Turn-Taking Dynamics in Child-Adult Conversations Across Social Contexts: A Comparative Study of Autistic and Typically Developing Children

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Abstract

Verbal conversations involve promptly responding to each other in a way that is appropriate to the social context. In this study, we disentangled different dimensions of turn-taking by investigating how the dynamics of child-adult interactions changed according to the activity (task-oriented versus freer conversation) and the familiarity of the interlocutor (familiar versus unfamiliar). The procedure involved 28 autistic children (16 male; mean age=10.8 ± 3.2 years) and 20 age-matched typically developing children (8 male; mean age=9.6 ± 3 years). Each child participated in 7 face-to-face, task-orientated conversations with their caregivers (330 sessions) as well as 7 more affiliative telephone conversations alternately with their caregivers (144 sessions, 60 typical development sessions) and an experimenter (192 sessions, 112 autism sessions). By modelling inter-turn response latencies in multi-level Bayesian location-scale models to include long tails, we found good test-rest reliability across sessions and contexts, and showed that context - familiarity in particular - strongly shaped group differences in response latencies. Autistic children exhibited more overlaps, produced faster response latencies and shorter pauses than than typically developing children – and these group differences were particularly salient when conversing with the unfamiliar interlocutor. Unfamiliarity also made the relation between individual differences and latencies evident: only in conversations with the experimenter were higher socio-cognitive skills, lower social motivation and lower social awareness associated with faster responses. Information flow and shared tempo were also influenced by familiarity: children adapted their response latencies to the predictability and tempo of their interlocutor's turn, but only when interacting with their parent and not the experimenter. We argue that these results highlight the need to construe turn-taking as immersed in a multi-dimensional social context that creates different affordances for communicative patterns.

1. Introduction

Humans navigate their social world by engaging in verbal conversations. The swift vocal exchanges that characterise conversation are complex feats of coordination. The modal response latencies of interactants in a typical adult conversation tend to be short, approximately 59-200 ms (Dingemanse & Liesenfeld, 2022; Levinson, 2016; Stivers et al., 2009), which is at the absolute limits of human reaction time and too rapid to rely on planning and production after the end of the turn (Magyari et al., 2014; Magyari & De Ruiter, 2012). Interlocutors must therefore proactively prepare their contingent responses, detect when the likely endpoint of the other(s)'s turn is, decide when to deliver their response, and predict how the other(s) will react in real time (Dale et al., 2013; Magyari & De Ruiter, 2012; Magyari et al., 2014). While adults draw upon their linguistic, interpersonal and world knowledge to plan and predict with such efficiency (Ford et al., 1996; Magyari & De Ruiter, 2012; Magyari et al., 2014), it remains an open question how children balance this complex juggling act and which skills and components are involved. In this paper, we investigate how child-adult turn-taking dynamics are influenced by the social context of the interaction, individual differences in socio-cognitive skills, turn-by-turn information flows as well as moment-to-moment dynamics of interpersonal adjustment in both typical and atypical development.

The fundamental timing structures of turn-taking emerge early in ontogeny (Hilbrink et al., 2015; Levinson, 2016), have deep evolutionary roots (Pika et al., 2018; Ravignani & de Reus, 2019; Levinson, 2006, 2016; Verga et al., 2023) and exhibit similar structures across languages (Stivers et al., 2009; Dingemanse & Liesenfeld, 2022). Turn-taking has been argued to be part of - and partly derivable from - a package of fundamental capacities that enable human social behaviour (Levinson, 2006, 2016). Accordingly, turn-taking has important social implications. Shorter inter-turn latencies facilitate efficient information exchange (Fusaroli et al., 2014; Templeton et al., 2022, 2023) and foster a sense of connection and shared motivation (Dideriksen, Christiansen, Tylén, et al., 2023; Fusaroli et al., 2014, 2019; Fusaroli & Tylén, 2016; Konvalinka & Roepstorff, 2012; Tylén et al., 2013). Adults in verbal interactions with shorter inter-turn response latencies, for example, report enjoying their conversations more (Templeton et al., 2022), while longer response latencies in conversations between strangers – but not friends – produce awkwardness and shifts in conversational topics (Templeton et al., 2023). Because the central timing structures of turn-taking – that is, avoiding excessive overlaps and minimizing latency between turns – is such a foundational precursor for social interactions, it becomes crucial to understand how these interactional skills are grounded in a network of other individual differences – especially in individuals with social atypicalities like autism.

The inter-turn response latencies of autistic children have frequently been described as delayed in the literature (Nguyen et al., 2022), and many empirical studies corroborate this finding across different ages, languages and social contexts (W. Fay & Schuler, 1980; Heeman et al., 2010; Ochi et al., 2019a; Warlaumont et al., 2014). However, a few recent studies find the opposite pattern of results – faster turn-taking in autistic 2.5-4.5 year-old children in spontaneous interactions compared to typically developing controls (Fusaroli et al., 2024), no difference between autistic 10-year-old girls and typically developing children (Cho et al., 2023), and no clear difference between autistic adults and controls (Wehrle et al., 2023a). Qualitative studies also show that autistic children generally do not display difficulties in conversational turn-taking with caregivers (Ochs et al., 2004; Bottema-Beutel et al., 2018). This is possibly due to caregivers learning to produce scaffolding sequences that enable precisely contingent responses (Bottema-Beutel et al., 2018; Bottema-Beutel et al., 2022) – just as caregivers do in interactions with typically developing children who also exhibit frequent delays and non-contingent responses (Dunn & Shatz, 1989; Ervin-Tripp, 1982).

The conflicting results in studies of turn-taking in atypical populations are likely caused by response latencies systematically varying as a function of social context and subpopulation heterogeneity. For instance, the degree of familiarity of the interlocutor (Doherty-Sneddon et al., 2013), the specific experimental task (Casillas & Frank, 2017; Forgeot d'Arc et al., 2020), and the socio-demographic and clinical characteristics of the sample (Fusaroli et al., 2024; Cho et al., 2023) may all affect turn-taking dynamics (Nguyen et al., 2022). Response latencies in this sense may not be a one-size-fits-all individual behaviour that remains consistent across social contexts; rather, different social contexts can lead to distinct patterns of turn-taking behaviors, with differences between autistic and typically developing children becoming evident only in certain social situations. Understanding these dimensions of variation in turn can provide valuable insight into the mechanisms underlying turn-taking dynamics.

To improve our understanding of how turn-taking dynamics systematically change across these sources of heterogeneity and to extract insights from new dimensions in the methodological landscape, the current study leveraged a large corpus of child-adult interactions with autistic and typically developing children. This longitudinal corpus allowed us to evaluate empirical results across multiple social contexts and experimental sessions and to assess the extent to which overlaps and pauses play a role in turn-taking dynamics. The following section articulates important components in the temporal dynamics of turn-taking and motivates how we tackle them in our research questions.

1.1. Components of Turn-Taking

Response latencies in verbal conversations are often conceived of as the expression of individual traits – specifically, that the unique tempo of children's responses is shaped by individual cognitive profiles and developmental trajectories (Fusaroli et al., 2024; Cho et al., 2023). Conversations, however, are deeply embedded in a social context: a relaxed chat and an oral examination do not have the same tempo, and individual people might exhibit distinct behaviours across different social contexts. Not least, response latencies vary on a turn-by-turn basis, as a function of what is said and of the tempo the interlocutor is adopting (Warlaumont et al., 2014; Tylén et al., 2013; Fusaroli et al., 2014, 2019). We construe the temporal dynamics of turn-taking as a window into this complex network of interacting factors and argue that a nuanced perspective on verbal interactions requires consideration of the following five components: i) conversational task, ii) interlocutor familiarity, iii) socio-cognitive, linguistic and motor skills, iv) turn-by-turn flow of information, and v) turn-by-turn interpersonal adjustment.

1.1.1 Conversational Task and Interlocutor Familiarity

Verbal interactions do not happen in a vacuum, but emerge as an intrinsic part of joint activities (Fusaroli et al., 2014; Fusaroli & Tylén, 2012). Different activities provide distinct affordances and constraints for conversations (Olsen & Tylén, 2023; Parish-Morris et al., 2019; Cola et al., 2022; Dale, 2015). For instance, a joint task that requires children and parents to tell each other where to place stickers on a blank picture may demand a focus on precise information transfer as well as require interlocutors to allow each other sufficient time to place the stickers before responding. In contrast, the situational demands of a spontaneous conversation about holidays would not require as much precision and likely require fewer long pauses to ensure efficient communicative patterns Dideriksen, Christiansen, Tylén, et al. (2023); Dideriksen, Christiansen, Dingemanse, et al. (2023); Dideriksen et al. (2019); Fusaroli et al. (2017).

Equally important is the person we interact with in joint activities. Chatting with a long-known friend is very different from talking with a stranger at a party, and discussing which toy to bring at a show-and-tell at school is very different if doing so with a peer compared to a teacher. In child-adult interactions, the familiarity of the interlocutor changes how both autistic and typically developing children interact (Doherty-Sneddon et al., 2013; Dawson et al., 2002; Forgeot d'Arc et al., 2020). Adults interacting with friends likewise take longer to respond compared to when interacting with strangers, and their occasional long pauses are perceived more positively (Templeton et al., 2022, 2023).

Turn-taking patterns in child-adult conversations, then, represent an interaction between the structural demands of the task and the degree of familiarity with an interlocutor. Whether turn-taking dynamics of verbal interactions are invariant across these dimensions is an open question. The study design of the current paper allowed us to evaluate how different affordances emerging from the task and the familiarity of the interlocutor produced differences between the autism and typical development group in their turn-taking behaviours (cf., Research Question 1 & 2 below). Children and adults were recorded in each of these social contexts in multiple weekly sessions to disentangle heterogeneity due to session-by-session variation from systematic contextual variation.

1.1.2 Individual Socio-Cognitive Differences

The challenges posed by various contextual demands and interlocutors require a complex network of skills. For instance, promptly responding requires highly developed linguistic skills: that is, the ability to integrate semantic, syntactic and pragmatic information to anticipate an imminent termination of a turn (Magyari & De Ruiter, 2012). Smooth turn-taking also requires navigating the social world: inferring others' intentions, anticipating what they might do next, planning behaviors so that the other can read our intentions, and so on (Heesen & Fröhlich, 2022; Levinson, 2006; Waade et al., 2023). The interaction engine hypothesis argues that such core human socio-cognitive skills underlie our ability to interact and take turns effectively (Levinson, 2016). Individual differences in social cognition and abilities to pick up on and integrate social cues thus likely play a important role in turn-taking dynamics. Motor development also changes the nature of children's interactions with the world around them, making them better at promptly orienting towards information sources, as well as promptly anticipating and reacting to them. These skills have crucial downstream effects on their own communicative abilities (Iverson, 2010; West & Iverson, 2021), as well as on the contingent responses from caregivers (Karasik et al., 2014; Tamis-LeMonda & Adolph, 2013). Individual differences among children can alter how the children themselves interact with caregivers but also change the input that children receive from caregivers, as exemplified by studies showing that adults adapt to the demands of their addressees – whether they be non-native speakers (Uther et al., 2007; Piazza et al., 2022), children (Cox et al., 2023; Hilton et al., 2022), children with autism (Neimy et al., 2017; Warlaumont et al., 2014; Leezenbaum et al., 2014), infants with cochlear implants (Dilley et al., 2020; Kondaurova et al., 2013), or pets (Jardat et al., 2022; Panneton et al., 2023).

Crucially, different contextual and interlocutor demands might engage these individual skills to a higher or lower degree. For instance, the behaviour of familiar interlocutors might be easier for children to anticipate and respond to, while the ability to promptly take turns with an unfamiliar interlocutor might be more highly dependent on socio-cognitive skills (Bigelow, 1999; Jaffe et al., 2001). In other words, assessing how individual differences relate to response latencies as we vary the characteristics of the social context is essential to improving our understanding of their role in turn-taking. In this study, we incorporated rich measures of individual differences to examine how socio-cognitive, linguistic and motor differences among children might change the turn-taking dynamics of interactions across social contexts with different task demands (cf., Research Question 3 below).

1.1.3 Information Flow

Conversational demands also vary on a turn-by-turn basis in the amount of information shared, the effort required to parse what has been said, and the effort required to plan the next utterance. Adult inter-turn response latencies, for example, depend on the predictability of the content discussed (Bögels et al., 2015), and preschool children produce shorter inter-turn response latencies with more predictable ends to questions (Lindsay et al., 2019; Casillas & Frank, 2017). Intuitively, children having to respond to a complex, open-ended question (e.g., "What are your thoughts on the story we just read?") will likely produce longer response times compared to a predictable, closed-ended question (e.g., "How many apples are there?").

In this study, we attempted to capture the interplay between turn-by-turn information flow and turn-taking dynamics across different conversational tasks and social contexts. In particular, we quantified the effort required to process an utterance in terms of how predictable it was from previous turns (the more predictable, the less effort needed). Analogously, we quantified the effort needed to plan an utterance in terms of how predictable the utterance to be produced next by the listener was compared to previous turns. We then assessed whether these measures had reliable associations with inter-turn response latencies (cf., Research Question 4 below).

1.1.4 Shared Tempo

Beyond pure exchanges of information, conversations are also a social dance in which interlocutors might come to share a common tempo of well-timed exchanges (Wilson & Wilson, 2005; Fusaroli et al., 2014). For example, in a conversation between a child and caregiver during a routine activity (e.g., preparing a meal), the child might naturally match the caregiver's rhythm, responding with pauses that mirror the caregiver's slower pace. However, during a more structured activity, like a reading lesson, the caregiver might adopt a faster tempo, prompting the child to respond more quickly. This shift in tempo is not just a matter of individual response speed but reflects an ongoing process of adaptation, where both participants adjust their timing in response to the conversational and social context, as well as to each other (Pouw & Holler, 2022; Zamm et al., 2015). There are general findings of strong correlations between child and caregiver response latencies (Nguyen et al., 2022); however, these findings are based only on summary estimates (the average response latency across the whole conversation) and cannot say much about the dynamics of co-adaptation on a turn-by-turn basis – nor about how different contextual and interlocutor demands, or individual differences, might influence such co-adaptation (Fusaroli et al., 2024). Further, vocal interactions likely involve dynamic ebb-and-flow waves of mutual convergence and scaffolding that takes place during local transactions (Ritwika et al., 2020; Warlaumont et al., 2014; Pouw & Holler, 2022), but little is known about how this unfolds in child-adult interactions. Accordingly, in our study we included an analysis of these temporal dependencies: how child and caregiver adjust to each other's - and their own - previous latencies on a turn-by-turn basis across contexts. Investigating this split-second world of local interactions offers deeper insights into the interpersonal and mutually negotiated dynamics underlying turn-taking (cf., Research Question 5 below).

1.2. Research Questions

- **Research Question 1**: Are response latencies an individual trait, broadly invariant across measurements, or does the social context (conversational task and familiarity of the interlocutor) matter?
- **Research Question 2**: Does autism involve - on average - slower response latencies than typical development - once explicitly accounting for long pauses and overlaps? How is the finding shaped by context?
- **Research Question 3**: Are differences in turn-taking behaviour grounded in individual differences (social cognition, social awareness and social motivation, language skills and motor skills)? How are the findings shaped by context?
- **Research Question 4**: Is turn-taking behaviour across social contexts grounded in the turn-by-turn information flows (predictability of previous and current utterance)?
- **Research Question 5**: Is turn-taking behaviour across social contexts grounded in the turn-by-turn temporal adjustments in the interaction?

The study design in this paper allowed us to examine how different affordances emerging from the task and the familiarity of the interlocutor produced differences between the autism and typical development group in their turn-taking behaviors. For instance, children with above-average social skills may be better at detecting and using social cues when interacting with unfamiliar interlocutors - and this may determine the contexts for which we would expect a difference in response latencies between autistic and typically developing children. By construing verbal conversations as immersed in a multi-dimensional social context and directly addressing these different components of turn-taking, we aimed to start uncovering their complex interplay and to present a nuanced understanding of individual and group differences.

2. Methods

2.1. Participants

The study involved 28 autistic (10 female) and 20 typically developing children (12 female) children, matched at the group level on age, IQ and self-reported race (see **Table 1**). The autistic children were previously diagnosed with Autistic Disorder or Pervasive Developmental Disorder - Not Otherwise Specified (PDD-NOS) by physicians or psychologists. Participants were recruited via an electronic health record system at a large hospital-based academic medical center in the U.S., flyers and inquiry forms, and internal databases. All participants underwent the "Telephone Screening Interview" (TSI) developed by the researchers at the Center for Autism Research to ascertain adherence to inclusion and exclusion criteria (such as autism diagnostic history, family history, or upcoming changes to intervention/medication). The inclusion criteria were as follows: all participants had i) to be between 6 and 18 years of age, ii) to have English as their primary language, iii) to be verbally fluent (consistent with chronological age), iv) to have an IQ score above 75, and v) autistic participants had to have a current Social and Communication Questionnaire (SCQ) score above 10, and neurotypical, non-psychiatric controls had to have an SCQ score of below 11, where higher scores represent a higher degree of social communication impairment (Berument et al., 1999; Chesnut et al., 2017). The exclusion criteria were as follows: i) known genetic or neurological condition that impacts neurodevelopment or vocal production/language, ii) a history of expressive language deficits or severe neurological injury likely to affect expressive language and communication behavior, iii) extreme prematurity (<32 weeks), iv) diagnosis of hearing impairment or cochlear implant, v) plan to begin or change medication or intervention during study duration, and vi) neurotypical, non-psychiatric controls with first-degree family members with autism.

2.2. Procedure

2.2.1 Data Collection

Participant data were collected over the course of several telephone sessions. After an information call and having provided consent, the participants and their families underwent the screening questionnaire (TSI) and the Social and Communication Questionnaire (Berument et al., 1999; Chesnut et al., 2017). Subsequent assessment relied on the following tools:

- Wechsler Abbreviated Scale of Intelligence, 2nd Edition (WASI-II) (Wechsler, 2008; McCrimmon & Smith, 2013)
- Clinical Evaluation of Language Fundamentals, 5th Edition (CELF-5) (Wiig et al., 2013; Denman et al., 2017)
- Vineland Adaptive Behavior Scales, 3rd Edition (Vineland-3) - the motor scale in particular (S. et al., 2016; Farmer et al., 2020)
- Social Responsiveness Scale (SRS), 2nd edition - the social cognition, social motivation and social awareness scales in particular (Constantino, 2012; Bruni, 2014).

Table 1: *Descriptive statistics of the population. IQ stands for Wechsler Abbreviated Scales of Intelligence – 2nd Edition (WASI II). SCQ stands for Social and Communication Questionnaire. SRS stands for Social Responsiveness Scales – 2nd Edition. CELF stands for Clinical Evaluation of Language Fundamentals - 5th edition. VAB stands for Vineland Adaptive Behavior - 3rd edition. The five last rows display details about the turns for each of the groups under investigation. Median and Mean Turn Length refers to the average difference in seconds between the startpoint and endpoint of children's turns across conditions.*

Variable	Autism Group	Typical Development
Sample Size	28 (16 male, 2 non-binary)	20 (8 male)
Age (years)	10.82 (3.14)	9.6 (3.02)
IQ	112.88 (13.26)	118.16 (13.15)
SCQ	16.68 (16.68)	1.2 (1.2)
SRS (Raw)	77.57 (25.99)	12.75 (9.13)
SRS (T-score)	67.77 (9.92)	42.5 (3.44)
Language (CELF)	107.67 (13.15)	109.53 (11.4)
Social Cognition (SRS)	13.71 (5.46)	1.8 (2.21)
Social Motivation (SRS)	12.36 (6.11)	3 (2.13)
Motor (VAB)	82.54 (3.82)	85.25 (2.07)
Social Awareness (SRS)	10.39 (3.51)	2.5 (2.04)
Number of Sessions	190	140
Number of Turns	21733	14628
Average Turns Per Session	27.7	26.3
Median Turn Length (sec)	2.87 (8.22)	2.69 (9.93)
Mean Turn Length (sec)	5.69 (8.22)	5.97 (9.93)

After evaluation according to the above assessment tools, participants underwent phone-based recording sessions – approximately once per week over a period of seven weeks. During the first session with the child, staff remained on the line to facilitate tasks with the parent and child, while in following sessions children and parents completed the tasks on their own. The participants participated in two speech recording tasks: i) a matching game and ii) prompted conversations. In the matching game, the child and parent each received a sticker sheet and a blank picture and were instructed to take turns in telling the other person where to place the stickers. The aim of the game for the child and parent was to have the pictures look the same, despite them not being able to see each other's sticker sheet. In the prompted conversations, children were given guided prompts (e.g. planning a birthday party, or food preferences) and interacted alternately with their caregivers in even weeks and with an initially unfamiliar experimenter in odd weeks. These two conversational tasks were inspired by traditionally used task-oriented (such as the referential game map task) and conversational tasks (Dideriksen, Christiansen, Tylén, et al., 2023; N. Fay et al., 2018), but adjusted for repeated engaging conversational interactions within the context of this study. The total number of sessions and information about the number and length of turns for the respective groups can be viewed in **Table 1**.

2.2.2 Recording and Transcribing Turns

To record participants' speech we relied on an automated phone bank collection system - supporting single and dual speaker modes - originally developed by the University of Pennsylvania Linguistic Data Consortium and adapted for use with autistic participants. The speech recordings were transcribed by trained annotators using a web-based transcription tool with a built-in speech activity detector function. The annotators were specifically trained on autistic speech to ensure $> 92\%$ word-level transcription reliability. Data transcription involved annotators assessing and correcting the timestamps for the automatically identified speech segment boundaries and at the same time transcribing the audio files. Conversational turns were identified as sequences of speech by one interlocutor without interruption from the other, thus generating an ABABAB structure. Fully overlapping speech between interlocutors occurred occasionally (e.g., during some backchannels). In order to preserve the sequential nature of the transcript, such cases were interleaved within the current speaker's utterance at the first pause longer than 1 second while leaving the timecodes unchanged. The impact of different definitions of conversational turns has been assessed in previous studies and shown to be robust to differences (Fusaroli et al., 2023).

