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## Impact of the temporal dynamics of speech and gesture on communication in Autism Spectrum Disorder

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### Abstract

Autism Spectrum Disorder (ASD) is characterized by difficulties in communication and social interaction. Abnormalities in the use of gestures or flow of conversation are frequently amongst the clinical observations that contribute to a diagnosis of the disorder but the mechanisms underlying these communication difficulties remain unclear. While studies in children show a reduced use of co-speech gestures overall (e.g., Sowden et al., 2013), de Marchena and Eigsti (2010) found that in adults some gestures are used with similar frequency in ASD and typically developing (TD) populations, but that gestures produced by ASD individuals are less strongly time-locked to speech than in TD individuals. This may indicate that abnormal temporal processes contribute to impaired social skills in ASD (Allman, 2011). The objectives of this study were three-folded: 1) characterise the temporal dynamics of speech and gesture coordination in ASD in naturalistic speech; 2) quantify the use of gestures in ASD; 3) test the hypothesis that atypical temporal coordination between speech and gestures results in a lesser quality in communication. The context of a previously published study of memory in ASD (Maras et al., 2013) provided the opportunity to examine video recordings of 16 ASD and 17 TD adults attempting to recall details of a standardised event they had participated in (a first aid scenario). The current analysis was designed to quantify the participants' communicative behaviours in three ways: 1) Segmenting the videos to identify each gesture and document its precise timing aimed to establish whether gestures are used differently in ASD and TD participants; 2) Extracting the quantity of movement as well as the pitch and volume of speech over time allowed us to characterise whether gestures were time-locked to speech similarly in ASD and TD individuals; 3) Collecting subjective ratings on the

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quality of communication displayed in the audio-only or audio-visual recordings helped to establish to what extent the use of gestures improved the quality of communication in ASD and TD participants. Overall, our results indicated no main group difference in the use and coordination of speech and gesture: both groups produced the same quantity of movement over time [ $t(33)=-0.165$ ,  $p>.8$ ], and gestures were produced within the same time window and with a similar distribution by ASD and TD individuals ( $\eta^2_p=.042$ ). Similarly, no group differences were found in the subjective ratings on the quality of communication: in both groups the use of gestures improved comprehension and engagement from the listener. Interestingly, in line with previous report, we found that ASD individuals spoke on average louder than TD individuals [ $t(33)=-3.520$ ,  $p<.005$ ]. Notably, all measures showed a large inter-individual variability in both groups. The current data do not suggest that ASD individuals experience more difficulties than TD participants in time processes relevant to communicating personally experienced events. However, large inter-individual differences could contribute to communication difficulties in some participants. It will be important for future studies to examine the timing of communicative behaviours during reciprocal interactions, that place demands not only on coordinating speech with gesture but to coordinate one's own behaviour with that of others.

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