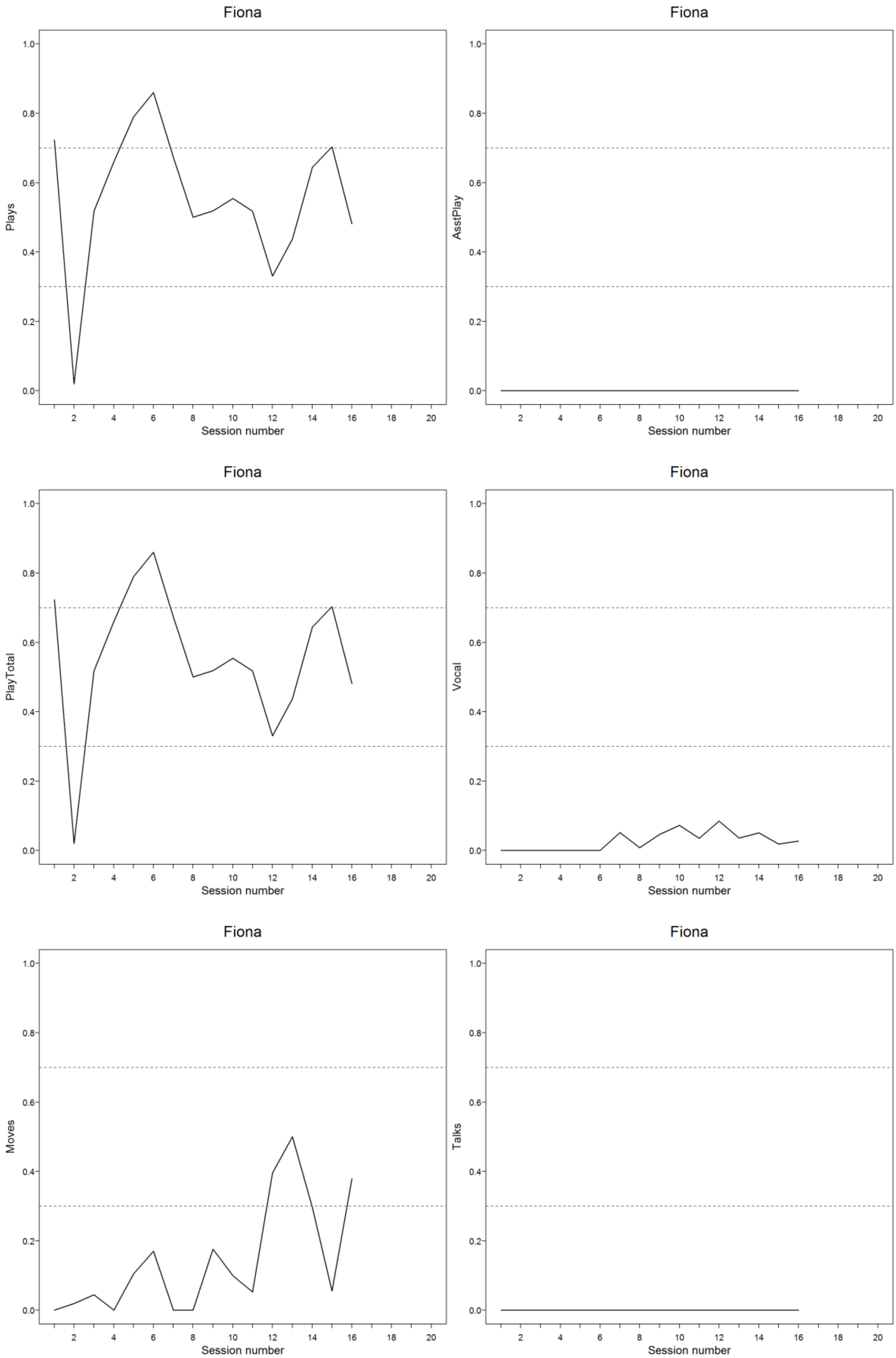
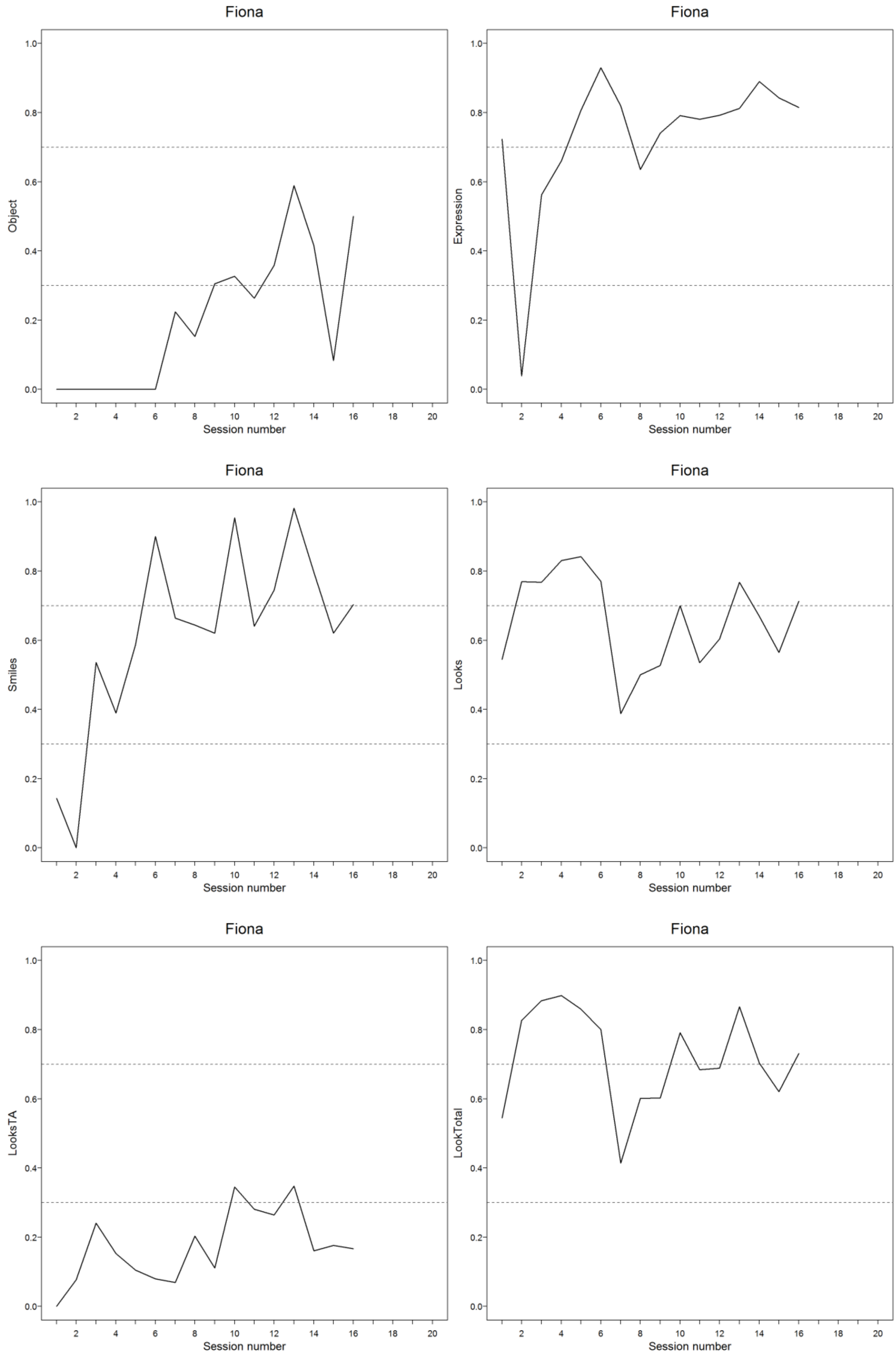
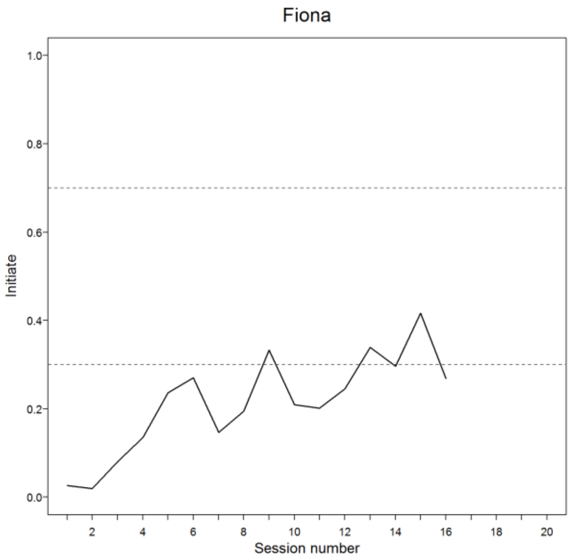
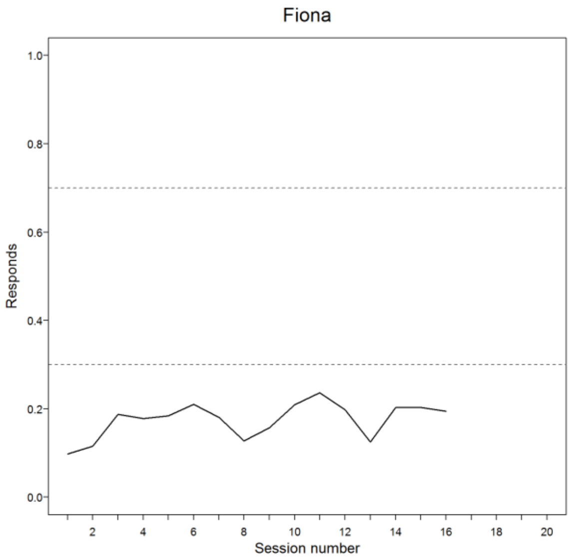

Eric
Out
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

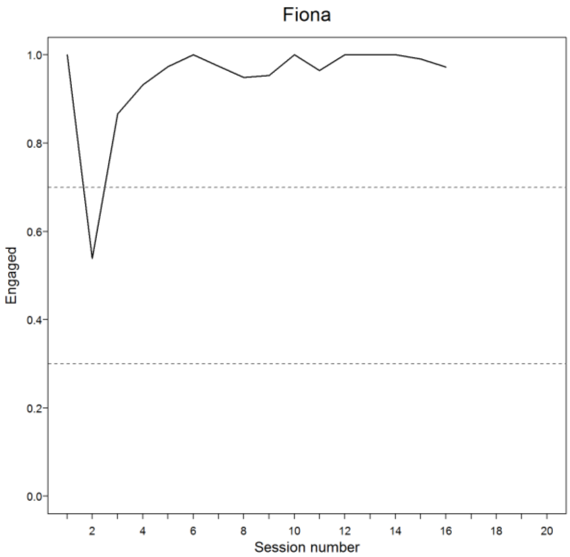
Figure Appendix 16: Variables Fiona

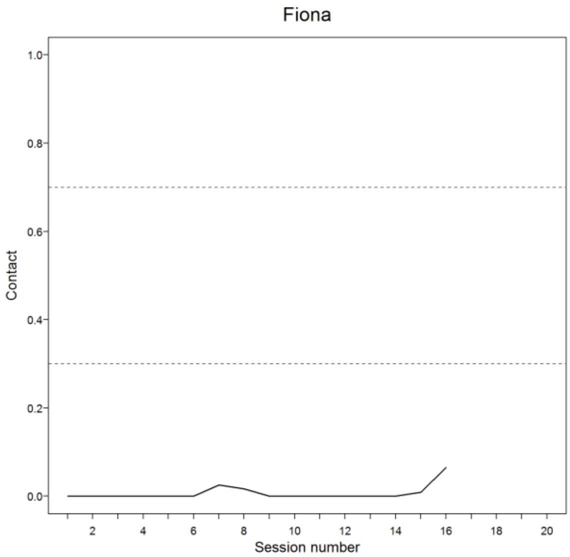


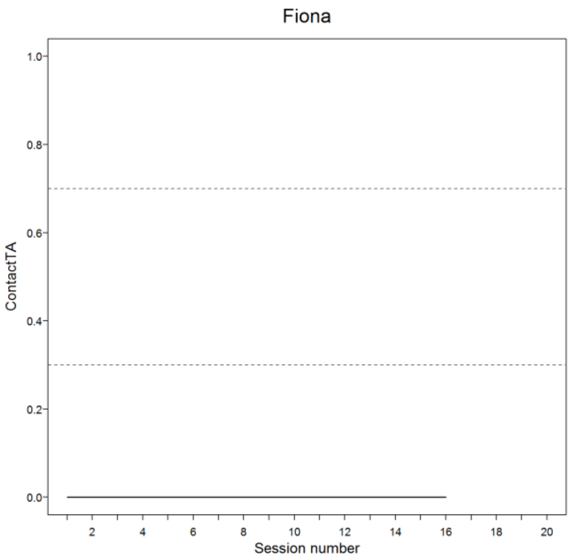

Fiona
Object
Session number
Fiona
Expression
Session number
Fiona
Smiles
Session number
Fiona
Looks
Session number
Fiona
LooksTA
Session number
Fiona
LookTotal
Session number

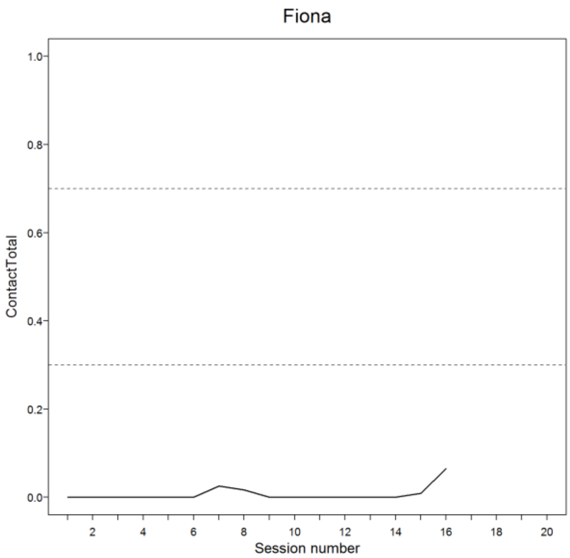

Fiona
Initiate
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Fiona
Responds
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Fiona
Engaged
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Fiona
Contact
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Fiona
ContactTA
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Fiona
ContactTotal
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

