Commentary on "Why does music therapy help in autism?" by N. Khetrapal

ANJALI K. BHATARA[1]
Division of Head and Neck Surgery, David Geffen School of Medicine at UCLA

ABSTRACT: Khetrapal reviews the literature on music and autism and stresses the need for a greater focus on the cognitive and neural mechanisms underlying both autism and music perception. I build upon this review and discuss the strong connections between speech prosody and emotion in music. These connections imply that emotion recognition training in one domain can influence emotion recognition in the other. Understanding of emotional speech is frequently impaired in individuals with ASD, so music therapy should be explored further as a possible treatment.

Submitted 2009 February 7; accepted 2009 February 20.

KEYWORDS: *music therapy, autism, emotion, speech prosody*

IN this issue, Khetrapal reviews recent literature on music perception and autism and provides evidence that the majority of research in music therapy has shown noticeable, beneficial effects for individuals with autism spectrum disorders (ASD). She further notes that music therapy as an intervention is in dire need of "true experiments" (more controlled and random assignment research), and that researchers in this field have a unique opportunity to explore a relatively new area – emotion recognition training and treatment of deficits in emotion understanding in ASD with the use of music.

ASD and General Emotion Perception

Khetrapal begins by stating that people with ASD "fail to interpret and recognize facial and vocal expressions of emotion" but this is an oversimplification. Several studies of ASD have shown impaired emotion processing from facial and vocal expressions (Adolphs, Sears, & Piven, 2001; Baron-Cohen, Spitz, & Cross, 1993; Downs & Smith, 2004; Gross, 2004; Hobson, Ouston, & Lee, 1988; Pierce, Glad, & Schreibman, 1997) and in measures of prosody perception (Järvinen-Pasley, Peppé, King-Gordon & Heaton, 2008), but the participants with ASD rarely fail completely at recognizing emotions in these experiments. In fact, many studies have shown no impairments at all in emotion recognition (Castelli, 2005; Loveland et al., 1997; Ozonoff, Pennington, & Rogers, 1990). This large inconsistency is likely to be due to task differences (Loveland, 2005) and differences in cognitive functioning of participants. Though the results of these studies may seem to contradict each other, it is generally accepted that people with ASD are impaired in emotion recognition. Deficits in understanding of other people's emotions and thoughts are a large part of the diagnosis of ASDs (as in the Autism Diagnostic Observation Scale; Lord et al., 2000). The question is this: in which specific aspects of emotion understanding are people with ASD impaired, and following this, how do we alleviate these difficulties with emotion understanding?

Music Therapy and ASD

Khetrapal writes that the success of music therapy is because individuals with ASD "show no deficits in processing affect from music." This statement of causality may not be entirely accurate. It is true that evidence so far shows that people with ASD are unimpaired in recognizing emotions from music, and this is most likely the source of the benefits resulting from music therapy. However, the definition of music therapy is somewhat vague: "the use of music in the accomplishment of therapeutic aims" (Bunt, 1994) and its techniques range anywhere from music improvisation, listening, or performance, to song writing, lyric discussion, or musical imagery (American Music Therapy Association, 2009). Therefore, the beneficial effects of music therapy are likely to be due to different sources, depending on which techniques are used. For example, benefits could be due to the relative structure of the therapy session combined with less of a social requirement than verbally based therapy. Social anxiety disorder is

frequently comorbid with ASD (Simonoff et al., 2008) so social situations are often anxiety-inducing for people with ASD. Therefore, some of the benefits of music therapy may result from it providing an opportunity to communicate and connect with another person while having more clearly defined rules and less anxiety than a typical verbal interaction.

Although papers discussing music therapy and ASD are scarce, there are two additional important papers that support Khetrapal's argument that music therapy is beneficial for people with ASD. Whipple (2004) performed a meta-analysis on nine studies of musical intervention in ASD and concluded that these interventions have a universally positive effect. The meta-analysis was necessarily based on a small number of studies, many of which lack control groups or have only a few participants, yet it is an important step toward providing evidence that music therapy is worth an investment of time and money. In addition, there was one controlled study published after Whipple's meta-analysis (Kim, Wigram & Gold, 2008) that showed improvisational music therapy resulting in improvements in social skills known as "joint attention" behaviors, which include eye contact and turn-taking.

ASD and Auditory Perception

As noted by Khetrapal, evidence shows that people with ASD have unimpaired or even enhanced pitch perception abilities. However, this is not restricted to musical tones as Khetrapal suggested. Participants with ASD show enhanced pitch perception ability for single pitches, (Bonnel et al., 2003; Heaton, 2003), small intervals (Heaton, 2005), and pitches within chords (Heaton, 2003) as well as pitches within speech (Järvinen-Pasley, Wallace, Ramus, Happé & Heaton, 2008).