2.3. Different Conceptions of Turn-Taking

Inter-turn response latencies were calculated by subtracting the onset of an utterance from the offset of the previous utterance. This yielded both negative (overlaps) and positive response latencies (gaps), including a non-trivial number of long pauses. In previous research, overlaps have often been excluded as failures of communication, or have been considered to be qualitatively different from gaps (Ochi et al., 2019b). Long pauses have likewise either been included but ignored (i.e., using likelihood functions without long right tails), or been excluded as outliers at various thresholds changing from study to study (Gratier et al., 2015; Clark & Lindsey, 2015). These different conceptions of turn-taking – and their concomitant methodological choices – can lead to different findings even when using the same dataset. For example, two studies explicitly including overlaps found that response latencies for the autism group were equivalent or faster than those of the typical development group (Fusaroli et al., 2024; Wehrle et al., 2023b), contrary to those studies excluding overlaps (Ochi et al., 2019a).

In this study, we choose to include both overlaps and long pauses and to explicitly account for them in the statistical modeling. We made this choice because overlaps constitute a substantial portion of conversations: between 25% and 50% of conversational utterances are estimated to start before the previous interlocutor is done with speaking Dingemanse & Liesenfeld (2022), and this is argued to be even more frequent in conversations involving children Ervin-Tripp (1979); Garvey & Berninger (1981). Moreover, there is a growing recognition that just like long gaps can mean many different things – from thoughtful engagement of the interlocutor to a desire to avoid a topic Templeton et al. (2023) – so can overlaps. Overlaps can indicate shared attention and mutual understanding – as in backchannels – completion of the interlocutor's utterance, or they may signal disagreement and the need for potential repair Dideriksen, Christiansen, Tylén, et al. (2023). Overlaps can thus play a crucial role in building and maintaining rapport Bryant et al. (2016); Bryant

(2020); Templeton et al. (2022); Cummins (2019), and they likely have many other under-explored productive functions. Overlaps and long pauses thus form a natural part of smooth turn-taking, and we argue that our statistical modelling approaches need to incorporate these components for a nuanced picture of turn-taking dynamics (see also Fusaroli et al. (2024) for statistical arguments on why removing overlaps and long pauses truncates an otherwise continuous distribution and often violates model assumptions). To allay concerns of comparability with previous studies and to investigate how the number of overlaps and long pauses changes according to the social context, moreover, we conducted supplementary analyses excluding overlaps and modelling of long pauses (see Supplementary Materials).

2.4. Statistical Models

The distributional properties of response latencies in turn-taking produce unique modelling challenges (see **Figure 1**). Turn-taking distributions involve negative latencies from overlapping speech, a large centre of mass just above zero, and positive skew from occasional long pauses between turns (Heldner & Edlund, 2010). To accommodate these distributional properties in our models, we built Bayesian multi-level models with ex-Gaussian likelihoods for all of our research questions. This form of likelihood combines a Gaussian distribution with an exponential distribution, allowing for the flexibility to represent the central tendency together with the positive skew often observed in empirical turn-taking data. Specifically, in our Bayesian framework, the ex-Gaussian likelihood was parameterized by three parameters: the mean (μ) and variance (σ) of the Gaussian component, as well as the rate (β) of the exponential tail.

To investigate research questions 1 and 2, we modeled each of the parameters — the mean (μ), and variance (σ) of the Gaussian component, as well as the rate (β) of the exponential tail — as conditioned on diagnostic group and conversational context (matching game vs. conversations with parents vs. conversations with experimenters). We allowed the estimates to vary within each combination of these factors – similar to a full interaction model – to assess group differences across the tasks and familiarity of the interlocutor. We included varying slopes in the model to allow for the estimates across conversational contexts to vary within individual children and as a function of visit. Variance was partially pooled by child within their respective diagnostic group to accommodate the potential for between-group differences in heterogeneity in mean and variance. To investigate the test-retest reliability of our measures of turn-taking, we extracted estimates of the mean (μ), variance (σ) and rate (β) by visit and diagnostic group. We then calculated a correlation matrix of the estimates within each diagnostic group across the 7 sessions and assessed both average correlation and the impact of distance on the correlation estimate. We also extracted participant-level predictions to assess the test-retest reliability of individual children across social contexts. More information about the specification of our models, including priors, model checks and control analyses can be found in **Model Information and Quality Checks** in Supplementary Materials.

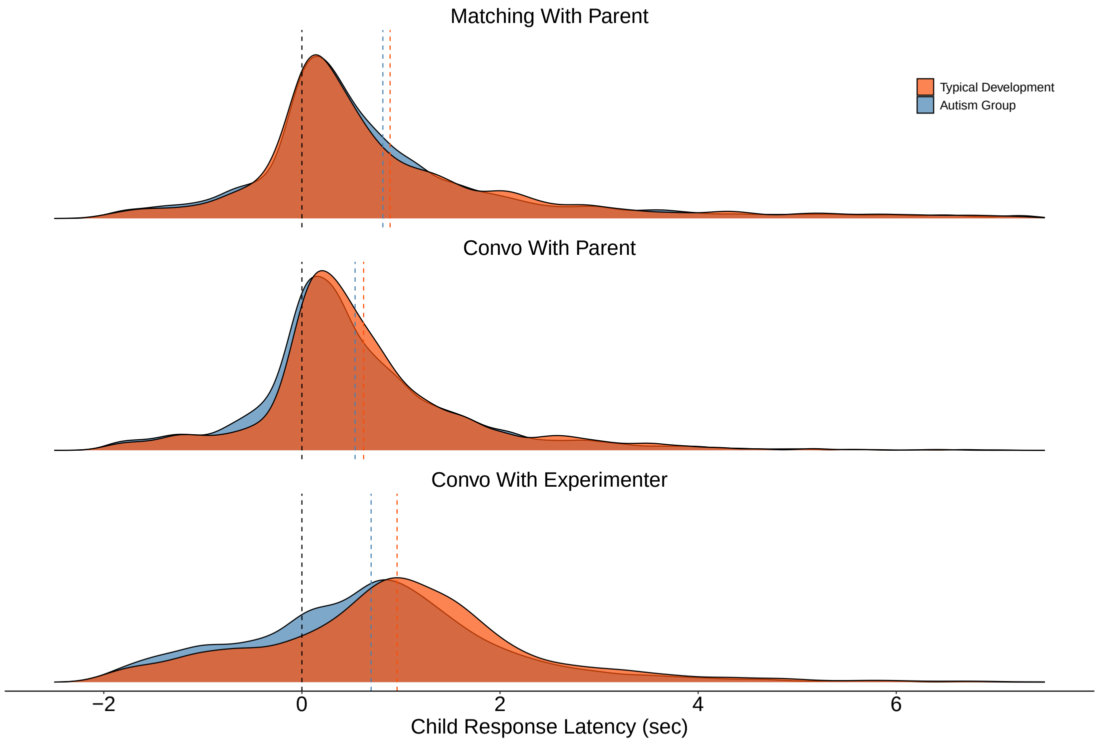

Figure 1: *Panel of plots to demonstrate the distributional properties of child response latencies across different combinations of contexts and familiarity. The black dashed line marks a response latency of zero, the orange dashed line the mean in the typical development group, and the blue dashed line the mean of the autism group. As can be gleaned from the plots, response latencies involve both negative response latencies (overlapping speech), a large centre of mass just above zero, as well as positive skew (long pauses between turns)*

To investigate the role of individual differences in socio-cognitive, linguistic and motor development (Research Question 3) we added scaled scores of SRS (Social Cognition, Social Motivation, Social Awareness), CELF, and the Vineland Motor Scale to the first model. Their relation to response latencies was allowed to vary by diagnostic group, conversational context and familiarity (equivalent to a full interaction model), so we could assess how the findings differed across contexts. We chose to use SRS scores of socio-cognitive skills instead of Vineland Socialization scores as in the study by Fusaroli et al. (2024), since individual abilities were measured only once during data collection. Vineland scores have been shown to be highly sensitive to small variations between weekly sessions (Chatham et al., 2018) and would therefore introduce noise in the association between underlying social skills measured at one point and response latencies measured over several sessions.

To investigate the role of linguistic predictability (Research Question 4), we calculated cosine similarity between utterance-level transformer-based embeddings of successive turns extracted using the all-mpnet-base-v2 model from the Sentence Transformers library (Reimers & Gurevych, 2020). The all-mpnet-base-v2 model is based on the Transformer architecture, specifically using the MPNet (Masked and Permuted Network) variant (Song et al., 2020). MPNet is an advanced transformer model that combines the benefits of BERT (Bidirectional Encoder Representations from Transformers) and XLNet (a generalized autoregressive pre-training method). The embeddings generated by all-mpnet-base-v2 can be used to calculate cosine similarity between sentences. Cosine similarity measures the cosine of the angle between two vectors in a multi-dimensional space, providing a value between -1 and 1. Higher values indicate greater similarity. In this context, these cosine similarity scores between successive turns served as a measure of linguistic predictability; by examining the similarity between consecutive turns in a conversation, we can quantify how predictable one speaker's response is based on the previous turn, and then model the effect of predictability on response latencies. We incorporated cosine similarity of both the adult and child utterances as scaled fixed effects, conditioned on conversational context as in the above models, and allowed both the effect of predictability of the adult and child utterance to vary by child and as a function of visit. To check whether short low-content utterances like backchannels unduly affected the analysis (Corps et al., 2022), we ran control models with backchannels and utterances with fewer than three words excluded (see **Tables 19** and **20** in Supplementary Materials).

To investigate the role of interpersonal adjustment (Research question 5), we built a multivariate outcome model with the response latencies of the child speaker being conditioned on their own previous response latency as well as the previous response latency of their adult interlocutor, and vice versa with the adult speakers. Varying effects in the two equations were modeled as correlated between children and their interlocutors. This model is thus similar to structural equation modeling approaches such as the actor-partner interdependence (Cook & Kenny, 2005) and the dyadic coupling (Helm et al., 2012) models.

To evaluate the impact of overlaps on response latency patterns for research questions 1, 2 and 3, we conducted two control analyses. First, we re-ran the models excluding overlaps (i.e., negative latencies) to determine how the inclusion of overlaps in the main analyses potentially influenced our results. Except for specifying a truncated prior indicating no value could be below 0 to facilitate the sampling process, these control models and their specifications were identical to the primary models. Second, to assess the extent of overlap in each group for each task, we ran a multi-level logistic regression model, with the rate of overlap conditioned on diagnostic group, conversational context, and familiarity of the interlocutor, using the same varying effects structure as in the primary model.

As an overall control analysis, we created surrogate dyads to emulate the baseline turn-taking that would happen by chance if there were no contingency between adult and child responses (cf., **Table 21** in Supplementary Materials). The surrogate pairs were created by pairing the time codes of the caregiver of a different child within the same diagnostic group and visit with the time codes of the child. This control analysis shows how our patterns of results cannot be reduced to simple differences in vocalization rates and duration but are due to the specific contingency in the interpersonal temporal sequence of vocalizations. Results from this surrogate analysis can be found in **Table 21** in Supplementary Materials.

Full details on model specification, including weakly informative priors, and model quality checks are available in the Supplementary Materials. Estimates from the models are reported as mean and 95% Credible Intervals (CI) of the posterior estimates. We calculated evidence ratios (ER) for our hypotheses in the form of the posterior probability of the directed hypothesis against the posterior probability of all the alternatives; that is, if we expected higher response latencies in autistic children, we would count the posterior samples compatible with this hypothesis and divide them by the number of posterior samples compatible with a null or negative effect. An evidence ratio of 5 thus implies that the evidence in favour of the hypothesis is 5 times greater than the evidence in favour of the alternative model or hypothesis. An evidence ratio of 'Inf' implies that all posterior samples are in the direction of the hypothesis, such that the ratio in favour becomes infinite. Throughout the results section, we compare posterior estimates between those in the experimenter and parent conversations, on the one hand, and between those in parent conversations and the matching game (conducted only with parents), on the other hand, in order to ascertain the effect of the familiarity of the interlocutor and the effect of experimental task on response latencies, respectively.

All code and data for these analyses is provided on OSF (URL).

3. Results

3.1. Social Context and Diagnostic Group (RQ1 & RQ2)

3.1.1 Average Response Latencies (μ)

The overarching findings for Research Questions 1 and 2 are shown in **Table 2** and **Figure 2**. There were strong differences according to social context. Children exhibited slower response latencies when conversing with the unfamiliar experimenter than with their parent in both the autism (200ms [24, 378], ER = 28.1) and typical development group (355ms [114, 596], ER = 95.2). The children also produced slower latencies when solving the matching game than when more freely conversing with their parents in both the autism (296ms [139, 449], ER = 146.1) and typical development group (296ms [133, 462], ER = 146.1).

Diagnostic group also mattered. Response latencies for autistic children were faster than for those in the typical development group when aggregating across conditions (-143ms [-282, -3], ER = 20.7). This effect was the strongest in the conversations with the unfamiliar experimenter (-246 [-501, 0], ER = 19), followed by the matching game (-91 [-250, 72], ER = 4.8, difference in strength from the conversation with the experimenter: -155ms [-460, 151], ER = 4.1) and the conversations with the parent (-91 [-299, 115], ER = 3.5, difference in strength from the conversation with experimenter from the matching game 0.06ms [-231, 232], ER = 1). Test-retest reliability of response latency estimates across the seven sessions was high within each social context (see also **Figure 10**) as well as within each child (see also **Figure 11** in the Supplementary Materials). An analysis of how response times changed across genders showed a slight tendency for girls and non-binary children to be faster than boys in the autism group, but comparisons between the autism and typical development group remained robust (see **Table 13** in Supplementary Materials). There were also no clear developmental changes in child response latencies according to the increasing familiarity of the experimenter over the course of the multiple visits (see **Figure 18**).

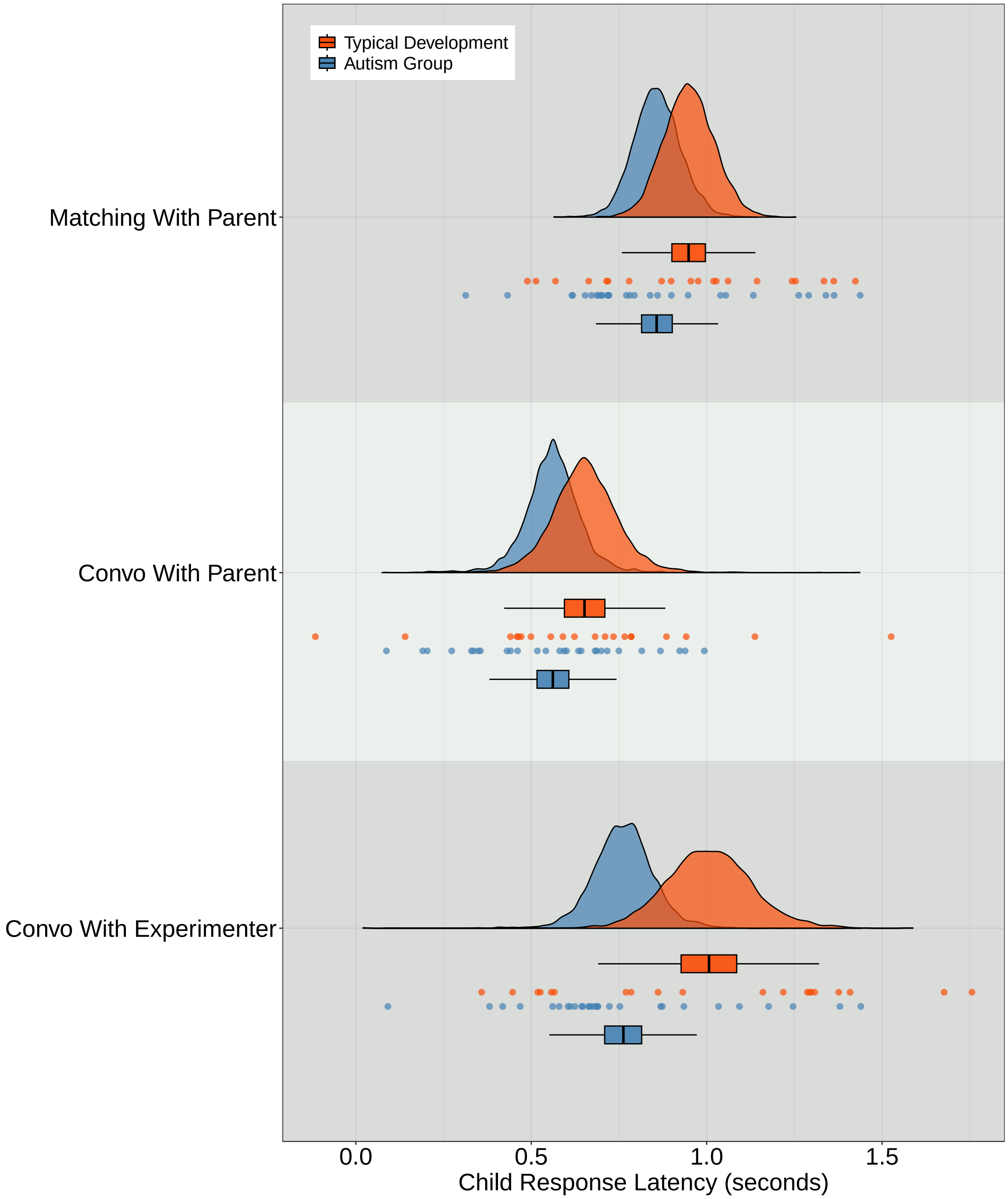

Figure 2: *Panel of plots to demonstrate model estimates for child response latencies across different conversational contexts for the two diagnostic groups: Autism Group (blue) and Typical Development Group (orange). The small points represent participant-level posterior predictions from the model. The density plots and boxplots show aggregated posterior predictions for the conversational activities.*

Table 2: *Posterior estimates for child response latencies across individual conditions (Matching Game, Convo With Parent (Conversations with Parents) and Convo With Experimenter (Conversations with Experimenter) and aggregated across conditions (Aggregate Estimate) for different model parameters: the Gaussian component (Latency) in milliseconds, proportion of latencies below zero (Overlap Proportion) in proportions, Standard Deviation (Sigma) in milliseconds, exponential component (Beta, or long pauses) on log scale, and Test-Retest Reliability across sessions in correlations. All of the parameter estimates listed in this table have an evidence ratio above 40 for a test of difference to zero.*

	Tasks	**Autism Group**	**Typical Development**
Latency	Matching With Parent	858ms [752, 970]	949ms [834, 1070]
	Convo With Parent	562ms [437, 690]	653ms [501, 807]
	Convo With Experimenter	762ms [626, 901]	1008ms [811, 1211]
	Aggregate Estimate	727ms [641, 813]	870ms [766, 975]
Overlap Proportion	Matching With Parent	0.22 [0.19, 0.26]	0.22 [0.19, 0.25]
	Convo With Parent	0.23 [0.19, 0.28]	0.17 [0.13, 0.22]
	Convo With Experimenter	0.24 [0.2, 0.29]	0.2 [0.15, 0.24]
	Aggregate Estimate	0.23 [0.21, 0.26]	0.19 [0.17, 0.22]
Sigma	Matching With Parent	618ms [573, 666]	529ms [483, 580]
	Convo With Parent	534ms [475, 600]	602ms [525, 689]
	Convo With Experimenter	962ms [889, 1037]	899ms [829, 977]
	Aggregate Estimate	682ms [647, 719]	659ms [621, 700]
Beta	Matching With Parent	0.19 [0.11, 0.27]	0.28 [0.18, 0.37]
	Convo With Parent	-0.35 [-0.47, -0.23]	-0.31 [-0.46, -0.17]
	Convo With Experimenter	-0.25 [-0.37, -0.15]	-0.18 [-0.33, -0.03]
	Aggregate Estimate	-0.14 [-0.2, -0.07]	-0.07 [-0.15, 0.01]
Test-Retest Reliability	Matching With Parent	0.42 [0.24, 0.48]	0.28 [-0.08, 0.48]
	Convo With Parent	0.83 [0.81, 0.86]	0.81 [0.8, 0.82]
	Convo With Experimenter	0.7 [0.66, 0.78]	0.61 [0.48, 0.68]

3.1.2 Frequency and Impact of Overlaps

The proportion of overlaps changed across social contexts and diagnostic group (see **Table 2**). Autistic children were more likely to overlap with adults compared to typically developing children when aggregated across contexts (0.04 [0, 0.08], ER = 21.1). Conversations with parents displayed the biggest group difference (0.06 [0, 0.12], ER = 15.8) followed by conversations with the experimenter (0.05 [-0.01, 0.11], ER = 10.4, strength of difference to conversations with the parent: -0.01 [-0.09, 0.07], ER = 1.5) and the matching game (0.01 [-0.04, 0.05], ER = 1.6, smaller strength of difference to conversations with parents: -0.05 [-0.12, 0.01], ER = 9.2). Removing overlaps did not substantially affect the overall findings on response latencies; the autism group was still faster than the typical development group in the matching game and conversations with the experimenter, albeit not with parents (see **Table 11** and **Figure 12** in Supplementary Materials).

3.1.3 Variance in Response Latencies (σ)

Different social contexts were related to a different degree of variance in response latencies (see **Table 2**). Conversations with an unfamiliar experimenter displayed the highest variance for both the autism group (on log scale: 0.59 [0.45, 0.73], ER = Inf) and the typical development group (0.4 [0.24, 0.56], ER = Inf), followed by the matching game for the autism group (0.15 [0.01, 0.29], ER = 21.8) and conversation with parent for the typical development group (-0.13 [-0.29, 0.03], ER = 9.4). Autistic children displayed a slightly higher degree of variance than typically developing children when aggregated across conditions (on log scale: 0.03 [-0.04, 0.11], ER = 3.2). The strongest between-group difference was in the matching game (on log scale: 0.16 [0.04, 0.27], ER = 56.5) followed by the conversations with parents (on log scale: -0.12 [-0.3, 0.06], ER = 6.4, difference to conversations with parents on log scale: 0.27 [0.06, 0.49], ER = 59.2) and conversations with the experimenter (on log scale: 0.07 [-0.04, 0.18], ER = 5.4, difference to parent conversations: on log scale: 0.19 [-0.03, 0.39], ER = 12.3).

