

Music therapy in the assessment and treatment of autistic spectrum disorder: clinical application and research evidence

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Accepted for publication 19 December 2005

Abstract

Background Children and adolescents with autistic spectrum disorder (ASD) presenting with significant limitations in conventional forms of verbal and non-verbal communication are found to respond positively to music therapy intervention involving both active, improvisational methods and receptive music therapy approaches. Improvisational musical activity with therapeutic objectives and outcomes has been found to facilitate motivation, communication skills and social interaction, as well as sustaining and developing attention. The structure and predictability found in music assist in reciprocal interaction, from which tolerance, flexibility and social engagement to build relationships emerge, relying on a systematic approach to promote appropriate and meaningful interpersonal responses.

Results Published reports of the value and effectiveness of music therapy as an intervention for children with ASD range from controlled studies to clinical case reports. Further documentation has emphasized the role music therapy plays in diagnostic and clinical assessment. Music therapy assessment can identify limitations and weaknesses in children, as well as strengths and potentials. Research evidence from a systematic review found two randomized controlled trials that examined short-term effects of structured music therapy intervention. Significant effects were found in these studies even with extremely small samples, and the findings are important because they demonstrate the potential of the medium of music for autistic children. Case series studies were identified that examined the effects of improvisational music therapy where communicative behaviour, language development, emotional responsiveness, attention span and behavioural control improved over the course of an intervention of improvisational music therapy.

Keywords

music therapy, assessment, research evidence, autism, clinical reports

Introduction

Children and adolescents with autistic spectrum disorder (ASD) present with significant limitations in the development of verbal language and conventional forms of non-verbal communication such as eye-contact, gesture and body language, with a correspondingly limited development of communicative skills (Kasari *et al.* 1990; Sigman & Kasari 1995;

Robertson *et al.* 1999). Music therapy has been recommended as an effective treatment in facilitating communication, as music is a medium that involves a complex range of expressive qualities, dynamic form and dialogue, and offers a means by which some form of alternative communication can be established to help achieve engagement, interaction and relationships (Trevarthen 1999; Wigram 2002a). Timing in mother–infant babble

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and preverbal engagement has been suggested as the foundation of human communication, and this type of interaction relies on shared or joint attention, where complex neuro-behavioural co-ordination provides the foundation for higher functions such as communication and social interaction (Siegel 1999; Trevarthen 1999). Research has shown how infants are born with a strong tendency to share attentional states and feelings with others (Stern 1985; Mundy *et al.* 2000; Jaffe *et al.* 2001; Trevarthen 2001, 2002; Ricciardelli *et al.* 2002). Children learn to follow and then direct others' attention and behaviour (Carpenter *et al.* 2002).

Difficulties in initiating and sustaining joint attention and reciprocity are evident as reliable deficits in children with autism, which provide diagnostic indicators for children as young as 6 months of age (Charman *et al.* 1997; Maestro *et al.* 2002). Initiating and sustaining joint attention is a primary therapeutic goal of music therapy, for which improvisational music making provides a useful medium. During the early development of music as a therapeutic tool, Alvin (Alvin 1978; Alvin & Warwick 1991) and Nordoff and Robbins (1977) all referred to processes where the therapist would 'meet the child' in music, where musical attunement is achieved and the child's expressive or non-expressive production can be matched and reflected in the therapist's music. Improvisational music therapy is typically a child-centred therapy, and for autistic children their response to this approach emerges when they realize that the therapist's music is reflecting something to do with them. This non-verbal, musical interaction can emulate a mother-infant interaction, where reciprocity in rhythmic, melody and dynamic style is analogous to the way the therapist responding to the child (Stern 1985; Pavlicevic 1990; Trevarthen 2001, 2002). Children with autism still demonstrate a need for structure and a systematic approach to promote appropriate and meaningful interpersonal responses (Trevarthen *et al.* 1996; Trevarthen 2002).

Music is considered effective as a therapeutic medium because music contains many different levels of structure, yet provides the variability and flexibility needed to counteract the more rigid characteristics of the pathology. Research studies

and clinical reports have shown that music created spontaneously and creatively through structured and flexible improvisation attracts the attention and provokes engagement in children with ASD, and promotes the development of reciprocal, interactive communication and play (Edgerton 1994; Wigram 1999, 2000; Oldfield 2001).

