

Table S1

Key findings of studies

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
<u>INITIATIONS</u> - A bid to begin a verbal exchange.		
<u>TERMINATIONS OR CLOSINGS</u> – A bid to end an existing verbal exchange, includes accepting a bid to end an exchange.		
Adams et al. (2002)		Unable to isolate initiation results as conflated with other pragmatic categories.
Eales (1993)		Unable to isolate results as conflated with other pragmatic categories.
Jones and Schwartz (2009)	The group with autism began interactions less than the TD group. Unable to isolate termination results as conflated with other pragmatic categories.	
Volden (2004)	Unable to isolate results as conflated with other pragmatic categories.	
<u>TOPIC PRESERVATION</u> - Includes 1) topic maintenance – the degree to which individuals stay on the current topic in an appropriate manner, and 2) elaborations – extending the current topic by adding information that has not previously been provided in the exchange.		
Adams et al. (2002)		Unable to isolate results as conflated with other pragmatic categories.
Bauminger-Zviely et al. (2014)	HFA group offered more irrelevant or inappropriate details. HFA group showed significantly lower conversational quality than their typically developing peers but showed greater competence when interacting with friends rather than non-friends.	

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
Capps et al. (1998)		Autism group offered new or relevant information less often than the group with developmental delays. No difference in the frequency of requests for relevant information.
Capps, Losh, and Thurber (2000)		The group with developmental delays offered more novel and relevant information than the group with autism.
Eales (1993)		Autism group made more inappropriate utterances than the group with developmental receptive language disorders..
Jones and Schwartz (2009)	TD group acknowledged partner bids more frequently than the group with autism. Also measured how bids were responded to but did not report separately therefore unable to distinguish if bids were rejected, ignored or if the topic was changed.	

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
Nadig et al. (2010)	<p>No difference in the ratio of elaborations to utterances.</p> <p>No general difference between groups on the proportion of contingent responses although HFA group were more contingent when talking about a topic of interest.</p> <p>HFA group was more likely to be over informative or under informative than the TD group.</p> <p>HFA group were more likely to produce self-contingent elaborations that maintained a topic they introduced themselves.</p> <p>Both groups initiated very few questions regardless of topic, there were no difference between groups.</p>	
Paul et al. (2009)	Group with autistic disorder/PDD-NOS produced more out-of-sync content than TD group.	Group with autistic disorder/PDD-NOS produced more out-of-sync content than the group with Asperger syndrome.
Tager-Flusberg and Anderson (1991)		Autistic group is less contingent and added less information on a topic than the group with Down syndrome.
TOPIC SHIFT - This term is used to refer to the extent to which one resists or attempts shifts to a different topic during an on-going verbal exchange. It includes an insistence on talking about restricted topics or steering the conversation towards restricted topics (topic preoccupation/perseveration).		
Bauminger-Zviely et al. (2014)	HFA group more likely to perseverate on a topic of interest.	
Eales (1993)		Unable to isolate results as conflated with other pragmatic categories.

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
Paul et al. (1987)		No difference in groups on levels of perseveration compared Fragile X syndrome group or a group with intellectual disability.
Paul et al. (2009)	When compared to a typically developing group both the group with autism or PDD-NOS and the group with AS made more unannounced topic shifts. Only the AS group was significantly different to the TD group in topic preoccupation.	
Roberts et al. (2007)	FXS-ASD group made more non-contingent topic changes than TD group. Both FXS-ASD and FSX groups tended to perseverate on a topic more than TD group.	FXS-ASD group made more non-contingent topic changes than Down syndrome group and group with just FXS. Both FXS-ASD and FSX groups tended to perseverate on a topic more than the group with DS.
Tager-Flusberg and Anderson (1991)		Unable to isolate results as conflated with other pragmatic categories.
<u>TURNTAKING</u> - The extent to which opportunities for turns are appropriately taken or given during a conversation (does not refer to the quality of turns, just whether the turn itself was taken or given).		
Adams et al. (2002)		No significant difference between talkativeness during exchange and talkativeness within turns in AS and conduct disorder groups.