3.1.4 Long Pauses (β)

The prevalence of long pauses (i.e., the exponential tail) was influenced by social context and diagnostic group (see **Table 2**). The matching game displayed a higher tendency for long pauses than the conversations with the unfamiliar experimenter in both the autism group (0.54 [0.41, 0.68], ER = Inf) and typical development group (0.59 [0.43, 0.76], ER = Inf). Conversations with parents had a lower tendency to include long pauses than in conversations with the experimenter in the autism group (0.09 [-0.07, 0.26], ER = 5.1) and typical development group (0.13 [-0.07, 0.33], ER = 6.6). Autistic children produced fewer long pauses when aggregated across conditions (on a log scale: -0.07 [-0.17, 0.04], ER = 6) and during both the matching game (-0.09 [-0.21, 0.04], ER = 7) and experimenter conversations (-0.08 [-0.26, 0.11], ER = 3.2), but not during the conversations with parents (-0.04 [-0.23, 0.15], ER = 1.7). There were no reliable differences in the strength of group differences across social contexts.

3.2. Individual Differences (RQ3)

The overarching findings for our investigation of individual differences are shown in **Table 3** and **Figure 3**. Our control analyses excluding overlaps displayed analogous findings across all measures of individual differences (see **Table 16** in Supplementary Materials, although see **Figure 14** for an analysis of overlaps according to individual differences).

3.2.1 Social Cognition

Children with higher social cognition skills displayed faster responses across groups and contexts, although the effect was much more evident in typically developing children (Autism Group: -71ms [-194, 55], ER = 5; Typical Development: -419ms [-792, -55], ER = 30.4; Difference: 349ms [-46, 738], ER = 12.7), see **Table 3** and **Figure 3**. The influence of social context changed according to social context. Typically developing children - but not autistic ones - showed a bigger impact of social cognition in the conversation with the unfamiliar experimenter than in the matching game with parents (difference: -558ms [-1407, 307], ER = 6.3) as well as in the matching game compared to the conversations with parents (-243ms [-875, 381], ER = 3).

3.2.2 Social Awareness

Typically developing children - but not autistic ones - displayed a strong association between social awareness and responses across contexts: the higher the awareness the slower the responses (Autism Group: 11ms [-116, 140], ER = 1.3; Typical Development: 270ms [-8, 548], ER = 17.5; difference: -259ms [-569, 48], ER = 11.2). The effect of social awareness was most evident in the conversation with the experimenter compared to in the matching game (472ms [-107, 1077], ER = 10) as well as in the matching game compared to the conversation with parents (200ms [-251, 653], ER = 3.5).

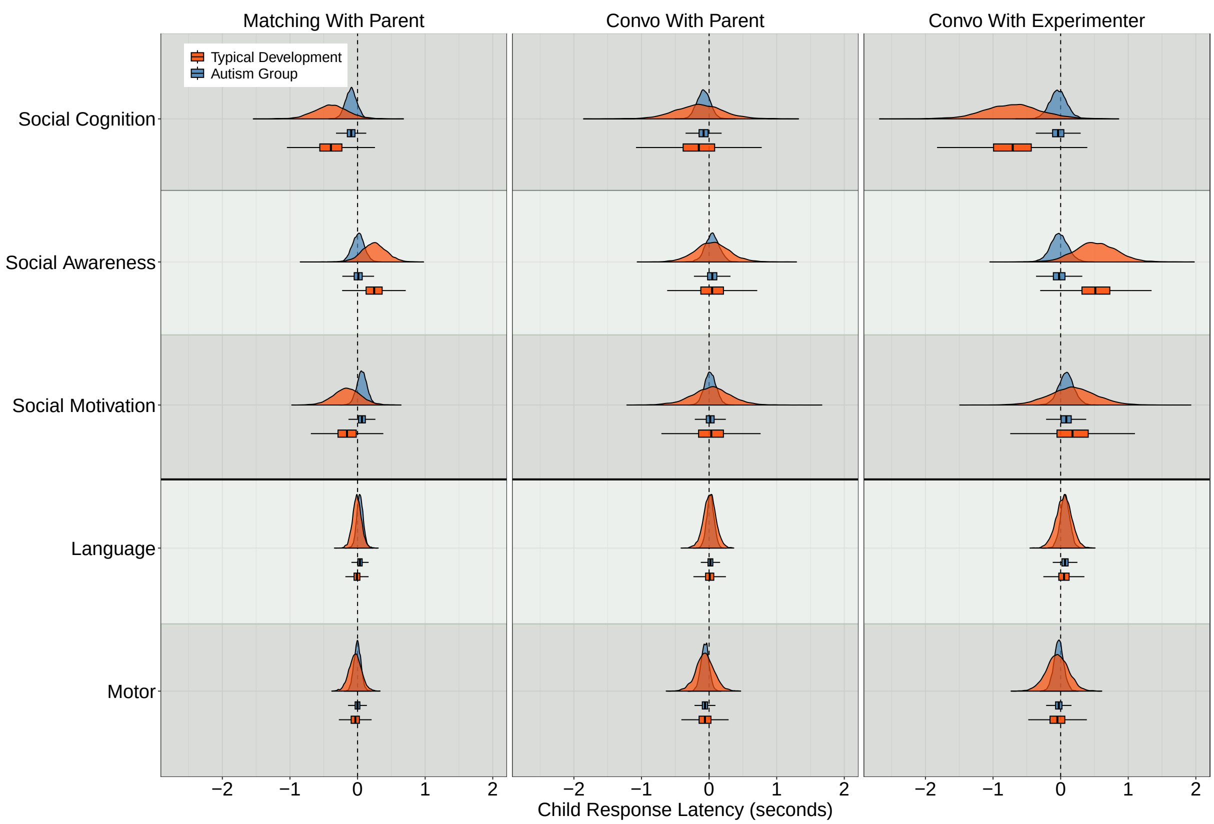

Figure 3: *Panel of plots to demonstrate how model estimates for child response latencies change with measures of individual differences. The posterior estimates denote the change in child response latency as a function of one standard deviation increase in each measure. The three top measures (i.e., Social Cognition, Social Awareness, Social Motivation) came from the Social Responsiveness Scale, Language skills refer to the Clinical Evaluation of Language Fundamentals, and Motor Skills refer to Vineland Adaptive Behaviour Scales.*

3.2.3 Social Motivation

The relation between social motivation and response latencies was small and uneven across groups and contexts and all results were tentative. Autistic children showed a consistent but only very slight slowdown with higher motivation (55ms [-55, 166], ER = 3.9), especially in interactions with the experimenter (82ms [-103, 274], ER = 3.4). Typically developing children seemed to display that effect only in the conversation with an unfamiliar experimenter (176ms [-399, 757], ER = 2.3) and the opposite effect in the matching game with parents (-156ms [-486, 179], ER = 3.6).

3.2.4 Language Skills

Similarly, there was only anecdotal evidence for a relation between language skills and response latencies across groups and contexts. We restrict the reporting here to the main effect. Autistic children with higher language skills showed an overall tendency for slightly slower response times compared to the typical development group, but there was only tentative evidence for a difference between groups (40ms [-28, 108], ER = 5.1; 16ms [-84, 116], ER = 1.6, difference: 24ms [-94, 149], ER = 1.7).

3.2.5 Motor Skills

Lastly, there was likewise only anecdotal evidence for a relation between motor skills and response latencies across groups and contexts. Children with higher motor skills had slightly faster response latencies in the autism group (-30ms [-103, 44], ER = 3) as well as in the typical development group (-48ms [-189, 97], ER = 2.5), but there was no evidence for a difference between groups 18ms [-143, 175], ER = 1.4).

Table 3: *Posterior estimates for how child response latencies change across individual conditions (Matching Game, Conversations With Parents and Conversations With Experimenter) and all conditions (Aggregate Estimate) as a function of each of the types of skills listed below (Motor, Cognitive Skills, Language Skills, Social Awareness and Social Motivation). The three top measures (i.e., Social Cognition, Social Awareness, Social Motivation) came from the Social Responsiveness Scale, Language skills refer to the Clinical Evaluation of Language Fundamentals, and Motor Skills refer to Vineland Adaptive Behaviour Scales. The estimates denote the change in child response latency as a function of one standard deviation increase in the skills of the children.*

	Skills	**Autism Group**	**Typical Development**
Social Cognition	Matching With Parent	-94ms [-233, 48]	-395ms [-804, 17]
	Convo With Parent	-82ms [-245, 78]	-152ms [-734, 436]
	Convo With Experimenter	-36ms [-245, 175]	-711ms [-1400, 5]
	Aggregate Estimate	-71ms [-194, 55]	-419ms [-792, -55]
Social Awareness	Matching With Parent	10ms [-139, 159]	246ms [-49, 550]
	Convo With Parent	46ms [-123, 217]	46ms [-373, 476]
	Convo With Experimenter	-22ms [-234, 194]	518ms [21, 1031]
	Aggregate Estimate	11ms [-116, 140]	270ms [-8, 548]
Social Motivation	Matching With Parent	65ms [-60, 191]	-156ms [-486, 179]
	Convo With Parent	18ms [-125, 162]	26ms [-468, 499]
	Convo With Experimenter	82ms [-103, 274]	176ms [-399, 757]
	Aggregate Estimate	55ms [-55, 166]	16ms [-300, 323]
Language	Matching With Parent	36ms [-42, 116]	-8ms [-117, 104]
	Convo With Parent	19ms [-71, 109]	9ms [-146, 162]
	Convo With Experimenter	65ms [-51, 180]	48ms [-148, 236]
	Aggregate Estimate	40ms [-28, 108]	16ms [-84, 116]
Motor	Matching With Parent	-1.33ms [-87, 85]	-34ms [-186, 118]
	Convo With Parent	-61ms [-158, 37]	-61ms [-288, 162]
	Convo With Experimenter	-27ms [-148, 94]	-49ms [-326, 219]
	Aggregate Estimate	-30ms [-103, 44]	-48ms [-189, 97]

3.3. Predictability (RQ4)

The overarching findings for our investigation of predictability are shown in **Table 4** and **Figure 4**. Since short low-content utterances like backchannels might unduly affect the analysis, we also performed a control analysis excluding them. We find the same relations between predictability of other's and own utterances and response latencies as in the main analysis (see **Table 19** and **Table 20** in Supplementary Materials).

3.3.1 Predictability of Previous Adult Utterance

There was strong evidence that both autistic and typically developing children responded faster to more predictable utterances from their interlocutor (Autism Group: -29ms [-48, -10], ER = 118; Typical Development: -32ms [-61, -2], ER = 23.3; difference: 2.31ms [-34, 38], ER = 1.2). Conversations with parents generated bigger effects of predictability across groups compared to those with the experimenter (Autism Group: -30ms [-80, 23], ER = 4.9; Typical Development: -61ms [-140, 19], ER = 9). There were weaker effects in the matching game compared to in conversations with the parent, but only for the typically developing children (Autism Group: 0.2ms [-45, 43], ER = 1.1; Typical Development: 54ms [-17, 123], ER = 8.9).

3.3.2 Predictability of Own Utterance

There was strong evidence that both autistic and tyically developing children responded faster if they were planning a low predictability utterance than a high predictability utterance (Autism Group: 68ms [45, 91], ER = Inf; Typical Development: 50ms [22, 78], ER = 415.7, difference: 18ms [-17, 55], ER = 3.9). The effects were more evident in conversations with the unfamiliar experimenter compared to with parents (Autism Group: -121ms [-178, -63], ER = 453.5; Typical Development: -114ms [-187, -39], ER = 130.6), and lower in the matching game compared to conversations with parents for the autism group but not for the typical development group (Autism Group: -48ms [-97, 1], ER = 17.8; Typical Development:19ms [-34, 75], ER = 2.6).

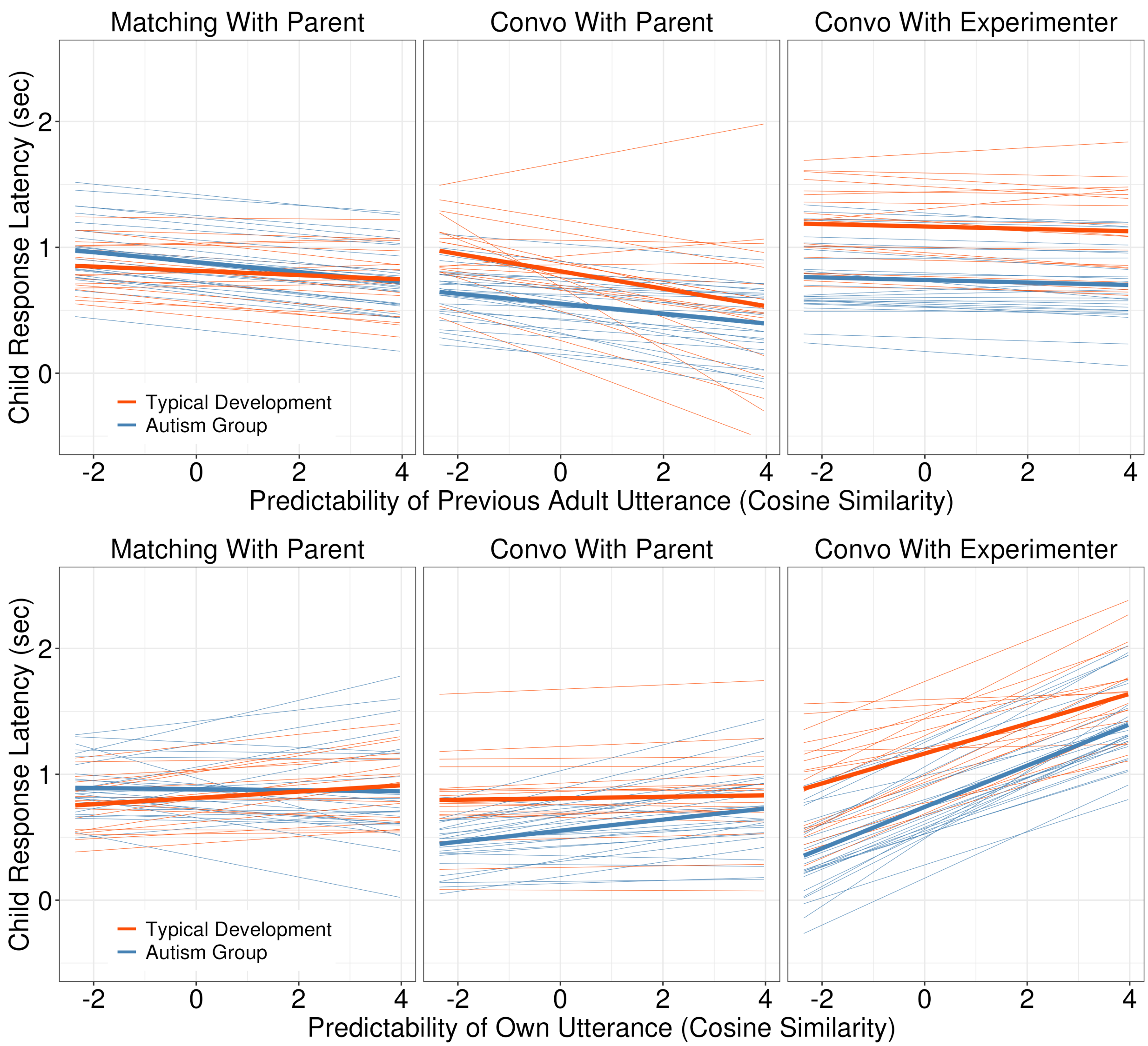

Figure 4: *Panel of plots to demonstrate how model estimates for child response latencies change with the predictability of the previous adult response latency (top) and semantic predictability of own utterance (bottom). The cosine similarity score here represents scaled values (i.e., one unit increase equals one standard deviation increase in cosine similarity). The faded lines are posterior predictions from the model for individual child participants in the study, whereas the thicker lines are average predictions*

Table 4: *Posterior estimates for how child response latencies change across individual conditions (Matching Game, Parent Conversations and Experimenter Conversations) and all conditions (Aggregate Estimate) as a function of the predictability of the previous adult utterance and child utterance. The estimates denote the change in child response latency as a function of one standard deviation increase in the predictability of the utterance*

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	Tasks	**Autism Group**	**Typical Development**
Predictability of Previous Adult Utterance	Matching With Parent	-39ms [-64, -13]	-16ms [-52, 23]
	Convo With Parent	-39ms [-74, -3]	-70ms [-128, -10]
	Convo With Experimenter	-10ms [-46, 28]	-9ms [-61, 45]
	Aggregate Estimate	-29ms [-48, -10]	-32ms [-61, -2]
Predictability of Own Utterance	Matching With Parent	-4.24ms [-38, 33]	25ms [-14, 67]
	Convo With Parent	44ms [8, 81]	6ms [-31, 42]
	Convo With Experimenter	165ms [122, 210]	119ms [56, 183]
	Aggregate Estimate	68ms [45, 91]	50ms [22, 78]

3.4. Shared Tempo (RQ5)

The overarching findings for our investigation of shared tempo are shown in **Table 5** and **Figure 5**. The analysis revealed a disparity between autistic and typically developing children in both interpersonal and self adjustment of response latencies across social contexts. When looking at the adult interlocutors, we see weak positive effects across different social contexts and no robust differences between the autism and typical development group (see **Figure 9** and **Table 10** in Supplementary Materials).

3.4.1 Interpersonal Adjustment

Autistic children demonstrated a small but reliable positive adjustment to their interlocutors' response latencies, whereas typically developing children did not (Autism Group: 28ms [5, 50.08], ER = 41.9; Typical Development: 3.03ms [-29, 35], ER = 1.3; difference: 25ms [-13, 64], ER = 5.7). Autistic children displayed a higher degree of adjustment in conversations with parents compared to in the matching game (-38ms [-80, 3], ER = 14.3), whereas autistic children in conversations with the experimenter showed no interpersonal adjustment compared to the parent conversation (68ms [-0.13, 137.54], ER = 18.7). In comparison, typically developing children displayed no effect of the latency of the previous adult turn, and no clear differences across contexts.

3.4.2 Self Adjustment

Children in both groups displayed a small but reliable positive adjustment to their own previous response latency (see **Table 5** and **Figure 5**). The autistic children more driven by their own previous response latency when aggregated across social contexts (Autism Group: 35ms [16, 53], ER = 749; Typical Development: 13ms [-13, 38], ER = 3.9; difference: 22ms [-8, 54], ER = 7.3). Children in the autism group adapted slightly less to their own response latencies in the matching game compared to when conversing with their parents (-22ms [-65, 22], ER = 3.9), but there were no differences of this sort in the typical development group

(11ms [-54, 73], ER = 1.6). The strongest difference between the groups was in conversations with the experimenter (36ms [-20, 91], ER = 5.8), followed by conversations with parents (32ms [-39, 101], ER = 3.7), and there were no differences in the matching game (-1.05ms [-33, 30], ER = 1.1).

