



AUTISM: Deficit or Difference?

A reconsideration of the way we assess Theory of Mind



TRY ME FIRST

Introduction:



This study investigated whether autistic people responded differently compared to non-autistic people to six subtle linguistic changes to tense and articles in an adapted Wellman and Estes (1986) spoon test.

The original Wellman and Estes (1986) spoon test:

'Person A had a spoon, Person B was thinking of a spoon, who can touch the spoon?'

The original test (1986) assessed if children could tell the difference between tangible and imaginary items. This test was indicative of a child's ability to understand thinking. By providing the answer 'person A,' the child demonstrates an ability to distinguish between tangible objects and the mental state of another, making an 'ontological distinction' (Wellman & Liu, 2004). The ability to understand the mental state of oneself and another is called Theory of Mind (ToM). This test assessed the second developmental stage of ToM.

This test was later adapted by Baron-Cohen for use with autistic children (Baron-Cohen, 1997). Autistic people have been theorised to exhibit ToM deficits which have been linked to difficulties in understanding, interacting and communicating with non-autistic people (Baron-Cohen, 2001). ToM ability has been linked to pragmatic language ability in both autistic and non-autistic populations (Martin & McDonald, 2003; Fernández, 2013)

The following research stems from the growing evidence that the link between pragmatics and ToM is not as clear as once thought (Domaneschi & Bambini, 2020), and conflating pragmatics into ToM is a possible cause for "methodological confusion" (Bosco, et al, 2018). Considering autistic people have been theorised to lack later stage ToM ability based on pragmatic language skills, it is imperative to investigate if autistic people process linguistic phenomena differently in the context of ToM tests.

This research looked at whether a combination of subtle linguistic changes to the 'spoon test' affected autistic and non-autistic people differently. It was predicted that possessing or thinking of 'a' or 'the' spoon in the past or present tense would not detract from the physical property of the object. We examined whether changing the tense of the verb and/or the definiteness of the article detracted from the physical property of the object, and therefore, whether it altered the test effect of being able to make an ontological distinction indicative of ToM ability.

Method:



A between-group experimental design in the form of a pilot study utilizing an online questionnaire was conducted with 100 autistic and 74 non-autistic participants. Twelve questions were asked in a consistent order; eleven questions varied in tense and article from the original test in **six** places. The original Wellman and Estes (1986) question was used as a control question and corresponds to question 8. Participants were asked to select from five answers; 'Person A', 'Person B', 'Both', 'Neither' and 'I don't know'. Differences in responses to subtle linguistic changes were indicated by overall differences in which response autistic and non-autistic people gave to each of the questions.

'has' 1	'the' 2	'is' 3	'the' 4
Person A had a spoon,	(Line 1)	Person A has the spoon,	(L1)
Person B was thinking of a spoon.	(Line 2)	Person B is thinking of the spoon.	(L2)
who can touch the spoon?	(Line 3)	who could touch a spoon?	(L3)
'could' 5	'a' 6		

Research question:

Do autistic people respond differently compared to non-autistic people to subtle linguistic variations in tense and articles in an adapted version of Wellman and Estes spoon test?

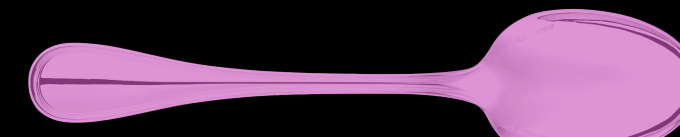
Hypothesis 1:

The non-autistic group will consistently provide the response 'Person A' across all questions, regardless of linguistic changes, consistent with the original results.

Hypothesis 2:

The tense and article changes will cause the autistic group to give a range of responses across the twelve questions.

Analysis:



A Pearson's Chi square test was used to assess the statistical significance of the differences between responses of the autistic group and the non-autistic group. Variation ration was used to assess the variability in the data.

References:

Baron-Cohen, S. (1990). Are autistic children 'Behaviorists'? An examination of their mental-physical and appearance-reality distinctions. *Journal of Autism and Developmental Disorders*, 19, 579-600.

Baron-Cohen, S. (1997). *Mindblindness: An essay on autism and theory of mind*. MIT press.

Baron-Cohen, S. (2001). Theory of mind in normal development and autism. *Prisma*, 34, 174-183.

Bosco, F. M., Tirassa, M., & Gabbatore, I. (2019). Why Pragmatics and Theory of Mind Do Not (Completely) Overlap. In *Frontiers in Psychology* (Vol. 9, p. 1453).

Domaneschi, F., & Bambini, V. (2020). Pragmatic Competence. In Fridland, E., & Pavese, C. (Eds.), *The Routledge handbook of philosophy of skill and expertise*. Routledge. Chapter 33.

Fernández, C. (2013). Mindful storytellers: Emerging pragmatics and theory of mind development. *First Language*, 33(1), 20-46.