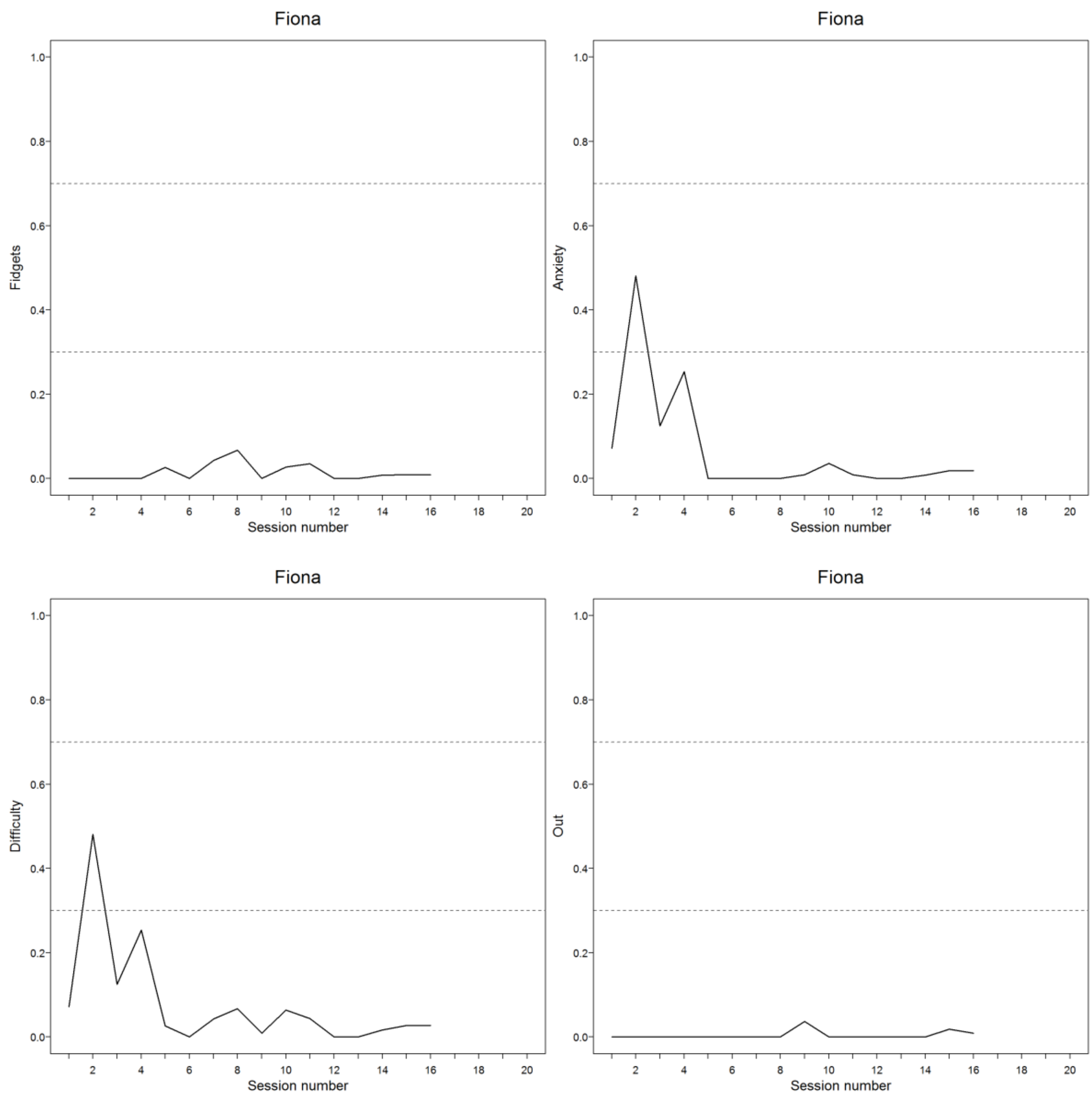
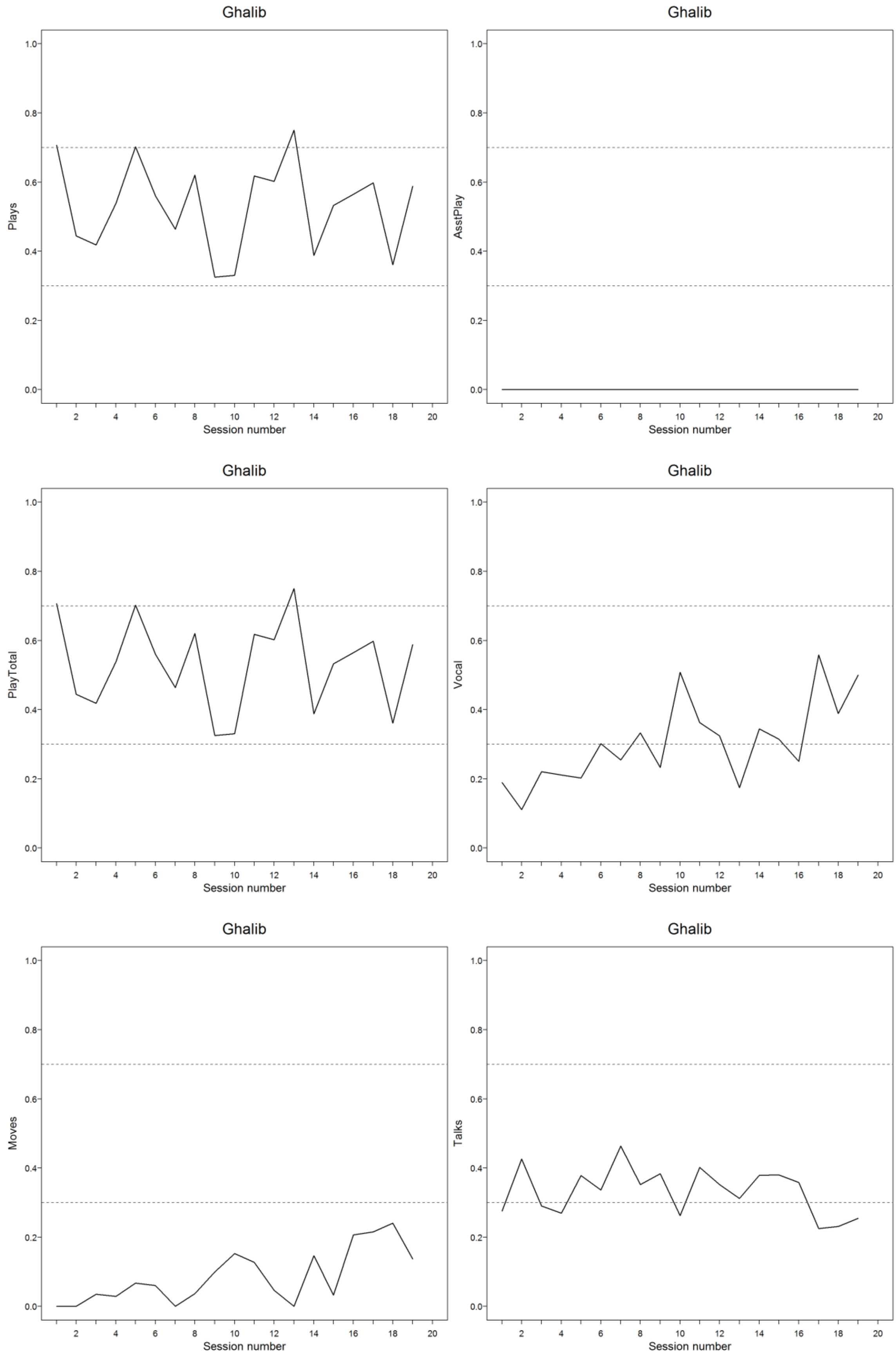
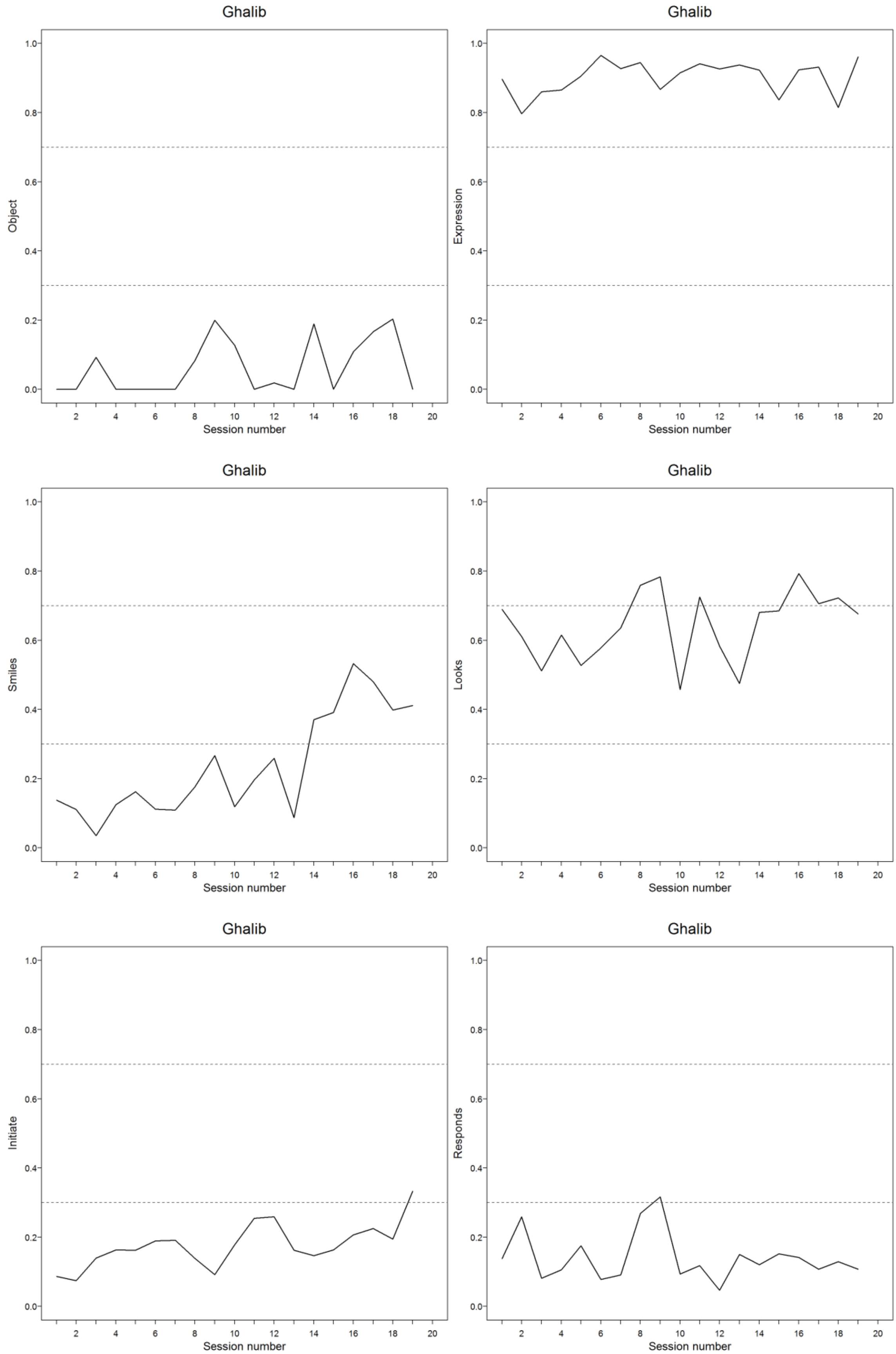

Fiona
Fidgets
Fiona
Anxiety
Fiona
Difficulty
Fiona
Out
Session number
0.0
0.2
0.4
0.6
0.8
1.0
2
4
6
8
10
12
14
16
18
20

Figure Appendix 17: Variables Ghalib





Ghalib
Object
Session number
Ghalib
Expression
Session number
Ghalib
Smiles
Session number
Ghalib
Looks
Session number
Ghalib
Initiate
Session number
Ghalib
Responds
Session number