Table 5: *Posterior estimates for how child response latencies change across individual conditions (Matching Game, Parent Conversations and Experimenter Conversations) and all conditions (Aggregate Estimate) as a function of the latency of the previous adult utterance (Interpersonal Adjustment) and previous child response latency (Self-Adjustment). The estimates denote the change in child response latency as a function of a one-second increase in the response latency of the previous utterance.*

	Tasks	**Autism Group**	**Typical Development**
Interpersonal Adjustment	Matching With Parent	25ms [5, 45.23]	12ms [-16, 42]
	Convo With Parent	63ms [27, 101]	8ms [-42, 55]
	Convo With Experimenter	-5ms [-58, 49]	-11ms [-89, 64]
	Aggregate Estimate	28ms [5, 50.08]	3.03ms [-29, 35]
Self Adjustment	Matching With Parent	28ms [9, 46]	29ms [2.59, 54.77]
	Convo With Parent	50ms [9, 90]	18ms [-36, 77]
	Convo With Experimenter	27ms [-6, 58]	-9ms [-55, 37]
	Aggregate Estimate	35ms [16, 53]	13ms [-13, 38]

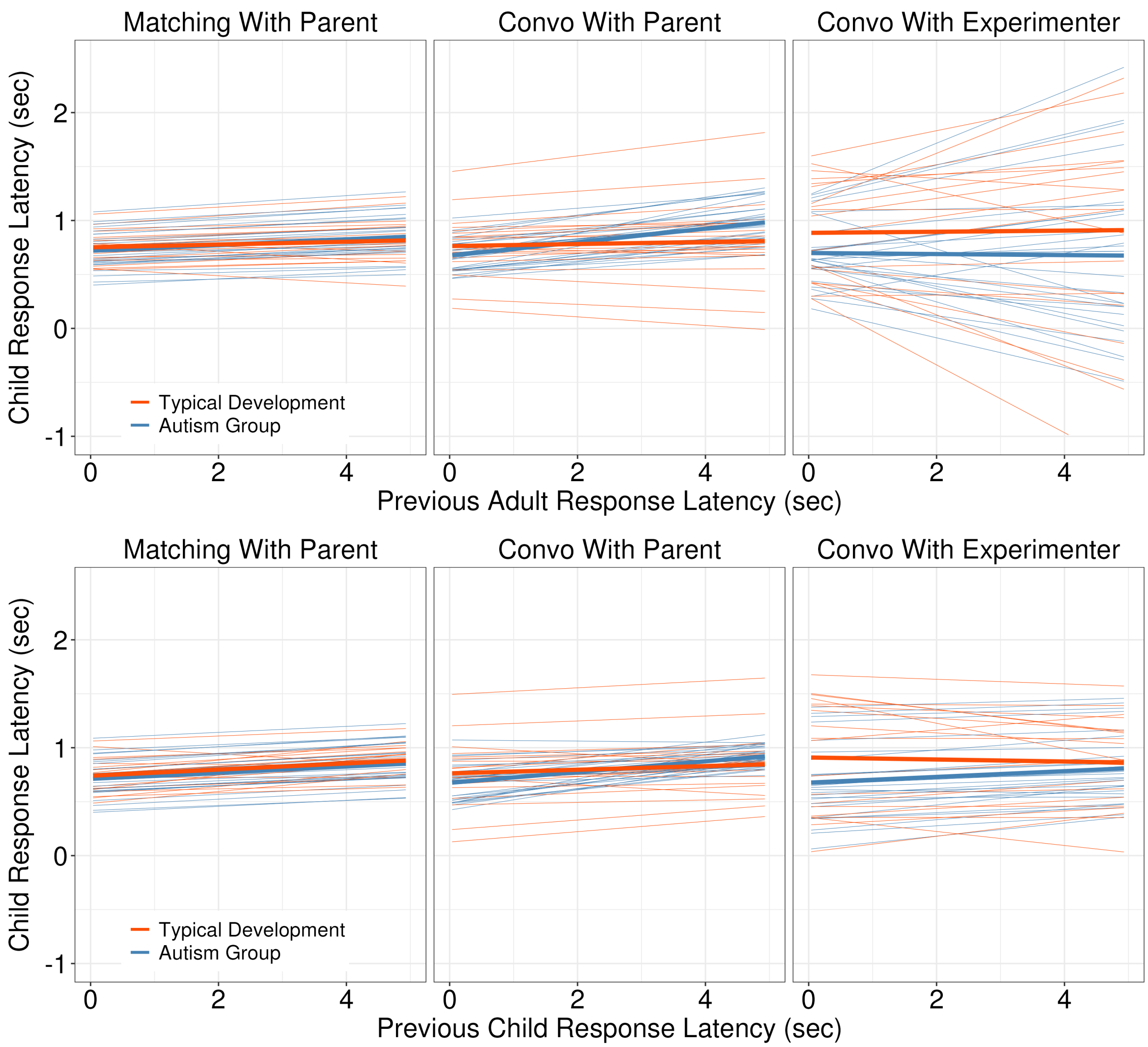

Figure 5: *Panel of plots to demonstrate how model estimates for child response latencies change with the latency of the previous adult response latency (top) and the previous child response latency (bottom).*

4. Discussion

In this study, we set out to disentangle the interplay of different components of turn-taking to provide a more nuanced grasp of individual and group differences across social contexts. We argued that a fuller understanding of child-adult turn-taking dynamics requires consideration of how results vary across multiple sessions and in different social contexts (RQ1) within atypical and typical development (RQ2) as well as how these dynamics interact with individual differences (RQ3) and turn-by-turn variations due to informational content (RQ4) and shared tempo (RQ5). Inter-turn response latencies were consistent across repeated measures *within social contexts*, but exhibited substantial differences across social contexts (RQ1). This pattern of findings suggests that these turn-taking dynamics represent a stable but context-specific construct. Conversations with a familiar interlocutor enabled faster turn-taking (i.e., slower child response latencies with the experimenter compared to the parent), and more structured tasks slowed down the conversation (i.e., slower responses in the matching game compared to conversations with their parent). We also found substantial differences between diagnostic groups (RQ2), and these were modulated by social context. Autistic children produced faster (more overlaps and shorter gaps) and more variable inter-turn response latencies compared to typically developing children – and the difference was particularly salient in interactions with the unfamiliar interlocutor. Weaker evidence was available for group-specific individual differences (RQ3). Higher socio-cognitive and motor skills were related to faster response latencies (RQ3). These effects were particularly evident in conversations with unfamiliar interlocutors. Autistic children with higher social motivation and linguistic scores – and typically developing children with higher social awareness scores - exhibited slower responses. Social context also shaped how turn-by-turn information flow related to response latencies (RQ4). The more predictable the interlocutor's previous utterance and the less predictable the child's own coming utterance, the faster the response. Yet, with unfamiliar experimenters, the predictability of the other's utterance ceased to play a role, and the predictability of the child's own utterance became a stronger predictor. Analogously, social context modulated the turn-taking dynamics of intra- and interpersonal adjustment (RQ5). Only the autism group adjusted their response times to those of the adult's preceding turn – and only in interactions with their parents. Both groups displayed a weak but positive auto-correlation of their own successive response latencies, but less so when interacting with the experimenter.

Together, these findings highlight how turn-taking dynamics are shaped by the complex interplay of social context, group and individual differences as well as turn-by-turn flows of information and shared tempo. In the following sections, we discuss the observed turn-taking differences between typically developing and autistic children and advance possible mechanisms underlying them. We then focus on the role of familiarity and task in shaping turn-taking dynamics.

4.1. Why do we see faster responses in Autism?

4.1.1 Overlaps & Long Pauses

While some studies find that autistic individuals exhibit slower conversational response latencies (about 300ms) than neurotypicals (Ochi et al., 2019a; Nguyen et al., 2022), our findings showed the opposite pattern. We found that autistic children are faster by around 140ms, and this result accords with two other recent studies (Fusaroli et al., 2024; Wehrle et al., 2023b). To better understand this finding, we first discuss whether the discrepancy could be explained by different methodological choices regarding overlaps, long pauses, and context of conversations. We then advance several complementary hypotheses as to the mechanisms involved in autistic children being faster than typically developing ones.

Part of the reason for this finding could be that previous studies often exclude overlaps from the analysis (Nguyen et al., 2022; Ochi et al., 2019a). Autistic children overlap more with their adult interlocutors, yet this explains the difference in timing only in the conversation with parents - a finding analogous to Fusaroli et al. (2024). After excluding overlaps, autistic children still have shorter gaps in the matching game and in conversations with the experimenter (see **Table 11** in Supplementary Materials).

A second possibility is that these group differences could be explained by a different use of the occasional long pause. Long pauses violate the statistical assumptions (normality of residuals) in most previous studies and we accommodated for them with a long-tailed distribution (ex-Gaussian) where the tail can vary by group and individual. Not accommodating for the long tail hides the difference between groups in the matching game (but not in the other conversations, see control analysis in **Table 15** in Supplementary Materials). In other words, during the matching game, autistic children had a lower frequency of long pauses than typically developing children. Not accounting for this difference biased the estimated latencies in opposite directions: assuming an equal number of pauses, autistic children's estimates were biased towards slower responses (i.e., the control model expects more pauses than actually happened), and typically developing children were biased towards faster responses (i.e., the control model expects fewer pauses than actually happened). Thus, the group difference in the matching game would be masked if not properly accounting for long pauses. In other words, we can at least partially explain the contrast with previous findings via differences in statistical treatment of the data – at least for the matching game and conversations with parents. Yet, interactions with the unfamiliar interlocutor continue to yield a clear group difference even when controlling for overlaps and long pauses – we tentatively propose reasons for this finding in the next section.

4.1.2 Mechanisms of Turn-Taking

Including overlaps and accounting for a different use of long pauses by group can better capture differences between the autism and typical development group; however, we still need to explain why autistic children are faster (more overlaps, shorter gaps, fewer long pauses) than typically developing children. We advance possibly complementary speculative explanations. While autistic children might exhibit atypical processing and behaviors, adults might also bring different expectations to a conversation with autistic children and accordingly provide different scaffolding and reactions to them than to typically developing children (Ferjan Ramírez et al., 2020).

Autistic children are often attributed a large suite of differences in socio-cognitive and other abilities (Frith & Happé, 1994; Fletcher-Watson & Happé, 2019). In our analyses, we included individual differences in social cognition, motivation and awareness, language and motor skills, which we had hypothesized to be directly involved in the development of turn-taking skills. Yet, when considering the prevalence of overlaps, short gaps and scarcity of long pauses, executive function could be another important mechanism to be measured in future work. Executive function is often argued to be atypical in autism (Russell, 1997; Hlavatá et al., 2018), a picture that is further complicated by the high co-morbidity with ADHD and its impulse control symptomatology (Carrascosa-Romero & De Cabo-De La Vega, 2015; Bougeard et al., 2021). Atypical executive function might imply downstream effects on planning, mental flexibility, impulsivity and inhibition in social interactions (Hughes et al., 1994; Hill, 2004; Hlavatá et al., 2018; Geurts et al., 2014).

In other words, the faster response latency in autism might be related to impulsivity, which is expected to be higher in autism than in typical development (Bougeard et al., 2021).

For instance, as an utterance unfolds it becomes more and more predictable. Autistic children might have a lower threshold for predictability - or even be more likely to just lose attention - and jump in earlier. This might involve increased backchannels, or partly neglecting the social nicety of letting the other finish (Dobbinson et al., 1998). Overlaps might be emphasized in the relaxed atmosphere of a conversation with a caregiver, where indeed the propensity to overlap is particularly high for autistic children.

Conversations, however, are an interpersonal endeavor. Group differences in children's response latencies may also be driven by the behaviors of the adult in the interaction, and the feedback cycles of adjusting to each other Fusaroli et al. (2014, 2019); Dingemanse et al. (2023); Cox et al. (2023). For example, while adult interlocutors did display comparable response latencies, overlap proportions, long pauses and degrees of variability across the two groups (cf., **Table 7** and 12 in Supplementary Materials), they also produced more predictable utterances when interacting with autistic children (see **Table 17** in Supplementary Materials). This is in line with previous work showing that parents of autistic children - likely in adaptation to their children's slightly atypical verbal and social behavior, or influenced by interventions - would produce shorter utterances and employ a smaller vocabulary Fusaroli et al. (2019). Thus, autistic children might not be more impulsive and more likely to interrupt their interlocutor; they may simply be reacting to predictable information in a typical way – and if typically developing children were to engage with the same predictable language, they may behave in similar ways to the autistic children. Further, adults might be sensitive to interventions emphasizing how they need to produce good examples of social interactions and well-composed language (Ferjan Ramírez et al., 2020; Huber et al., 2023). A typically developing child overlapping with the adult might quickly gain the floor; while an autistic child might not, and the adult might keep speaking until the utterance reaches a possible conclusion.

In sum, autistic children respond faster than typically developing ones, and the social context modulates how this is manifested in terms of increased overlaps, faster gaps and fewer long pauses. However, we need to improve our understanding of the mechanisms through which this happens. We need to move towards a more fine-grained perspective on individual differences (e.g. including graded measures of impulsivity). We also need to move towards a more interpersonal perspective on social interactions: how are adults shaping their behaviors and reactions when interacting with autistic children – and how are autistic children in turn reacting to this? We also need to integrate more qualitative perspectives on what actually happens as adults and children take turns in dialogue (Bottema-Beutel et al., 2022), including the social context, contingency and the diverse functions of gaps and overlaps.

4.2. Temporal Dynamics as Shaped by Familiarity of Interlocutor

The familiarity of the interlocutor (i.e., caregiver versus experimenter) played a crucial role in shaping not only the children's response latencies, but also how differences by diagnostic group, individual characteristics and turn-by-turn dynamics played out. Engaging in verbal exchanges with unfamiliar interlocutors fundamentally differs from doing so with familiar interlocutors. For example, college students responded faster when interacting with unfamiliar interlocutors to communicate active listening and engagement – and these signals were more crucial in the higher social pressure of interacting with a stranger than with a familiar interlocutor Templeton et al. (2022, 2023). The children in this study, on the contrary, slowed their response latencies (by around 200ms in autism and 350ms in typical development), varied them more, and produced long pauses more frequently when interacting with the unfamiliar experimenter than with the familiar parent.

One possible explanation is that interactions with unfamiliar interlocutors are much more challenging for still developing children. While adults can be prompted by the increased social pressure to give at least the impression of a prompt and smooth turn-taking, this might be too tall of an order to expect from children. Unfamiliarity brings the challenge of additional unpredictability and uncertainty to the interaction. The interlocutors do not share a history of interactional routines, and that makes inference and anticipation more challenging (Kimhi et al., 2014; Ying Sng et al., 2018; Pickering & Garrod, 2021; Tylén et al., 2013). We observe, for example, that the average predictability of the speech content in adult utterances was lower in unfamiliar than in familiar interlocutors (see **Table 17** in Supplementary Materials), and this measure of predictability does not even account for the accumulated common ground and the multi-modal and social cues that children might have learned to pick up on in familiar adults throughout years of interactions.

The challenges involved in increased uncertainty might also be reflected in the relative lack of responsiveness to the unfamiliar interlocutor. The predictability of the other's utterances and previous response latencies mattered less when interacting with unfamiliar interlocutors - instead, response latencies were relatively more affected by the predictability of their own production. With increased uncertainty, children are less able to promptly engage and pick up on cues.

In conversations with unfamiliar experimenters, we see the largest difference between autistic and typically developing children across social contexts, with typically developing children showing a big relative slowdown. This is in line with complementary evidence that autistic children do not display as large a reaction as typically developing children in the presence of unfamiliar individuals compared to familiar ones (Stefanatos & Baron, 2011). For example, in contrast to typically developing children, autistic children show no difference in gaze aversion when interacting with familiar and unfamiliar interlocutors (Doherty-Sneddon et al., 2013), no difference in brain activation in response to familiar versus unfamiliar face stimuli (Dawson et al., 2002), and less flexibility in their behavioural repertoire across different social tasks (Forgeot d'Arc et al., 2020; Nadig et al., 2015).

Further, socio-cognitive skills seem to have a stronger impact on response latencies exactly when facing unfamiliar interlocutors. In typical development, the higher the socio-cognitive skills and the lower the social awareness, the faster the response latencies - both due to increased overlaps (cf., **Figure 14**) and shorter gaps (cf., **Table 16**). Social awareness might make the children more cautious and careful in the presence of a stranger, and perhaps make them worried of cutting them off or just slower, while socio-cognitive skills might make them better at anticipating when an utterance is tapering to a conclusion. However, we did not see the same patterns in autistic children. Higher social motivation did slow autistic children down through fewer overlaps and longer gaps (cf., **Figure 14**) – perhaps again in cautious consideration of the unfamiliar situation, and them trying to do their best at steering clear from the interlocutor's utterances – but higher socio-cognitive skills did not speed them up.

The marked diagnostic difference in the impact of socio-cognitive skills could be caused by many diverse mechanisms. Autistic children tend to have lower socio-cognitive skills (see

Table 1) and thus not able to fully take advantage of social cues. Alternatively, anxiety and/or impulse control issues - often associated with autism (Carrascosa-Romero & De Cabo-De La Vega, 2015; Bougeard et al., 2021) - might make them less sensitive to social cues they might otherwise catch to various degrees in more familiar settings.

In sum, familiarity seems to have a strong impact on turn-taking and interact with individual and group differences as well as turn-by-turn dynamics. As unfamiliarity emphasizes differences by diagnosis and socio-cognitive skills, it might be considered a highly informative context to assess turn-taking skills. Yet, the findings also emphasize that atypical performance with unfamiliar conversation partners only tell part of the story about children's ability to engage with their everyday social context.

4.3. Limitations and future work

The current work is limited by a common issue: since child populations – and even more so those with neurodevelopmental conditions – are highly heterogeneous across different ages, much work still needs to be done to assess its generalizability. For instance, previous work on younger (2-5 year olds) children has shown similar but not identical patterns Fusaroli et al. (2024), and it is as yet unclear whether the differences can be attributed to the different ages in the populations.

As we start measuring more fine-grained individual differences, we focused on skills traditionally related to language acquisition: socio-cognitive, linguistic and motor skills. Yet, the current findings exhibited substantial heterogeneity in response latencies beyond differences in such skills. The findings that unfamiliar interlocutors elicit markedly different response latency patterns suggest that measures of anxiety levels could be important (Vasa et al., 2020). Further, the reliable pattern of higher overlaps in autistic children suggests that measures of impulsivity should be likewise collected to better understand the mechanisms at play.

Finally, the current line of work would strongly benefit from a more detailed and qualitative analysis of what goes on in the utterances and at turn transitions. This could in turn generate further questions, create better measures and inform new statistical models. Our current measure of predictability was purely based on a relatively short context of verbal data, while multimodal cues - from gaze to prosody - and the longer-term construction of common ground likely play an important role too (Bögels & Torreira, 2021; Local & Walker, 2012; Schaffer, 1983). Our current measure of response latency is likewise agnostic as to whether the previous utterance has concluded or been interrupted, as to whether the current utterance is an answer, a completion or completely unrelated to the previous one. Careful qualitative work has much to contribute to the understanding of the complexities and mechanisms of turn-taking (Fusaroli et al., 2023; Bottema-Beutel et al., 2022).

5. Conclusion

At the heart of turn-taking lies mutual interaction with the aim of sharing social interest and communicating information (Harrist & Waugh, 2002; Schertz et al., 2018). Here we built a framework of crucial components to improve our understanding of turn-taking according to individual and group differences, task demands, interlocutor familiarity, and turn-by-turn information flow and shared tempo. This framework construes turn-taking as immersed in a social context with different affordances for interactions. We hope that our findings can contribute to a reevaluation of how we analyse verbal exchanges and create stronger theories about turn-taking dynamics in diverse populations.

6. Reproducibility Statement

All code and materials required to reproduce this research are publicly available and documented on github (`LINK`) and OSF (`https://osf.io/qhdzm/`).

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7. Supplementary Materials

The Supplementary Materials include additional results on how variability changes across visit, adult response latencies, test-re-test reliability, control analyses as well as model information and quality checks:

- Results on Variability for Child Response Latencies
- Results for Adults
  - Average Response Latencies (μ)
  - Individual Socio-Cognitive Differencs, Adults
  - Predictability, Adults
  - Shared Tempo, Adults
- Test-Re-Test Reliability
- Control Analyses
  - Child Latency With No Overlaps
  - Adult Latency With No Overlaps
  - Child Latency Estimates Across Gender
  - Model Estimates With No Sigma and No Beta
  - Model Estimates With Sigma But No Beta
  - Overlaps according to Individual Differences
  - Individual Differences With No Overlaps
  - Predictability Model With No Backchannels
  - Predictability Model With Short Utterances Removed
  - Model With Surrogate Pairs
  - Response Latencies as a Function of Visit
- Model Information and Quality Checks
  - Choice of Priors
  - Prior and Posterior Predictive Checks
  - Prior-Posterior Update Plots

7.1. Results on Variability for Child Response Latencies

Table 6: *Posterior estimates for child response latencies across individual conditions (Matching Game, Convo With Parent (Conversations with Parents) and Convo With Experimenter (Conversations with Experimenter) and aggregated across conditions (Aggregate Estimate) for different model parameters: Child SD (varying effects for individual children), Sigma Visit (change in standard deviation across visits) and Visit SD (standard deviation across visits).*

Child SD	Matching With Parent	261ms [207, 325]	260ms [199, 334]
	Convo With Parent	244ms [191, 307]	316ms [241, 404]
	Convo With Experimenter	302ms [238, 379]	444ms [336, 581]
	Aggregate Estimate	269ms [231, 311]	340ms [287, 403]
Sigma Visit	Matching With Parent	-0.03 [-0.05, -0.01]	0 [-0.02, 0.03]
	Convo With Parent	0.02 [-0.01, 0.06]	-0.04 [-0.09, 0]
	Convo With Experimenter	-0.02 [-0.04, 0]	0.01 [-0.01, 0.03]
	Aggregate Estimate	-0.01 [-0.02, 0.01]	-0.01 [-0.03, 0.01]
Visit SD	Matching With Parent	91ms [41, 169]	70ms [9.14, 149.9]
	Convo With Parent	83ms [6.24, 248.44]	76ms [4.47, 245.81]
	Convo With Experimenter	103ms [21, 247]	99ms [11, 260]
	Aggregate Estimate	92ms [43, 170]	82ms [31, 162]

7.2. Results for Adults

7.2.1 Average Response Latencies (μ)

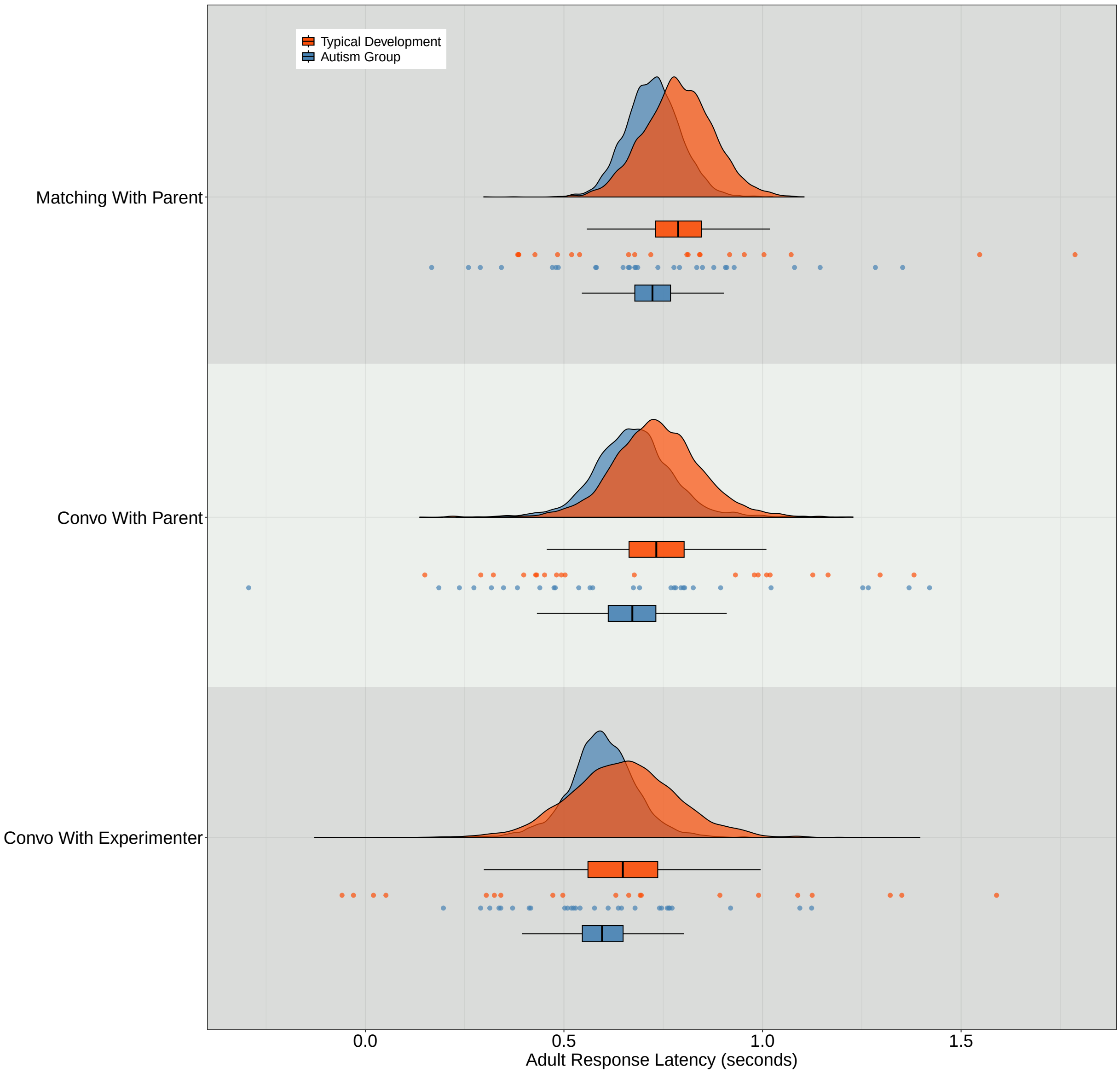

Figure 6: *Panel of plots to demonstrate model estimates for adult response latencies across different conversational contexts for the two diagnostic groups: Autism Group (blue) and Typical Development Group (orange). The small points represent participant-level posterior predictions from the model. The density plots and boxplots show aggregated posterior predictions for the conversational activities.*

