

Turn-taking in Children with Autism Spectrum Disorder: Discussion from Ne and Backchannel Interjections

Yuko Yoshimura, Koji Kawahara, and Hiroko Kawahara

Kanazawa University, Nagoya University of Foreign Studies

yukuchen@staff.kanazawa-u.ac.jp, kkoji@nufs.ac.jp



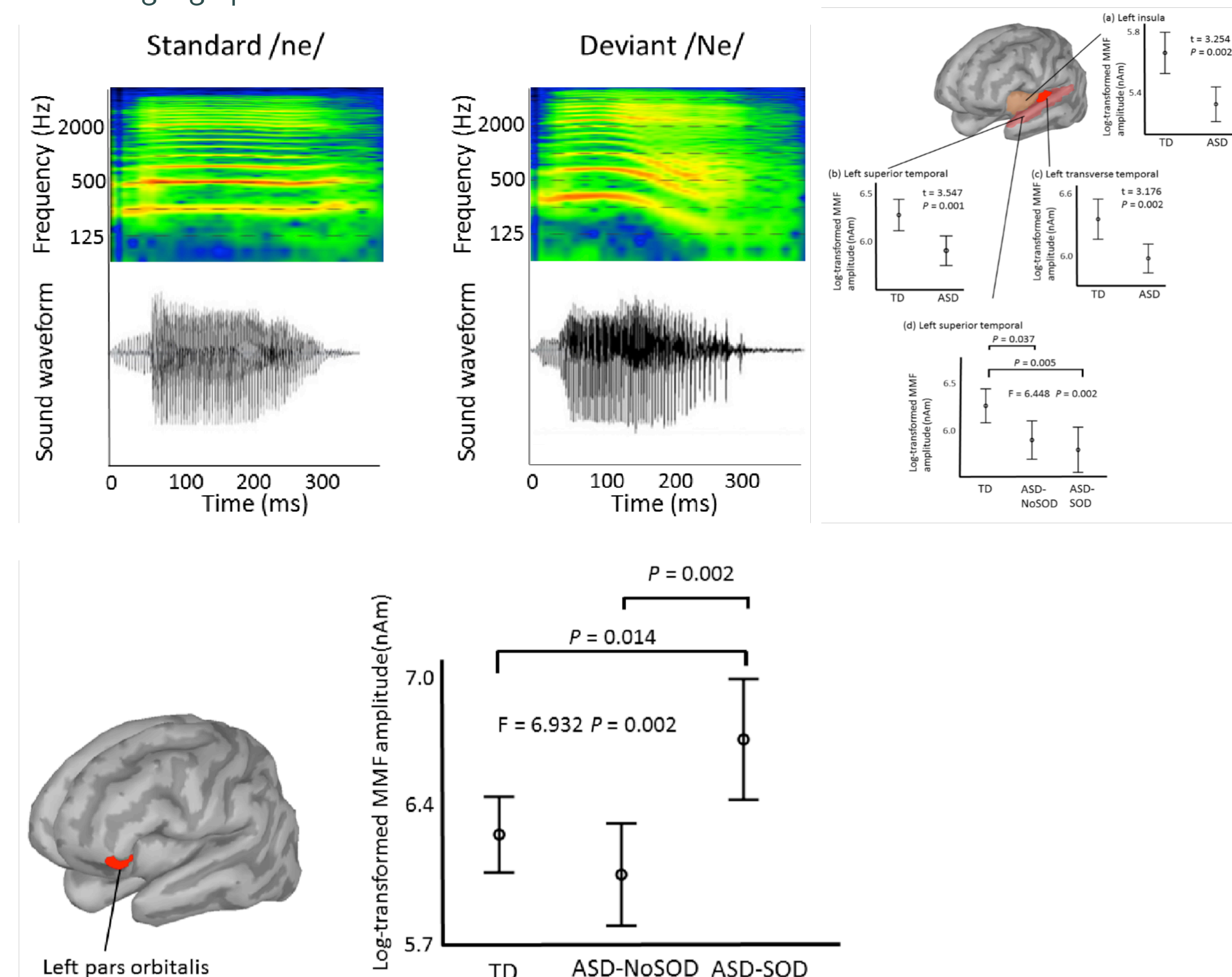
Introduction

Kuhl et al. (2006) examined social and linguistic processing of speech in children with ASD, showing that the expected mismatch negativity (MMN), which indicates syllable discrimination, is observed in typically developing children (TD) but not in children with ASD. However, some children with ASD, who are involved in typical social responses, produced event-related potentials (ERPs) in response to speech that are similar to the TD control group. Based on the result of Kuhl et al. (2006), Kuhl et al. (2013) further investigated whether social responses have an influence on children with ASD in word processing. The result is that one with social responses are not different from the control TD group, while the other with less typical responses lead to distinct patterns of neural response to linguistic stimuli.