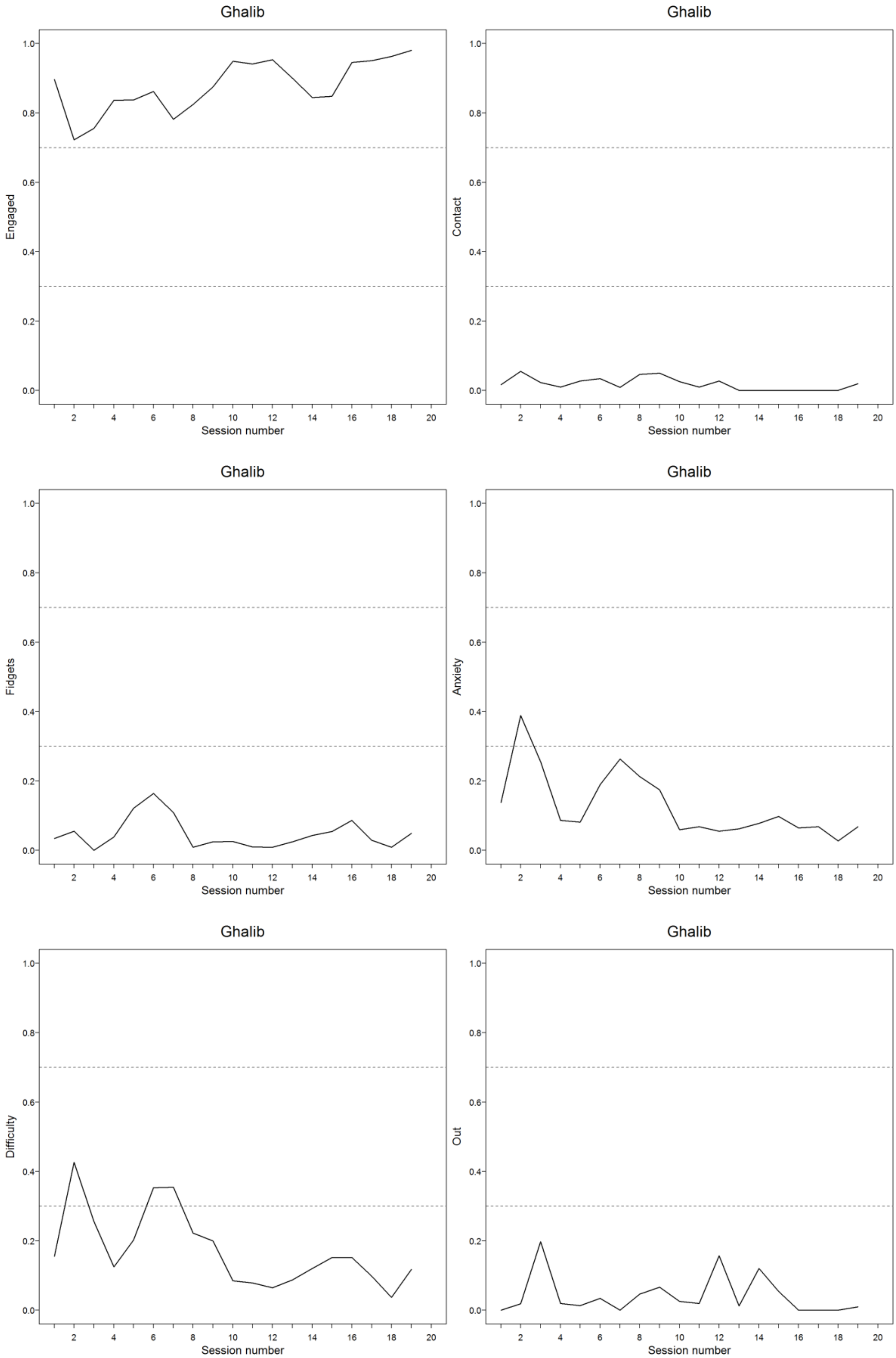
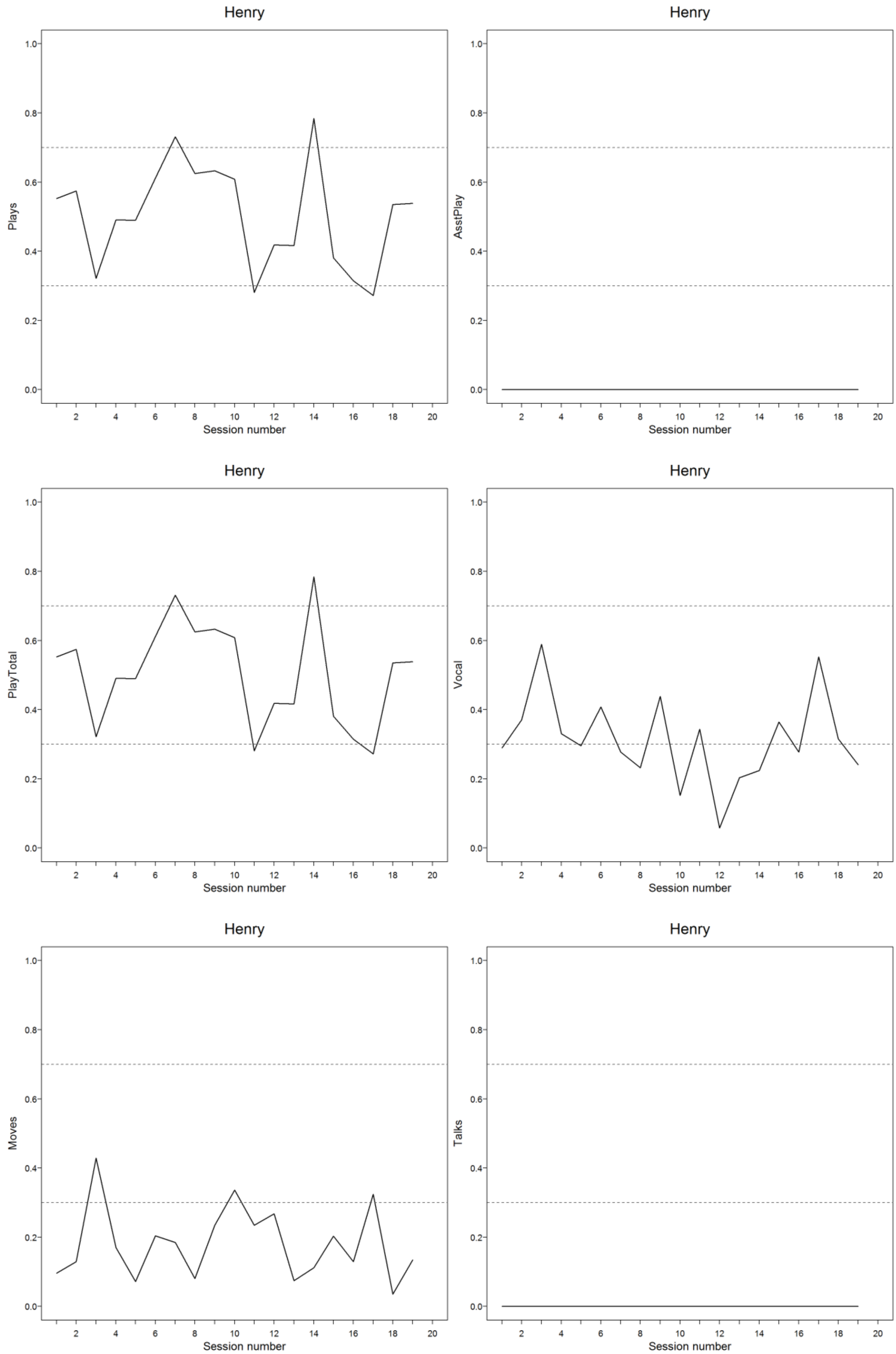
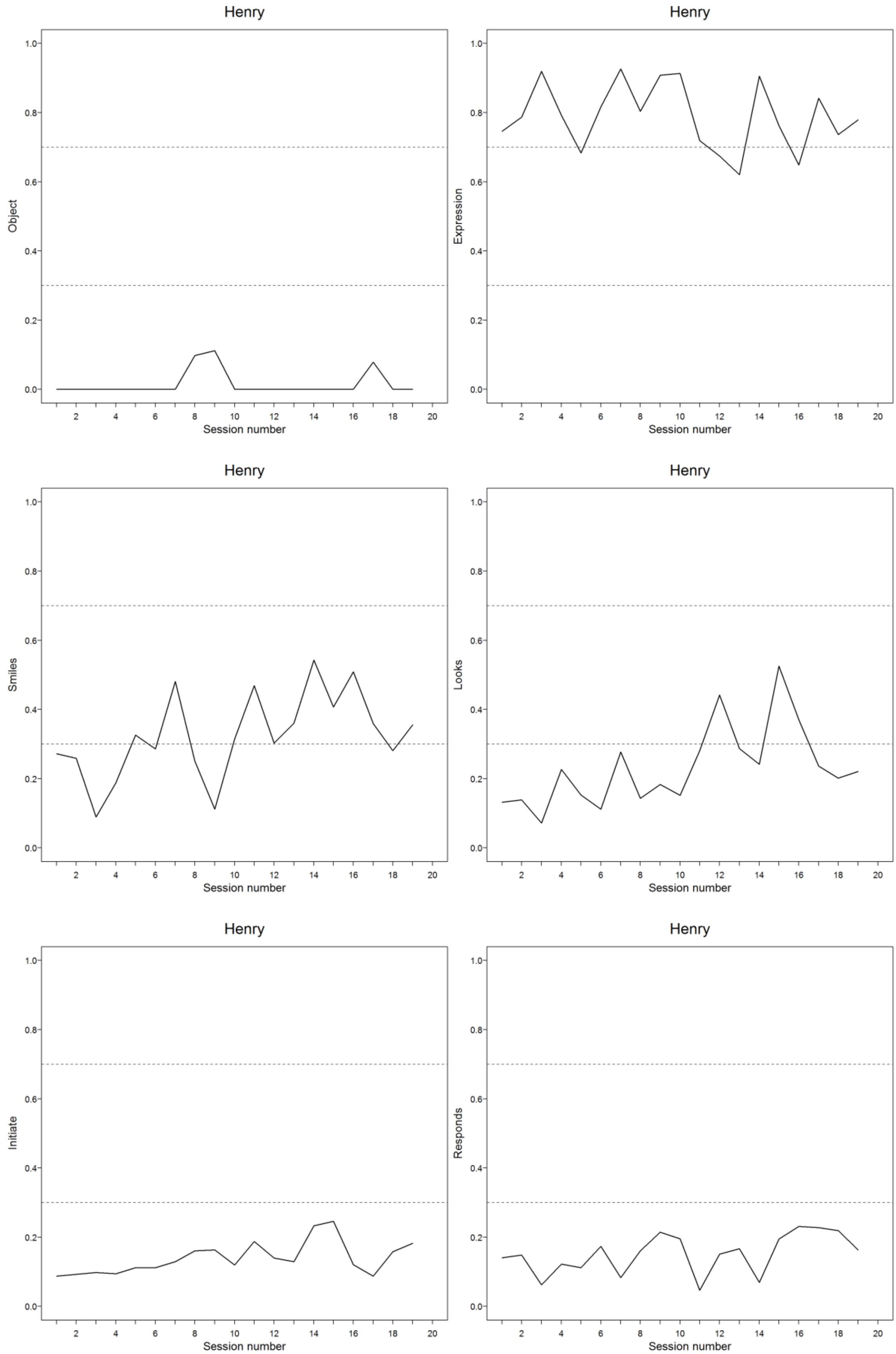
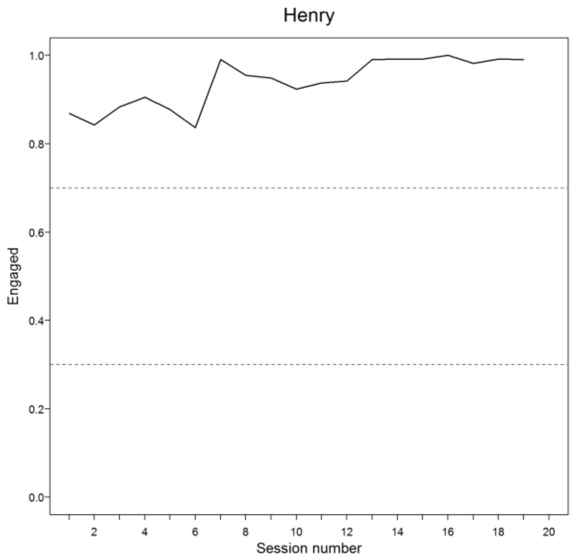
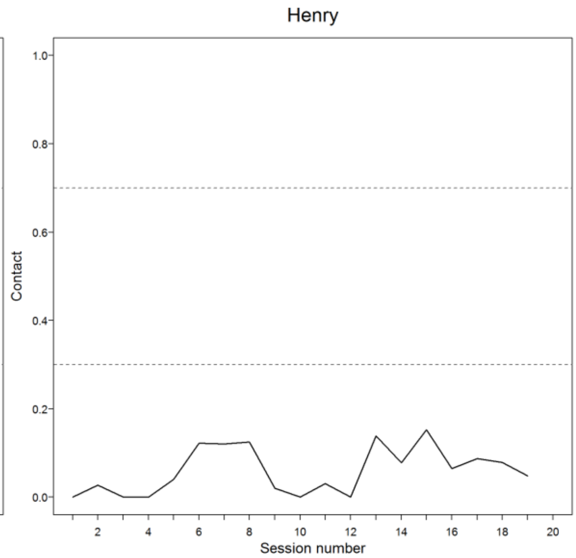

Ghalib
Engaged
Session number
Ghalib
Contact
Session number
Ghalib
Fidgets
Session number
Ghalib
Anxiety
Session number
Ghalib
Difficulty
Session number
Ghalib
Out
Session number

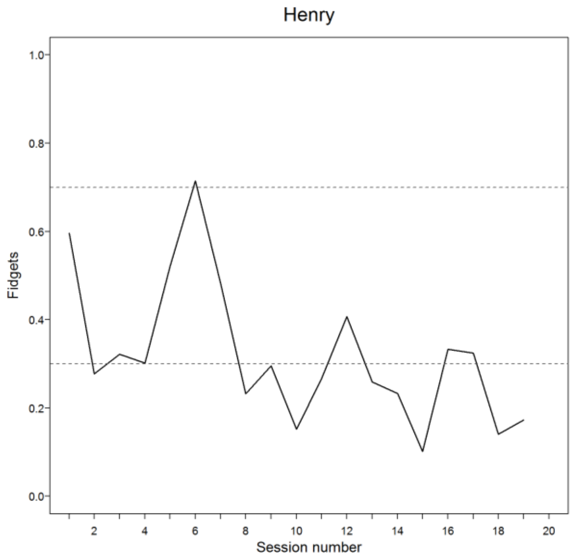
Figure Appendix 18: Variables Henry

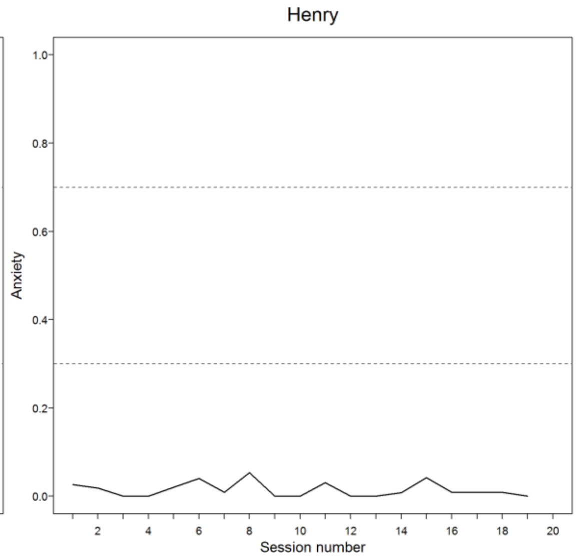


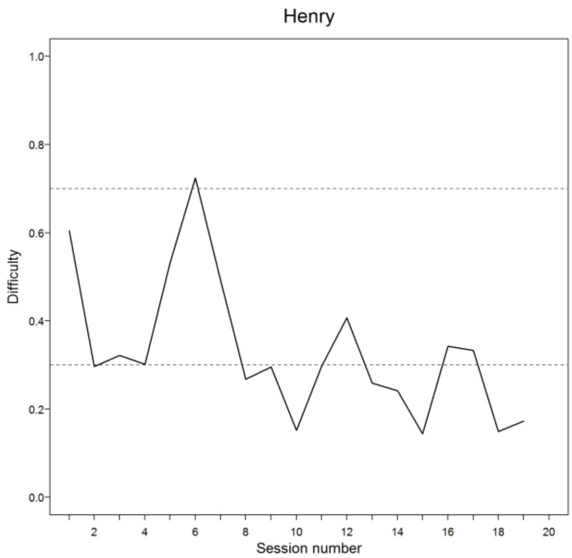

Henry
Object
Session number
Henry
Expression
Session number
Henry
Smiles
Session number
Henry
Looks
Session number
Henry
Initiate
Session number
Henry
Responds
Session number


Henry
Engaged
Session number


Henry
Contact
Session number


Henry
Fidgets
Session number


Henry
Anxiety
Session number


Henry
Difficulty
Session number

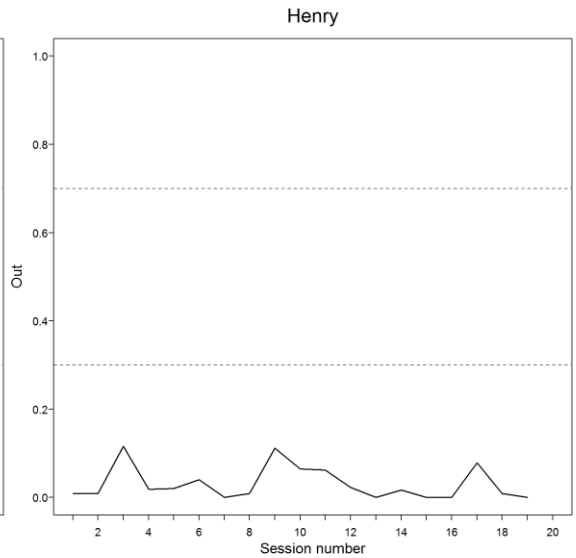
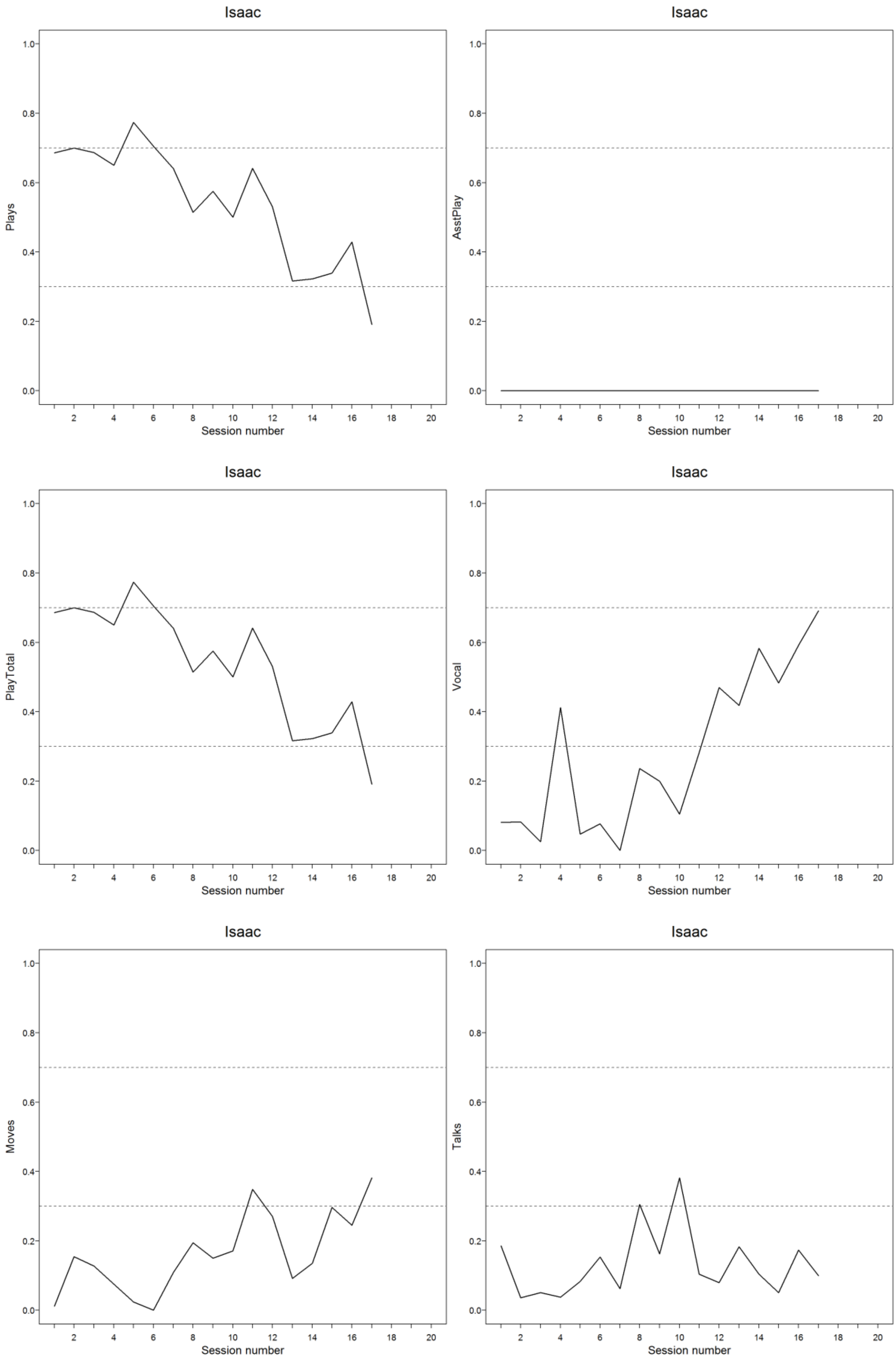
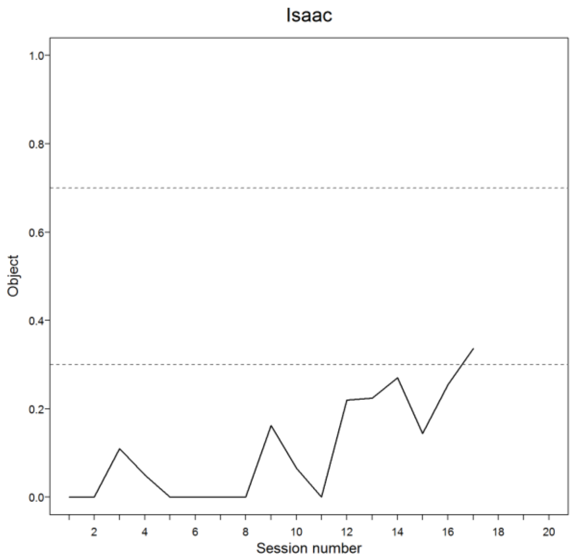
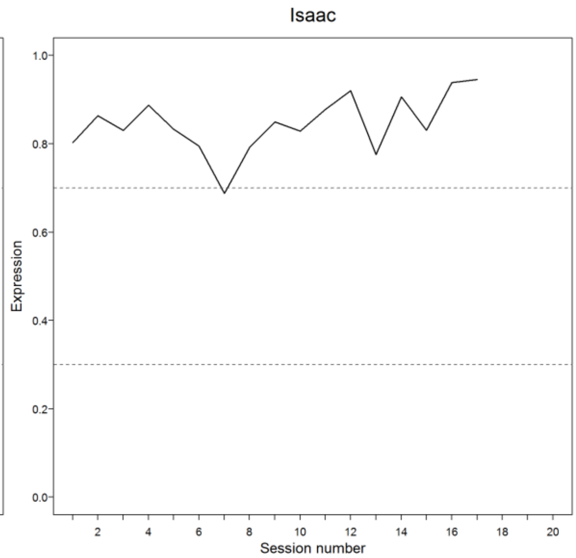
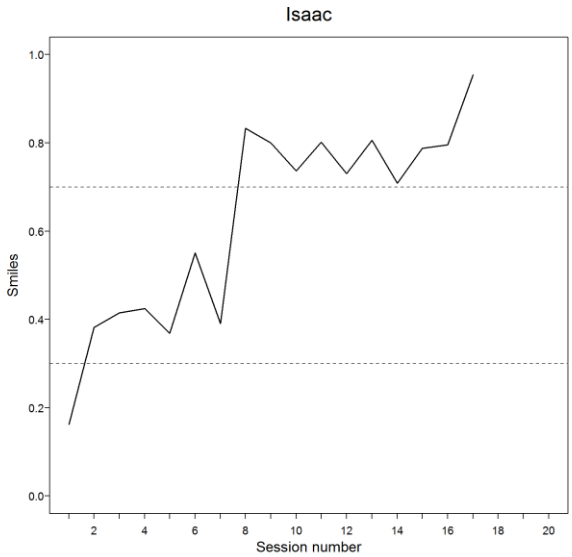