Table 7: *Posterior estimates for adult response latencies across individual conditions (Matching Game, Convo With Parent (Conversations with Parents) and Convo With Experimenter (Conversations with Experimenter) and aggregated across conditions (Aggregate Estimate) for different model parameters: the Gaussian component (Latency) in milliseconds, proportion of latencies below zero (Overlap Proportion) in proportions, Standard Deviation (Sigma) in milliseconds, exponential component (Beta, or long pauses) on log scale, and Test-Retest Reliability across sessions in correlations.*

	Tasks	**Autism Group**	**Typical Development**
Latency	Matching With Parent	724ms [613, 837]	788ms [642, 930]
	Convo With Parent	674ms [516, 837]	734ms [556, 919]
	Convo With Experimenter	597ms [450, 738]	648ms [430, 872]
	Aggregate Estimate	665ms [578, 754]	724ms [614, 833]
Overlap Proportion	Matching With Parent	0.3 [0.26, 0.34]	0.26 [0.22, 0.3]
	Convo With Parent	0.22 [0.18, 0.27]	0.22 [0.17, 0.28]
	Convo With Experimenter	0.29 [0.25, 0.33]	0.26 [0.2, 0.33]
	Aggregate Estimate	0.27 [0.24, 0.3]	0.25 [0.22, 0.28]
Sigma	Matching With Parent	506 [476, 539]	487 [459, 516]
	Convo With Parent	438 [389, 491]	526 [459, 604]
	Convo With Experimenter	861 [781, 945]	801 [725, 887]
	Aggregate Estimate	576ms [546, 608]	590ms [554, 627]
Beta	Matching With Parent	0.18 [0.1, 0.27]	0.15 [0.05, 0.26]
	Convo With Parent	-0.16 [-0.29, -0.04]	-0.14 [-0.32, 0.04]
	Convo With Experimenter	-0.44 [-0.59, -0.3]	-0.34 [-0.48, -0.2]
	Aggregate Estimate	-0.14 [-0.21, -0.07]	-0.11 [-0.2, -0.02]
Test-Retest Reliability	Matching With Parent	0.46 [0.36, 0.55]	0.36 [0.08, 0.52]
	Parent Conversation	0.83 [0.78, 0.89]	0.78 [0.75, 0.82]
	Convo With Experimenter	0.78 [0.74, 0.81]	0.76 [0.74, 0.77]

7.2.2 Individual Socio-Cognitive Differencs, Adults

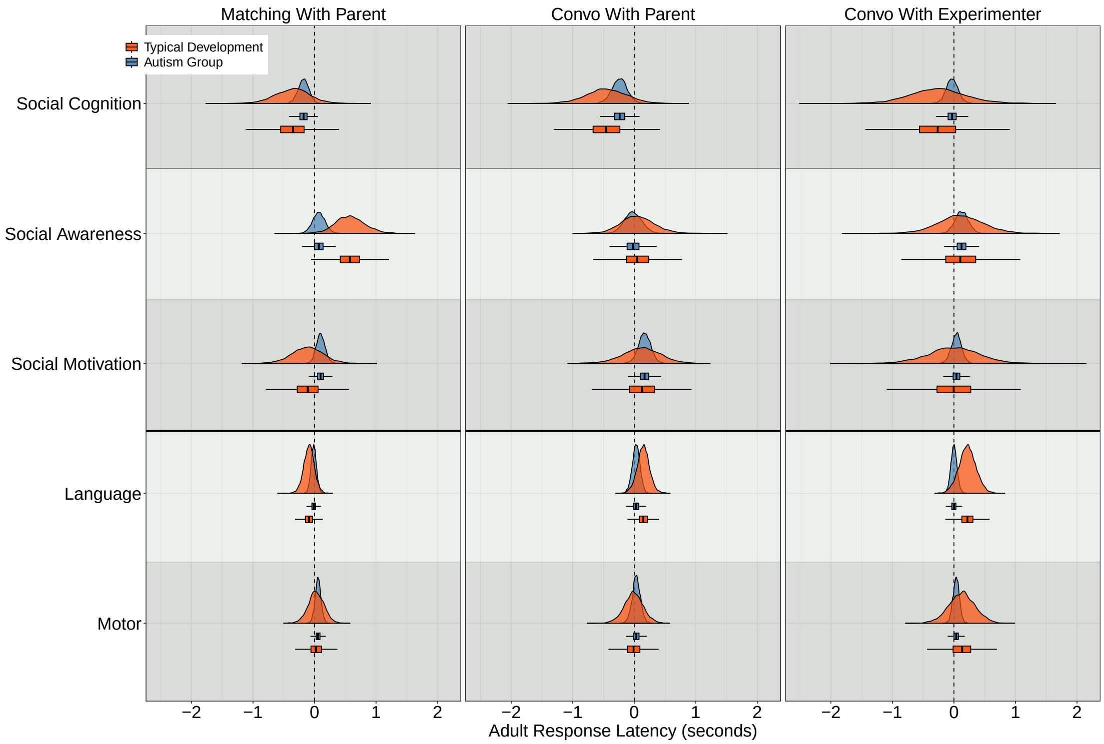

Figure 7: *Panel of plots to demonstrate how model estimates for adult response latencies change with measures of individual differences. The posterior estimates denote the change in adult response latency as a function of one standard deviation increase in each measure. The three top measures (i.e., Social Cognition, Social Awareness, Social Motivation) came from the Social Responsiveness Scale, Language skills refer to the Clinical Evaluation of Language Fundamentals, and Motor Skills refer to Vineland Adaptive Behaviour Scales.*

Table 8: *Posterior estimates for how adult response latencies change across individual conditions (Matching Game, Conversations With Parents and Conversations With Experimenter) and all conditions (Aggregate Estimate) as a function of each of the types of skills listed below (Motor, Cognitive Skills, Language Skills, Social Awareness and Social Motivation). The three top measures (i.e., Social Cognition, Social Awareness, Social Motivation) came from the Social Responsiveness Scale, Language skills refer to the Clinical Evaluation of Language Fundamentals, and Motor Skills refer to Vineland Adaptive Behaviour Scales. The estimates denote the change in adult response latency as a function of one standard deviation increase in the skills of the children.*

	Skills	**Autism Group**	**Typical Development**
Social Cognition	Matching With Parent	-181ms [-329, -40]	-358ms [-834, 107]
	Convo With Parent	-239ms [-445, -36]	-454ms [-994, 85]
	Convo With Experimenter	-29ms [-187, 134]	-262ms [-1001, 500]
	Aggregate Estimate	-149ms [-254, -45]	-358ms [-707, -13]
Social Awareness	Matching With Parent	71ms [-95, 241]	579ms [196, 993]
	Convo With Parent	-18ms [-252, 222]	58ms [-379, 532]
	Convo With Experimenter	124ms [-59, 307]	107ms [-501, 733]
	Aggregate Estimate	59ms [-55, 174]	248ms [-33, 554]
Social Motivation	Matching With Parent	99ms [-15, 221]	-113ms [-538, 299]
	Convo With Parent	169ms [2.16, 335.28]	118ms [-395, 619]
	Convo With Experimenter	40ms [-97, 174]	-8ms [-715, 664]
	Aggregate Estimate	103ms [20, 187]	-0.89ms [-319, 299]
Language	Matching With Parent	-12ms [-87, 64]	-90ms [-236, 54]
	Convo With Parent	30ms [-75, 133]	147ms [-22, 316]
	Convo With Experimenter	-0.11ms [-83, 85]	220ms [-12, 452]
	Aggregate Estimate	6ms [-48, 60]	92ms [-17, 201]
Motor	Matching With Parent	58ms [-24, 140]	26ms [-194, 240]
	Parent Conversations	34ms [-80, 145]	-10ms [-274, 250]
	Convo With Experimenter	36ms [-52, 122]	129ms [-229, 490]
	Aggregate Estimate	43ms [-14, 100]	48ms [-114, 212]

7.2.3 Predictability, Adults

Table 9: *Posterior estimates for how adult response latencies change across individual conditions (Matching Game, Parent Conversations and Experimenter Conversations) and all conditions (Aggregate Estimate) as a function of the predictability of the previous child utterance and adult utterance. The estimates denote the change in adult response latency as a function of one standard deviation increase in the predictability of the utterance.*

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	Tasks	**Autism Group**	**Typical Development**
Predictability of Previous Child Utterance	Matching With Parent	2.46ms [-26, 32]	37ms [6, 71]
	Convo With Parent	-10ms [-48, 28]	11ms [-29, 52]
	Convo With Experimenter	-36ms [-73, 1]	-34ms [-85, 16]
	Aggregate Estimate	-15ms [-35, 6]	4.66ms [-19, 29]
Predictability of Own Utterance	Matching With Parent	-8ms [-29, 14]	-4.16ms [-28, 19]
	Convo With Parent	-14ms [-38, 10]	4.98ms [-25, 35]
	Convo With Experimenter	47ms [14, 80]	55ms [16, 96]
	Aggregate Estimate	8ms [-8, 24]	19ms [-0.35, 37.7]

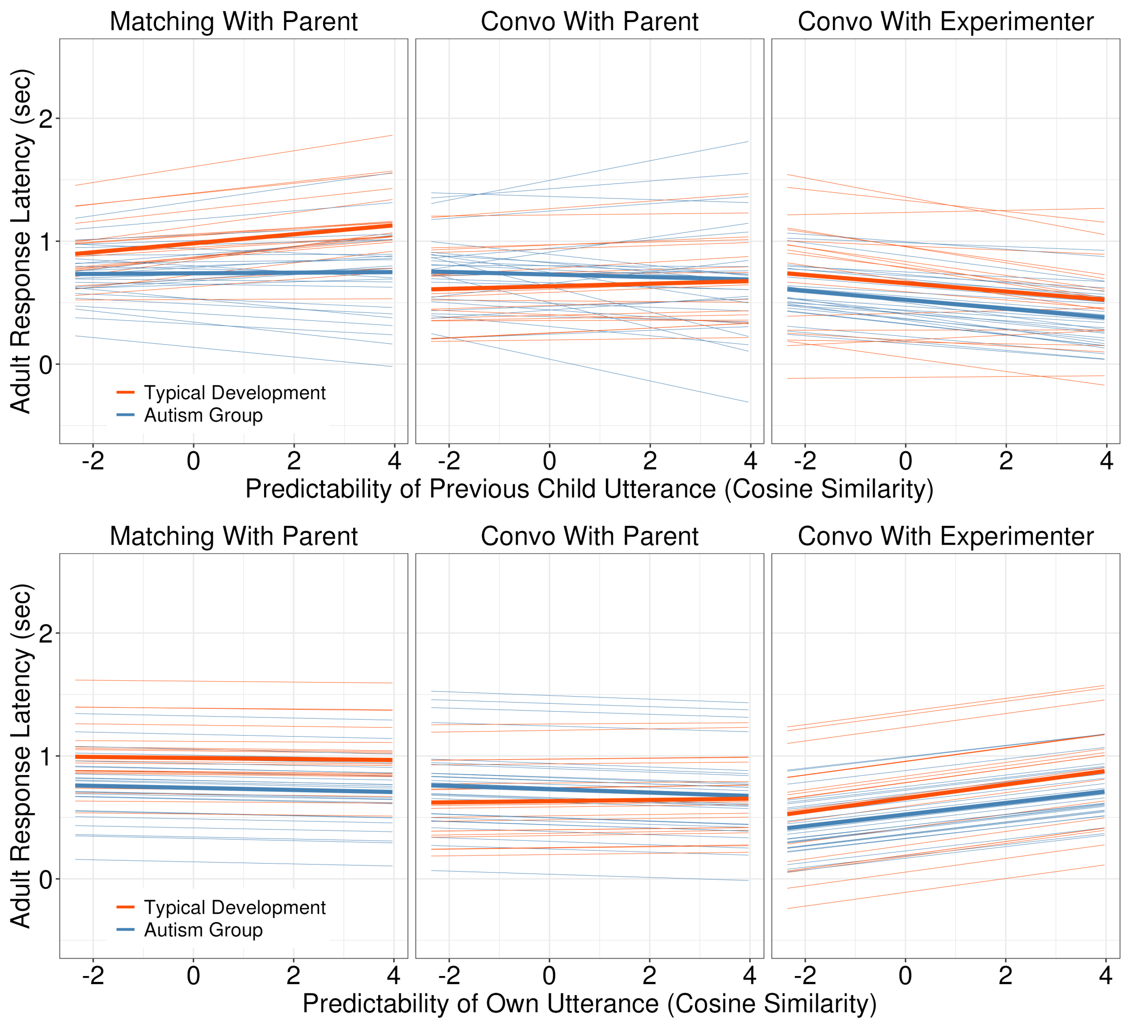

Figure 8: *Panel of plots to demonstrate how model estimates for adult response latencies change with the predictability of the previous child response latency (top) and semantic predictability of own utterance (bottom).*

7.2.4 Shared Tempo, Adults

Table 10: *Posterior estimates for how adult response latencies change across individual conditions (Matching Game, Parent Conversations and Experimenter Conversations) and all conditions (Aggregate Estimate) as a function of the latency of the previous child utterance (Interpersonal Adjustment) and previous adult response latency (Self-Adjustment). The estimates denote the change in adult response latency as a function of a one-second increase in the response latency of the previous utterance.*

	Tasks	**Autism Group**	**Typical Development**
Interpersonal Adjustment	Matching With Parent	42ms [25, 60]	20ms [-8, 48]
	Convo With Parent	38ms [2.11, 75.53]	37ms [-18, 92]
	Convo With Experimenter	20ms [-21, 61]	38ms [-9, 83]
	Aggregate Estimate	33ms [14, 52]	32ms [6, 58]
Self Adjustment	Matching With Parent	41ms [23, 58]	34ms [9, 60]
	Convo With Parent	73ms [43, 103]	34ms [-2.33, 70.35]
	Convo With Experimenter	106ms [56, 155]	80ms [48, 111]
	Aggregate Estimate	73ms [53, 93]	49ms [31, 68]

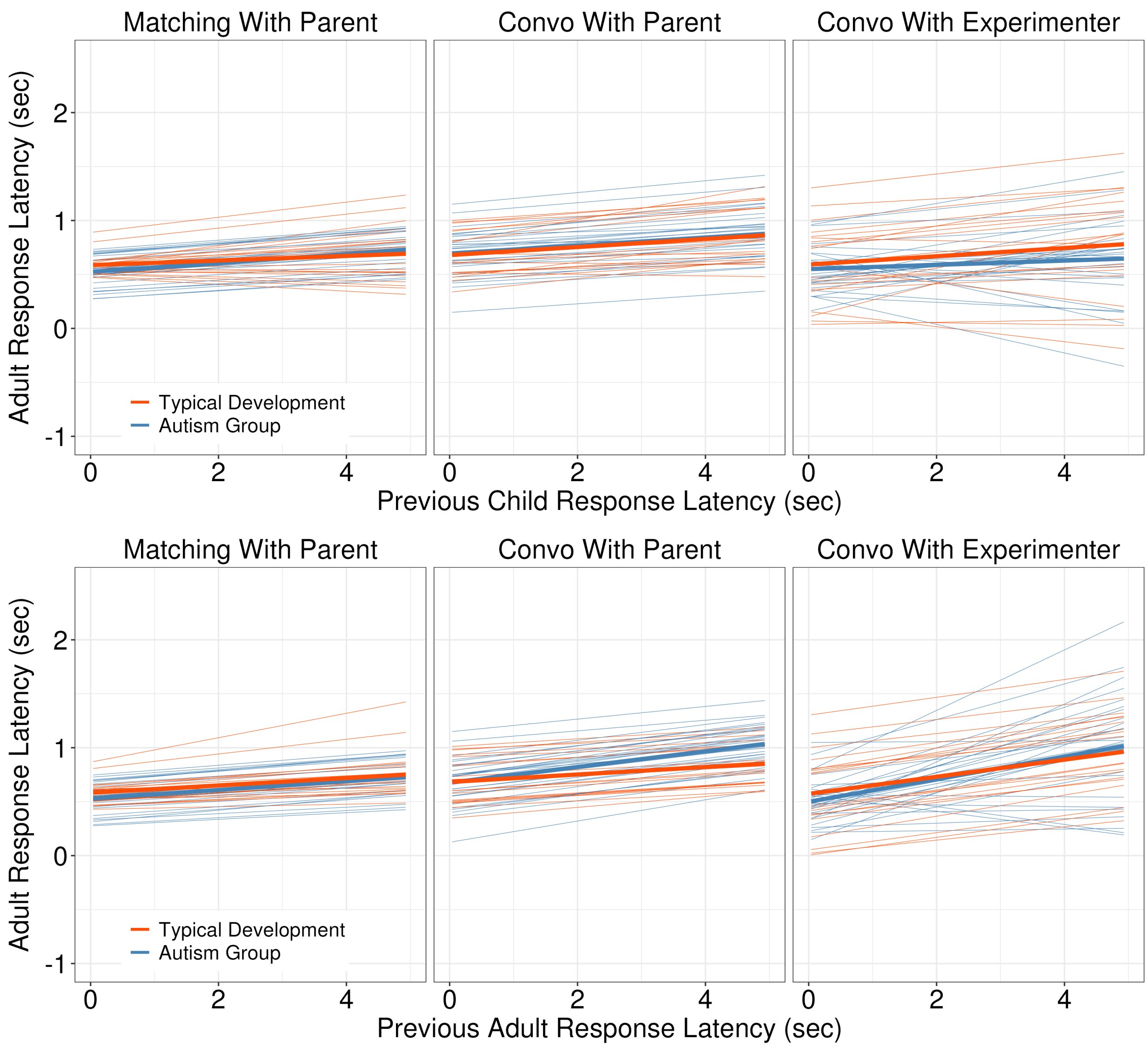

Figure 9: *Panel of plots to demonstrate how model estimates for adult response latencies change with the latency of the previous adult response latency (top) and the previous adult response latency (bottom).*

7.3. Test-Re-Test Reliability

As shown in **Figure 10**, there was evidence of a high degree of test re-test reliability across sessions in both the autism group and typical development group in parent conversations (see also **Table 2**).

Figure 10: *Panel of plots showing strength of correlations among visits for child latencies across different conditions.*

To determine the extent of test-retest reliability within each individual child, we also extracted the model estimates across different contexts for each individual child. We found a high degree of consistency in the response latencies, implying that those children who were fast in one social context also tended to be faster in other social contexts (see **Figure 11**).

Figure 11: *Panel of plots showing correlations among estimates of child-specific response latencies across different social contexts. Each point is the model estimate for a specific child and each child is connected across contexts with a line.*

7.4. Control Analyses

7.4.1 Child Latency With No Overlaps

To check the extent to which the inclusion of overlaps influenced our estimates in the main manuscript, we ran control model without overlaps, the estimates for which are in **Table 11**.