What requires more study is the capacity of individuals with ASD for temporal processing, which may be more important than pitch information in speech. Also, their ability to perceive pitch in speech may be heightened, but their ability to connect pitch with speech meaning seems to be impaired (e.g. in Järvinen-Pasley, Peppé, et al., 2008, who showed that children were unable to distinguish between interrogative phrases and statements, based on whether the pitch went up or down at the end of the phrase). Thus, the task before a music therapist may be to teach a patient to connect pitch and rhythm cues with meanings.

Emotion perception in music has been shown to be unimpaired in people with ASD, but thus far evidence has been limited to two studies. Both of these studies used musical stimuli that differed greatly in pitch and key, and so are largely dependent on tonal cues for emotion portrayal. As discussed by Khetrapal, the article by Khalfa, Roy, Rainville, Dalla Bella & Peretz (2008) showed that happy-sad distinctions in music are mainly dependent on pitch cues, so studying pitch was the most reasonable place to begin the exploration of musical emotion perception in ASD. These studies have shown that children with autism can match the emotion conveyed by a piece of music to a schematic happy or sad face (Heaton, Hermelin & Pring, 1999) or to a pictorial representation of a more complex emotion, such as tenderness (Heaton, Allen, Williams, Cummins & Happé, 2008). The second study may have required perception and encoding of cues other than pitch and key to make the emotion judgments (for example, differentiating fear from anger). However, it is unknown to what extent these other cues were required, and it is likely that pitch cues played a large role.

Whereas pitch perception has been shown to be typical or enhanced in individuals with ASD, there is some evidence that perception of timing is abnormal, as measured by evoked potentials (Lepistö et al., 2006) as well as by measures of speech-in-noise perception (Alcántara, Weisblatt, Moore, & Bolton, 2004; Groen et al., 2009). Perception of time structure and relative loudness as well as pitch are important for perception of emotion in both music and speech (Gabrielsson & Juslin, 1996; Scherer, Banse & Wallbott, 2001), and speech rate is especially important for classification of vocal emotion (Scherer, 1986). Therefore, a deficit in timing perception would certainly be detrimental to perception of emotion in speech as well as in some music (for example, when pitch cues are not sufficient). Indeed, a study of patients with Parkinson's disease who had difficulty with perception of timing, but not pitch found impairments in the patients' ability to identify vocal emotion (Breitenstein, Van Lancker, Daum, & Waters, 2001).

Future Directions

As Khetrapal suggests, music therapy may provide an answer to these questions. An important caveat is that, as mentioned above, music therapy consists of a broad range of techniques. Rather than studying "music therapy" as a whole, we must study particular types of techniques and be very clear about which we discuss.

We possess a few pieces of evidence that strongly suggest that some types of music interventions would be useful. We know that emotion expression in speech and music relies on many

common cues. We know that people with ASD generally have no impairments in pitch perception, and in fact may demonstrate enhanced pitch perception. If we can build upon this pitch perception ability, perhaps we can use music to train specific aspects of grammatical prosodic perception (e.g., showing that a pitch going up at the end of a sentence means a question) or even emotional prosodic perception (e.g. using music to duplicate some vocal cues of anger).

Before we can design these therapeutic programs to teach emotion understanding, we must answer a few additional questions: Which auditory emotion cues are most salient for children with ASD? Are they the same cues that typical children and adults use to recognize emotions? Which of these cues are shared by music and speech, and to what extent are they important for emotion recognition? Finally, which music therapy techniques are most beneficial or most useful for emotion recognition training? The number of questions left before us underscores the need, as Khetrapal has also argued, for more controlled studies of music therapy in ASD as well as a greater focus on the cognitive and neural mechanisms underlying emotion and music perception in both typical development and in ASD. In music, we have a huge resource of possible therapeutic benefits, and we must work harder to take advantage of it.

NOTE

[1] Please address all correspondence to: Anjali K. Bhatara, Division of Head and Neck Surgery, David Geffen School of Medicine at UCLA, CHS 62-132, Los Angeles, CA 90095-1624, U.S.A, abhatara@mednet.ucla.edu.

REFERENCES

Adolphs, R., Sears, L., & Piven, J. (2001). Abnormal processing of social information from faces in autism. *Journal of Cognitive Neuroscience 13*, 232-240.

Alcántara JI, Weisblatt EJ, Moore BC, Bolton PF. (2004) Speech-in-noise perception in high-functioning individuals with autism or Asperger's syndrome. *Journal of Child Psychology and Psychiatry, 45*, 1107-1114.

American Music Therapy Association (2005) "What do music therapists do?" Retrieved Feb. 4, 2009 from http://www.musictherapy.org/faqs.html.

Baron-Cohen, S., Spitz, A., & Cross, P. (1993). Do children with autism recognise surprise? A research note. *Cognition and Emotion, 7*, 507-516.

Bonnel, A., Mottron, L., Peretz, I., Trudel, M., Gallun, E., & Bonnel, A. M. (2003). Enhanced pitch sensitivity in individuals with autism: A signal detection analysis. *Journal of Cognitive Neuroscience, 15,* 226-235.