The purpose of this poster is to show the relationship between the development of the auditory processing system and the development of language abilities with a specific focus on language usage. Japanese is a good candidate to explore whether children with ASD have typical conversational abilities, because of the presence of ample speech-act particles including /ne/ that indicates transition-relevance place (TRP), where turn-construction units (TCU) reach possible completion and transition may happen (Sacks et al., 1974).

Main Objectives

Autism spectrum disorder (ASD) comprises a set of neurodevelopmental disorders characterized by deficits in social communication and restrictive and repetitive patterns of behavior, interests, and activities. Language abilities are highly variable in individuals with ASD, with difficulties that range from mild to severe impairments in pragmatics and/or social communication (Tager-Flusberg et al., 2001). Currently, language level is considered to be a continuous, rather than categorical variable. Intriguingly, accumulating electrophysiological evidence suggests that deficits in the discrimination of rapid sound changes are associated with impaired speech processing in children with ASD (Roberts et al., 2011) as well as developmental language disorders. Auditory mismatch negativity (MMN) or its magnetic mismatch field (MMF) is quantified by subtracting the average waveform generated in response to standard stimuli from the average deviant waveform; MMN typically peaks between 100 to 250 ms from the onset of the stimulus change (Naatanen et al., 2007). In previous studies in children, the MMN latency ranged between 100 and 400 ms, depending on the age, cognitive skill and stimulus type (Korpolahti et al., 2001; Pihko et al., 2005). MMN has been considered a suitable method to investigate speech development, even in infants, because MMN is elicited at all ages and is enhanced by native speech but not unfamiliar speech contrasts beginning at the age of 6 months (Kuhl et al., 2006). Atypical MMN/MMF responses have also been reported in populations with ASD (Kuhl et al., 2013). Numerous auditory electrophysiological studies have primarily focused on MMF in older children with ASD (older than 6 years); however, to our knowledge, no previous magnetoencephalography (MEG) studies have focused on analysis of the MMF source in younger children with ASD (age 6 and under). We investigated the MMF evoked by voice stimuli in 3- to 5-year-old typically developing (TD) children and children with autism spectrum disorder (ASD) using child-customized MEG. We used typical oddball sequences consisting of standard stimuli (46 times, 83 %) and deviant stimuli (90 times, 17%). The stimuli consisted of the Japanese syllable “ne” pronounced two different ways (Figure 1). A repetitive series of utterances of “ne” pronounced with a flat tone (/ne/) was used as the standard. This stimulus carries no intonational information. As a deviant stimulus, we used “ne” pronounced with a high falling tone (/Ne/), which carries intonational information (e.g., attention-seeking, emotional, declarative, or interrogative intonation). We used this syllable because /ne/ is a sentence-ending particle in Japanese and conveys prosodic information (Anderson et al., 2007). The children with ASD exhibited significantly decreased activation in the left superior temporal gyrus compared with the TD children for the MMF amplitude (Figure 2). If we classified the children with ASD according to the presence of a speech onset delay (ASD - SOD and ASD - No SOD, respectively) and compared them with the TD children, both ASD groups exhibited decreased activation in the left superior temporal gyrus compared with the TD children. In contrast, the ASD - SOD group exhibited increased activity in the left frontal cortex (i.e., pars orbitalis) compared with the other groups (Figure 3). For all the children with ASD, there was a significant negative correlation between the MMF amplitude in the left pars orbitalis and language performance. The left inferior frontal cortex may play an important role in the detection or rapid pitch changes in subjects with ASD at the cost of language performance.



Materials and Methods

Based on the tradition of conversation analysis, we used informal face-to-face conversational data. Language in context helps us understand how it is shaped by and for interaction. We focused on the role of the interjection /ne/ in real conversation (Sacks et al, 1974; Tanaka, 2001). We used the four video corpora and four samples in the TalkBank system that is for sharing and studying conversational interactions. The age of participants varies from three years old to seven years old. Data collection was based on naturally occurring conversations between an experimenter and a

subject and families and friends, following established methods of conversation analysis. Participants often engaged in additional activities during these conversations. The interjection is used in a variety of positions; sentence initial, internal and final positions. It is used for summoning, confirmation, inviting affiliation, repair initiation and so forth. All conversations were in Japanese and free and social ones. We have counted the number of /ne/ that has some conversational function in the material and counted the reduplicated form such as “nee nee” as a single unit.