Table 11: *Posterior estimates for child response latencies across individual conditions (Matching Game, Convo With Parent (Conversations with Parents) and Convo With Experimenter (Conversations with Experimenter) and aggregated across conditions (Aggregate Estimate) for different model parameters: the Gaussian component (Latency) in milliseconds, Standard Deviation (Sigma) in milliseconds, and exponential component (Beta, or long pauses) on log scale.*

	Tasks	**Autism Group**	**Typical Development**
Latency	Matching With Parent	1238ms [1181, 1298]	1328ms [1246, 1414]
	Convo With Parent	873ms [808, 938]	885ms [788, 986]
	Convo With Experimenter	1265ms [1165, 1360]	1454ms [1327, 1581]
	Aggregate Estimate	1125ms [1077, 1174]	1222ms [1152, 1291]
Beta	Matching With Parent	0.2 [0.15, 0.25]	0.27 [0.2, 0.33]
	Convo With Parent	-0.17 [-0.24, -0.09]	-0.17 [-0.27, -0.06]
	Convo With Experimenter	-0.09 [-0.17, -0.01]	-0.07 [-0.19, 0.05]
	Aggregate Estimate	-0.02 [-0.06, 0.03]	0.01 [-0.05, 0.07]
Sigma	Matching With Parent	7 [3.76, 11.67]	6 [3.33, 10.76]
	Convo With Parent	10 [4.82, 20.03]	23 [10, 45]
	Convo With Experimenter	201 [163, 245]	326 [286, 372]
	Aggregate Estimate	24ms [18, 33]	36ms [25, 48]

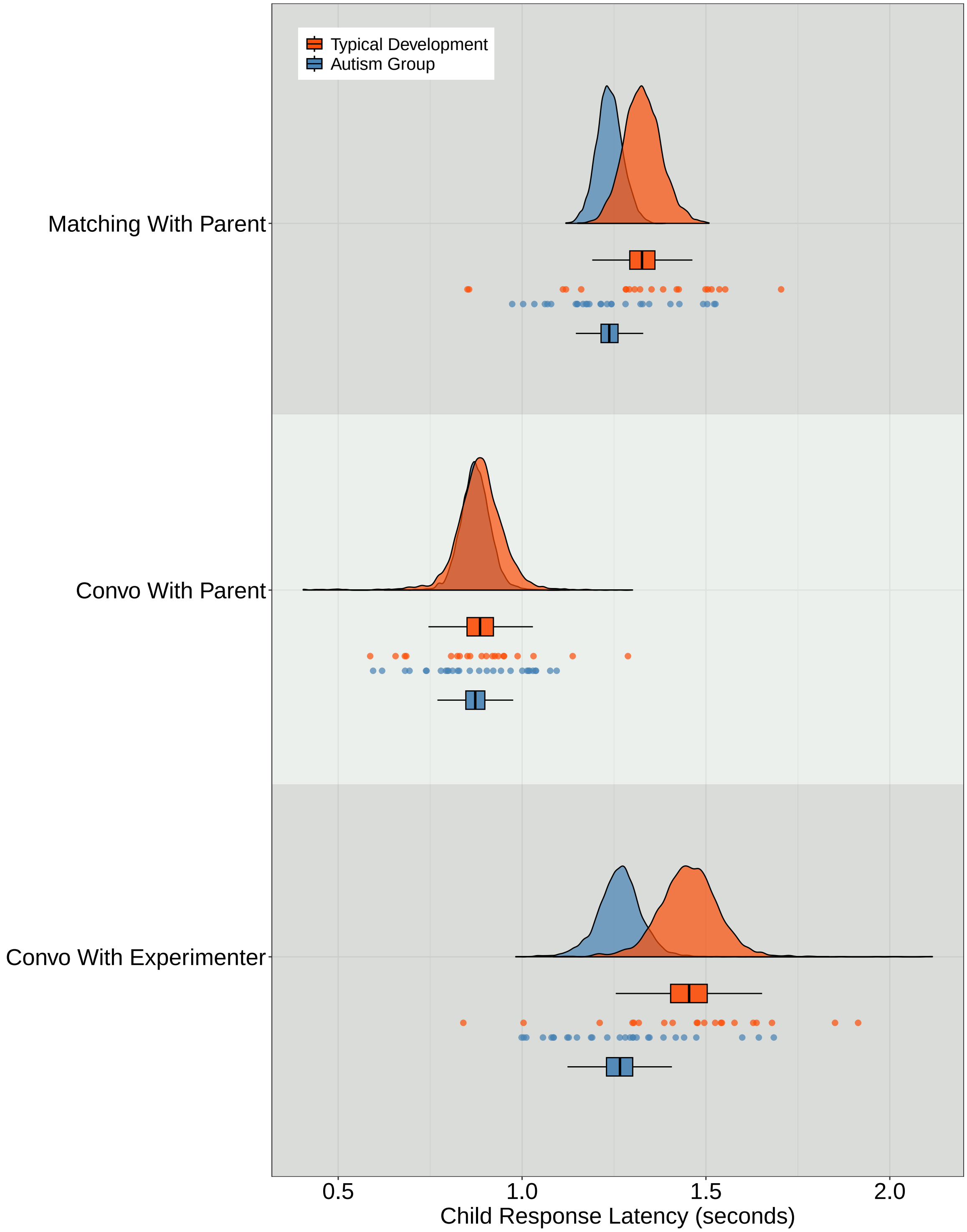

Figure 12: *Panel of plots to demonstrate model estimates for child response latencies across different conversational contexts for the two diagnostic groups: Autism Group (blue) and Typical Development Group (orange). The small points represent participant-level posterior predictions from the model. The density plots and boxplots show aggregated posterior predictions for the conversational activities.*

7.4.2 Adult Latency With No Overlaps

Table 12: *Posterior estimates for adult response latencies across individual conditions (Matching Game, Convo With Parent (Conversations with Parents) and Convo With Experimenter (Conversations with Experimenter) and aggregated across conditions (Aggregate Estimate) for different model parameters: the Gaussian component (Latency) in milliseconds, Standard Deviation (Sigma) in milliseconds, and exponential component (Beta, or long pauses) on log scale.*

	Tasks	**Autism Group**	**Typical Development**
Latency	Matching With Parent	1195ms [1135, 1257]	1192ms [1092, 1298]
	Convo With Parent	942ms [853, 1027]	1021ms [898, 1157]
	Convo With Experimenter	1135ms [1032, 1240]	1144ms [1009, 1279]
	Aggregate Estimate	1090ms [1036, 1142]	1119ms [1046, 1196]
Beta	Matching With Parent	0.17 [0.12, 0.22]	0.14 [0.05, 0.22]
	Convo With Parent	-0.09 [-0.16, -0.01]	-0.06 [-0.18, 0.07]
	Convo With Experimenter	-0.34 [-0.47, -0.21]	-0.31 [-0.43, -0.19]
	Aggregate Estimate	-0.08 [-0.14, -0.03]	-0.07 [-0.14, -0.01]
Sigma	Matching With Parent	6 [3.1, 9.5]	7 [3.73, 11.57]
	Convo With Parent	9 [4.62, 14.61]	15 [9, 26]
	Convo With Experimenter	249 [217, 284]	234 [197, 276]
	Aggregate Estimate	23ms [17, 30]	29ms [22, 37]

Figure 13: *Panel of plots to demonstrate model estimates for adult response latencies across different conversational contexts for the two diagnostic groups: Autism Group (blue) and Typical Development Group (orange). The small points represent participant-level posterior predictions from the model. The density plots and boxplots show aggregated posterior predictions for the conversational activities.*

7.4.3 Child Latency Estimates Across Gender

Table 13: *Posterior estimates for child response latencies across genders and individual conditions (Matching Game, Convo With Parent (Conversations with Parents) and Convo With Experimenter (Conversations with Experimenter) and aggregated across conditions (Aggregate Estimate).*

	Male	**Female**	**NonBinary**
Autism Group			
Matching With Parent	892ms [755, 1029]	830ms [679, 981]	740ms [428, 1041]
Convo With Parent	621ms [496, 748]	521ms [356, 690]	412ms [70, 773]
Convo With Experimenter	793ms [646, 938]	738ms [552, 926]	696ms [286, 1114]
Aggregate	769ms [672, 864]	697ms [577, 817]	616ms [357, 883]
Typical Development			
Matching With Parent	1033ms [853, 1213]	895ms [748, 1040]	
Convo With Parent	719ms [505, 934]	626ms [454, 799]	
Convo With Experimenter	941ms [670, 1208]	1061ms [829, 1282]	
Aggregate	898ms [743, 1051]	860ms [737, 982]	

7.4.4 Model Estimates With No Sigma and No Beta

To explore how the estimates change with a vaying beta and varying sigma component, we ran a control model without the varying beta and varying sigma component. The posterior estimates from this model can be viewed in **Table 14** below.

Table 14: *Posterior estimates for child response latencies across individual conditions (Matching Game, Convo With Parent (Conversations with Parents) and Convo With Experimenter (Conversations with Experimenter) and aggregated across conditions (Aggregate Estimate) for different model parameters without a varying beta and sigma.*

	Tasks	**Autism Group**	**Typical Development**
Latency	Matching With Parent	785ms [704, 868]	813ms [729, 899]
	Convo With Parent	726ms [585, 867]	832ms [662, 1002]
	Convo With Experimenter	766ms [629, 909]	970ms [761, 1177]
	Aggregate Estimate	759ms [672, 844]	872ms [764, 981]
Child SD	Matching With Parent	204ms [157, 261]	195ms [137, 269]
	Convo With Parent	210ms [157, 277]	340ms [253, 447]
	Convo With Experimenter	352ms [277, 442]	460ms [354, 589]
	Aggregate Estimate	256ms [215, 303]	332ms [276, 395]
Visit SD	Matching With Parent	69ms [25, 134]	42ms [3.62, 100.02]
	Convo With Parent	115ms [16, 308]	78ms [4.7, 254.14]
	Convo With Experimenter	81ms [8, 214]	114ms [26, 273]
	Aggregate Estimate	88ms [37, 172]	78ms [30, 158]

7.4.5 Model Estimates With Sigma But No Beta

To explore how the estimates change with a vaying beta component, we ran a control model without the varying beta component but retained the varying sigma component. The posterior estimates from this model can be viewed in **Table 15** below.

Table 15: *Posterior estimates for child response latencies across individual conditions (Matching Game, Convo With Parent (Conversations with Parents) and Convo With Experimenter (Conversations with Experimenter) and aggregated across conditions (Aggregate Estimate) for different model parameters with a varying sigma but no beta.*

	Tasks	**Autism Group**	**Typical Development**
Latency	Matching With Parent	758ms [679, 839]	786ms [711, 868]
	Convo With Parent	699ms [584, 809]	793ms [642, 947]
	Convo With Experimenter	830ms [699, 957]	1057ms [855, 1256]
	Aggregate Estimate	762ms [683, 837]	879ms [779, 982]
Sigma	Matching With Parent	645 [599, 694]	569 [520, 622]
	Convo With Parent	495 [440, 557]	571 [496, 660]
	Convo With Experimenter	897 [834, 963]	879 [808, 956]
	Aggregate Estimate	659ms [626, 695]	659ms [617, 701]
Child SD	Matching With Parent	189ms [145, 242]	183ms [130, 251]
	Convo With Parent	204ms [151, 267]	308ms [233, 404]
	Convo With Experimenter	328ms [259, 410]	453ms [340, 592]
	Aggregate Estimate	240ms [202, 282]	315ms [260, 377]
Visit SD	Matching With Parent	72ms [31, 134]	38ms [2.98, 93.19]
	Convo With Parent	82ms [6, 248]	80ms [4.95, 248.07]
	Convo With Experimenter	84ms [11, 213]	94ms [9, 240]
	Aggregate Estimate	79ms [34, 153]	71ms [23, 147]
Sigma Visit	Matching With Parent	-0.03 [-0.05, -0.01]	0 [-0.02, 0.03]
	Convo With Parent	0.02 [-0.01, 0.06]	-0.04 [-0.09, 0]
	Convo With Experimenter	-0.02 [-0.04, 0]	0.01 [-0.01, 0.03]
	Aggregate Estimate	-0.01 [-0.02, 0.01]	-0.01 [-0.03, 0.01]

7.4.6 Overlaps according to Individual Differences

To explore the extent to which potential increases or decreases in response latencies were a function of a greater proportion of overlaps, we modelled the proportion of overlaps (i.e., negative latencies) according to individual differences among children, as shown in **Figure 14**

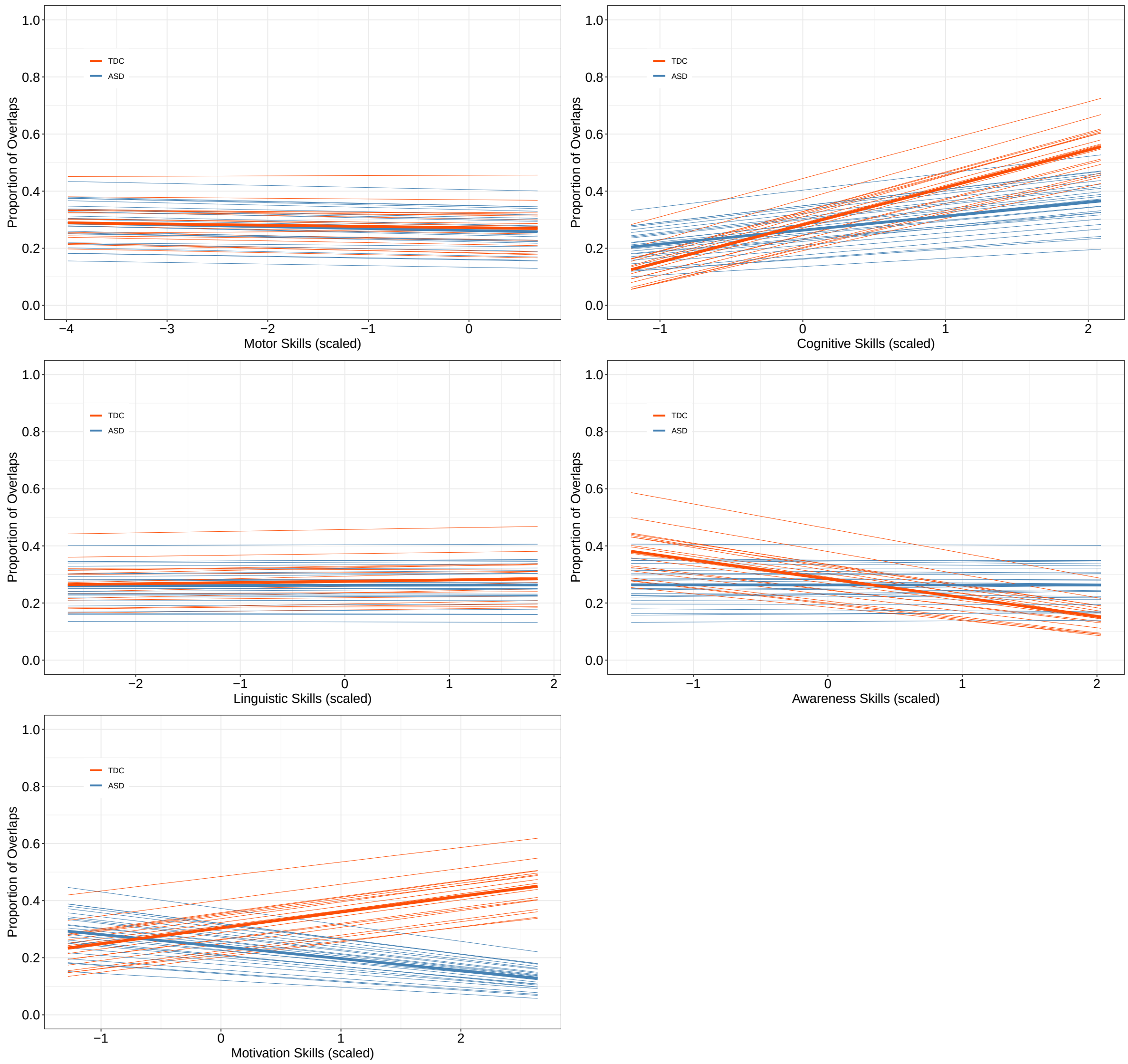

Figure 14: *This panel of plots displays the proportion of overlaps according to individual differences of the children. The faded lines are posterior predictions from model for individual subjects and how the proportion of overlaps changes for each of the continuous predictors.*

7.4.7 Individual Differences With No Overlaps

To check the extent to which overlaps were driving the estimates of change in response latencies according to individual differences, we ran the same individual differences model on data where overlaps (i.e., negative latencies) were excluded. The posterior estimates from this model can be viewed in **Table 16** below.

Table 16: *Posterior estimates when excluding overlaps for how child response latencies change across individual conditions (Matching Game, Parent Conversations and Experimenter Conversations) and all conditions (Aggregate Estimate) as a function of each of the types of skills listed below (Motor, Cognitive Skills, Language Skills, Social Awareness and Social Motivation). The estimates denote the change in child response latency as a function of one standard deviation increase in the skills of the children. The parameter estimates with an evidence ratio of above 10 for a test of difference to null are marked with a *.*

	Skills	**Autism Group**	**Typical Development**
Social Cognition	Matching With Parent	-13ms [-42, 15]	-95ms [-382, 147]
	Convo With Parent	12ms [-30, 55]	50ms [-171, 291]
	Convo With Experimenter	-76ms [-176, 27]	-490ms [-883, -83]
	Aggregate Estimate	-26ms [-67, 16]	-178ms [-367, -4]
Social Awareness	Matching With Parent	4.24ms [-29, 37]	69ms [-81, 252]
	Convo With Parent	27ms [-21, 77]	-59ms [-205, 81]
	Convo With Experimenter	-4.11ms [-117, 108]	190ms [-65, 449]
	Aggregate Estimate	9ms [-39, 56]	67ms [-44, 189]
Social Motivation	Matching With Parent	4.48ms [-21, 30]	-46ms [-219, 116]
	Convo With Parent	-26ms [-64, 11]	78ms [-77, 245]
	Convo With Experimenter	84ms [-3.38, 169.97]	90ms [-194, 377]
	Aggregate Estimate	21ms [-15, 57]	40ms [-84, 165]
Language	Matching With Parent	1.94ms [-14, 18]	20ms [-33, 84]
	Convo With Parent	16ms [-8, 43]	-18ms [-73, 35]
	Convo With Experimenter	0.01ms [-57, 58]	35ms [-59, 131]
	Aggregate Estimate	6ms [-18, 31]	12ms [-29, 55]
Motor	Matching With Parent	0.18ms [-18, 18]	11ms [-69, 94]
	Convo With Parent	-6ms [-35, 21]	-9ms [-89, 67]
	Convo With Experimenter	41ms [-21, 101]	-15ms [-155, 130]
	Aggregate Estimate	12ms [-14, 36]	-4.13ms [-67, 57]

7.4.8 Predictability Model With No Backchannels

As shown in **Table 17**, the overall degree of utterance predictability differed slightly across interactional contexts, with both the child and adult utterances agreeing with each other in terms of their overall degree of predictability.

Table 17: *Overview of Average Utterance Predictability Across Different Contexts*

Condition	Diagnosis	Adult Predictability	Child Predictability
Matching With Parent	Autism Group	0 (0.98)	-0.02 (0.96)
Matching With Parent	Typical Development	-0.02 (1.02)	-0.07 (0.97)
Convo With Parent	Autism Group	0.08 (1.05)	0.19 (1.02)
Convo With Parent	Typical Development	0.08 (1.1)	0.23 (1.04)
Convo With Experimenter	Autism Group	-0.08 (1)	0.01 (0.98)
Convo With Experimenter	Typical Development	-0.15 (0.97)	-0.03 (0.98)

To check the potential influence of backchannels on the posterior estimates, we screened utterances that occurred most frequently (n > 10) in the corpus, removed backchannels from the data, and ran the same predictability model. **Table 18** provides an overview of the 15 most frequently occurring backchannels in the corpus. The estimates from this control model are shown in **Table 19**.

Table 18: *Table with examples of backchannels that were excluded from this control model.*

Backchannel	n
mhm	1089
yeah	951
okay	938
laugh	303
yes	249
no	195
yep	138
um	132
oh	123
hm	108
uhhuh	86
uh	72
mm	70
mhm okay	66
oh okay	61

Table 19: *Posterior estimates for how child response latencies change across individual conditions (Matching Game, Parent Conversations and Experimenter Conversations) and all conditions (Aggregate Estimate) as a function of the predictability of the previous adult utterance and child utterance. The estimates denote the change in child response latency as a function of one standard deviation increase in the predictability of the utterance (i.e., cosine similarity).*

	Tasks	**Autism Group**	**Typical Development**
Predictability of Previous Adult Utterance	Matching With Parent	-38ms [-65, -12]	-16ms [-51, 23]
	Convo With Parent	-39ms [-73, -3]	-69ms [-127, -11]
	Convo With Experimenter	-13ms [-51, 26]	-12ms [-69, 43]
	Aggregate Estimate	-30ms [-50, -11]	-32ms [-62, -2]
Predictability of Own Utterance	Matching With Parent	-21ms [-44, 3]	13ms [-17, 41]
	Convo With Parent	47ms [19, 76]	6ms [-28, 40]
	Convo With Experimenter	164ms [127, 200]	119ms [71, 166]
	Aggregate Estimate	63ms [46, 81]	46ms [24, 67]

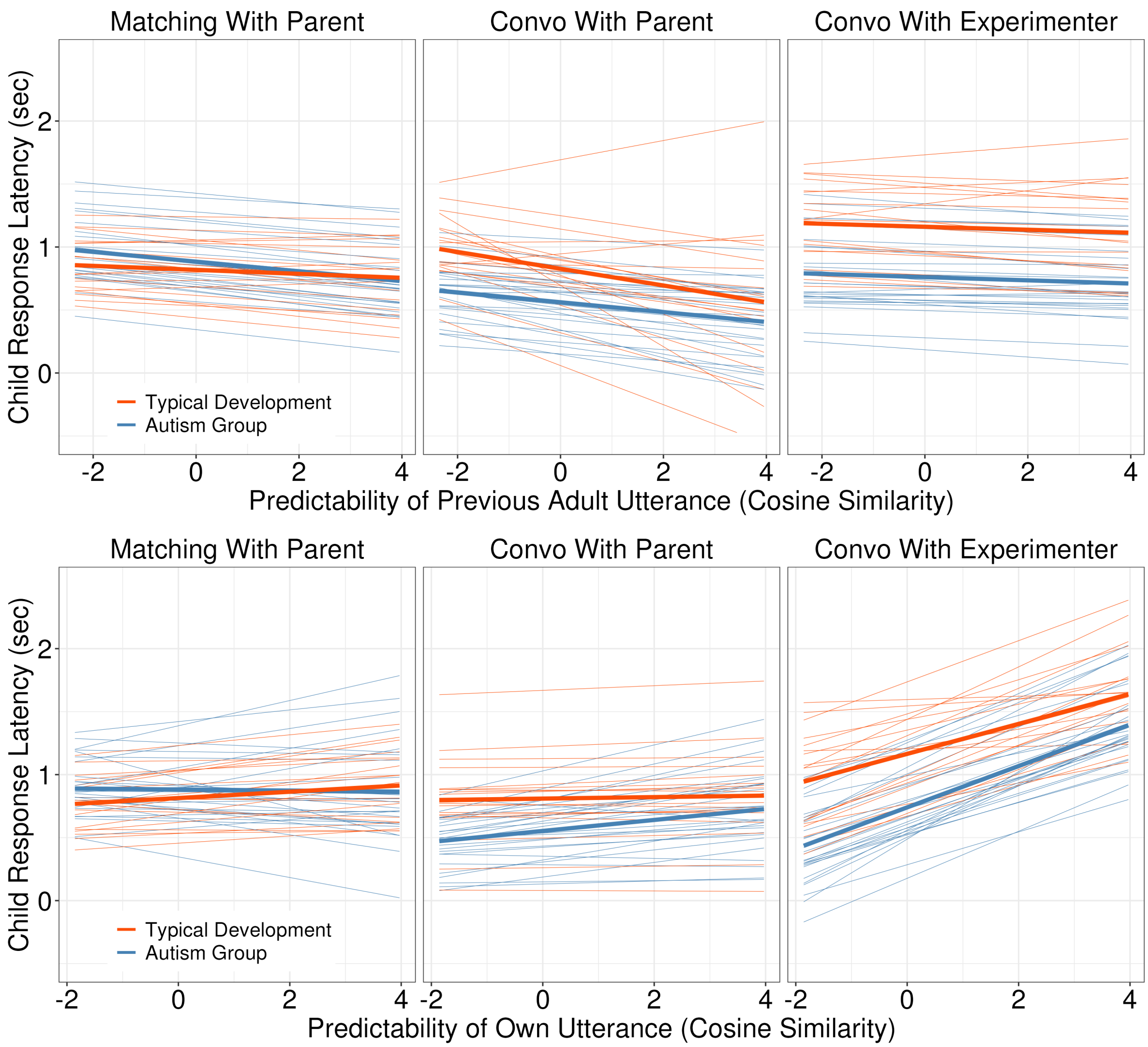

Figure 15: *Posterior estimates in a model excluding backchannels. The plot shows how child response latencies change across individual conditions (Matching Game, Parent Conversations and Experimenter Conversations) and all conditions (Aggregate Estimate) as a function of the predictability of the previous adult utterance and current child utterance.*

7.4.9 Predictability Model With Short Utterances Removed

To check the potential influence of shorter utterances on the posterior estimates, we removed all utterances under three words in the corpus and ran the same predictability model as in the main manuscript. The estimates from this control model are shown in **Table 20**.

