**Title**: Why are toddlers with greater likelihood for autism more unengaged during parent-child interactions? Preliminary evidence for hyporesponsiveness as a mediating mechanism

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**Introduction**: Toddlers with autism spend much of their time unengaged or focused on object play during parent-child interactions (Patterson et al., 2014). Given that qualitatively different or reduced social engagement is a core early marker of autism, several intervention approaches have focused on coaching parents to use therapeutic strategies to decrease unengagement and increase joint engagement in their children during naturalistic interactions (Waddington et al., 2021). Yet, the underlying mechanisms that result in young autistic children being more unengaged in parent-child interactions remain unclear; elucidating these mechanisms may lead to more personalized interventions, including identifying distinctive moments during dyadic interactions to implement specific strategies. Here, we examined whether hyporesponsiveness might function as one such mechanism, where we expected hyporesponsiveness to mediate the relationship between likelihood for autism and unengagement during parent-child interactions in toddlerhood. To ensure the robustness of hyporesponsiveness as a putative mediator across the spectrum of etiologies for autism, we focused on a mixed sample of toddlers with severe (Angelman syndrome; AS), moderate (Down syndrome; DS), and minimal (neurotypical; NT) developmental challenges.

**Method**: Participants included 36 parent-child dyads (AS: *n* = 7, DS: *n* = 16, NT: *n* = 13) who participated in a longitudinal tele-assessment study on early atypical and typical development. Children were 12.9 to 27.5 months old (*M* = 20.7, *SD* = 4.5) and balanced in sex (53% female); parents were 24.6 to 43.6 years old (*M* = 34.6, *SD* = 4.6) and largely female (94%). Parents completed the M-CHAT-R/F (Modified Checklist for Autism in Toddlers, Revised with Follow-up; Robins et al., 2014) and SEQ (Sensory Experiences Questionnaire; Baranek et al., 2006) which screen for autism and assess autism-relevant sensory features, respectively. We examined the M-CHAT-R/F total score, with higher scores representing greater likelihood for autism. For the SEQ, we focused on the hyporesponsiveness scale, with a scoring range of 1 to 5 and higher scores indexing greater hyporesponsiveness. Additionally, dyads participated in a parent-child interaction activity at home using a set of standard toys. We conducted behavioral coding offline to determine the percentage of time that each toddler was unengaged with their parent or toys (Bakeman & Adamson, 1984). For mediation analyses, we used standard regression models to estimate total, direct, and indirect effects, with the indirect effect representing the degree of mediation; we performed bootstrapping with 10,000 simulations to test the statistical significance of the mediation (Preacher & Hayes, 2004).

**Results**: Our sample of toddlers differed substantially in M-CHAT-R/F total score (*M* = 4.89, *SD* = 4.55, range: 0–14), spanning the full continuum of low (42%), moderate (28%), and high (31%) likelihood for autism. Hyporesponsiveness scores ranged from 1.00 to 3.67 (*M* = 1.64, *SD* = 0.58) and included both typical (64%) and clinically significant (36%) levels of hyporesponsiveness. On average, toddlers spent 25.4% (*SD* = 18.6, range: 0.0–78.3) of their time in an unengaged state. As expected, the total effect of M-CHAT-R/F score on percentage of unengagement, without accounting for hyporesponsiveness score, was positive and statistically significant (*p* < .001) and estimated to be 2.16 (95% CI: 0.89–3.55). Consistent with predictions, after accounting for hyporesponsiveness score, the direct effect of M-CHAT-R/F score on percentage of unengagement had a smaller estimate of 1.46 (95% CI: 0.35–3.21) but remained statistically significant (*p* = .010), suggesting partial mediation. Notably, the indirect mediating effect of hyporesponsiveness score, which was estimated to be 0.70 (95% CI: -0.08, 1.57), accounted for 32.4% of the total effect, though this indirect mediating effect was only marginally significant (*p* = .087).

**Discussion**: We demonstrated a positive association between likelihood for autism and unengagement during parent-child interactions in toddlers with a range of developmental challenges. Notably, we found preliminary evidence that hyporesponsiveness partially mediates this association, highlighting the importance of considering sensory profiles in understanding and intervening on engagement states during parent-child interactions for toddlers with increased likelihood for autism. Future work may examine whether specific aspects of hyporesponsiveness (e.g., sensory modalities) contribute to these mediation effects, which may ultimately advance mechanism-based, personalized interventions for young autistic children.

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