Henry
Out
Session number

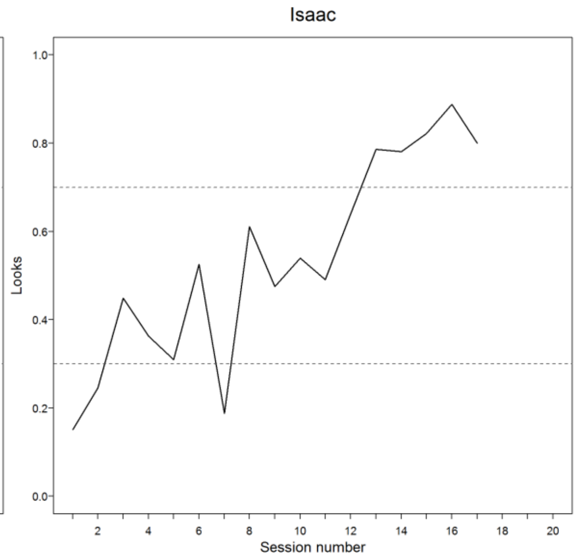
Figure Appendix 19: Variables Isaac

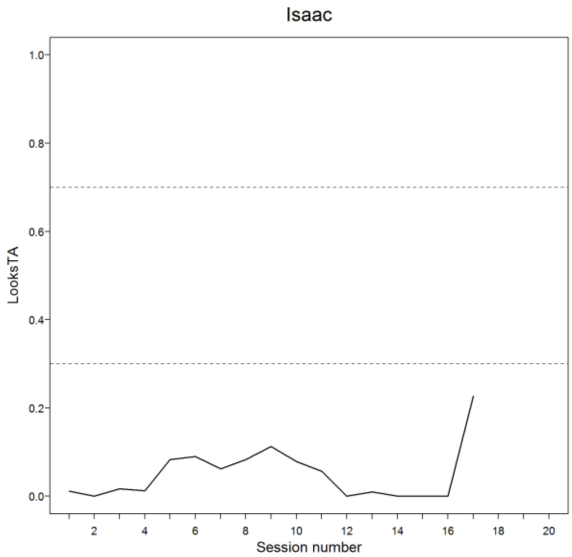


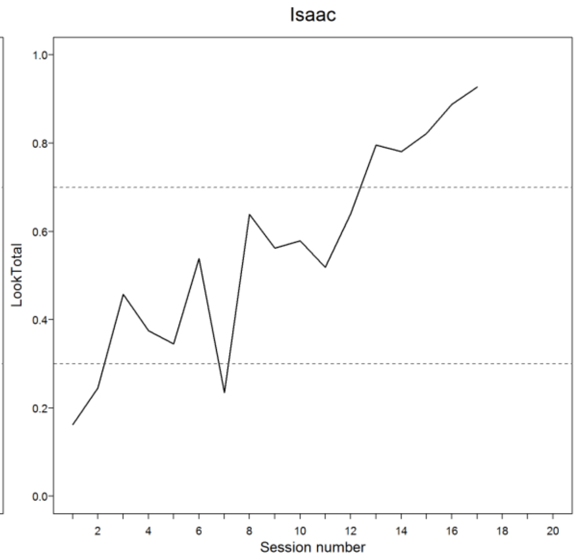

Isaac
Object
Session number

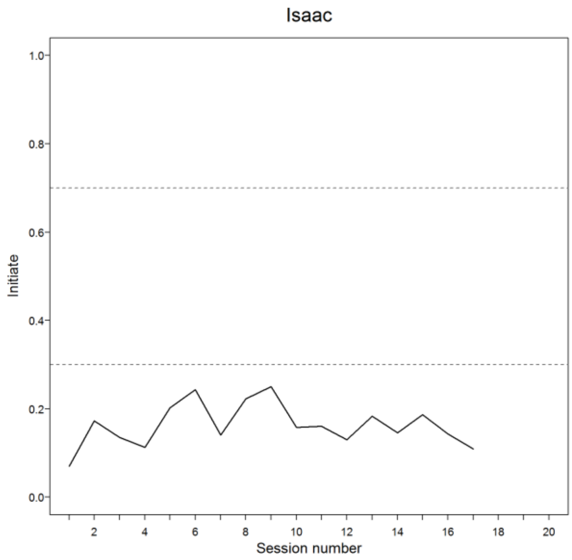

Isaac
Expression
Session number

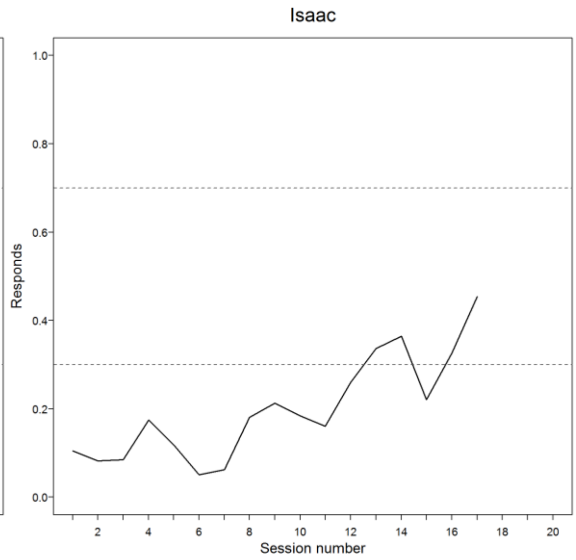

Isaac
Smiles
Session number

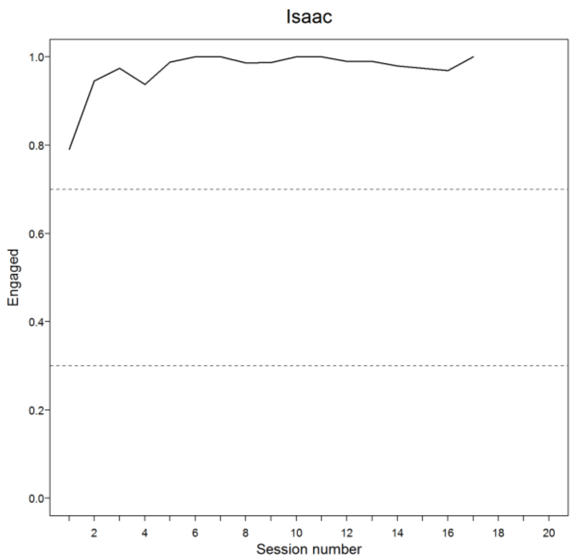

Isaac
Looks
Session number

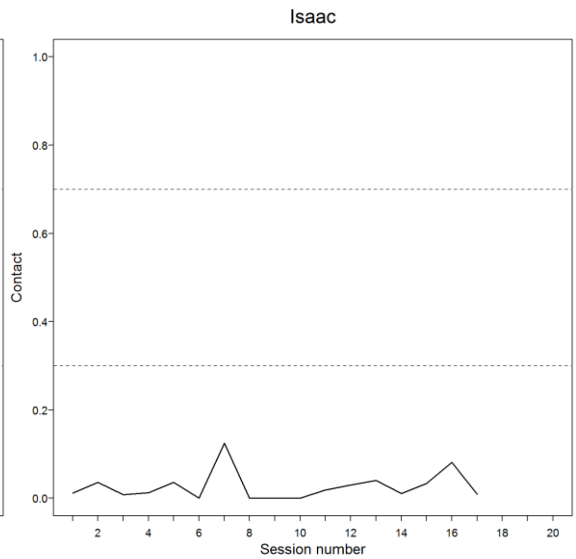

Isaac
LooksTA
Session number

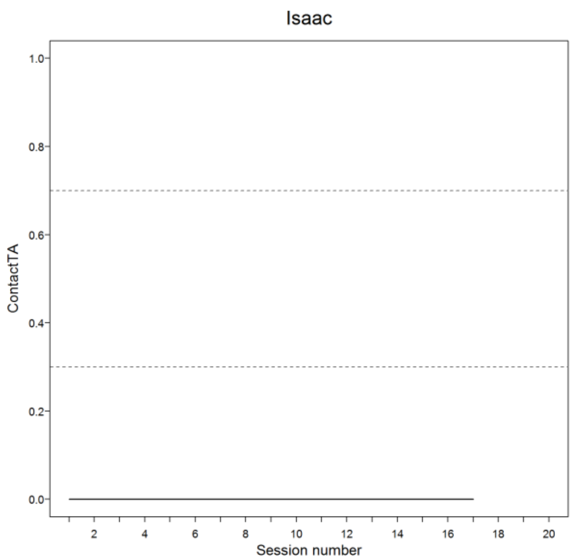

Isaac
LookTotal
Session number

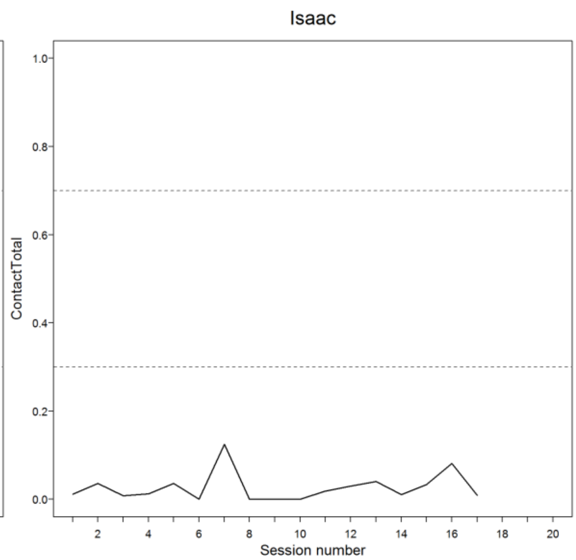

Isaac
Initiate
Session number


Isaac
Responds
Session number


Isaac
Engaged
Session number


Isaac
Contact
Session number


Isaac
ContactTA
Session number


Isaac
ContactTotal
Session number

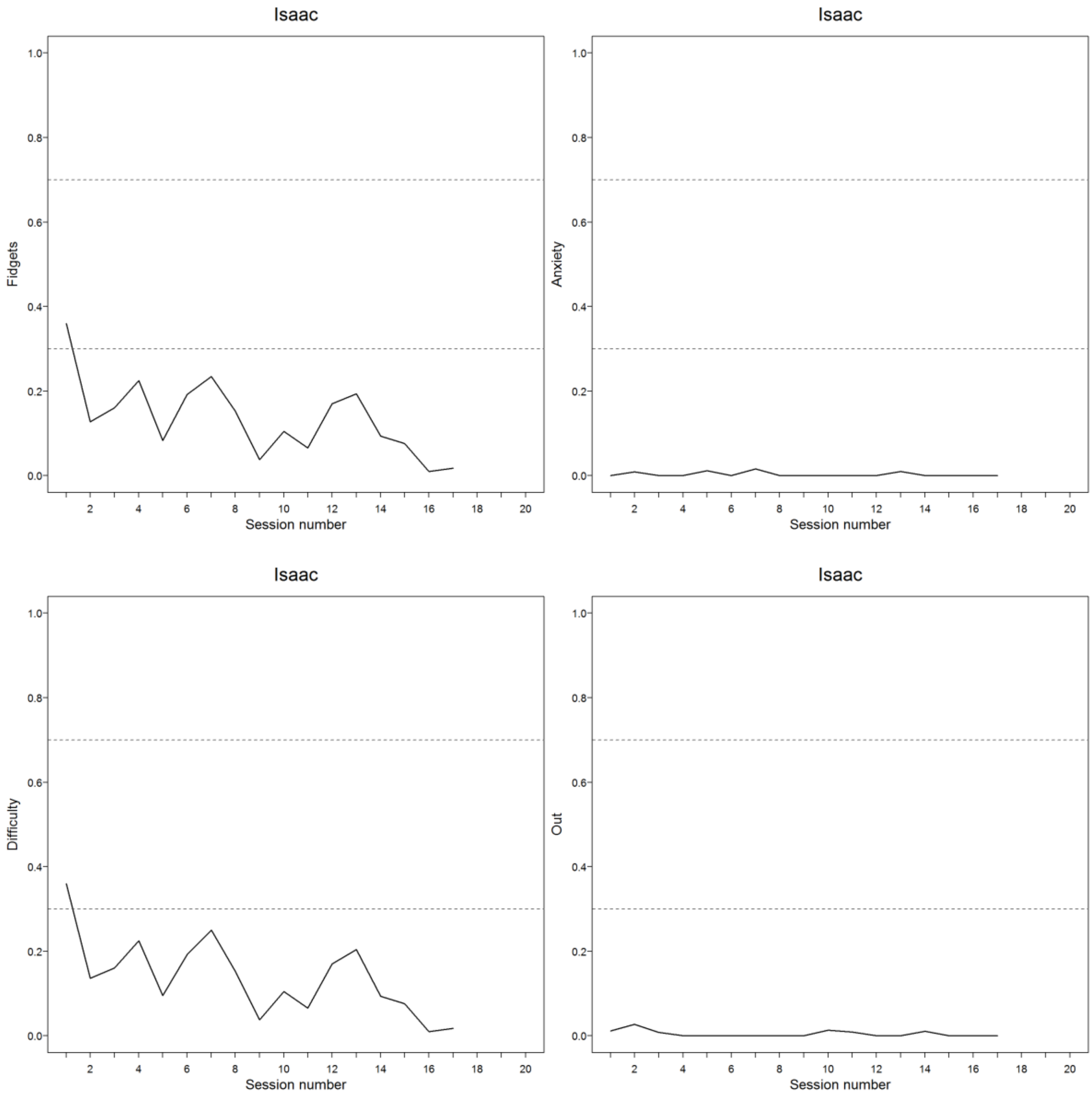
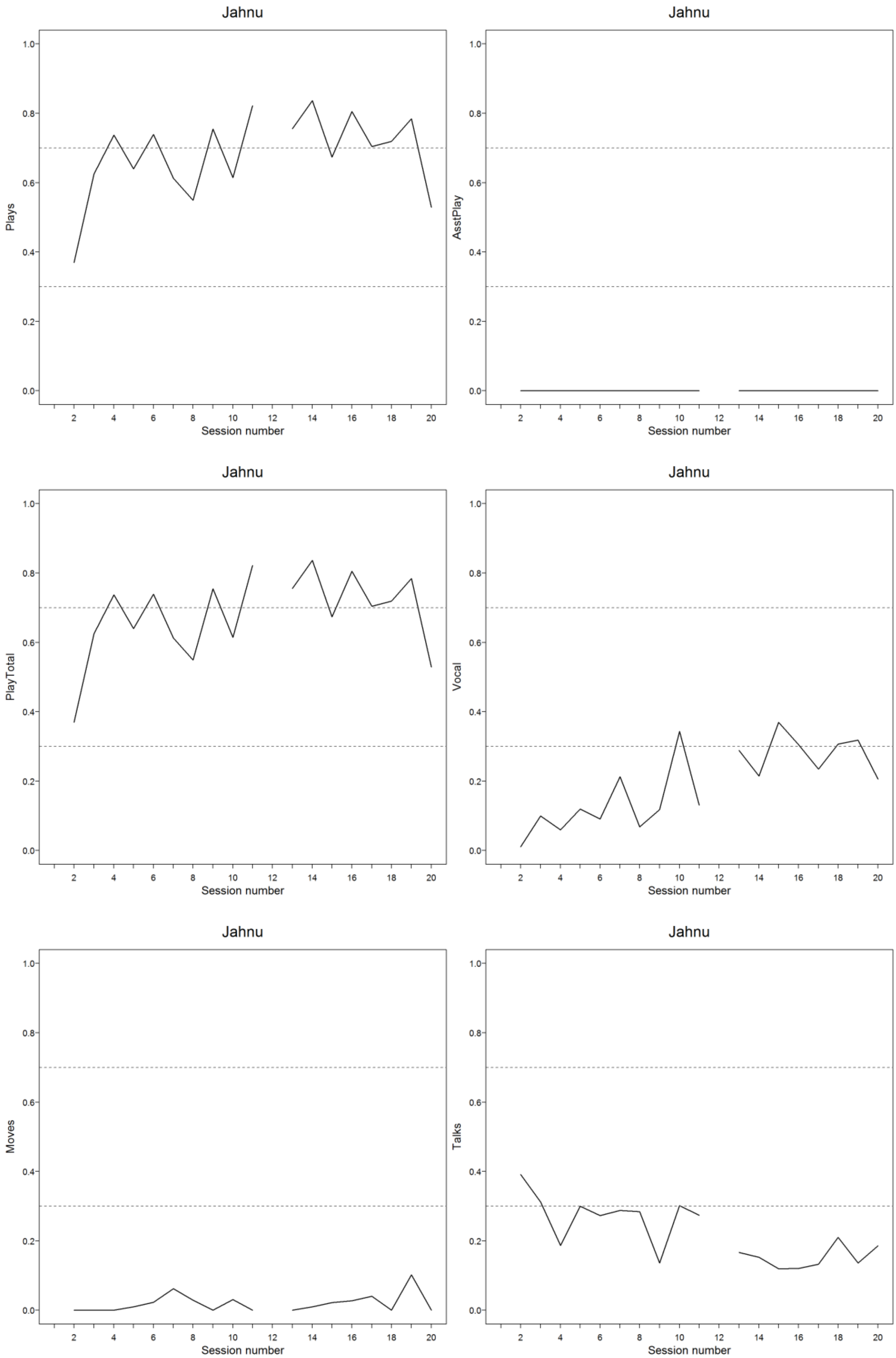