Table 20: *Posterior estimates for how child response latencies change across individual conditions (Matching With Parent, Parent Conversations and Experimenter Conversations) and all conditions (Aggregate Estimate) as a function of the predictability of the previous adult utterance and child utterance. The estimates denote the change in child response latency as a function of one standard deviation increase in the predictability of the utterance (i.e., cosine similarity).*

	Tasks	**Autism Group**	**Typical Development**
Predictability of Previous Adult Utterance	Matching With Parent	-54ms [-93, -14]	33ms [-18, 86]
	Convo With Parent	-25ms [-66, 17]	-72ms [-136, -6]
	Convo With Experimenter	-36ms [-93, 21]	-11ms [-83, 61]
	Aggregate Estimate	-38ms [-66, -11]	-17ms [-53, 20]
Predictability of Own Utterance	Matching With Parent	-31ms [-60, -3]	-7ms [-47, 32]
	Convo With Parent	10ms [-26, 47]	-12ms [-58, 34]
	Convo With Experimenter	188ms [145, 230]	108ms [50, 166]
	Aggregate Estimate	56ms [34, 77]	29ms [1.13, 56.88]

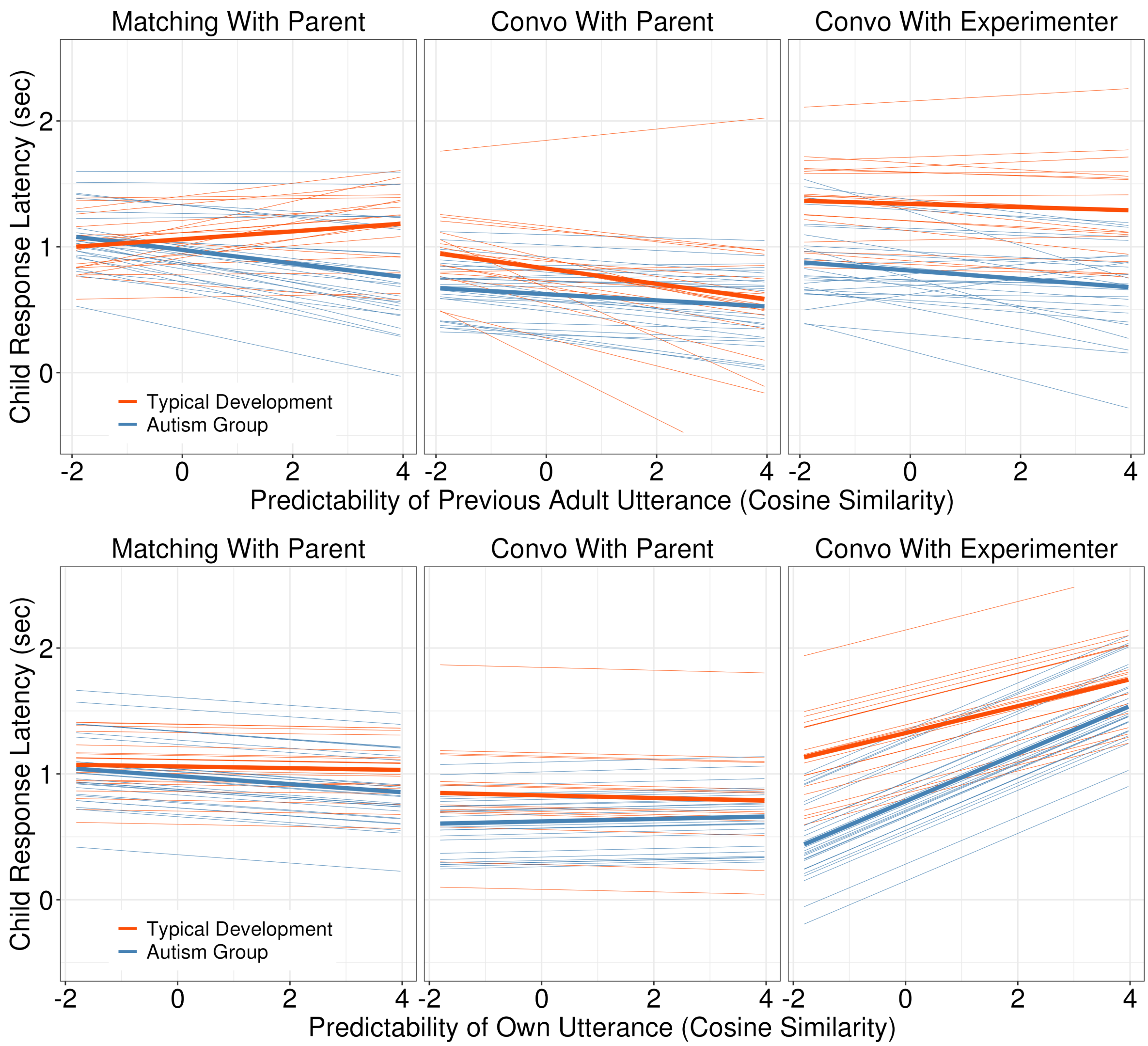

Figure 16: *Posterior estimates in a model excluding utterances below three words. The plot shows how child response latencies change across individual conditions (Matching Game, Parent Conversations and Experimenter Conversations) and all conditions (Aggregate Estimate) as a function of the predictability of the previous adult utterance and current child utterance.*

7.4.10 Model With Surrogate Pairs

As a control analysis, we ran the first model after rotating the dataset; that is, pairing the utterances of one child with the interactant of another child and recalculating the response latencies between turns. The estimates from this control model are shown in **Table 21**.

Table 21: *Posterior estimates for child response latencies across individual conditions (Matching Game, Convo With Parent and Experimenter Conversations) and aggregated across conditions (Aggregate Estimate) for different model parameters: the Gaussian component (Latency), exponential component (Beta), Residual Heterogeneity (Sigma), between-subjects standard deviation (Child SD), standard deviation across visits (Visit SD), Residual Heterogeneity across visits (Sigma Visit) and proportion of latencies below zero (Overlap Proportion).*

	Tasks	Autism Group	Typical Development
Latency	Matching With Parent	27ms [-1632, 1806]	-202ms [-1896, 1544]
	Convo With Parent	-1823ms [-2576, -1087]	-2070ms [-3003, -1079]
	Convo With Experimenter	-2927ms [-3751, -2156]	-2009ms [-2671, -1330]
	Aggregate Estimate	-1574ms [-2293, -831]	-1427ms [-2183, -632]
Sigma	Matching With Parent	17735 [13366, 23464]	16909 [12333, 23217]
	Convo With Parent	4737 [3299, 6966]	4662 [2355, 8587]
	Convo With Experimenter	8091 [5725, 11433]	5827 [3685, 9164]
	Aggregate Estimate	8793ms [7070, 10988]	7716ms [5553, 10557]
Child SD	Matching With Parent	3015ms [1756, 4627]	3100ms [1917, 4587]
	Convo With Parent	1102ms [744, 1526]	823ms [458, 1261]
	Convo With Experimenter	1579ms [1070, 2196]	1096ms [687, 1611]
	Aggregate Estimate	1899ms [1405, 2496]	1673ms [1224, 2220]

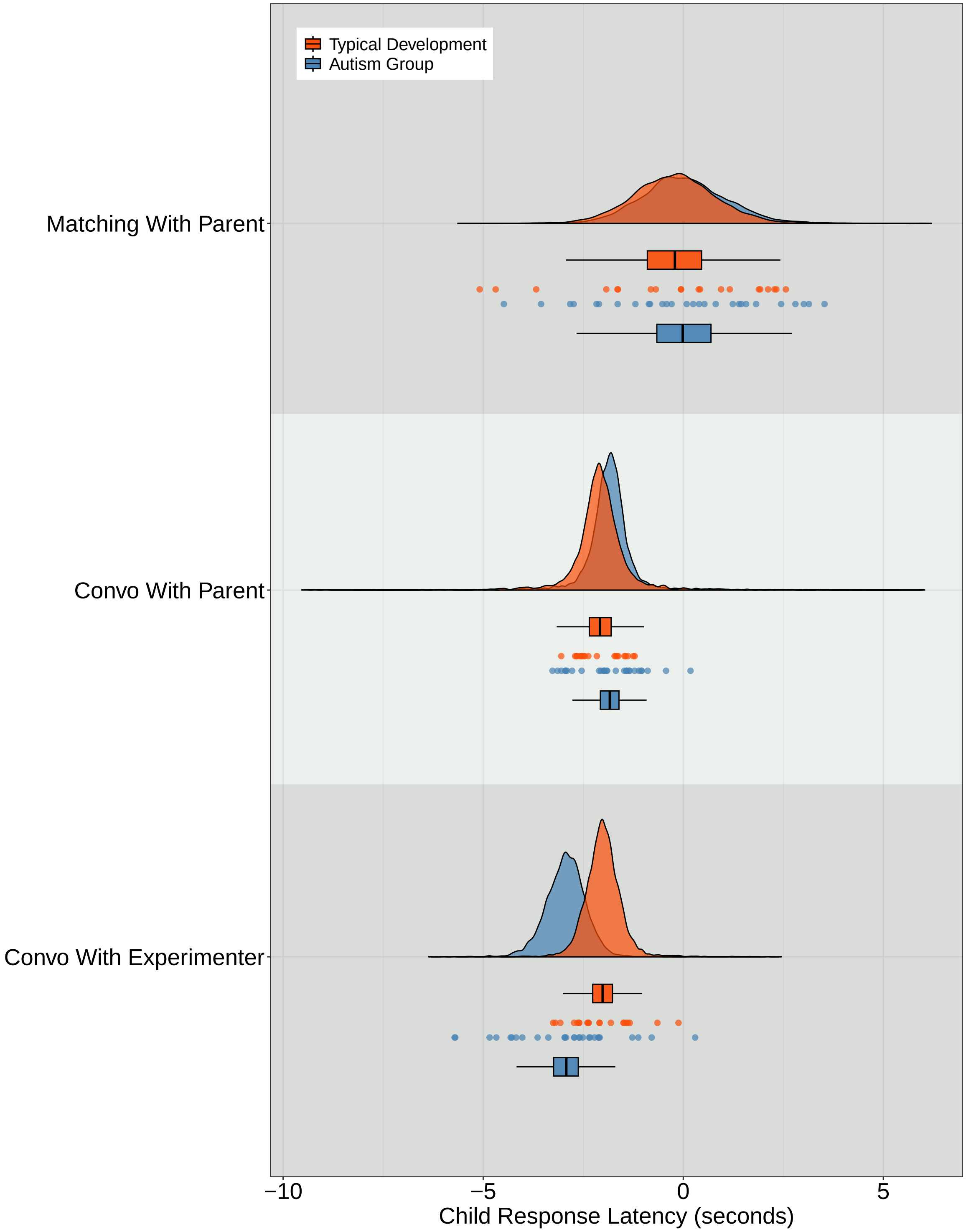

Figure 17: *Posterior estimates for surrogate child response latencies across individual conditions (Matching Game, Parent Conversations and Experimenter Conversations) and aggregated across conditions (Aggregate Estimate) for different model parameters: the Gaussian component (Latency), exponential component (Beta), Residual Heterogeneity (Sigma), between-subjects standard deviation (Child SD), standard deviation across visits (Visit SD), Residual Heterogeneity across visits (Sigma Visit) and proportion of latencies below zero (Overlap Proportion).*

7.4.11 Response Latencies as a Function of Visit

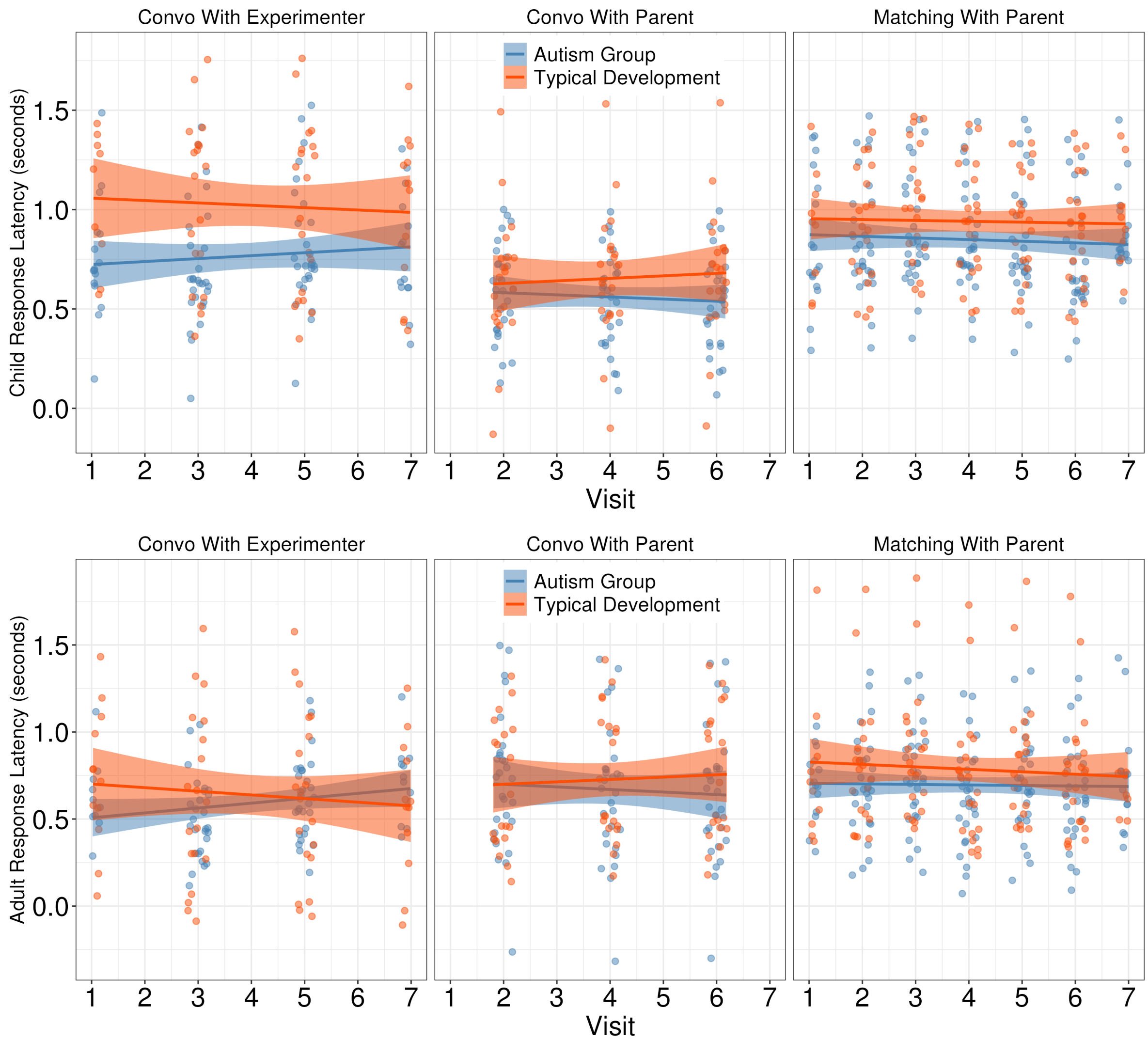

Figure 18: *Posterior estimates for child response latencies across social contexts as a function of visit.*

7.5. Model Information and Quality Checks

7.5.1 Choice of Priors

We chose weakly informative priors in order to ensure that their influence on the estimates was small and to discount extreme effect sizes as unlikely (cf. Lemoine, 2019; Gelman, Simpson & Betancourt, 2017). For the overall distribution, we chose an ex-Gaussian distribution. Our prior for the Gaussian component was specified as having a mean of 1 and standard deviation of 1 based on our prior expectations for child response latencies in a turn-taking context (Nguyen et al., 2022). This prior implies that we expect approximately 95% of the child latencies to fall between -1sec and 3sec. For the between-subject variability across different conversational contexts, we encoded our expectations with a truncated (i.e., standard deviation must have positive values) Gaussian prior with a mean of 0 and a standard deviation of 0.3, which implies that we expect the vast majority of values for the between-subject variability within diagnostic group to be between 0 and 0.6sec. For the rate parameter of the exponential component of the distribution, we specified a Gaussian prior with a mean of 0 and standard deviation of 1 and allowed this to vary for each task and familiarity for each participant.

The models were fitted with Hamiltonian Monte Carlo samplers with 2 parallel chains with 5,000 iterations each, an adapt delta of 0.99 and a maximum tree depth of 20 in order to ensure no divergence in the estimation process. The quality of the models was assessed by i) ensuring Rhat statistics to be lower than 1.1, ii) carrying out prior and posterior predictive checks, iii) plotting prior against posterior estimates and assessing whether the posteriors had lower variance than the priors, iv) ensuring no divergences in the process of estimation, v) checking that the number of effective bulk and tail samples was above 200, vi) conducting prior sensitivity analyses.

As an example of what the basic *brms* formula looked like, here is the formula for the first model (cf., code on OSF for the full code and *brms* formulae for other models):

> Latency ~ 0 + Diagnosis:Task:Familiarity + (0 + Task:Familiarity | p | gr(ID, by = Diagnosis)) + (0 + Diagnosis:Task:Familiarity | r | Visit),
>
> Sigma ~ 0 + Diagnosis:Task:Familiarity + Diagnosis:Task:Familiarity:Visit + (0 + Task:Familiarity:Visit | p | gr(ID, by = Diagnosis)),
>
> Beta ~ 0 + Diagnosis:Task:Familiarity + (0 + Task:Familiarity | p | gr(ID, by = Diagnosis)) + (0 + Diagnosis:Task:Familiarity | r | Visit)

7.5.2 Prior and Posterior Predictive Checks

We performed quality checks of the models by carrying out prior and posterior predictive checks. The below prior predictive checks (on the left) indicate that our priors predict values within the order of magnitude of the distribution. The posterior predictive checks (on the right) indicate that the models have captured the distributions of data. These plots provide reassurance that our models capture relevant aspects of the overall distributions of dependent variables.