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
Bauminger-Zviely et al. (2014)	<p>No statistically significant difference between groups in the talkativeness measure. HFA group was more talkative when talking with non-friends.</p> <p>HFA group was more unresponsive to interlocutor than TD group and also more unresponsive to non-friend partners.</p> <p>HFA group showed less to and fro conversation as a whole and with non-friend partners.</p> <p>No difference in conversational dominance between TD and HFA groups.</p> <p>No difference in terseness between TD and HFA groups.</p>	
Eales (1993)		AD group more impaired than a group with developmental receptive language disorder. AD group offered more inappropriate utterances and more empty turns.
Paul et al. (2009)	AS group significantly different to TD group. They were more unresponsive and offered little reciprocal to and fro.	
Tager-Flusberg and Anderson (1991)		Tracked development over time against MLU development. TD children tend to increase contingent utterances as MLU increases. AD group did not show this tendency. DS group more contingent in their speech than AS group.

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
<u>CONVERSATIONAL BALANCE</u> - The quantitative extent of conversational balance as compared between conversation partners within a social verbal exchange e.g. comparing MLU, number of turns, percentage of responses etc.		
Adams et al. (2002)		No difference between groups.
Nadig, Lee, Singh, Bosshart, and Ozonoff (2010)	No difference between groups.	
Ziatas, Durkin, and Pratt (2003)	No difference between groups.	No difference between groups.
<u>REPAIRING</u> - The extent to which clarification of an utterance that has been misunderstood or is unclear is provided or requested.		
Adams et al. (2002)	This measure was coded but no results were provided.	
Bauminger-Zviely et al. (2014)	HFA group was less able to provide adequate clarification to a confusion that resulted from the original message than TD group.	
Capps, Kehres, and Sigman (1998)		No difference in the number of requests for clarification between AD and a group with developmental delays (no quantitative data provided).

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
Volden (2004)	There was no difference in the number of attempts made to repair, number of gestures used and the number of meta-comments produced as the request for clarification progressed from “what” to “I don’t understand” and finally to “tell me another way” but the group with autism or PDD-NOS were more likely to produce bizarre or abruptly change the topic or end the interaction when presented with a request for clarification than the TD group.	
<u>INTERRUPTING</u> - An attempt to join or provide information during an on-going verbal exchange between other people or respond to an interruption.		
Paul et al. (2009)	Unable to isolate results as conflated with other pragmatic categories.	
<u>PRESUPPOSITION</u> - A level of inferred knowledge or understanding that modifies the language used to convey messages in a social context. (McCormick, 2003; Owens Jr, 2014)		
Adams, Green, Gilchrist, and Cox (2002)	Unable to isolate results as conflated with other pragmatic categories.	
Bauminger-Zviely, Karin, Kimhi, and Agam-Ben-Artzi (2014)	HFA group provided less background information than TD group. No difference in referencing pronouns and use of terminology.	
Fine, Bartolucci, Szatmari, and Ginsberg (1994)	HFA group referred to cultural entities (e.g., “the queen”) more than AS and a clinical control group but frequencies were very low.	

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
Paul, Orlovski, Marcinko, and Volkmar (2009)	AS group used more overly formal or informal speech when communicating than TD group.	AS group used more overly formal or informal speech when communicating than the HFA & PDD-NOS groups.
<u>PARALINGUISTICS</u> - This term is used to refer to parts of communication that modifies verbal meaning of speech e.g. eye-gaze, volume, intonation, rate, body language, pitch, facial expression or gestures.		
Bauminger-Zviely et al. (2014)	The HFA group was significantly different to the TD group in rate of speech (too slow or too fast), unusual intonation, inappropriate physical distance, inappropriate gestures, facial expression and eye gaze or eye contact. There was no difference in the volume of speech.	
Capps et al. (1998)		No difference in the use of head shakes and nods to indicate yes or no responses. Compared to group with developmental delays the group with autism nodded less when listening to a partner speak.
Eales (1993)		Unable to isolate results as conflated with other pragmatic categories.
Jones and Schwartz (2009)	Unable to isolate results as conflated with other pragmatic categories.	
Nadig et al. (2010)	There was no significant between group difference on eye-gaze during a conversation.	