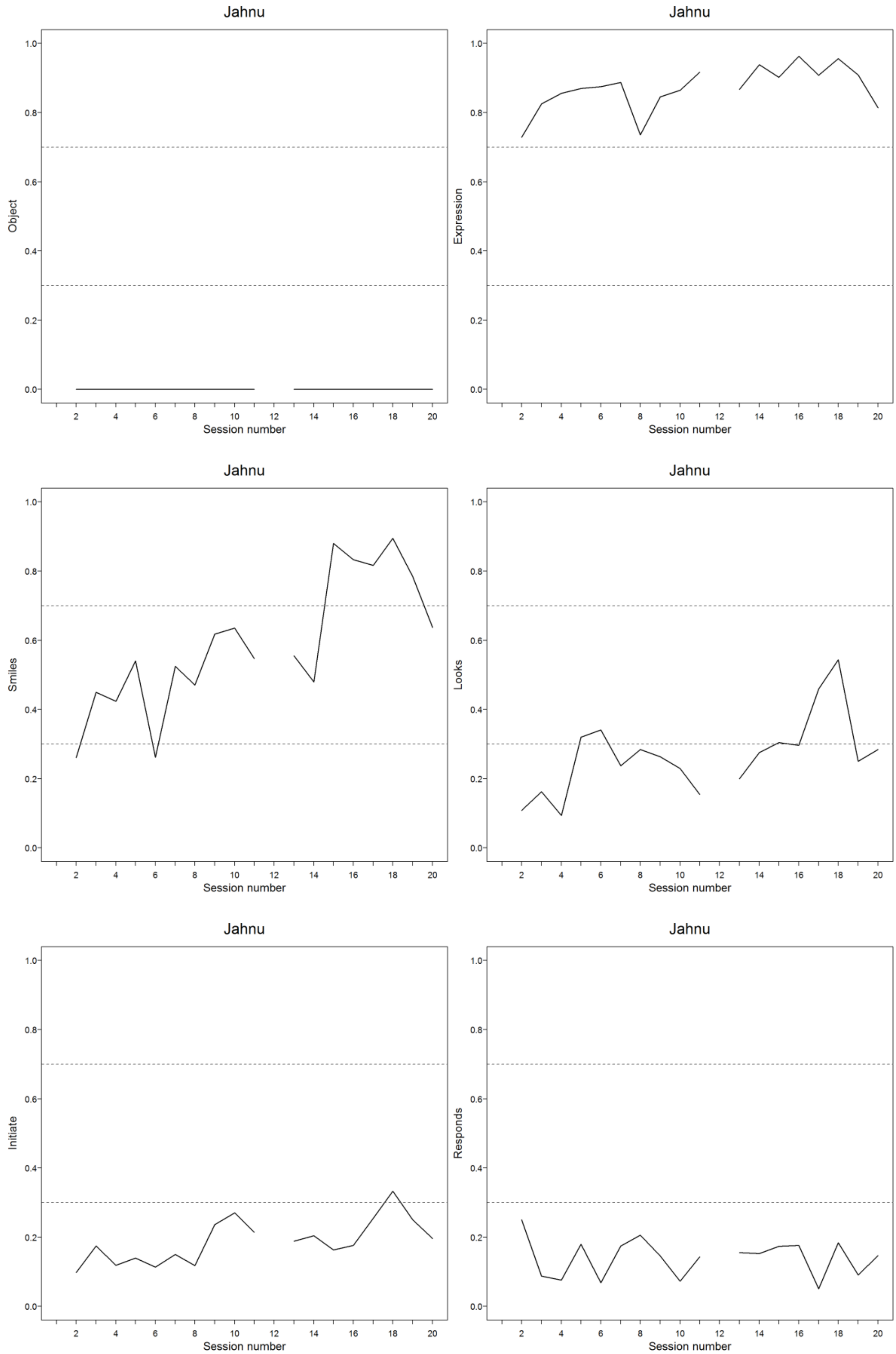
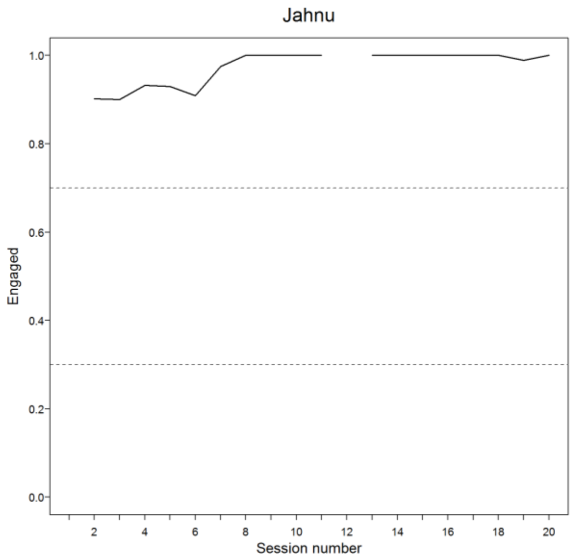
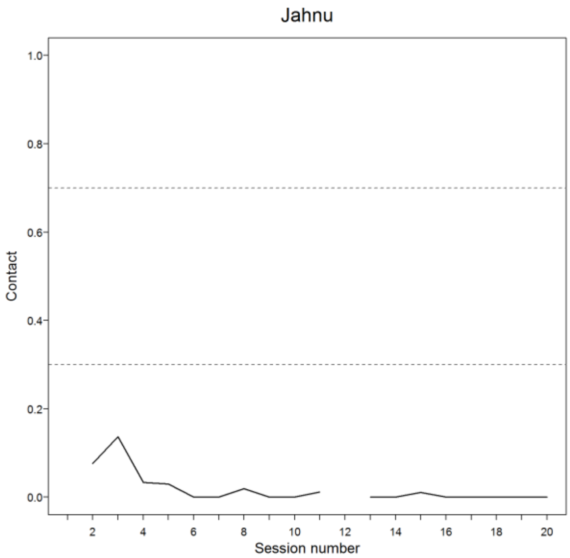

Isaac
Fidgets
Session number
Isaac
Anxiety
Session number
Isaac
Difficulty
Session number
Isaac
Out
Session number

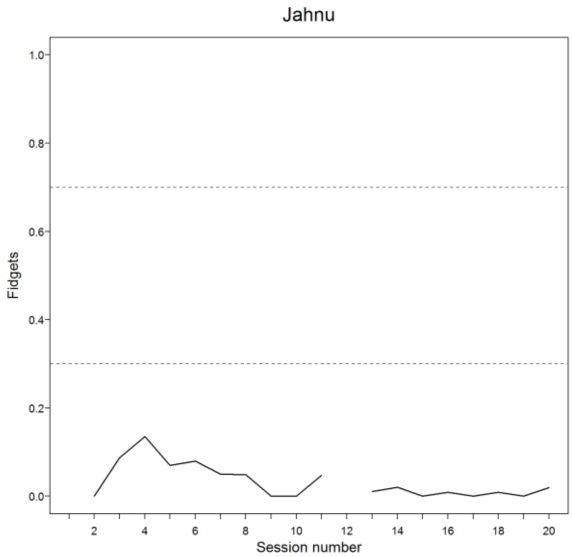
Figure Appendix 20: Variables Jahnu

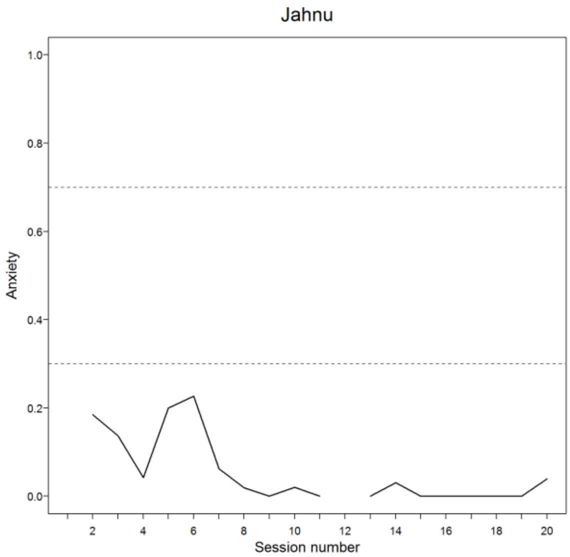


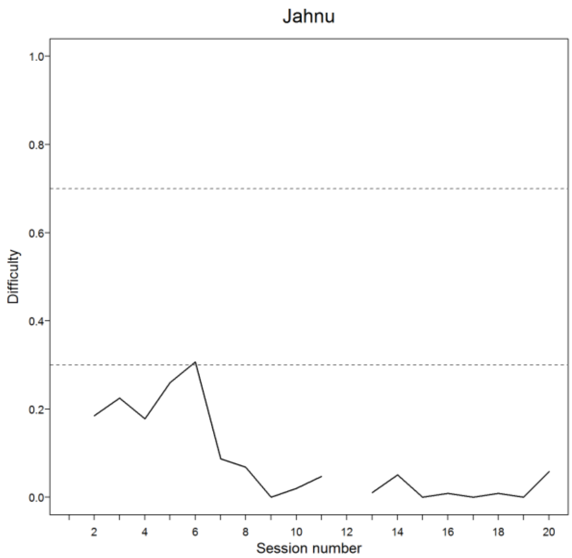

Jahnu
Object
Session number
Jahnu
Expression
Session number
Jahnu
Smiles
Session number
Jahnu
Looks
Session number
Jahnu
Initiate
Session number
Jahnu
Responds
Session number


Jahnu
Engaged
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Jahnu
Contact
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Jahnu
Fidgets
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Jahnu
Anxiety
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Jahnu
Difficulty
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