Results

We investigated whether children with ASD are responsive in conversations and are willing to attract attention or make a request. Kajikawa (2004) point out that by 3;3 years of age, turn-taking is fairly smooth and frequent overlaps are observed between mother-child conversations. Based on the video corpora, we have counted the number of the turn management /ne/. We have found that although children with ASD responded as quickly as TD children (Stivers, 2009) if they were asked by /ne/ and were told beginning with /ne/, there is no single statement by children with ASD using /ne/ to make a request or confirm as has been pointed out by Watanuki (1997). We have also found that there is no time lag in the conversation between children with ASD and the examiner as long as the interjection is concerned. This is applied to TD children in the control corpora.

However, children with ASD did not make use of /ne/ in the four corpora. The result of the production of /ne/ is summarized in the following tables.

	A (7:2)	B (5:3)	C (5:2)	D (5:7)
Time of corpus	73:39	56:56	45:20	46:25
/ne/	0	0	0	0

Table 1: Children with ASD Summary

	Asato (5:00)	Tomito (5:00)	Jun (3:08)	Taishoo (3:01)
Time of corpus	74:58	80:57	52:30	45:49
/ne/	18	51	10	29
Once Per Seconds	46.4	95.2	315.2	94.8

Table 2: TD children Summary

Analysis

Children with ASD are responsive to a conversational turn, containing /ne/. This indicates that they actually hear the /ne/ sound and understand its function. What is intriguing is the fact that they do not utter the interjection /ne/, while they can pronounce the sound such as “nezumi” (mice).

By contrast, TD children often use the interjection /ne/ (twice per minute on average) and there is a significant difference between TD children and children with ASD ($t = 0.023$).

From the comparative studies, we conclude that children with ASD show no significant delay in response compared with TD children as long as turn taking is concerned. However, they are not willing to make a request or confirm in conversations. These are important strategies in conversations in order not to cause misunderstandings with each other. A conclusion drawn from this research is that children with ASD have difficulties in conversations or social interactions, because they are not willing to be involved in interactions probably due to the atypical brain function. Therefore, the difference in brain function leads to production errors, not receptive ones.

Conclusions

- The children with ASD exhibited significantly decreased activation in the left superior temporal gyrus compared with the TD children for the MMF amplitude.
- For all the children with ASD, there was a significant negative correlation between the MMF amplitude in the left pars orbitalis and language performance.
- In turn-taking, the children with ASD are receptive enough to a prior turn.
- However, they do not confirm or repair conversations. The turn-management /ne/ is not used.

References

- [1] V Anderson, M Hiramoto, and A Wong. Prosodic analysis of the interactional particle Ne in Japanese gendered speech. *Japanese/Korean Linguistics*, 15:43-54, 2007.
- [2] Sachiyo Kajikawa, Shigeaki Amano, and Tadahisa Kondo. Speech overlap in Japanese: Mother-child conversations. *Journal of Child Language*, 31:215-230, 2004.
- [3] P Korpilahti, C Krause, I Holopainen, and A Lang. Early late mismatch negativity elicited by words and speech-like stimuli in children. *Brain Lang*, 76:332-339, 2001.
- [4] PK Kuhl, S Coffery-Cornia, D Padden, J Munson, A Estets, and G Dawson. Brain responses to words in 2-year-olds with autism predict developmental outcomes at age 6. *PLoS ONE*, 8(5):e64967, 2013.
- [5] PK Kuhl, E Stevens, A Hayashi, T Deguchi, S Kiritani, and P Iverson. Infants show a facilitation effect for native language phonetic perception between 6 and 12 months. *Developmental Science*, 9(2):F13-F21, 2006.
- [6] R Naatane, P Paavilainen, T Rinne, and K Alho. The mismatch negativity (MMN) in basic research of central auditory processing: a review. *Clin Neurophysiol*, 118:2544-2590, 2007.
- [7] Pihko:2005. Magnetic fields evoked by speech sounds in preschool children. *Clinical Neurophysiology*, 116:112-119, 2005.
- [8] TP Roberts, KM Cannon, K Tavabi, L Blaskey, SY Khan, JF Monroe, S Qasmieh, SE Levy, and JC Edgar. Auditory magnetic mismatch field latency: a biomarker for language impairment in autism. *Biol Psychiatry*, 70:263-269, 2011.
- [9] Helen Tager-Flusberg, Robert Joseph, and Susan Folstein. Current directions in research on autism. *Met Retard Dev Disabil Res Rev*, 7:21-29, 2001.
- [10] Hiroko Tanaka. The particle ne as a turn-management device in Japanese conversation. *Journal of Pragmatics*, 32:1135-1176, 2000.
- [11] Toru Watanuki. Zihaisyoozi niokeru kyookan kakutokuhyoogen ne nosiyoono ketuzyo (children with ASD do not use /ne/ that expresses empathy). *Hattatu syoogai kenkyuu (Japanese Journal on Developmental Disabilities)*, 19:146-157, 1997.