The development of musical creativity involves a subtle process of learning patterns within musical structures and frames that then spontaneously develop variability in dynamics, tempo, duration and accentuation. For children with significant impairments in their basic innate skills in communication, this musical interaction provides a context and vehicle for reciprocal interaction and development that noticeably ameliorates a lack of sharing and turn-taking in play, as well as repetitive, rigid and somewhat unchanging patterns, and a need for sameness. Active music making promotes interest and motivation to a degree that leads to joint attention and tolerance of shared engagement.

As a general principle, music therapists trained in Europe employ free musical (clinical) improvisation as the main media in therapy, as it does not require any level previous musical skill or competence in the children and allows the music making the potential to be an expression of the child's personality and feelings, in the way any artistic medium can form a vehicle for this purpose. Both musical and therapeutic skills are required of the therapist to help children with entrenched and rigid behaviour to develop or change, even though there will always be a limit to the degree and permanence of that change. Applied therapeutic methods such as 'dialoguing' (a process where therapist and child/children communicate through their musical play; Bruscia 1987; Wigram 2004) and musical 'frameworking' where the therapist provides a functional and consistent musical structure within which the child's musical play fits (Wigram 2004) are effective in disturbing and breaking through rigid patterns of musical behaviour and play.

Diagnostic and clinical assessment

Music Therapy has a relevant role in the diagnosis of autism through the differentiation of character-

istic behaviours, and in clinical assessment by evaluating strengths and weaknesses in many areas of development (Wigram 2002a; Oldfield 2004). Formal standardized assessment tests in cognitive psychology that measure intelligence and cognitive functioning are highly procedural, and do not allow any flexibility to spontaneously explore a child's creative potential, particularly when a pathology such as ASD limits this area of development. Music making is potentially a rich medium for promoting creativity and, as a form of assessment, it offers many opportunities for assessing the areas of social engagement and non-verbal communication which are precisely the areas in which children with autism and Asperger Syndrome have some of their most profound difficulties. Music therapy assessment evaluates more than just social engagement, and by analysing musical events and musical behaviour, the evaluation and interpretation of quantitative and qualitative data on many aspects of a child's activity offers additional relevant information (Wigram 2002a). The frequency and duration of musical events that take place when therapist and child are playing can be counted for a quantitative analysis. Musical material, such as tempo changes, rigid or flexible rhythmic patterns, phrasing, changes in intensity and general variability in style, can be analysed and measured (Bruscia 1987; Wigram 2000).

A primary need for this population is stability in the structure of their environment within which they can feel secure, and within which they can demonstrate their potential communicativeness and creativity. The type of music making that occurs spontaneously in music therapy offers this type of 'safe' structure, while still expanding rigid boundaries to achieve greater flexibility. Stable and recognizable musical frameworks (music within a stable pulse and meter, jazz, baroque and Spanish idioms) can provide security, and at the same time allow creative improvisation within the structure. An important guideline in both tonal and atonal improvisation is to include repetition of ideas, sequences and repeated phrases to ensure that there is some direction and familiarity in the musical material. As Schögler (1998, 2003) has demonstrated, the communicative musicality of an improvised jazz duet has a narrative structure

based on a shared pulse similar to that of spontaneous interplay of expressions in a mother–infant dyad. Improvisational music therapy has a wide range of defined and applicable techniques which, when systematically applied, provide an appropriate framework for developmental therapeutic work (Wigram 2004).

Assessment tools, both quantitative and qualitative, have been developed for the analysis and interpretation of musical material in creative improvisation. Evaluation or assessment scales developed to date have focused on a variety of aspects of the music therapy process, including musical interaction (Pavlicevic 1995), responsiveness, engagement and musical communicativeness (Nordoff & Robbins 1977), diagnosis (Raijmaekers 1993; Wigram 2000; Oldfield 2004), cognitive, perceptual, motor and visual skills (Grant 1995), sound-musical profiles (Di Franco 1999), elements that contribute to the structure of music (Erdonmez Grocke 1999), the predictability of music (Wigram 2002b) and the analysis of improvised music (Bruscia 1987). Analysing musical improvisations as the 'raw data' of the therapy in order to identify, compare, interpret and reach conclusions about a child's personality, pathology and presentation is an important procedure of music therapy assessment. Improvised music provides a rich source of data and, when analysed comprehensively, contains highly relevant information that has been obtained through a spontaneous and creative process.