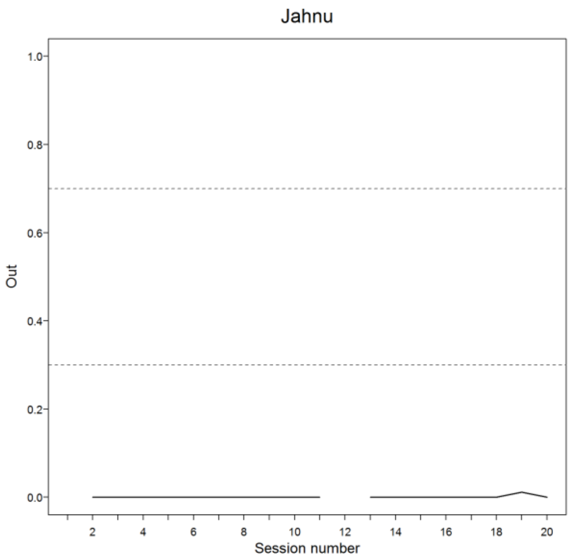
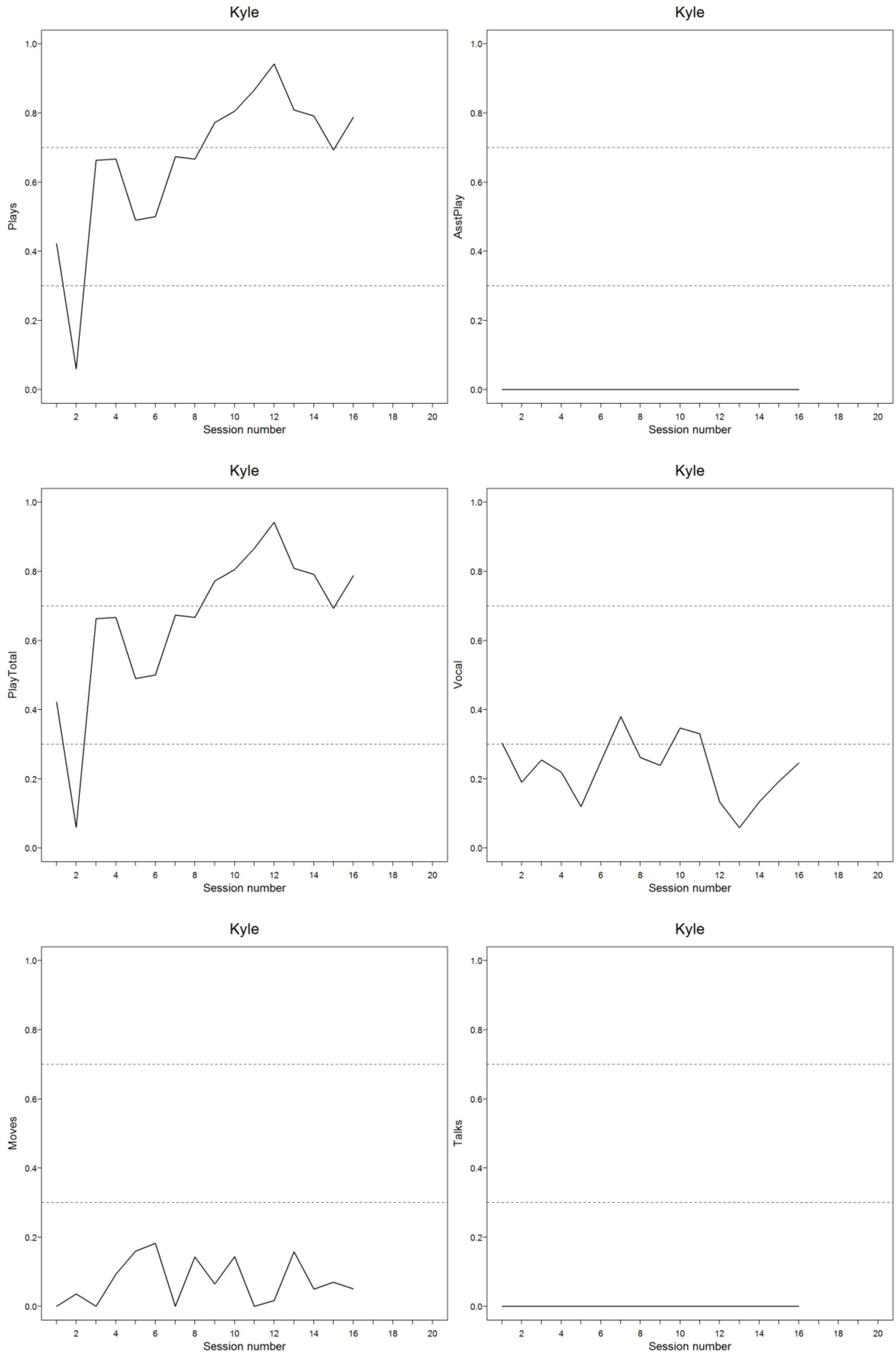
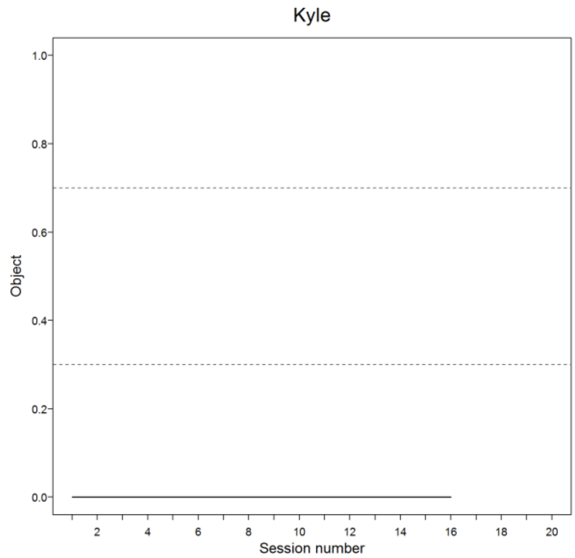
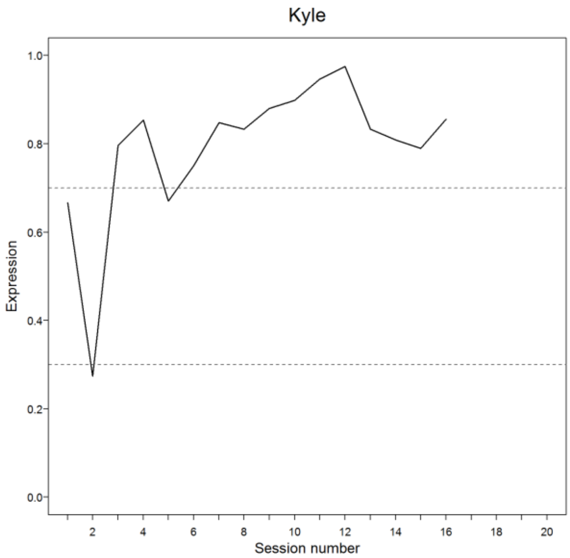
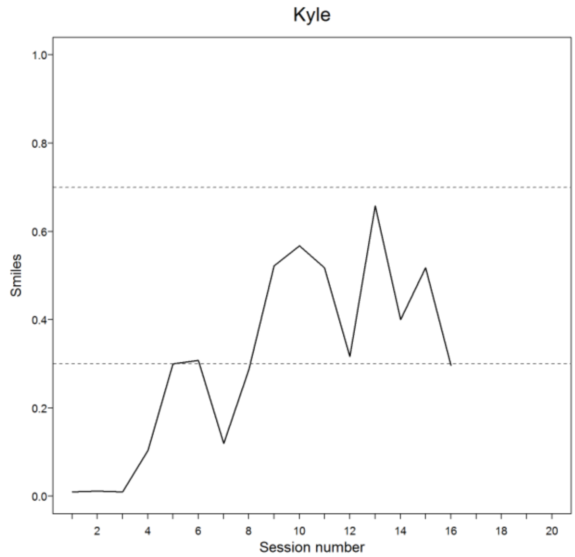

Jahnu
Out
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

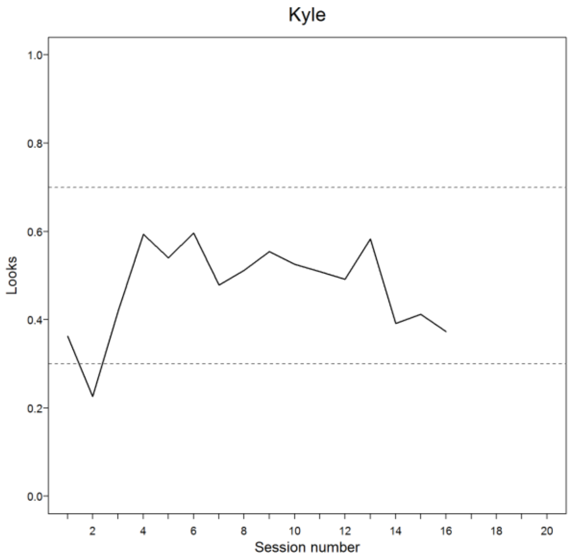
Figure Appendix 21: Variables Kyle

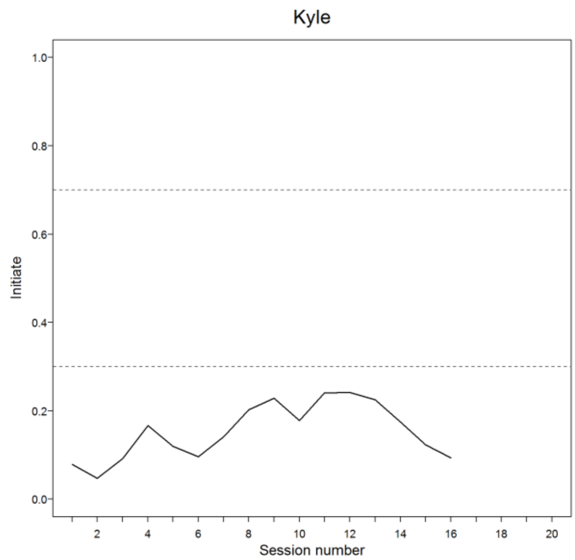


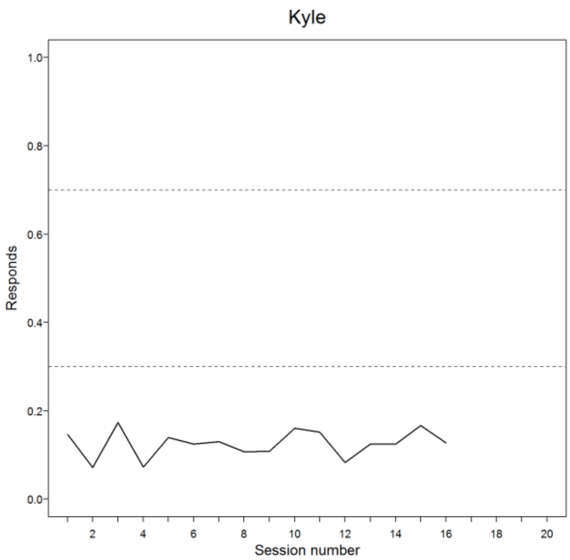

Kyle
Object
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Kyle
Expression
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Kyle
Smiles
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Kyle
Looks
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Kyle
Initiate
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Kyle
Responds
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number

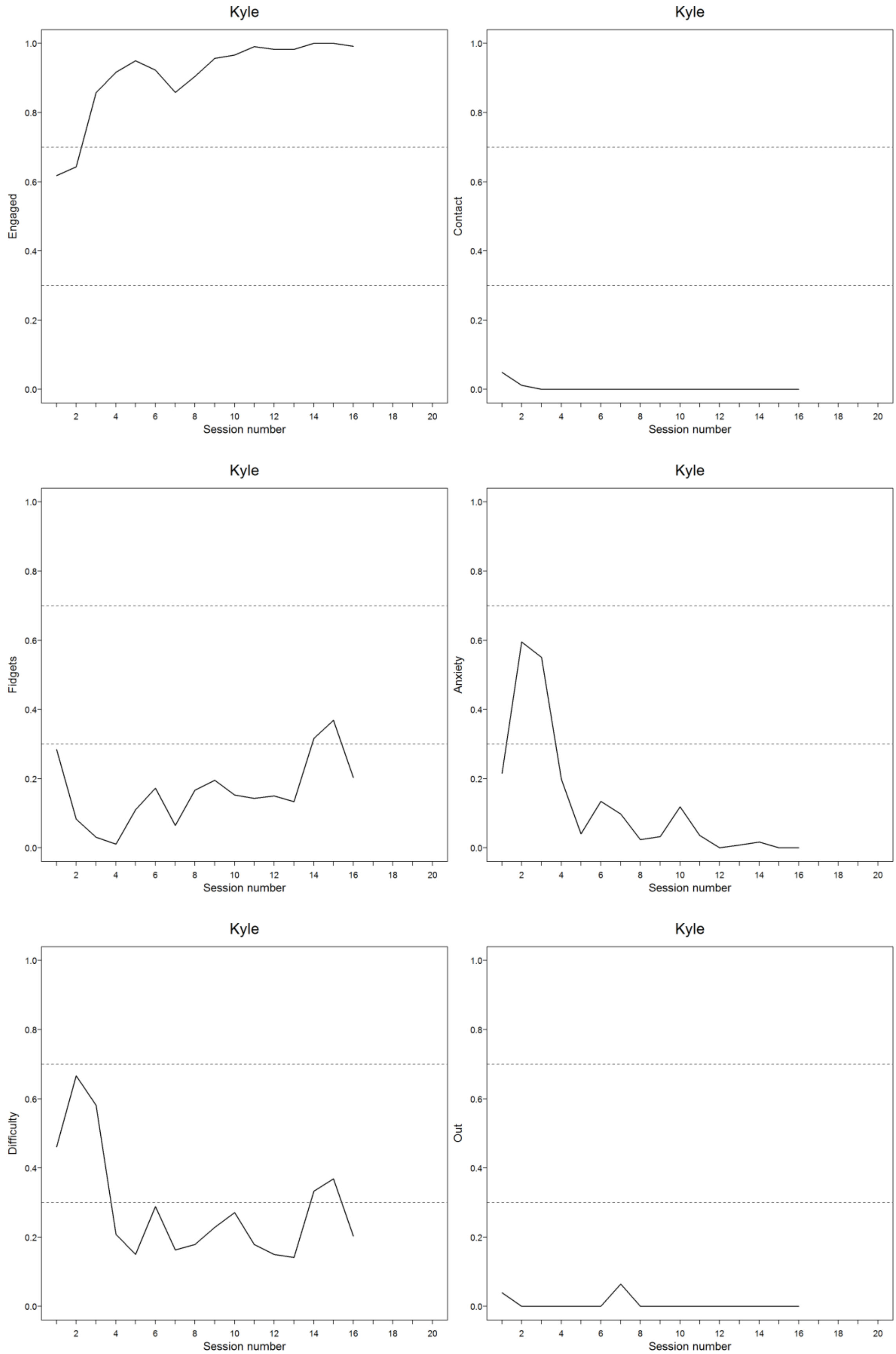
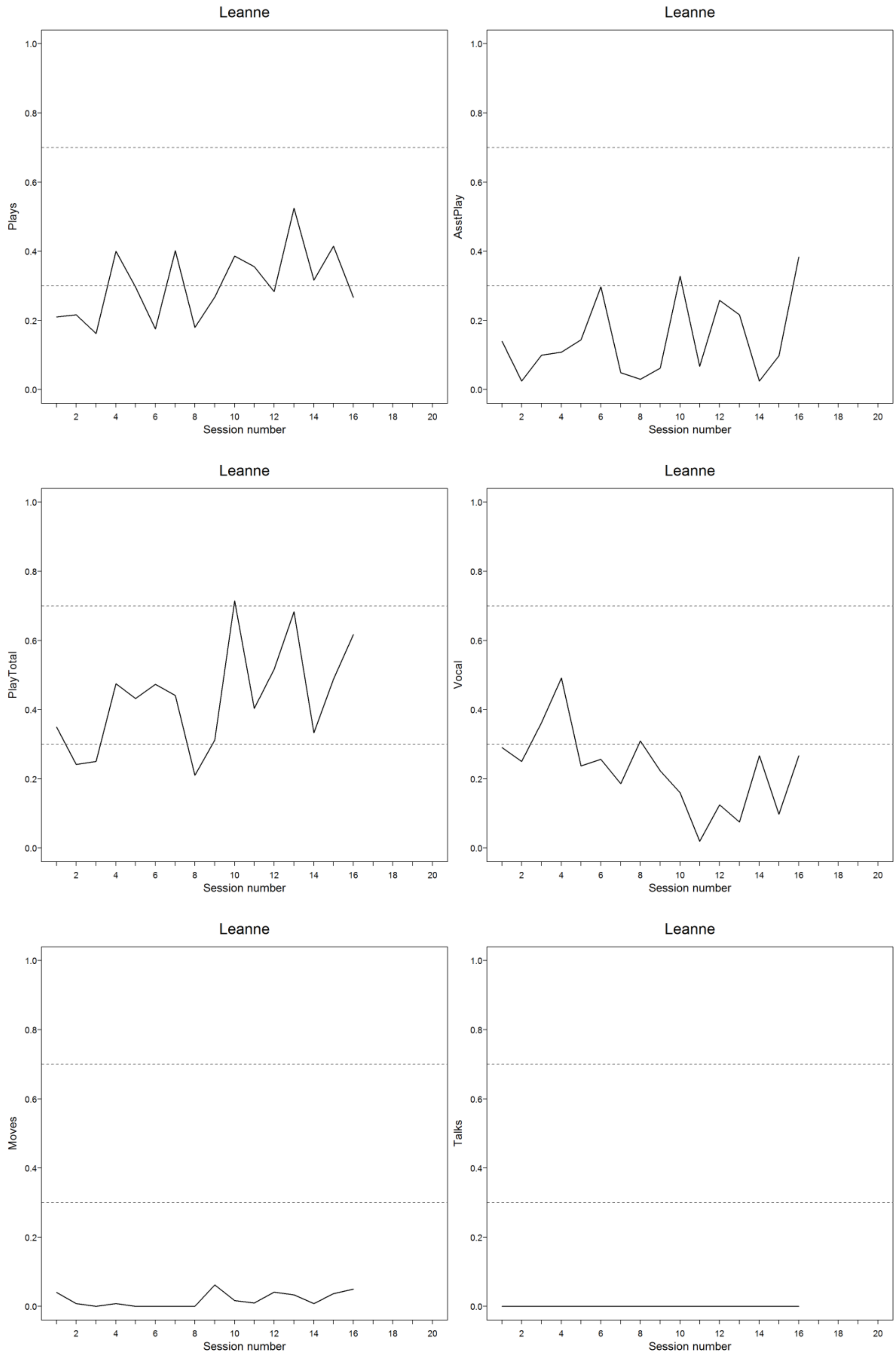
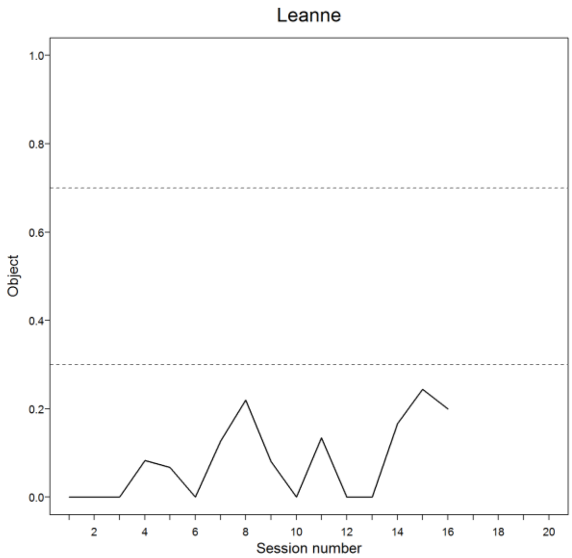
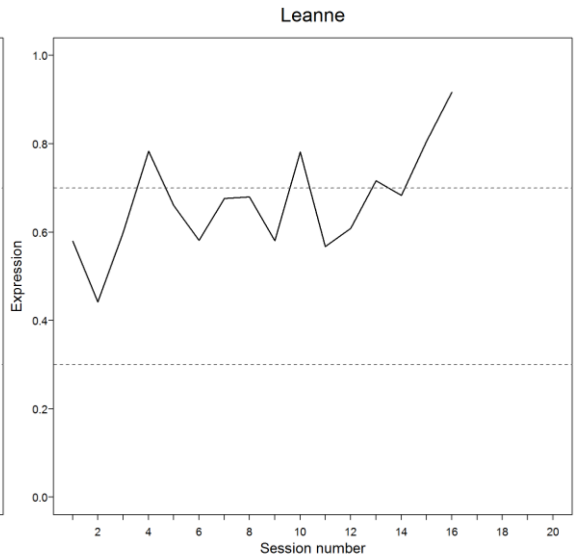
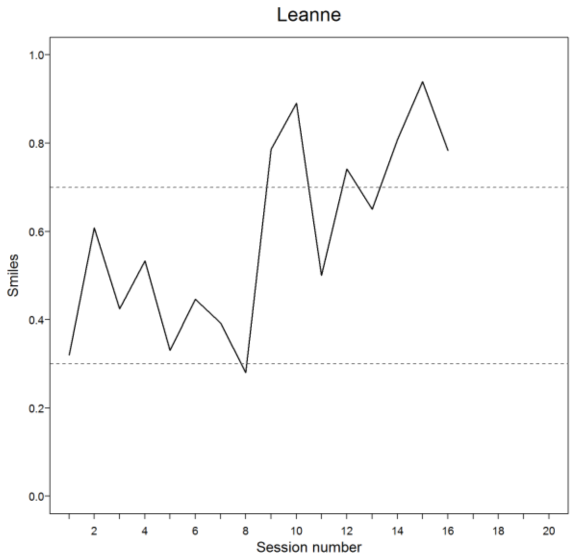