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
Paul et al. (1987)		Compared to a group with Fragile X syndrome and a group with intellectual disability, there was no significant difference between groups in vocal quality, volume, rate of speech or intonation patterns.
Paul et al. (2009)	Both the HFA/PDD-NOS and AS group used more inappropriately formal speech and produced unusual intonation and eye gaze than the TD group.	
Price et al. (2008)	Unable to isolate results as conflated with other pragmatic categories.	
Volden (2004)	No between group difference in the use of gestures and intonation when repairing a conversation.	
<u>OTHER PRAGMATIC CATEGORIES</u> - Any pragmatic measures not specified above.		
Adams et al. (2002)		Unable to isolate results as conflated with other pragmatic categories.
Bang, Burns, and Nadig (2013)	The HFA group produced a significantly smaller number of personal narratives than the TD group. Only 6 out of 20 individuals in the HFA group produced a personal narrative compared to 15/17 in the TD group. Out of those only 3 of the HFA group produced a specific (rather than a habitual) narrative compared to 10 individuals in the TD group.	

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
Bauminger-Zviely et al. (2014)	HFA group were more likely to produce confusing accounts, inappropriately reference other's emotions, use scripted or stereotyped language and awkward expression and less able to resolve a conflict. There was no difference in the way students signal a humorous message when it is not detected by the partner.	
Capps et al. (1998)		<p>There was no difference in the way adults behave towards kids with autism and kids with developmental delays.</p> <p>The group with autism is more likely to repeat comments and questions verbatim, offer literal comments and offer no response to a comment or query.</p> <p>No difference was found in the number of "I don't know" or "Yes" or "No" responses or one word responses between groups.</p> <p>No difference in the number of questions an adult partner asks of participants with autism or developmental delays.</p>
Eales (1993)		<p>The group with autistic disorder showed lower initiation ratios and produced more inappropriate utterances and empty turns than the group with developmental receptive language disorders.</p>

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
Jones and Schwartz (2009)	<p>The group with autism produced significantly fewer comments and directives than the TD group.</p> <p>The individuals with autism also rejected or ignored more bids for communication than the TD group, although the rates of rejection were quite high for both groups (55% and 38% respectively).</p> <p>No difference in number of questions asked by participants.</p>	
Nadig et al. (2010)	<p>Unable to isolate results as conflated with other pragmatic categories.</p> <p>No difference in the number of questions an adult partner asks of HFA or TD participants.</p>	
Paul et al. (2009)	<p>The AS group provided more inappropriate or irrelevant details than the TD group during conversation. No difference between the AD/PDD-NOS group and the TD group was found.</p>	
Price et al. (2008)	<p>Unable to isolate results as conflated with other pragmatic categories.</p>	
Roberts et al. (2007)	<p>The group with Fragile X and autism was more non-contingent than TD group.</p>	<p>The group with Fragile X and autism was more non-contingent than the group with Down syndrome and the group with Fragile X syndrome only.</p>

Pragmatic category – Operational definition	Results	
	Compared to typically developing group	Compared to other groups (e.g., Down syndrome, developmental delays etc.)
Ziatas et al. (2003)	<p>The group with autism identified events and objects much more than TD group.</p> <p>The group with autism also explained causal relationships much less than each of the other comparison groups.</p> <p>The group with AS labelled fewer objects and events than the TD group.</p>	<p>The group with autism identified events and objects much more than the AS and the group with speech language impairment (SLI).</p> <p>They referred to their internal states of mind much less than the AS group but this comparison was not significant for the SLI and TD groups.</p> <p>The group with autism explained causal relationships much less than AS or SLI group.</p> <p>The group with AS described events or objects, express personal judgements and claimed speaker rights less than the SLI group.</p>

