Journal of Child Language (2025), **52,** 1063–1079
doi:10.1017/S0305000924000321

ARTICLE

Uh and *um* in autism: The case of hesitation marker usage in Dutch-speaking autistic preschoolers

Marjolein Mues[1,2], Ellen Demurie[2], Maide Erdogan[2], Sarah Schaubroeck[2], Manon Krol[3], Amy Goodwin[4], Jan Buitelaar[3], Eva Loth[4] and Herbert Roeyers[2]

[1]Brain Development Lab, Department of Psychology and Human Development, Vanderbilt University, USA, [2]Research in Developmental Disorders Lab, Department of Experimental-Clinical and Health Psychology, Ghent University, Belgium, [3]Donders Institute, Radboud University Medical Center, Nijmegen, The Netherlands and [4]Institute of Psychiatry, Psychology and Neuroscience, King's College London, UK
Corresponding author: Marjolein Mues; Email: marjolein.mues@vanderbilt.edu

(Received 15 March 2023; revised 29 May 2024; accepted 04 August 2024; first published online 25 September 2024)

Abstract
English-speaking autistic children use the hesitation marker *um* less often than non-autistic children but use *uh* at a similar rate. It is unclear why this is the case. We employed a sample of Dutch-speaking children from the Preschool Brain Imaging and Behavior Project to examine hesitation markers in autistic and non-autistic preschoolers with the aim to 1) make a crosslinguistic comparison of hesitation marker usage and 2) examine hypotheses regarding the underlying linguistic mechanisms of hesitation markers: the symptom hypothesis and the signal hypothesis. We found initial group differences in all hesitation markers but these results were rendered insignificant after controlling for age, sex and nonverbal cognition. We found significant correlations between hesitation marker usage and expressive and receptive language, but not autism traits. Lastly, we show interesting cross-linguistic differences in hesitation marker usage between Dutch-speaking participants and previously described English-speaking participants, such as a preference for *um* over *uh*.

Keywords: autism; expressive language; receptive language; hesitation markers

Introduction

Fluent spontaneous speech is rare in everyday communication and our conversations often contain disfluencies such as pauses, self-repairs and hesitation markers. These disfluencies are sometimes viewed merely as errors and are therefore not always included in linguistic theories (Ferreira & Bailey, 2004). Hesitation markers such as *uh* and *um* specifically can be seen as unwanted interruptions or "noise" in communication. However, hesitation markers, also referred to as fillers or filled pauses (see Goldman-Eisler, 1968; Maclay & Osgood, 1959), may in effect play an important role in our communication.

For example, upon hearing a hesitation marker, listeners may provide assistance to the speaker by helping the speaker with word finding problems (e.g., Clark & Wilkes-Gibbs, 1986; Maclay & Osgood, 1959). Extensive evidence shows that hesitation markers can also fulfill a role towards the listener (Arnold et al., 2003; Corley & Hartsuiker, 2011; Corley et al., 2007; Fox Tree, 2001). Hesitation markers can, for example, aid in letting the listener know when new information is introduced into the conversation (Arnold et al., 2003) and support listener comprehension and language processing (Corley & Hartsuiker, 2011; Corley et al., 2007; Fox Tree, 2001). The frequency of hesitation markers used by the speaker may also inform the listener about the knowledgeability of the speaker regarding the conversation topic (Arnold et al., 2003) or their mental state (Brennan & Williams, 1995; Clark & Fox Tree, 2002). In sum, hesitation markers seem to support pragmatic language, the aspect of language concerning social communication and language use in interaction with others (Levinson, 1983).

There are two main linguistic hypotheses about the underlying mechanisms of hesitation marker use: the symptom hypothesis and the signal hypothesis. According to the symptom hypothesis, hesitation markers are simply byproducts, or symptoms, of difficulties in speech planning and production (e.g., Levelt, 1989). This hypothesis thus suggests that hesitation markers are involuntary and automatic, and any helpful effects for aiding listener comprehension are therefore unintentional according to this hypothesis. However, it seems that speakers do have (selective) control over their use of *uh* and *um* and that these hesitation markers are thus not uttered entirely involuntary (Clark & Fox Tree, 2002). For example, speaker use fewer hesitation markers in formal than informal settings showing that they can reduce or eliminate using *uh* and *um* when needed (Clark & Fox Tree, 2002). Therefore, the signal hypothesis implies that hesitation markers should not merely be considered as symptoms of difficulty in speech planning and production, but rather as deliberate signals to announce an upcoming speech delay to the listener before speaking (Clark & Fox Tree, 2002). In this hypothesis, hesitation markers are thus deliberate language features, intentionally supporting listener comprehension (Clark & Fox Tree, 2002).