Kyle
Engaged
Session number
Kyle
Contact
Session number
Kyle
Fidgets
Session number
Kyle
Anxiety
Session number
Kyle
Difficulty
Session number
Kyle
Out
Session number

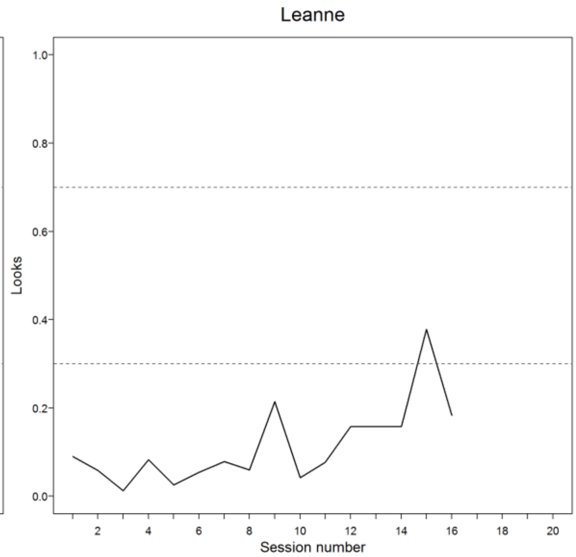
Figure Appendix 22: Variables Leanne

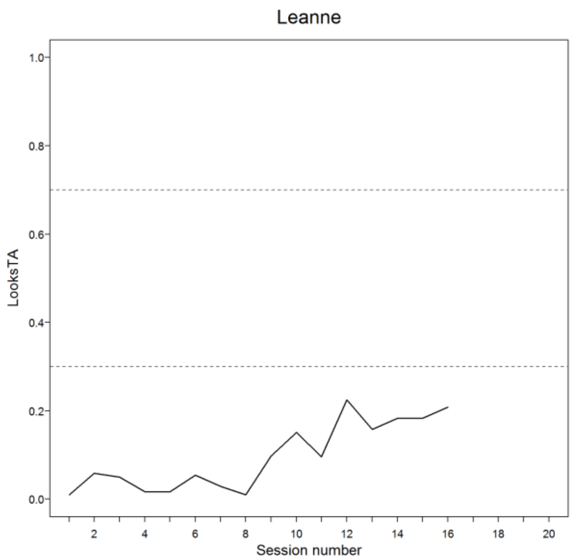


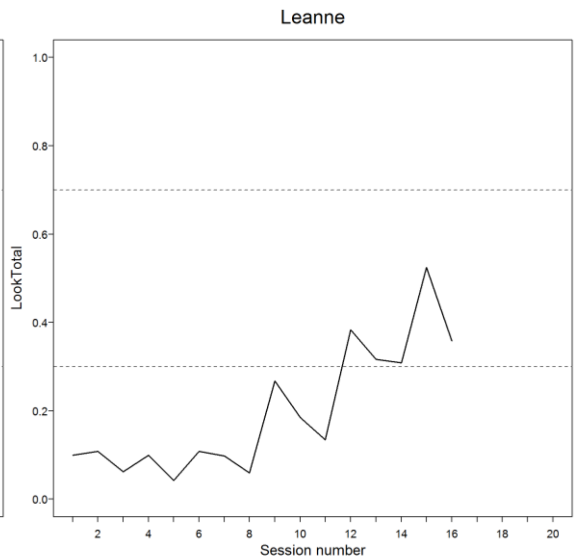

Leanne
Object
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number

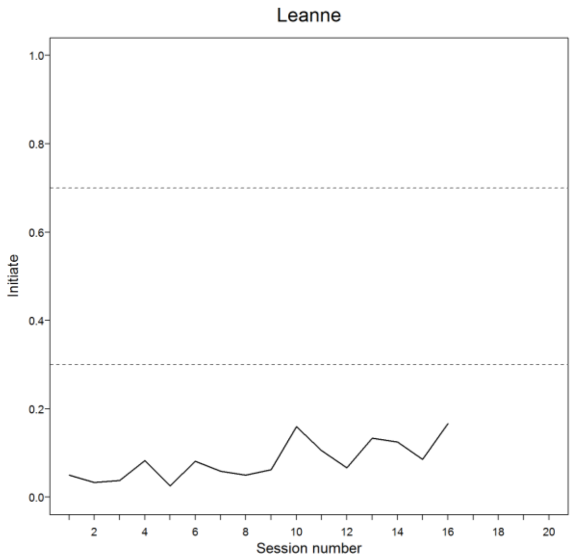
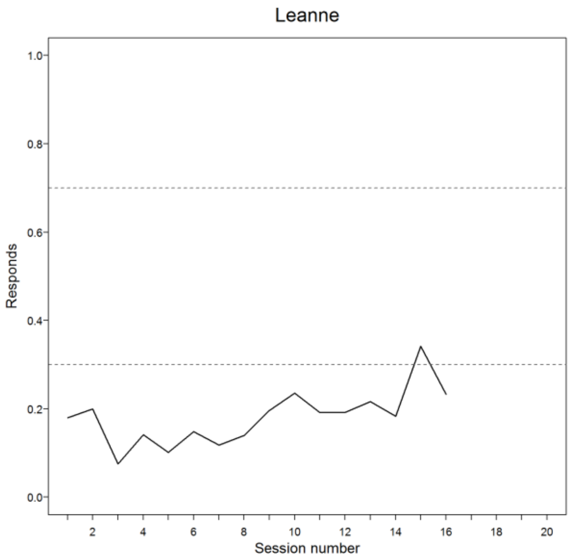
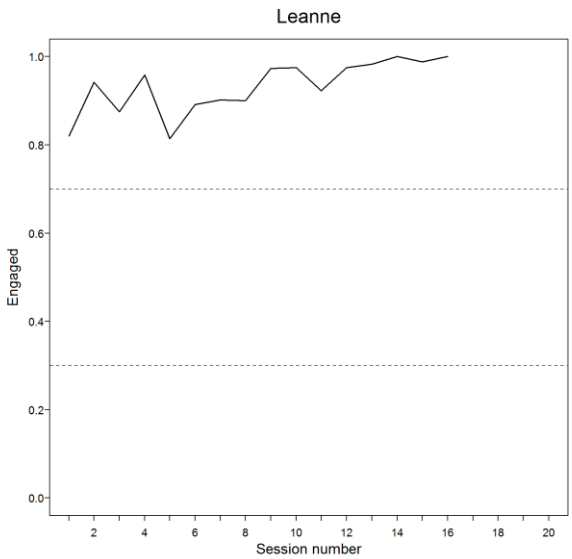
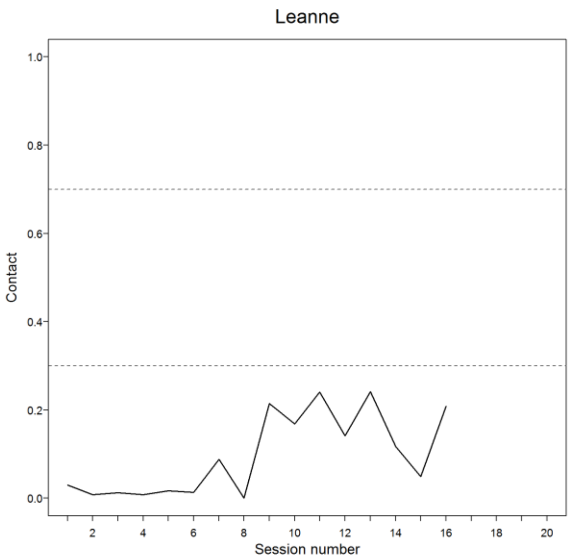
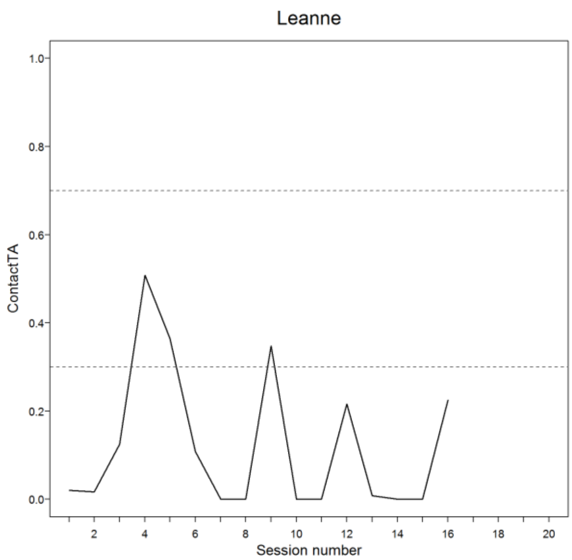
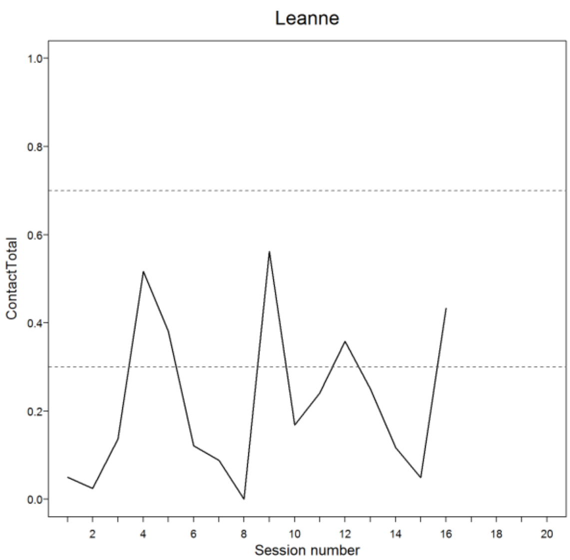

Leanne
Expression
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number

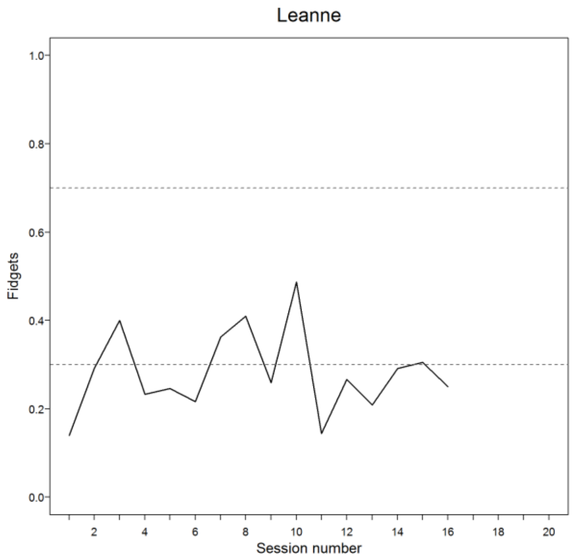

Leanne
Smiles
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number

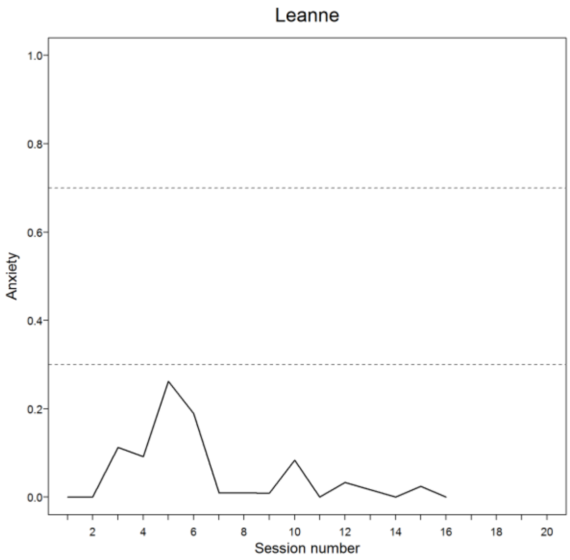

Leanne
Looks
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number

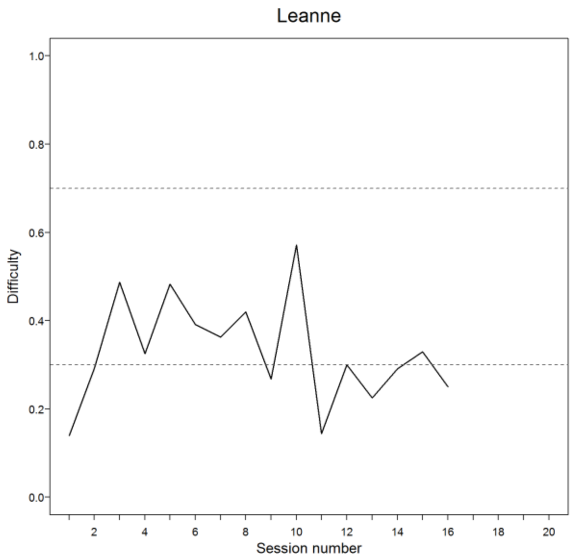

Leanne
LooksTA
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number


Leanne
LookTotal
0.0 0.2 0.4 0.6 0.8 1.0
2 4 6 8 10 12 14 16 18 20
Session number