One assessment tool that focuses specifically on musical elements as the basis for analysing change or lack of change in children is the Improvisation Assessment Profiles (Bruscia 1987). This is a complex, detailed and extensive method of analysing musical material from a music therapy session to provide relevant evidence for diagnosis or indicated clinical intervention (Wigram 1999). In the complete tool, Bruscia has defined six specific profiles as areas of investigation when categorizing events in musical improvisation, or interpreting the musical production of the child: autonomy, variability, integration, salience, tension and congruence. Each profile provides specific criteria for analysing a musical improvisation, and the criteria for all the profiles form a 'continuum of five gradi-

ents or levels, ranging from one extreme or polarity to its opposite' (Bruscia 1987, p. 406).

The two profiles that are particularly relevant for the analysis of musical material of children with ASD are the *autonomy profile* and the *variability profile*. The autonomy profile deals with the kinds of role relationships formed between the improvisers. The scales within the profile describe the extent to which each musical element and component is used to lead or follow. In the autonomy profile, the range of gradients by which the assessment can categorize the relationship between therapist and child are dependent: follower-partner-leader-resistor. Analysing the balance of the role relationship through this profile is informing for both diagnosis and assessment. Children with ASD typically present with high scores in the leader/resister gradients, owing to their difficulties in listening to, responding to or even being interested in co-play with another. Improvements in their abilities to engage can be measured through this profile. The variability profile deals with how rigid or variable the musical material produced by the child tends to be, which is particularly appropriate as children with ASD very typically have rigid patterns of play and activity. Scales related to musical elements such as tempo, dynamic, melody, rhythm and phrasing within the profile describe the extent to which each musical element or component stays the same or changes. In the variability profile, the range of gradients by which the assessment can categorize the playing style are: rigid-stable-variable-contrasting-random. Children with ASD typically demonstrate rigid characteristics in their playing, and improvements in their variability and flexibility can be measured through this profile (Bruscia 1987, pp. 404-405; Wigram 2000, 2002a).

The application of these tools for the analysis of characteristics in improvised music allows interpretation of musical events that can support diagnostic criteria, and can also reveal change over time. Children with pervasive developmental disorder demonstrate some of the same pathological problems in music making as they do in their everyday life and play. In particular, one sees evidence of stereotypies and rigidity in musical play.

For example, the typical non-functional use of toys is also found in the way an autistic child behaves with musical equipment: spinning and twiddling jingles on a tambourine, fiddling with the butterfly nut of a cymbal and spinning the cymbal, bunching and watching the swaying pattern of a set of bars suspended on a wooden frame (windchimes), stroking and fiddling with metallic instruments such as Indian cymbals or gongs, and even playing with parts of the piano such as the folding music holder; the lid or the hammers (in a grand piano) are typical examples of this type of play (Wigram 1999). Music making of this kind should not be construed as musically intentional (or communicatively intentional), and unless some element of creative musical process can be evoked in the development of the music making, one will typically see the child lost in rather repetitive and rigid patterns of movement, just as one sees in other aspects of their aimless activity. When this emerges in diagnostic assessment, it adds weight to the evidence for presenting characteristics of ASD. Conversely, there are examples where children demonstrate better than expected interaction in a non-verbal milieu, engaging in appropriate musical play, and not presenting with 'autistic-like' characteristics in the playing, that may provide evidence of primary language delay or disorder, rather than ASD.

Music therapy assessment can therefore identify limitations and weaknesses in clients, as well as strengths and potentials. The case reports that also add to the existing literature further support the value of assessment and clinical intervention, and offer clinical examples of improvement in social engagement, attention and motivation through musical engagement in music therapy interventions in both short-term and longer-term interventions (Evers 1992; Brown 1994; Howat 1995; Robarts 1996; Schumacher & Calvert-Kruppa 1999; Oldfield *et al.* 2003).

There has been a significant development of interest in the therapeutic community in seeking effective therapeutic strategies to ameliorate the highly restrictive pathological characteristics in autistic children to development, and a variety of research initiatives into music therapy for children and adolescents with ASD have developed alongside.