References

- Adams, C., Green, J., Gilchrist, A., & Cox, A. (2002). Conversational behavior of children with Asperger syndrome and conduct disorder. *Journal of Child Psychology and Psychiatry*, 43, 679-690. doi:10.1111/1469-7610.00056
- Bang, J., Burns, J., & Nadig, A. (2013). Brief report: Conveying subjective experience in conversation: Production of mental state terms and personal narratives in individuals with high functioning autism. *Journal of Autism and Developmental Disorders*, 43, 1732-1740. doi:10.1007/s10803-012-1716-4
- Bauminger-Zviely, N., Karin, E., Kimhi, Y., & Agam-Ben-Artzi, G. (2014). Spontaneous peer conversation in preschoolers with high-functioning autism spectrum disorder versus typical development. *Journal of Child Psychology and Psychiatry*, 55, 363-373. doi:10.1111/jcpp.12158
- Capps, L., Kehres, J., & Sigman, M. (1998). Conversational abilities among children with autism and children with developmental delays. *Autism*, 2, 325-344. doi:10.1177/1362361398024002
- Capps, L., Losh, M., & Thurber, C. (2000). "The frog ate the bug and made his mouth sad": Narrative competence in children with autism. *Journal of Abnormal Child Psychology*, 28, 193-204. doi:10.1023/A:1005126915631
- Eales, M. J. (1993). Pragmatic impairments in adults with childhood diagnoses of autism or developmental receptive language disorder. *Journal of Autism and Developmental Disorders*, 23, 593-617. doi:10.1007/BF01046104
- Fine, J., Bartolucci, G., Szatmari, P., & Ginsberg, G. (1994). Cohesive discourse in pervasive developmental disorders. *Journal of Autism and Developmental Disorders*, 24, 315-329. doi:10.1007/bf02172230

- Jones, C. D., & Schwartz, I. S. (2009). When asking questions is not enough: An observational study of social communication differences in high functioning children with autism. *Journal of Autism and Developmental Disorders*, 39, 432-443. doi:10.1007/s10803-008-0642-y
- McCormick, L. (2003). Introduction to language acquisition. In L. McCormick, D. F. Loeb, & R. L. Schiefelbusch (Eds.), *Supporting children with communication difficulties in inclusive settings: School-based language intervention* (2nd. ed.). Boston, MA: Allyn and Bacon.
- Nadig, A., Lee, I., Singh, L., Bosshart, K., & Ozonoff, S. (2010). How does the topic of conversation affect verbal exchange and eye gaze? A comparison between typical development and high-functioning autism. *Neuropsychologia*, 48, 2730-2739. doi:10.1016/j.neuropsychologia.2010.05.020
- Owens Jr, R. E. (2014). *Language disorders: A functional approach to assessment and intervention* (Sixth ed.): Pearson Higher Ed.
- Paul, R., Dykens, E., Leckman, J. F., Watson, M., Breg, W. R., & Cohen, D. J. (1987). A comparison of language characteristics of mentally retarded adults with fragile X syndrome and those with nonspecific mental retardation and autism. *Journal of Autism and Developmental Disorders*, 17, 457-468. doi:10.1007/bf01486963
- Paul, R., Orlovski, S. M., Marcinko, H. C., & Volkmar, F. (2009). Conversational behaviors in youth with high-functioning ASD and Asperger syndrome. *Journal of Autism and Developmental Disorders*, 39, 115-125. doi:10.1007/s10803-008-0607-1
- Price, J. R., Roberts, J. E., Hennon, E. A., Berni, M. C., Anderson, K. L., & Sideris, J. (2008). Syntactic complexity during conversation of boys with fragile X syndrome and Down syndrome. *Journal of Speech, Language, and Hearing Research*, 51, 3-15. doi:10.1044/1092-4388(2008/001)

Roberts, J., Martin, G. E., Moskowitz, L., Harris, A. A., Foreman, J., & Nelson, L. (2007).

Discourse skills of boys with fragile X syndrome in comparison to boys with Down syndrome. *Journal of Speech, Language and Hearing Research*, 50, 475-492.

doi:10.1044/1092-4388(2007/033)

Tager-Flusberg, H., & Anderson, M. (1991). The development of contingent discourse ability in autistic children. *Journal of Child Psychology and Psychiatry*, 32, 1123-1134.

doi:10.1111/j.1469-7610.1991.tb00353.x

Volden, J. (2004). Conversational repair in speakers with autism spectrum disorder.

International Journal of Language & Communication Disorders, 39, 171-189.

doi:10.1080/13682820410001663252

Ziatas, K., Durkin, K., & Pratt, C. (2003). Differences in assertive speech acts produced by children with autism, Asperger syndrome, specific language impairment, and normal development. *Development and Psychopathology*, 15, 73-94.

doi:<https://doi.org/10.1017/s0954579403000051>