The Social Feedback Hypothesis and Communicative Development in Autism Spectrum Disorder: A Response to Akhtar, Jaswal, Dinishak, and Stephan (2016)

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We focus here on two issues raised by Akhtar, Jaswal, Dinishak, and Stephan (2016): (a) the roles of motor skill and motivation to communicate within the feedback-loop model and (b) the clinical implications of the model. We then briefly discuss two additional issues.

Motor Ability, Communicative Motivation, and the Social-Feedback-Loop Hypothesis

Akhtar et al. (2016) suggest that individuals with autism spectrum disorder (ASD) often have motor difficulties and that such motor difficulties could reduce the ability of those individuals to produce speech or speech-related sounds. Akhtar et al. also indicate that it could be counterproductive to focus on social motivation to communicate as a factor underlying reduced volubility in this group.

That some individuals with ASD have reduced motor and motor-learning abilities does not imply that their motor learning is not shaped in part by social feedback. Motor difficulties of children with ASD are entirely compatible with the our (Warlaumont, Richards, Gilkerson, & Oller, 2014) social-feedback-loop hypothesis. Motor-skill learning is influenced by reward (e.g., Buitrago, Ringer, Schulz, Dichgans, & Luft, 2004; Izawa & Shadmehr, 2011), so it is plausible that contingent social responses positively reinforce children both with and without ASD as they develop motor speech skills. Supporting this possibility, several computational models have shown how speech learning can be viewed as a type of motor learning that is influenced by reward (Howard & Messum, 2014; Miura,

Yoshikawa, & Asada, 2012; Warlaumont & Finnegan, 2016; Warlaumont, Westermann, Buder, & Oller, 2013).

At the same time, we do not reject the possibility that disruption in motivation to communicate might also play a role in the reduced numbers of vocalizations by some children with ASD. Some adults with ASD indicate that they have high motivation to communicate despite their limitations in motor speech skills, and these case reports demonstrate that not all cases of reduced volubility can be attributed to social motivation. However, such case reports cannot rule out the possibility that reduced social motivation to communicate plays a role for a significant contingent of autistic individuals. Our view on this question concerning the roles of social motivation, motor difficulty, and potentially other factors in reducing vocalization frequency and quality in children with ASD, and how motivation, motor ability, and communicative success dynamically influence each other, will be driven by empirical findings.

Clinical Implications of the Social-Feedback-Loop Idea

Akhtar et al. suggest that parents interacting with children with ASD may show different response contingencies than parents interacting with typically developing children because they adapt their responses to match the unique

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physical capabilities of their children. They express concerns that our (Warlaumont et al., 2014) finding of reduced contingency of adult responding would lead to intervention approaches that reduce adults' responses to the communication attempts of children with ASD.

We grant that it is possible that the reduced contingencies of adult responses reflect already near-optimal responding given the behavior of children with ASD. It might be fruitful to reframe this hopeful possibility as a hypothesis that fewer contingent adult responses to speech-related vocalizations facilitate communication ability (broadly construed) in ASD. This hypothesis could be tested by measuring response contingencies and relating them to communication outcomes.

We ourselves are optimistic that increased responding to vocalizations, especially speech-related vocalizations, may lead to better oral-communication outcomes for at least some children with ASD. The social-feedback-loop model does *not* imply any need for reduced responding to non-speech-related vocalization or to nonvocal communication attempts. We explicitly noted (Warlaumont et al., 2014) that an expected positive impact of parent-directed interventions is an increase in parents' overall responsiveness, which is likely to increase their children's overall rate of vocalization. A greater frequency of vocalization provides more opportunities for children to learn about the outcomes of multiple types of vocalizations. Furthermore, increasing the rate of adults' responses to children's speech-related vocalizations, without reducing the rate of adults' responses to children's non-speech-related vocalizations, is sufficient to increase the response-contingency measure in the social-feedback-loop model.

It is premature to make any clear recommendations regarding treatment on the basis of our previous findings. We would be pleased to see future work measure the impact of ongoing best-practice intervention trials on parent-infant interaction at home using our methods for analyzing daylong audio recordings. Such an approach could enable efficient, objective assessment of the impact of treatments on naturalistic interactions and the role of social feedback loops in treatment outcomes.

Vocal and Nonvocal Communication Codevelop Starting at Birth

Akhtar et al. claim that "nonverbal communication both precedes and provides the foundation for verbal communication" (p. 1529) and propose that proximity, posture, touch, and non-speechlike vocalizations may be more dominant channels of communication. It is important to note that we (Warlaumont et al., 2014) did not focus specifically on verbal or speechlike vocalizations, but more broadly on speech-*related* vocalizations, which include more primitive speech-related sounds, sometimes referred to as protophones (Oller et al., 2013). A considerable literature documents speech-related vocal communication in the earliest months of life (Bigelow & Power, 2014; Hsu & Fogel, 2001; Jasnow & Feldstein, 1986; Jones & Moss, 1971; Kaye & Fogel, 1980; Keller & Schölmerich, 1987; Oller, 1980; Oller et al., 2013; Stark, 1981).

Not All Differences Are Deficits

Finally, we agree with Akhtar et al. that not all differences associated with ASD are deficits. Families must decide which interventions and communication goals best suit their individual needs and preferences in light of the most comprehensive data available.

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