Overview of current research

This section aims at giving an overview of existing outcome research as an intervention for ASD. Several systematic reviews have been published in recent years, indicating a strong interest in music therapy for people with ASD and a growing awareness of the need to provide systematic research evidence for its effects. The first meta-analysis on the broader field of music therapy for children and adolescents with any psychopathology was published in 2004 (Gold *et al.* 2004). That review indicated that music therapy generally has a medium to large effect on this broader population; however, only one of the included studies addressed ASD specifically.

Two systematic reviews focusing more specifically on ASD have been completed to date, with conflicting results. The first review (Whipple 2004) included experimental studies of any design which examined the effects of music (interventions ranged from music therapy to background music) vs. no music on outcomes such as challenging behaviour and social interaction. Ten studies were included. Participants were individuals with autism ranging from 2.5 to 21 years. Sample sizes ranged from 1 to 20. Results showed a large, significant and homogeneous overall effect size ($d = 0.77$), suggesting that conditions involving music were more effective than conditions without music. However, the interventions used in the included studies were so heterogeneous that it is difficult to draw specific conclusions on the effects of music therapy from this review. Furthermore, important design features of the primary studies used, such as randomization and blinding, were not made transparent.

Another systematic review (Ball 2004) addressed the effects of music therapy vs. no treatment on outcomes such as behaviour, communication and social interaction in children with ASD. Randomized controlled trials (RCTs), controlled clinical trials (CCTs) and case series with at least 10 participants were included. Three studies were identified that met these criteria. Their results were summarized in a narrative way without meta-analytic pooling. Although all included studies had found significant effects, the authors concluded that the effects of music therapy were unclear.

There was little overlap between the reference lists of the two reviews, and only one study (Brownell 2002) was included in both. There is therefore a need for a more comprehensive review to overcome the shortcomings of these previous reviews.

A new systematic review is currently being undertaken in order to overcome the shortcomings of the previous reviews described above, and to possibly resolve the conflicts around their conflicting results. The protocol for this review has been published in the Cochrane Library (Gold & Wigram 2003), and the full review is now published (Gold *et al.*, 2006). It focuses on RCTs and CCTs comparing music therapy (or music therapy added to standard care) compared with standard care, placebo or no treatment and will include a thorough search as well as reliable extraction of data on design type, population, music therapy, additional treatment, outcome assessment and results (Gold & Wigram 2003).

What do the individual studies say? Two RCTs examined short-term effects of a structured music therapy intervention based on songs compared with an active control treatment which was designed to be similar to the music therapy except that no music was used. Both studies involved children with autism who responded positively to music, and both used a crossover design. In the first RCT (Buday 1995), 10 children (age: 0.5–9 years; 80% male) received 20 sessions of an educational intervention using songs in 1 week and 20 sessions of the same intervention using rhythmic speech instead of songs in the next week. The order of the interventions was randomized. The children's ability to correctly imitate signs and words during the sessions was rated by a blind assessor using a video recording. The results showed a significant difference in favour of the condition using music.

The second RCT (Brownell 2002) used a similar design but involved only four children (age: 6–9 years; all male). Targeted repetitive behaviours were monitored in the children's classroom during 4 × 5 consecutive days. During the first and third 5-day period, no intervention was provided (baseline). During the second 5-day period, two children listened to a social story presented within a song, whereas the other two heard a social story without music. These interventions were crossed

over in the fourth 5-day period. Results suggested that both interventions were significantly more effective than no intervention. A significant difference between the two interventions was found in one of the four cases and favoured the condition involving music.

Both RCTs used a dismantling approach to identify specific aspects of music as a medium for therapy. Such dismantling strategies usually require large samples, because both treatments contain active ingredients and therefore effect sizes are expected to be lower than when comparing an active treatment to no intervention or as an add-on to standard care. It is therefore quite impressive that some significant effects were found in these studies even with extremely small samples. The findings from these studies are important because they demonstrate the potential of the medium of music as a therapeutic intervention for autistic children. However, the generalizability of these studies to clinical practice is limited. The treatment in both studies was highly structured and specifically targeted at one behaviour, and only receptive music therapy techniques were used.