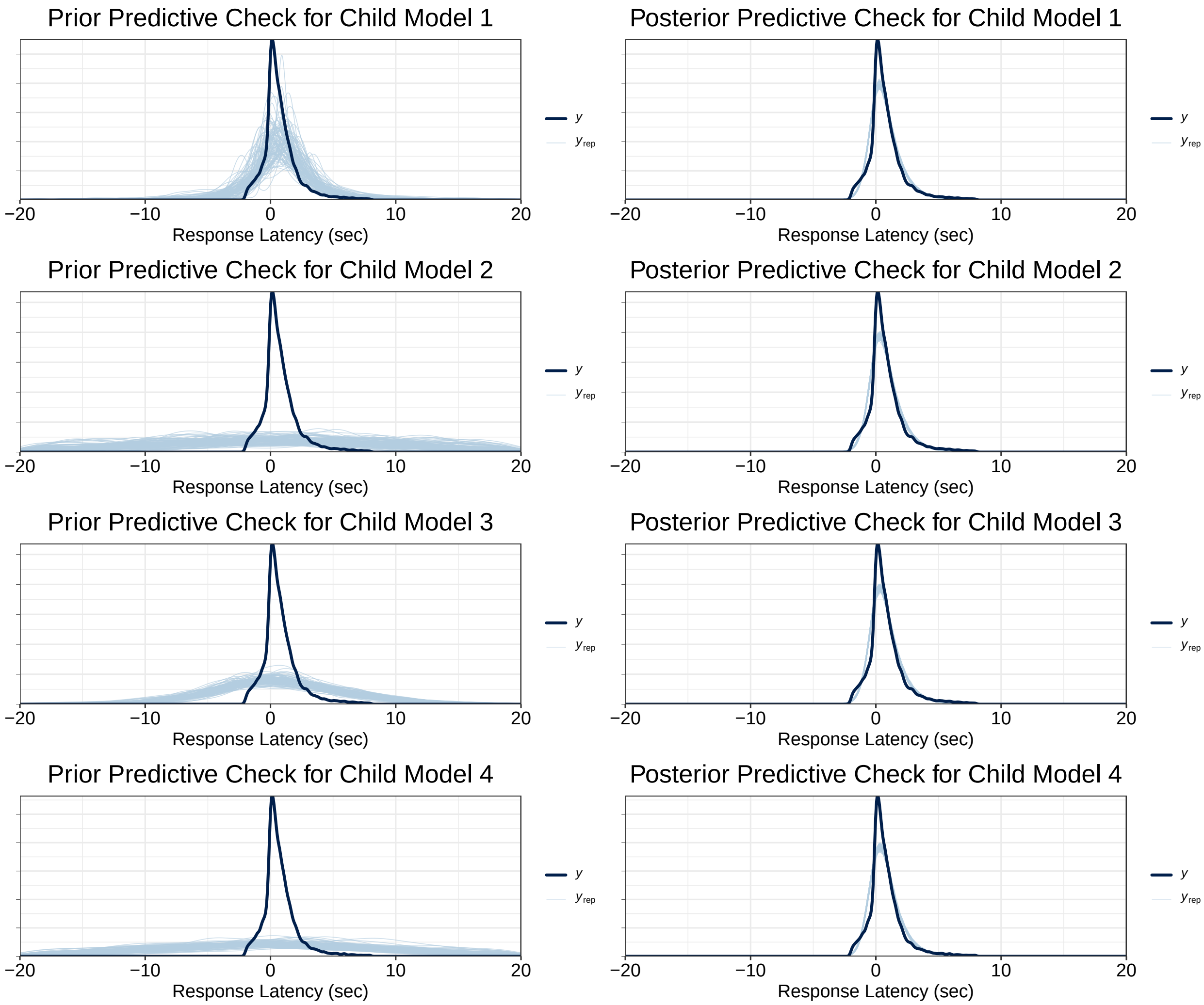

Figure 19: *Prior predictive checks (left column) and posterior predictive checks (right column) for child latency in models 1-4.*

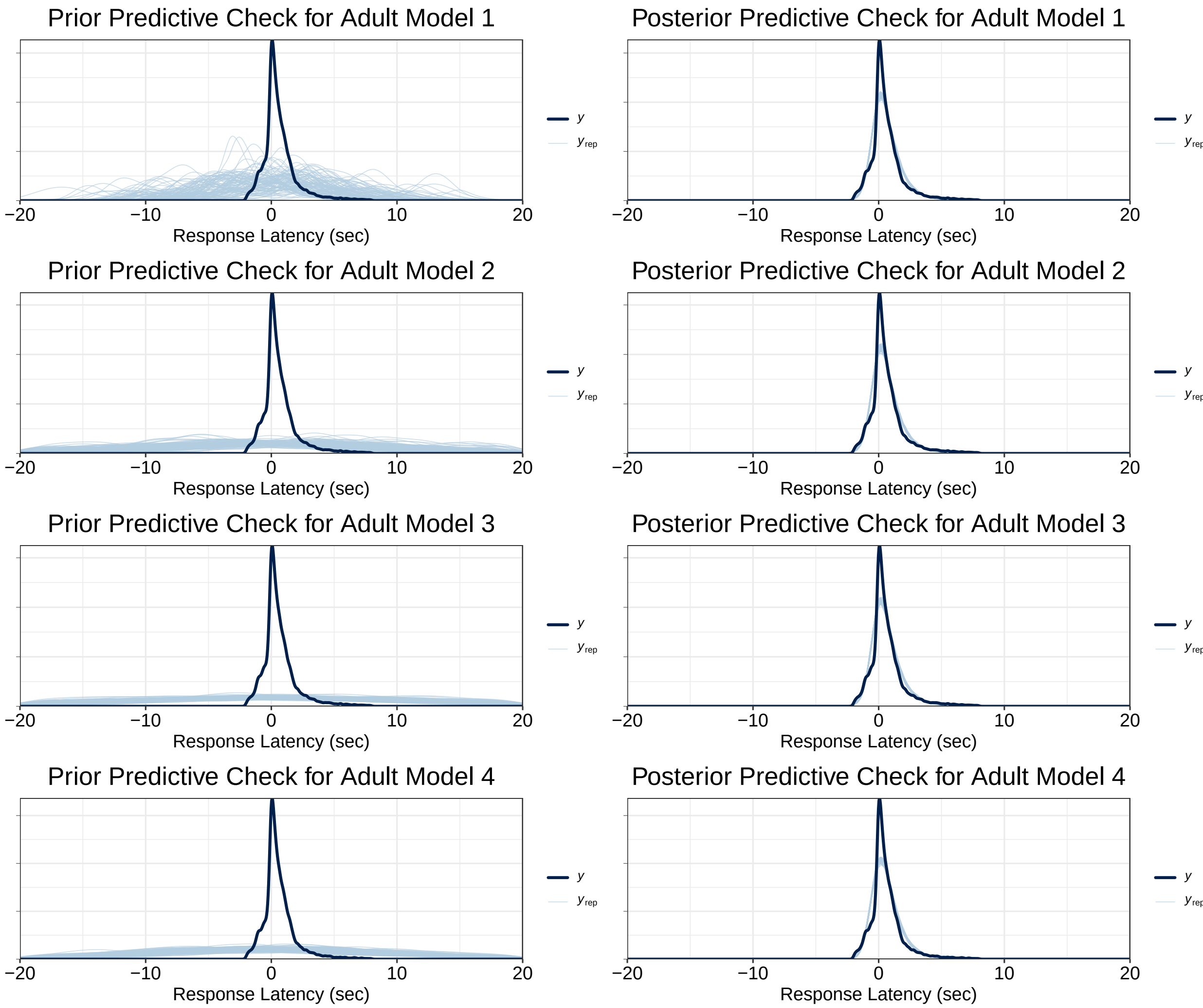

Figure 20: *Prior predictive checks (left column) and posterior predictive checks (right column) for adult latency in models 1-4.*

7.5.3 Prior-Posterior Update Plots

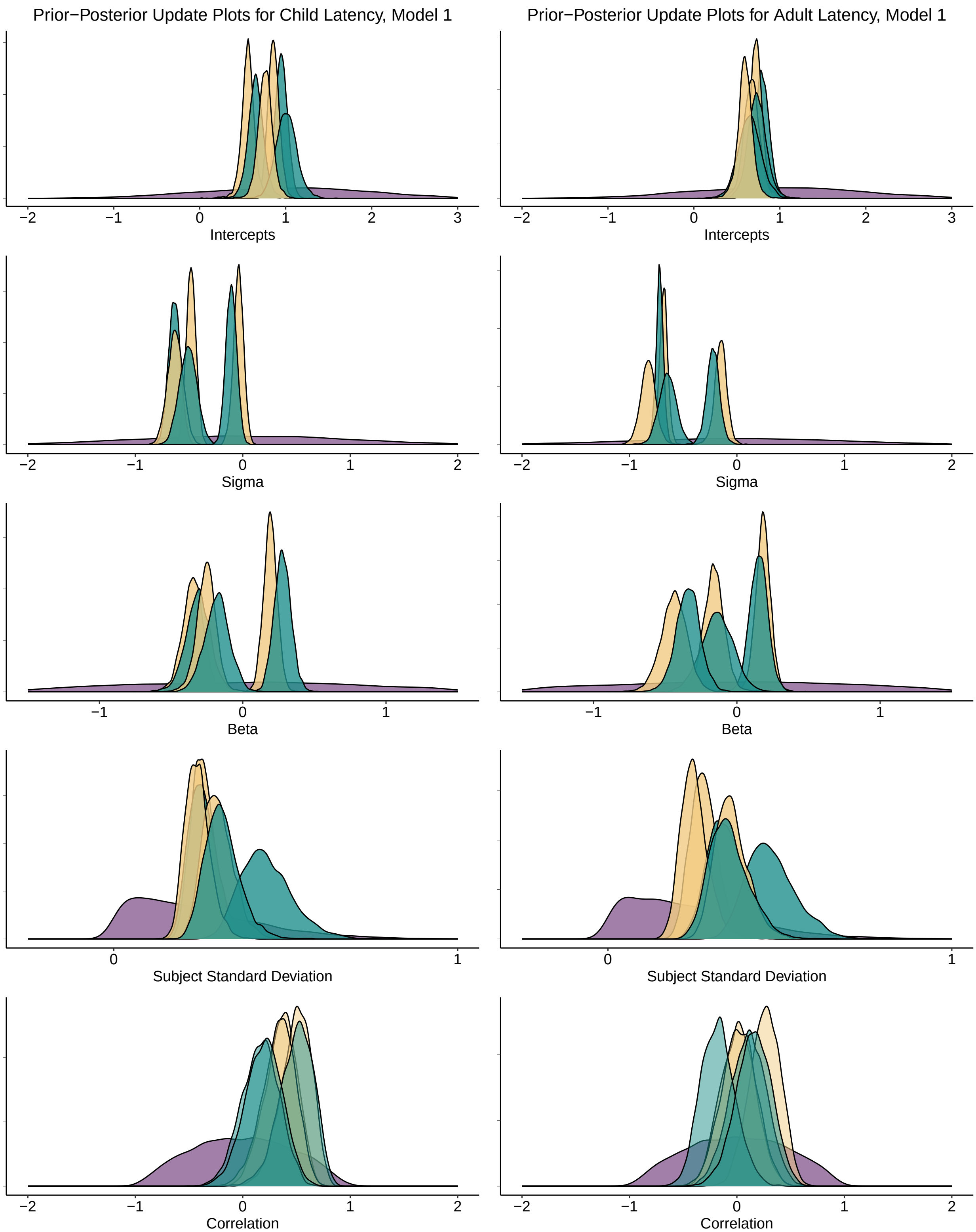

Figure 21: *Prior-posterior update checks for child and adult latency in Model 1. Purple density plots show the prior predictive density plot, turquoise density plots indicate posterior predictions for the typical development group, and yellow density plots denote the predicted estimates for the autism group.*

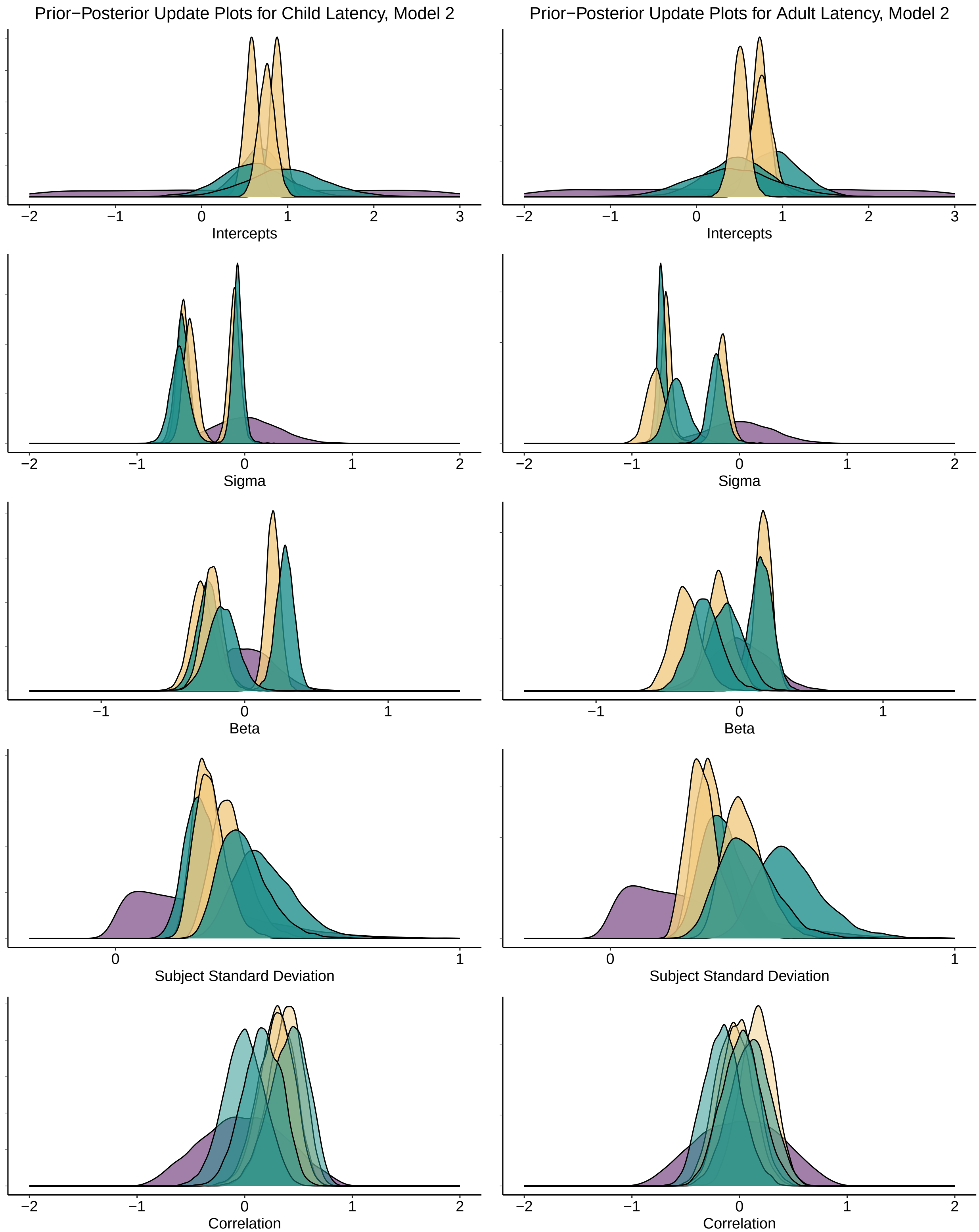

Figure 22: *Prior-posterior update checks for child and adult latency in Model 2. Purple density plots show the prior predictive density plot, turquoise density plots indicate posterior predictions for the typical development group, and yellow density plots denote the predicted estimates for the autism group.*

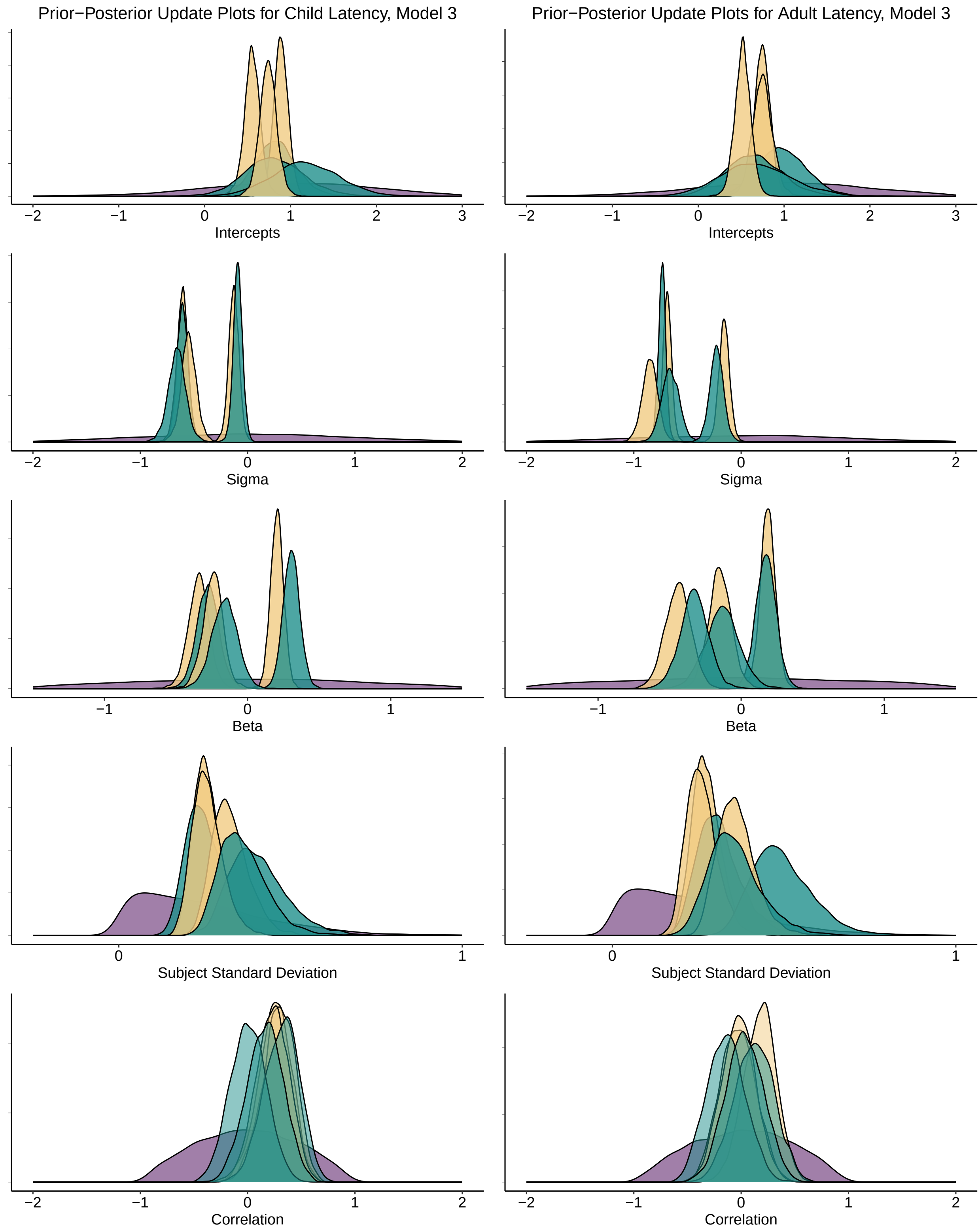

Figure 23: *Prior-posterior update checks for child and adult latency in Model 3. Purple density plots show the prior predictive density plot, turquoise density plots indicate posterior predictions for the typical development group, and yellow density plots denote the predicted estimates for the autism group.*

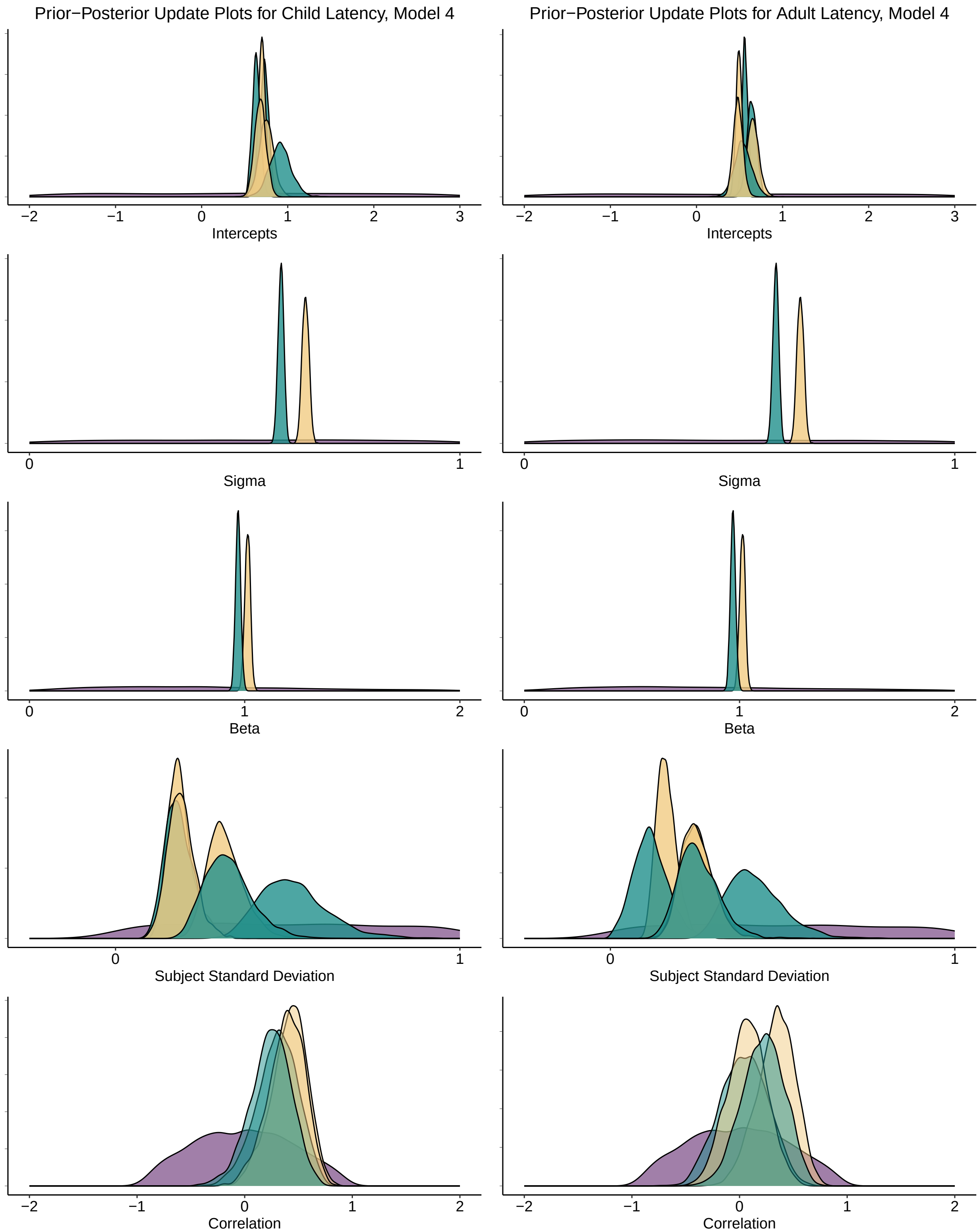

Figure 24: *Prior-posterior update checks for child and adult latency in the multivariate Model 4. Purple density plots show the prior predictive density plot, turquoise density plots indicate posterior predictions for the typical development group, and yellow density plots denote the predicted estimates for the autism group.*