Even within these two hypotheses, potential differences in usage patterns and potential functions between the hesitation markers *uh* and *um* may be present. One notable difference that points in this direction and that has been replicated cross-linguistically is that *uh* (IPA /ʌ/) signals a minor delay, while *um* (IPA /ʌm, əːm/) tends to be followed by a greater delay in speaking (Clark & Fox Tree, 2002 for English; Swerts, 1998 for Dutch). Moreover, the choice for a specific hesitation marker appears to be language-specific (Levelt, 1989; Maclay & Osgood, 1959). For example, although *uh* and *um* HAVE ROUGHLY THE SAME MEANING IN ENGLISH, DUTCH AND GERMAN, it has been shown that English and German native speakers more frequently use *um* than Dutch speakers (de Leeuw, 2007). Lastly it appears that the usage of both *uh* and *um* is changing in real time, as Wieling et al. (2016) show a cross-linguistic pattern in various Germanic languages indicating that the usage of *um* is increasing over time relative to that of *uh.*

In sum, hesitation markers are argued to play a role in pragmatic language, though differences between hesitation markers may exist and their underlying mechanisms remain unclear. One way to gain more insight into these underlying mechanisms is to examine hesitation marker usage in children with a diagnosis of autism spectrum condition, as difficulties in pragmatic language abilities are a hallmark of this diagnosis (Cardillo et al., 2021; Eigsti et al., 2011; Ellawadi & Ellis Weismer, 2015; Kelley et al., 2006; Landa, 2000). Autism spectrum condition, henceforth autism, is a neurobiological condition characterized by challenges in social communication and social interaction and restrictive, repetitive patterns of behavior (DSM-5, American Psychiatric Association, 2013).[1]

Several studies have investigated the use of *uh* and *um* in English-speaking autistic children and adults and report that autistic participants between the ages of four and twenty-one use *um* at a rate significantly below that of non-autistic controls but use *uh* at the same rate (Gorman et al., 2016; Irvine et al., 2016; Lawley et al., 2022; McGregor & Hadden, 2020). Autistic children also have a higher ratio of content to hesitation markers than non-autistic children (MacFarlane et al., 2017). Gorman et al. (2016) investigated *uh* and *um* in English-speaking autistic children between the ages of four and eight years old. They showed that the autistic children with relatively low support needs (formerly referred to as "high-functioning") (See footnote 1) in their sample produced significantly fewer instances of *um* compared to non-autistic children and that the use of *um* significantly correlated with parent-rated social communication abilities of the child, but not with structural language abilities. Irvine et al. (2016), who compared English-speaking autistic participants between eight and 21 years old with autistic participants with an "optimal outcome" and with non-autistic participants observed similar results. They too showed a significantly lower usage of *um* in the autistic group (without optimal outcome) compared to the two other groups, but no difference in the use of *uh. Um-rate* (i.e., the total frequency of *um* divided by the total number of words) was furthermore shown to be associated with the level of parent-rated autism characteristics as measured by the Social Communication Questionnaire, but not with structural language abilities (Irvine et al., 2016).

One study to date did find an initial difference in both *uh* and *um* rates (i.e., the total frequency of *uh* divided by the total number of words and the total frequency of *um* divided by the total number of words) comparing autistic and non-autistic participants between four and fifteen years old, but this finding ultimately reflected biological sex differences (Lawley et al., 2022). More specifically, female participants, both autistic and non-autistic, used *uh* less often than male participants, resulting in higher *um* to *uh* ratios for female participants compared to male participants (Lawley et al., 2022; Parish-Morris et al., 2017). When accounting for biological sex, group differences in *uh-rate* were no longer present and only lower frequencies for *um* in the autistic group remained (Lawley et al., 2022). Furthermore, contrary to previous findings, Lawley et al. (2022) observed a significant association between structural language abilities and *um* usage, with lower frequencies of *um* corresponding to lower structural language abilities. Unlike Gorman et al. (2016) and Irvine et al. (2016), the authors did however not observe any significant associations with social communication (Lawley et al., 2022). These contradictory findings may be due to large age ranges in the examined samples, or due to different language and social communication assessments.

These findings in autistic populations generally point towards different functional roles for *uh* versus *um.* After all, if they were entirely equal, frequency rates would likely not differ between the groups, and if hesitation markers were uttered involuntarily and automatically, we would expect the same frequency rates for autistic and non-autistic children. Moreover, that autistic children have a higher content-to-hesitation marker

[1]In collaboration with autistic stakeholders we use community preferred terminology compiled for AIMS-2-TRIALS, the overarching project that this study is a part of, throughout this paper. We refer for example to "Autism Spectrum Condition" rather than referring to autism as a disorder. A document summarizing the terminology guidelines can be found here: https://www.aims-2-trials.eu/wp-content/uploads/AIMS-2-TRIALS_Guide_-Preferred_Terminology_Glossary__Rationale.pdf.

ratio may point towards a more voluntary choice in using hesitation markers, providing further evidence for the signal hypothesis of hesitation markers. However, since autistic children have lower frequencies of using *um*, it is plausible that this hesitation marker plays a more prominent role in the conversational interaction between speaker and listener than *uh.* Many autistic children have pragmatic language difficulties, and this might in part be reflected by a failure to take the listener's perspective into account, thus resulting in lower *um*, but not *uh* frequencies. This is amplified by Irvine et al.'s (2016) results indicating that the level of autism characteristics plays a role in hesitation marker usage and that autistic children with higher support needs use fewer hesitation markers. It is likely that autistic children with relatively high support needs take the listener's perspective less into account than their peers with relatively lower support needs, who may have relatively less difficulty with social interaction in comparison, yet experience more difficulty with this when compared to non-autistic children.