Breitenstein, C., Van Lancker, D. Daum, I. & Waters, C. H. (2001). Impaired perception of vocal emotions in Parkinson's disease: Influence of speech time processing and executive functioning, *Brain and Cognition, 45*, 277-314.

Bunt, L. (1994) *Music therapy: An art beyond words.* London: Routledge.

Capps, L., Yirmiya, N., & Sigman, M. (1992). Understanding of simple and complex emotions in non-retarded children with autism. *Journal of Child Psychology and Psychiatry, 33*, 1169-1182.

Castelli, F. (2005). Understanding emotions from standardized facial expressions in autism and normal development. *Autism, 9*, 428-449.

Dalla Bella, S., Peretz, I., Rousseau, L., & Gosselin, N. (2001). A developmental study of the affective value of tempo and mode in music. *Cognition, 80*, B1-B10.

Downs, A. & Smith, T. (2004). Emotional understanding, cooperation, and social behavior in high-functioning children with autism. *Journal of Autism & Developmental Disorders, 34*, 625-635.

Gabrielsson, A., & Juslin, P. N. (1996). Emotional expression in music performance: Between the performer's intention and the listener's experience. Psychology of Music, 24, 68-91.

Groen WB, van Orsouw L, Huurne NT, Swinkels S, van der Gaag RJ, Buitelaar JK, et al. (2009) Intact spectral but abnormal temporal processing of auditory stimuli in autism. *Journal of Autism and Developmental Disorders*. Epub ahead of print retrieved Jan 20, 2009.

Gross, T. F. (2004). The perception of four basic emotions in human and nonhuman faces by children with autism and other developmental disabilities. *Journal of Abnormal Child Psychology, 32*, 469-480.

Heaton, P., Allen, R., Williams, K., Cummins, O., & Happé, F. (2008). Do social and cognitive deficits curtail musical understanding? Evidence from autism and Down syndrome. *British Journal of Developmental Psychology, 26,* 171-182.

Heaton, P., Hermelin, B., & Pring, L. (1998). Autism and pitch processing: A precursor for savant musical ability. *Music Perception, 15*, 291-305.

Heaton, P., Hermelin, B., & Pring, L. (1999). Can children with autistic spectrum disorders perceive affect in music? An experimental investigation. *Psychological Medicine, 29,* 1405-1410.

Hobson, R. P., Ouston, J., & Lee, A. (1988). Emotion recognition in autism: Coordinating faces and voices. *Psychological Medicine, 18*, 911-923.

Järvinen-Pasley, A., Peppé, S., King-Smith, G. & Heaton, P. (2008). The Relationship between form and function level receptive prosodic abilities in autism, *Journal of Autism and Developmental Disorders, 38,* 1328-1340.

Järvinen-Pasley, A., Wallace, G. W., Ramus, F., Happé, F., & Heaton, P. (2008). Enhanced perceptual processing of speech in autism. *Developmental Science, 11,* 109-121.

Juslin, P. N. & Laukka, P. (2003). Communication of emotions in vocal expression and music performance: Different channels, same code? *Psychological Bulletin, 129*, 770-814.

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*, 1758-1766

Lepistö T, Silokallio S, Nieminen-von Wendt T, Alku P, Näätänen R, Kujala T. (2006) Auditory perception and attention as reflected by the brain event-related potentials in children with Asperger syndrome. *Clinical Neurophysiololgy, 117*, 2161-2171.

Lord, C., Risi, S., Lambrecht, L., Cook, E. H., Leventhal, B. L. DiLavore, P.C., et al. (2000). The Autism Diagnostic Observation Schedule–Generic: A standard measure of social and communication deficits associated with the spectrum of autism. *Journal of Autism and Developmental Disorders, 30*, 205-223.

Loveland, K. A. (2005). Social-emotional impairment and self-regulation in autism spectrum disorders. In J. Nadel & D. Muir (Eds.), *Emotional development: Recent research advances* (pp. 365-382). New York: Oxford University Press.

Loveland, K. A., Tunali-Kotoski, B., Chen, Y., Ortegon, J., Pearson, D. A., Brelsford, K. A., et al. (1997). Emotion recognition in autism: Verbal and nonverbal information. *Development and Psychopathology, 9*, 579-593.

Ozonoff, S., Pennington, B. F., & Rogers, S. J. (1990). Are there emotion perception deficits in young autistic children? *Journal of Child Psychology and Psychiatry, 31*, 343-361.

Pierce, K., Glad, K. S., & Schreibman, L. (1997). Social perception in children with autism: An attentional deficit? *Journal of Autism and Developmental Disorders, 27*, 265-282.

Scherer, K. R., Banse, R., & Wallbott, H. G. (2001). Emotion inferences from vocal expression correlate across languages and cultures. *Journal of Cross-Cultural Psychology*, *32*, 76–92.

Simonoff, E. Pickles, A., Charman, T., Chandler, S., Loucas, T. & Baird, G. 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*, 921-929.

Whipple, J. (2004). Music in intervention for children and adolescents with autism: A meta-analysis. *Journal of Music Therapy, XLI*, 90-105.