Martin, I., & McDonald, S. (2003). Weak coherence, no theory of mind, or executive dysfunction? Solving the puzzle of pragmatic language disorders. *Brain and language*, 85(3), 451-466.

Wellman, H., Estes, D. (1986). Early understanding of mental entities: A reexamination of childhood realism. *Child Development*, 57, 910-923.

Wellman, H. M. & Liu, D. (2004). Scaling theory of mind tasks. *Child Development*, 75, 759-763.

Results:



Responses to all questions except 1, 2, and 10 were statistically significantly different between autistic and non-autistic participants.

Overall, out of the 12 questions, the autistic group responded with a majority of 'Person A' on 7 questions and the non-autistic group responded with a majority of 'Person A' on 6 questions.

Autistic responses were varied across 4 of the 5 response options. Non-autistic responses varied across 2 out of the 5 options.

The **past tense participle** of 'had' (L1), '**was**' (L2), and the modal verb '**could**' (L3) in conjunction with **specific placement of article variations** ('a' or 'the') demonstrated the **greatest impact in eliciting different responses** between the two groups. This is important because 'had' suggests Person A no longer possesses the spoon.

This is evident by Q3 & Q4, both the scenario and question were set in the past, the only difference being Q3 had the '**a** spoon' variation while Q4 had the '**the** spoon' variation.

	Person A	Both	Neither	I don't know
Autistic response	28%	21%	27%	23%
Non-autistic response	31%	26%	36%	7%

	Person A	Both	Neither	I don't know
Autistic response	39%	15%	19%	25%
Non-autistic response	38%	15%	38%	7%

Autistic and non-autistic participants responded significantly differently (<2% due to chance) when the scenario (L1 & L2) differed in time/tense to the question (L3). This was the set up in Q5, Q6, Q7 and Q8. It was particularly evident when the scenario was set in the past, but the question was asked in the present, such as in Q7 and Q8.

In Q5 lines 1 and 2 of the scenario both person A and B **has** or **is** thinking about '**a** spoon' in the present but the question (line 3) asked 'who **could** touch **the** spoon'.

In Q6 lines 1 and 2 of the scenario both person A and B **had** or **was** thinking of '**the** spoon' in the past but the question (line 3) asked 'who **can** touch **the** spoon'.

In Q7 lines 1 and 2 of the scenario both person A and B **has** or **is** thinking about '**the** spoon' in the present but the question (line 3) asked 'who **could** touch a spoon'.

In Q8 lines 1 and 2 of the scenario (the control question) both person A and B **had** or **was** thinking of '**a** spoon' in the past but the question (line 3) asked 'who **can** touch **the** spoon'.

	Person A	Both	Neither	I don't know
Autistic response	45%	20%	6%	29%
Non-autistic response	66%	22%	3%	9%

	Person A	Both	Neither	I don't know
Autistic response	8%	31%	33%	27%
Non-autistic response	20%	23%	45%	12%

	Person A	Both	Neither	I don't know
Autistic response	35%	36%	2%	25%
Non-autistic response	58%	35%	1%	6%

	Person A	Both	Neither	I don't know
Autistic response	9%	14%	37%	39%
Non-autistic response	16%	18%	50%	16%

Autistic and non-autistic participants responded significantly differently (<.04% due to chance) when line 1 and line 3 were both set in the past and line 2 was set in the present. This was evident in Q11 and Q12.

In Q11 'person A **had** a spoon, person B **is** thinking about a spoon. Who **could** touch **the** spoon'.

In Q12 'person A **had** **the** spoon, Person B **is** thinking about **the** spoon. Who **could** touch a spoon'.

	Person A	Both	Neither	I don't know
Autistic response	20%	15%	24%	39%
Non-autistic response	22%	18%	46%	15%

	Person A	Both	Neither	I don't know
Autistic response	21%	36%	10%	32%
Non-autistic response	27%	31%	34%	8%

The first hypothesis could be rejected; the non-autistic group did not consistently provide the response 'Person A' across all questions.

The second hypothesis could be accepted; the autistic group gave a variety of responses.

Discussion:



This research found the **past tense participles** 'had,' '**was**' and '**could**,' in conjunction with the **specific placement of article variations**, had the **greatest impact on eliciting statistically different responses** between autistic and non-autistic participants. It was found autistic people gave a variety of responses and non-autistic participants did not respond 'Person A' consistently across all twelve questions.

The data indicated **the original spoon test lacks reliability and validity** as a ToM test. These results contradict the original (Wellman & Estes, 1986) and replicated findings (Baron-Cohen, 1997) as neither group responded with a majority of 'Person A' on the control question (Q8). This study contained a considerably larger sample than original or replication studies, arguably giving more generalisability to these results than previous studies. The original Wellman and Estes (1986) study sample consisted of 36 non-autistic children and Baron-Cohen's replication consisted of 17 autistic children and 19 non-autistic children (Wellman and Estes, 1986; Baron-Cohen, 1990).



