**////Title: Conversational Prosodic Entrainment in Youths with Autism Spectrum Disorder**

**////Stand-first**:

Young people with autism spectrum disorder (ASD) often display unusual patterns of speech. Dr Heike Lehnert-LeHouillier and her colleagues from New Mexico State University in the USA, have undertaken one of the first studies to assess linguistic alignment, also known as entrainment, in the conversations of children and adolescents diagnosed with ASD. Their research concluded that when compared with a control group who were matched in terms of age, gender and non-verbal IQ, young people with ASD do show different entrainment levels across their conversations.

**////Body text:**

Autism spectrum disorder (ASD) refers to a diverse group of neurodevelopmental conditions. The severity and impact of these conditions can vary significantly – for example, some adults with ASD are able to live independently, whereas others require lifelong care.

According to the World Health Organization, on average around 1 in 160 children have ASD. Typically, the main characteristics are ongoing issues relating to social interaction and communication, with some individuals also displaying repetitive or restrictive behaviours or interests. People with ASD may also have difficulties changing between activities, a very strong focus on detail and atypical reactions when experiencing certain sensations. Although ASD is characterised by issues relating to communication, 70% of children who have been diagnosed do learn to speak and half are able to do so fluently. However, despite communicating in a way that is clear and makes sense to the listener, people with ASD often have unusual prosody in their speech.

Prosody refers to the patterns of stress and intonation within spoken language. We use stress in our speech to emphasise different parts of a word or sentence to change their meaning. This can be illustrated by the differing pronunciations of produce [PRO-duce] and produce [pro-DUCE]. Despite these words being spelt in the same way, the first pronunciation stresses the beginning of the word, turning it into a noun that describes an agricultural product. The second pronunciation emphasises the end of the word, transforming it into a verb, meaning to create.

Another integral element of prosody is intonation, which is the rise and fall of our voices when we speak. Intonation can also change the meaning of a sentence. Listen carefully to the following two examples. You saw Mary. [Read as a statement, fall in intonation at the end]. You saw Mary? [Read as a question, rise in intonation at the end]. The first example demonstrated a fall in intonation towards the end, indicating it is a statement, whereas the second example exhibited a rise in intonation making it become a question. The frequency and pitch of a person’s speech can demonstrate their ability to use prosody. People with ASD are often labelled as having ‘sing-songy’ or robotic speech and intonation patterns, which may indicate that this linguistic skill is deficient.

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Previous research has investigated if people with ASD have difficulty with perception and production of prosody. The results have often been unable to detect specific issues during testing, despite participants with ASD being perceived to have unusual speech patterns.

Dr Heike Lehnert-LeHouillier and her colleagues from New Mexico State University in the USA, felt that these inconclusive results may be due to the research analysis looking only at the speech of the participant when speaking without having to interact with a conversation partner.

To test their theory, they investigated the phenomenon known as prosodic entrainment between both parties over the course of a conversation. Conversational entrainment is when the speakers become attuned to each other by aligning their linguistic style. This has been shown to increase the perceived quality of a conversation, rapport and likability between the speakers. Prosodic entrainment can happen gradually throughout the conversation, known as linear convergence or be an ongoing process where variation is assessed when turn-taking occurs amongst the speakers. This study focused on the former, comparing similarities and differences between the beginning and end of the conversation.

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The study participants were 24 children and adolescents aged 9 to 15 years old, living in the Southwest of the USA and who spoke English as a first language. Half of the children had been diagnosed with ASD, the other half were matched in terms of age, gender and non-verbal IQ to ensure a comparable control group for analysis.

Each participant was partnered with a volunteer who took on the role of conversation partner. The participants and conversation partners were both given a picture, but each image differed slightly. Without showing the pictures to one another, they were tasked with finding the differences. This conversation was recorded and the researchers analysed the fundamental frequency and range of both speakers. Fundamental frequency is the level at which our vocal chords vibrate in voiced sounds throughout conversation.

Dr Lehnert-LeHouillier and the team compared the mean fundamental frequency and range within these conversations and between both speakers, to assess if there was entrainment convergence. They predicted that children and adolescents with ASD would show less entrainment.

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As predicted, the children and adolescents with ASD differed significantly from the control group in the entrainment of their mean fundamental frequency. Interestingly, the same results were not evident for the range of frequency, despite range differences being demonstrated in previous research. Dr Lehnert-LeHouillier theorised that this could be due to the age of the participants and the vocal changes they may be experiencing through puberty or because the study design focused on convergence across the whole conversation, rather than assessing turn-taking. Otherwise, it could simply be that differences in frequency range are not a barrier to successful communication in the same way that fundamental frequency appears to be.

The results also highlighted that age may be an influencing factor in mean fundamental frequency entrainment. The older participants with ASD were more likely to show convergence but the older participants within the control group actually showed less mean fundamental frequency entrainment. The researchers speculated that this could have been influenced by the reaction of conversation partners, noting that the experimental conversation partners made compensations for the lack of entrainment in older youths with ASD but not adolescents in the control group. The researchers also found that there was only a marginal relationship between language ability and mean fundamental frequency entrainment, revealing that at an individual level, those with higher language skills entrained less, regardless of having ASD.

Overall, Dr Lehnert-LeHouillier’s research is the first to demonstrate that youths with ASD differ from their peers in terms of mean fundamental frequency entrainment within conversations. Future research is required to establish the extent to which this can indicate the level of impairment in social communication, as well as how this correlates with other people’s perceptions of communicative competence in those with ASD.

This SciPod is a summary of the paper ‘Prosodic Entrainment in Conversations of Verbal Children and Teens on the Autism Spectrum’, from the open access journal, Frontiers in Psychology. https://doi.org/10.3389/fpsyg.2020.582221.

For further information, you can connect with Dr Heike Lehnert-LeHouillier at hlehnert@nmsu.edu.