Leanne
Initiate
Session number

Leanne
Responds
Session number

Leanne
Engaged
Session number

Leanne
Contact
Session number

Leanne
ContactTA
Session number

Leanne
ContactTotal
Session number


Leanne
Fidgets
0.0
0.2
0.4
0.6
0.8
1.0
2 4 6 8 10 12 14 16 18 20
Session number


Leanne
Anxiety
0.0
0.2
0.4
0.6
0.8
1.0
2 4 6 8 10 12 14 16 18 20
Session number


Leanne
Difficulty
0.0
0.2
0.4
0.6
0.8
1.0
2 4 6 8 10 12 14 16 18 20
Session number

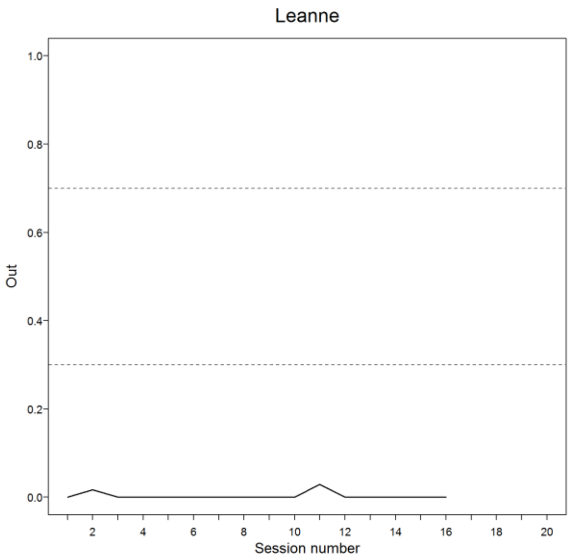
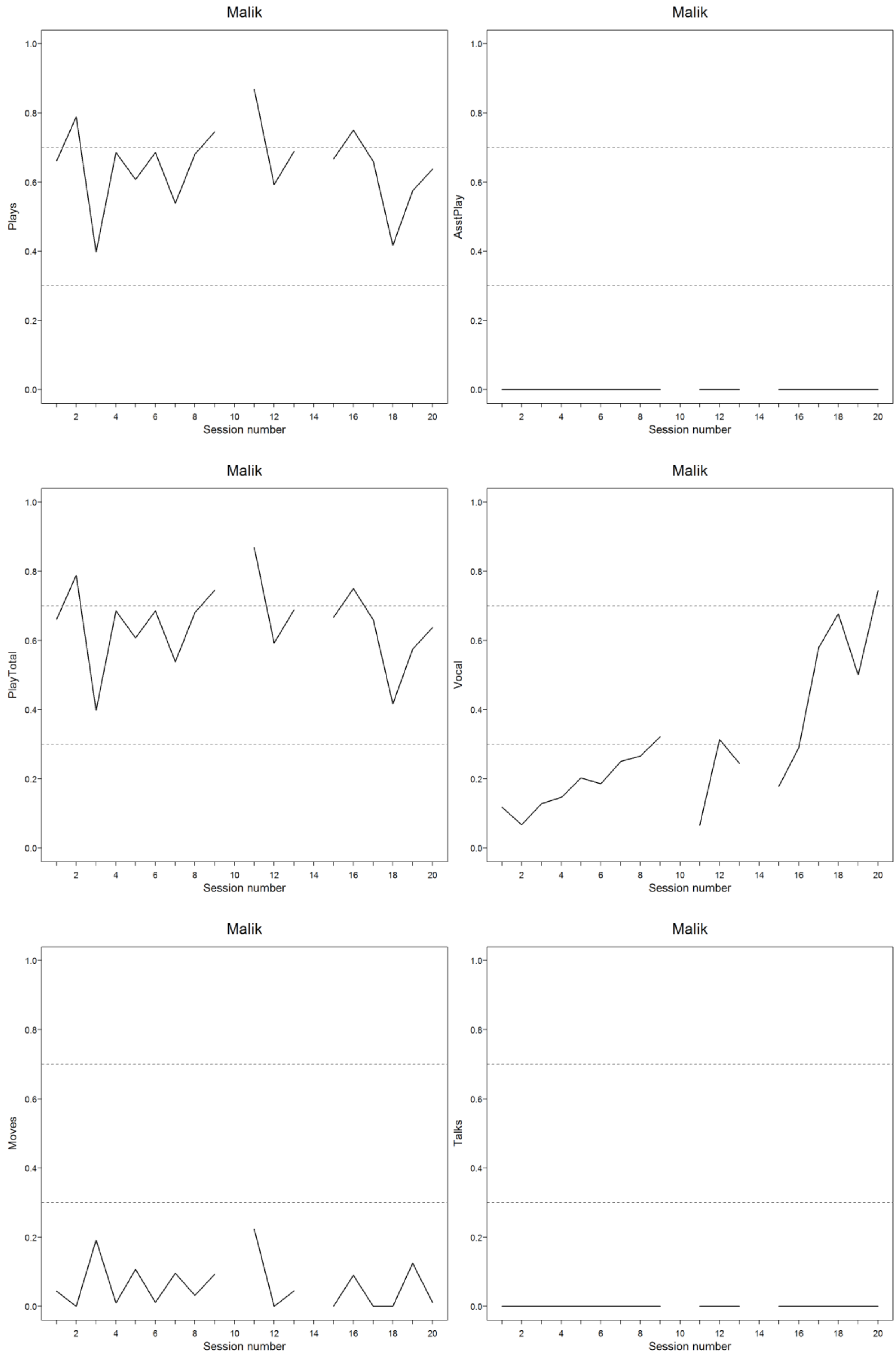
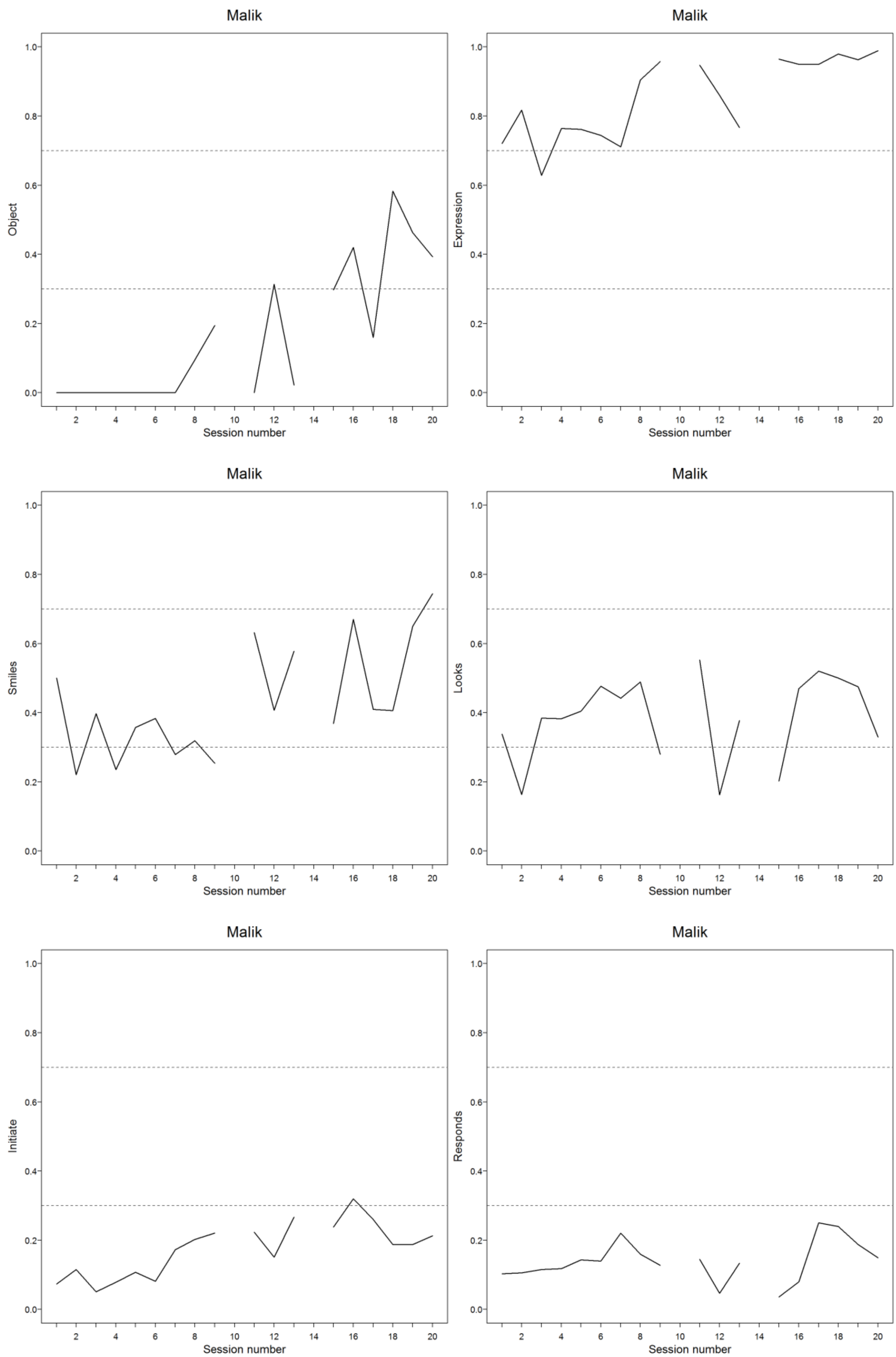
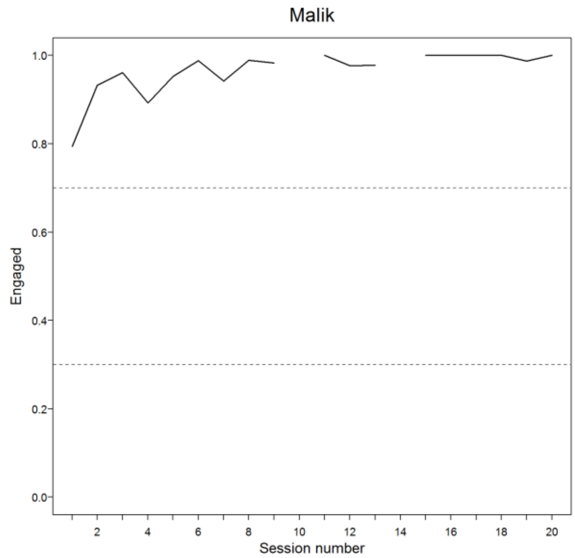

Leanne
Out
0.0
0.2
0.4
0.6
0.8
1.0
2 4 6 8 10 12 14 16 18 20
Session number

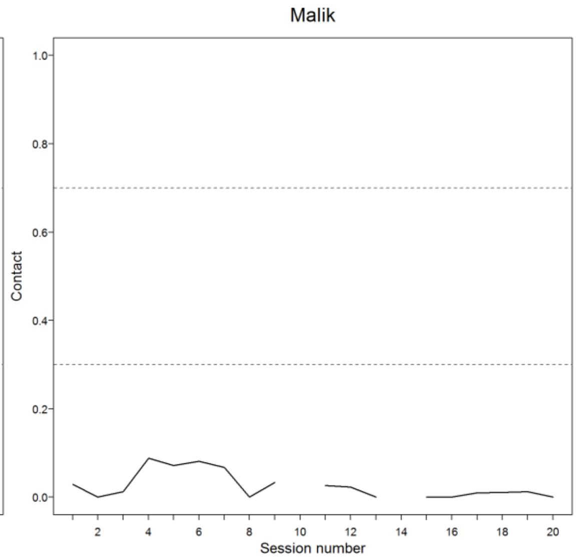
Figure Appendix 23: Variables Malik

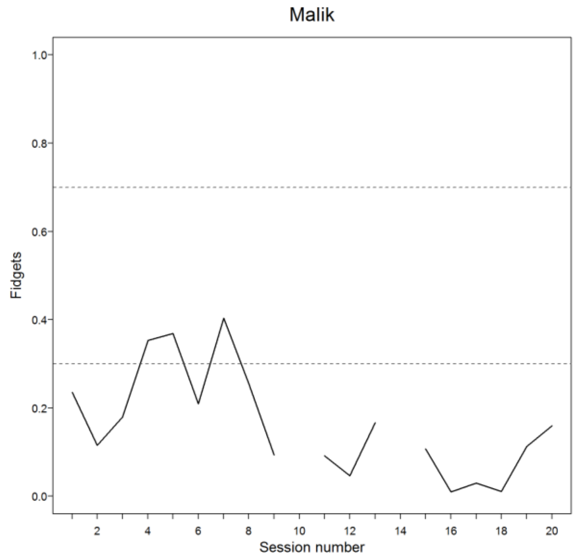


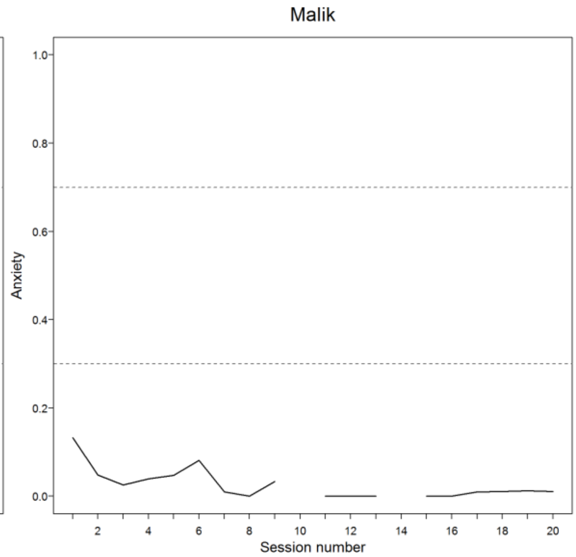


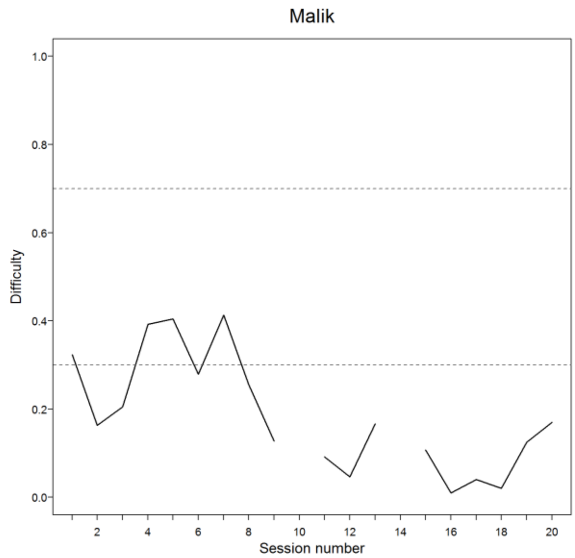
Malik
Object
Session number
Malik
Expression
Session number
Malik
Smiles
Session number
Malik
Looks
Session number
Malik
Initiate
Session number
Malik
Responds
Session number

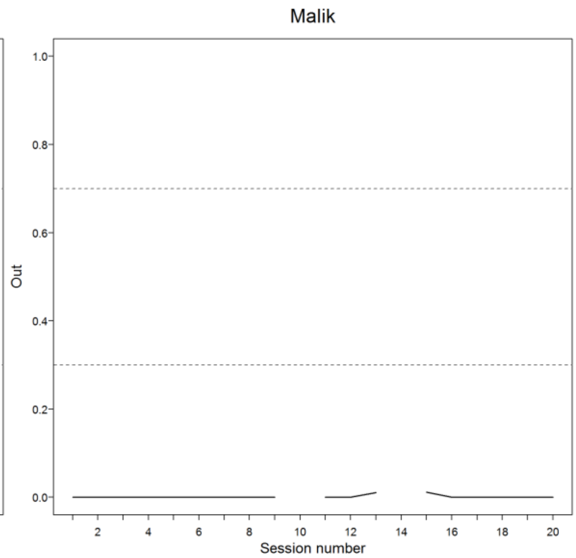

Malik
Engaged
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Malik
Contact
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Malik
Fidgets
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Malik
Anxiety
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Malik
Difficulty
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number


Malik
Out
1.0
0.8
0.6
0.4
0.2
0.0
2 4 6 8 10 12 14 16 18 20
Session number