Past tense participles and use of the modal verb had the greatest impact on eliciting different responses between groups. This is important because 'had' implies Person A no longer possesses the spoon, so no one can physically touch a/the spoon in the present. Under the original conceptualisation the correct answer indicative of ToM ability was 'Person A,' however, when the scenario is posed in past tense and the question is asked in present tense, Person A cannot touch something they do not possess. This is supported by participant responses to the control question (Q8), neither group made the ontological distinction across a sample of 174 participants. Interestingly, when the articles were kept the same throughout, and the scenario and question was presented consistently in the same tense (Q1, Q2, Q3, and Q4), neither group responded 'person A' on over 55% of these questions. This indicated consistent use of tense and articles (unlike the original test) also does not equate to a valid ToM test, adding further evidence to dispute the validity of the original test.



The original (1986) spoon test:

Person A **had** a spoon, Person B **was** thinking of a spoon. who **can** touch **the** spoon?

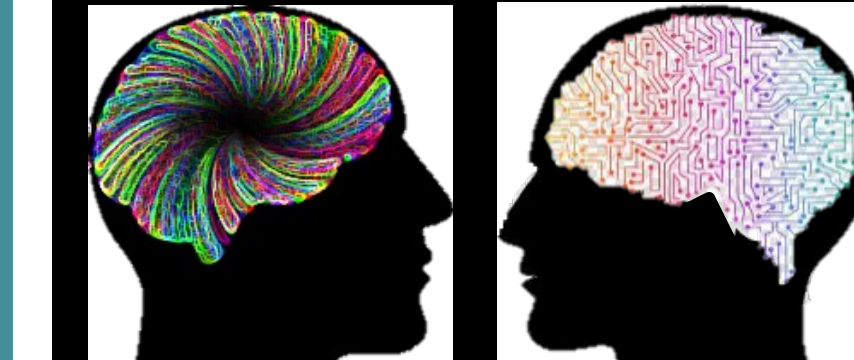
Q1 Person A **has** a spoon, Person B **is** thinking of a spoon. who **can** touch a spoon?

Q2 Person A **has** **the** spoon, Person B **is** thinking of **the** spoon. who **can** touch **the** spoon?

Q3 Person A **had** a spoon, Person B **was** thinking of a spoon. who **could** touch a spoon?

Q4 Person A **had** **the** spoon, Person B **was** thinking of **the** spoon. who **could** touch **the** spoon?

These results indicate autistic and non-autistic participants responded differently to the same linguistic changes based on neurotype. It is evident from the data the autistic group respond differently to past tense and article variations compared to the non-autistic group in an adapted versions of the Wellman and Estes (1986) test. The autistic group gave different majority responses on 6 questions and had a higher variation across responses compared to the non-autistic group. On the other 6 questions where both groups gave the same majority answer (Q1, Q2, Q5, Q6, Q9 and Q10), there were noticeable differences in majority size. This suggests autistic participants responded differently to the linguistic changes to the effect of providing



varied responses, compared to the non-autistic participants, who gave restricted responses. This is significant because if autistic people process linguistic phenomena differently in context compared to non-autistic people, this could potentially be affecting responses to similar ToM measures.

Autistic people have been theorised to exhibit communication deficits linked to ToM deficits (Baron-Cohen, 2001). It is imperative to separate linguistic ability from mentalizing abilities. It is evident the original spoon test did not do this and therefore lacks validity and replication as a ToM measure. We need to ascertain a higher certainty of validity and reliability in ToM measures to ensure we do not conflate mentalizing ability with language ability.

The methodological limitations are as follows: the sample was not representative of either target group population due to an overrepresentation of female participants in each group. Another limitation was the broad scope of the study. Due to lack of diagnosis confirmation, online participation and international reach, anyone could have potentially taken part despite exclusion criteria, which could have affected the sample. The questions were also presented in a consistent order which may have resulted in order effects.

PAST

Future Directions:



FUTURE

Further investigation into the impact of similar linguistic alterations in related ToM tests is needed. This research demonstrated tense and article changes impacted the autistic and non-autistic groups differently, and neither group could make the ontological distinction on the control question, indicative of one of the earlier stages of ToM ability. Future research should investigate whether the phenomenon of linguistic changes not altering overall meaning could affect other ToM tests, potentially rendering them invalid and unreliable, especially at more advanced stages. For example, **applying this to first and second order false belief tasks**. Additionally, tense should be investigated as a potential indicator of communicative breakdown between autistic and non-autistic people, due to how they responded significantly differently to the same linguistic changes.

Conclusions:



There is a **significant difference** between **autistic** and **non-autistic responses** to subtle linguistic changes to tense and articles.

The **original test lacks validity** and **reliability** as a **ToM test**.

Author: Rachel Cullen, PhD
Student; University of Kent.
cullenconsultancy.co.uk

Autistic people may **process** certain **linguistic phenomena** differently, compared to non-autistic people.