Music therapy in clinical practice, however, frequently involves active techniques including improvisation. Two prospective case series have examined the effects of improvisational music therapy (Edgerton 1994; Lee 2004). Using sample sizes of 11 and 15 respectively, these studies found that communicative behaviour, language development, emotional responsiveness, attention span and behavioural control improved over the course of an intervention of improvisational music therapy.

Generally, the research that has been conducted on the effects of music therapy for ASD to date has largely the character of pilot studies. Larger RCTs examining interventions which are closer to clinical practice are needed to confirm the positive results of the available studies. Large RCTs are generally considered to be the gold standard in outcome research, because they can provide the most reliable and unbiased information if conducted properly. However, there are some specific obstacles that have prevented the emergence of large-scale RCTs on clinical music therapy so far. First, ASD is a rare condition, and it is therefore difficult

to find large enough numbers of cases. The great degree of heterogeneity between clients with ASD and the high rates of comorbidity in this population make it even more difficult to achieve large and homogeneous samples that are also clinically meaningful. Another important obstacle is the complexity of clinical music therapy, especially in its improvisational forms, as an intervention. Complex interventions depend strongly on context variables such as therapist and setting, and it is therefore difficult to develop reliable evaluation strategies without endangering the intervention to lose its very substance (Rolvsjord *et al.* 2005). However, the existing studies have shown promising results and provide a good rationale for developing more rigorous research, and it is therefore our hope that this will continue to motivate researchers to invest time and energy into doing the research that is needed.

Conclusion

Music therapy intervention offers structure in improvisation that can provide a framework for the development of learning and adaptability. More creative skills are noted to emerge when a structure is given, in contrast with what one might see from an entirely free form of improvisation, where a lack of direction and model may leave the 'non-musician' child struggling to find out how they can 'create' music. Improvisation, musically structured or free, provides a complex source of data for analysis. But it is perhaps important to mention here that any perception by the lay population, and even fellow disciplines, that music therapy is a process designed primarily to give 'joy and happiness to all' is certainly misconceived. Working through difficult problems and gaining insight are often the central tasks of a music therapy intervention. Children with ASD present the same challenges in music therapy as they do in other therapeutic interventions, and in the educational milieu or home environment. To date, research provides some evidence of effect, and in secondary and tertiary diagnostic services, child development centres and clinical and educational milieus where music therapy is an included part of the multidisciplinary services, the contribution of this inter-

vention is most notable in promoting interpersonal communication, reciprocity and the development of relationship-building skills.

Acknowledgement

The authors acknowledge the support of the Research Council of Norway for part of this work.

References

- Alvin, J. (1978) *Music Therapy for the Autistic Child*. Oxford University Press, London, UK.
- Alvin, J. & Warwick, A. (1991) *Music Therapy for the Autistic Child*. Oxford University Press, London, UK.
- Ball, C. M. (2004) *Music Therapy for Children with Autistic Spectrum Disorder*. Bazian Ltd, London, UK. Available at: <http://www.signpoststeer.org> (accessed 10 February 2005).
- Brown, S. (1994) Autism and music therapy: is change possible and why music? *British Journal of Music Therapy*, 8, 15–25.
- Brownell, M. D. (2002) Musically adapted social stories to modify behaviors in students with autism: four case studies. *Journal of Music Therapy*, 39, 117–144.
- Bruscia, K. (1987) *Improvisational Models of Music Therapy*. Charles C. Thomas Publications, Springfield, IL, USA.
- 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, 189–202.
- Carpenter, M., Pennington, B. F. & Rogers, S. J. (2002) Interrelations among social-cognitive skills in young children with autism. *Journal of Autism and Developmental Disorders*, 32, 91–106.
- Charman, T., Swettenham, J., Baron-Cohen, S., Cox, A., Baird, G. & Drew, A. (1997) Infants with autism: an investigation of empathy, pretend play, joint attention, and imitation. *Journal of Developmental Psychology*, 33, 781–789.
- Di Franco, G. (1999) Music and autism: vocal improvisation as containment of stereotypes. In: *Music Therapy Applications in Developmental Disability, Paediatrics and Neurology* (eds T. Wigram & J. De Backer), pp. 93–118. Jessica Kingsley Publishers, London, UK.
- Edgerton, C. L. (1994) The effect of improvisational music therapy on the communicative behaviors of autistic children. *Journal of Music Therapy*, 31, 31–62.
- Erdonmez Grocke, D. E. (1999) A phenomenological study of pivotal moments in Guided Imagery and Music (GIM) therapy. The University of Melbourne, 524 pages. Dissertation Abstracts International #9982778. Also published on CD-ROM III (2001) and CD-ROM IV (2002) The University of Witten-Herdecke.
- Evers, S. (1992) Music therapy in the treatment of autistic children: medico-sociological data from the Federal Republic of Germany. *Acta Paedopsychiatrica: International Journal of Child and Adolescent Psychiatry*, 55, 157–158.
- Gold, C. & Wigram, T. (2003) Music therapy for autistic spectrum disorder (Protocol for a Cochrane Review). *The Cochrane Library, Issue 3, 2003*. John Wiley & Sons, Ltd., Chichester, UK.
- Gold, C., Voracek, M. & Wigram, T. (2004) Effects of music therapy for children and adolescents with psychopathology: a meta-analysis. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 45, 1054–1063.
- Gold, C., Wigram, T. & Elefant, C. (2006) Music therapy for autistic spectrum disorder (Cochrane review). *Cochrane Database of Systematic Reviews, Issue 2*.
- Grant, R. (1995) Music therapy assessment for developmentally disabled adults. In: *The Art and Science of Music Therapy: A Handbook* (eds T. Wigram, B. Saperston & R. West), pp. 273–287. Harwood Academic Publishers, London, UK.
- Howat, R. (1995) Elizabeth: a case study of an autistic child in individual music therapy. In: *The Art and Science of Music Therapy: A Handbook* (eds T. Wigram, B. Saperston & R. West). Harwood Academic Publishers, London, UK.
- Jaffe, J., Beebe, B., Feldstein, S., Crown, C. L. & Jansnow, M. D. (2001) *Rhythms of Dialogue in Infancy*. Monographs of The Society for Research in Child Development.
- Kasari, C., Sigman, M., Munday, P. & Yirmiya, N. (1990) Affective sharing in the context of joint attention interactions of normal, autistic, and mentally retarded children. *Journal of Autism and Developmental Disorders*, 20, 87–100.
- Lee, L.-Y. L. (2004) *Using musical improvisation to effect linguistic and behavioral changes in a cohort of Taiwanese autistic children*. Poster presented at the 6th annual conference of the American Music Therapy Association, Austin, TX, USA.
- Maestro, S., Muratori, F., Cavallaro, M. C., Pei, F., Stern, D., Golse, B. & Palacio-Espasa, F. (2002) Attentional skills during the first 6 months of age in autism spectrum disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 41, 1239–1245.
- Mundy, P., Card, J. & Fox, N. (2000) EEG correlates of the development of infant joint attention skills. *Journal of Developmental Psychobiology*, 36, 325–338.
- Nordoff, P. & Robbins, C. (1977) *Creative Music Therapy*. The John Day Company, New York, NY, USA.

- Oldfield, A. (2001) Music therapy with young children with autism and their parents: developing communications through playful musical interactions specific to each child. In: *Music Therapy in Europe* (eds D. Aldridge, G. Di Franco, E. Ruud & T. Wigram), pp. 47–62. Ismez, Rome, Italy.
- Oldfield, A. (2004) A comparison of music therapy diagnostic assessment (MTDA) and the autistic diagnostic observation schedules (ADOS). Unpublished PhD Dissertation. Anglia Polytechnic University, Cambridge, UK.
- Oldfield, A., Bunce, L. & Adams, M. (2003) An investigation into short-term music therapy with mothers and young children. *British Journal of Music Therapy*, 17, 26–45.
- Pavlicevic, M. (1990) Dynamic interplay in clinical improvisation. *Journal of British Music Therapy*, 4, 5–9.
- Pavlicevic, M. (1995) Interpersonal processes in clinical improvisation: towards a subjectively objective systematic definition. In: *The Art and Science of Music Therapy: A Handbook* (eds T. Wigram, B. Saperston & R. West), pp. 167–180. Harwood Academic Publishers, London, UK.
- Raijmakers, J. (1993) Music therapy's role in the diagnosis of psycho-geriatric patients in the Hague. In: *Music Therapy in Health and Education* (eds M. Heal & T. Wigram), pp. 126–136. Jessica Kingsley Publishers, London, UK.
- Ricciardelli, P., Bricolo, E., Aglioti, S. M. & Chelazzi, L. (2002) My eyes want to look where your eyes are looking: exploring the tendency to imitate another individual's gaze. *Neuroreport*, 13, 2259–2264.
- Robarts, J. (1996) Music therapy for autistic children. In: *Children with Autism: Diagnosis and Interventions to Meet Their Needs* (eds C. Trevarthen, K. Aitken, D. Papoudi & J. Robarts), pp. 132–160. Jessica Kingsley Publishers, London, UK.
- Robertson, J. M., Tanguay, P. E., L'Ecuyer, S., Sims, A. & Waltrip, C. (1999) Domains of social communication handicap in autism spectrum disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 38, 738–745.
- Rolvjord, R., Gold, C. & Stige, B. (2005) Research rigour and therapeutic flexibility: rationale for a therapy manual developed for a randomised controlled trial. *Nordic Journal of Music Therapy*, 14, 15–32.
- Schögler, B. W. (1998) Music as a tool in communications research. *Nordic Journal of Music Therapy*, 7, 40–49.
- Schögler, B. W. (2003) The pulse of communication in improvised music. In: *Proceedings of the 5th Triennial Conference of the European Society for the Cognitive Sciences of Music (ESCOM5)* (eds R. Kopiez, A. C. Lehmann, I. Wolther & C. Wolf). Hannover University of Music and Drama, Hannover, Germany.
- Schumacher, A. & Calvert-Kruppa, C. (1999) The AQR – an analysis system to evaluate the quality of relationship during music therapy. *Nordic Journal of Music Therapy*, 8, 188–191.
- Siegel, D. J. (1999) *The Developing Mind: Toward A Neurobiology of Interpersonal Experience*. Guildford, New York, NY, USA.
- Sigman, M. & Kasari, C. (1995) Joint attention across contexts in normal and autistic children. In: *Joint Attention: Its Origins and Role in Development* (eds C. Moore, P. Dunham), pp. 189–203. Lawrence Erlbaum Associates, Hillsdale, NJ, USA.
- Stern, D. N. (1985) *The Interpersonal World of the Infant: A View from Psychoanalysis and Developmental Psychology*. Basic Books, New York, NY, USA.
- Trevarthen, C. (1999) Musicality and the intrinsic motive pulse: evidence from human psychobiology and infant communication. *Musicae Scientiae*, 155–215 (special issue 1999–2000).
- Trevarthen, C. (2001) Intrinsic motives for companionship in understanding: their origin, development, and significance for infant mental health. *Infant Mental Health Journal*, 22, 95–131.
- Trevarthen, C. (2002) Autism, sympathy of motives and music therapy. *Enfance*, 1, 86–99.
- Trevarthen, C., Aitkin, K., Papoudi, D. & Robarts, J. (eds) (1996) *Children with Autism: Diagnosis and Interventions to Meet Their Needs*. Jessica Kingsley Publishers, London, UK.
- Whipple, J. (2004) Music in intervention for children and adolescents with autism: a meta-analysis. *Journal of Music Therapy*, 41, 90–106.
- Wigram, T. (1999) Assessment methods in music therapy: a humanistic or natural science framework? *Nordic Journal of Music Therapy*, 8, 6–24.
- Wigram, T. (2000) A method of music therapy assessment for the diagnosis of autistic and communication disordered children. *Music Therapy Perspectives*, 18, 13–22.
- Wigram, T. (2002a) Indications in music therapy: evidence from assessment that can identify the expectations of music therapy as a treatment for Autistic Spectrum Disorder (ASD): meeting the challenge of Evidence Based Practice. *British Journal of Music Therapy*, 16, 11–28.
- Wigram, T. (2002b) Physiological responses to music. In: *A Comprehensive Guide to Music Therapy. Theory, Clinical Practice, Research and Training* (eds T. Wigram, I. Nygaard Pedersen & L. O. Bonde), pp. 145–149. Jessica Kingsley Publishers, London, UK.
- Wigram, T. (2004) *Improvisation: Methods and Techniques for Music Therapy Clinicians, Educators and Students*. Jessica Kingsley Publishers, London, UK.

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