The discussed studies on the use of hesitation markers in autism have solely focused on English-speaking populations spanning a large age range, with developmental differences potentially obscuring results. Additionally, the usage of hesitation markers is known to be language specific in the sense that the relative frequencies of preferring one hesitation marker over the other is different even across related languages such as English, Dutch and German (de Leeuw, 2007), and as such, research in languages other than English is warranted as results cannot be viewed as universal. Cross-linguistic research on hesitation markers can contribute to further theory building surrounding the signal/symptom hypotheses. Studying this phenomenon in autism can illuminate what aspects of hesitation markers are primarily involved in dialogue and social interaction compared to features that are more purely linguistic in nature.

The present study

In the present study, we examined Dutch speaking autistic and non-autistic children between the ages of three and four and a half years old using a semi-spontaneous speech approach during caregiver-child interaction. This age group has not yet been studied as previous work has only included participants between four years old and early adulthood. The preschool age may be especially useful to learn more about the development of hesitation markers as language variability is at its greatest during this age (Pickles et al., 2014). Our goal was to investigate the hesitation markers *uh* and *um* in Dutch speaking preschoolers and ascertain if previous results found in English could be replicated in our younger, Dutch-speaking sample. We examined the following research questions:

1. Are differences in hesitation marker usage present between our sample of Dutch speaking autistic and non-autistic preschoolers and do potential differences still exist after controlling for chronological age, biological sex and nonverbal cognitive abilities?

Similar to previous work in English-speaking samples (Gorman et al., 2016; Irvine et al., 2016; Lawley et al., 2022; McGregor & Hadden, 2020), our hypothesis was that the autistic participants would use lower frequencies of *um* than non-autistic children. In accordance with previous work, we did not expect differences in *uh* frequency (Gorman et al., 2016; Irvine et al., 2016; McGregor & Hadden, 2020). Although our sample has a relatively small age range (preschoolers), we included age as a possible covariate as

https://doi.org/10.1017/S0305000924000321 Published online by Cambridge University Press

language abilities are highly variable during this age. Moreover, autistic children are sometimes delayed in their development compared to their non-autistic peers and thus age may play a role here (e.g., Gernsbacher et al., 2016).

2. Is hesitation marker usage correlated with level of autism characteristics or structural language abilities in this sample?

In previous work, it was demonstrated that the level of parent-rated autism characteristics correlated with hesitation marker usage in English (Irvine et al., 2016), especially for *um-rate.* Therefore, we hypothesized to find a similar effect in Dutch, using the Dutch version of the parent rated Social Responsiveness Scale (Constantino, 2005; Roeyers et al., 2005). We also examined structural language abilities. While two previous studies did not find a correlation between receptive and expressive language and hesitation marker usage (Gorman et al., 2016; Irvine et al., 2016), one recent study did find such an effect (Lawley et al., 2022). The role of structural language abilities in hesitation marker usage thus remains unclear. Given previous contradictory findings, we did not formulate an a priori hypothesis for this research question.

3. Does the hesitation marker usage in Dutch speaking preschoolers point towards a symptom or signal function of *uh* and *um*?

Previous work in the English language has provided evidence towards the signal hypothesis of hesitation markers and pointed towards potentially different functions of *uh* and *um* (Gorman et al., 2016; Irvine et al., 2016). We expected to find confirmation for this hypothesis in Dutch, although it has been established that *um* is less frequently present in Dutch compared to English (de Leeuw, 2007).

Method

Participants

This study is part of a larger longitudinal European investigation of autistic children called the Preschool Brain Imaging and Behavior Project (PIP), part of the AIMS-2-TRIALS consortium. PIP consists of five international data acquisition sites (King's College London in the United Kingdom, Radboud University in The Netherlands, Karolinska Institutet in Sweden, Assistance Hopitaux Public de Paris in France and Ghent University in Flanders, Belgium). In the present study only data collected at Ghent University in Belgium and the Radboud University in The Netherlands were examined as we focus on Dutch-speaking children.

Children were recruited through social media advertisements, kindergartens, children play groups and primary schools as well as centers for neurodevelopmental disorders and clinical practices for the autistic group. Participants were included after a screening by phone to confirm that children were able to participate in the study (e.g., were able to sit up straight, follow simple directions and were able to undergo MRI scanning, which was an inclusion criterion of PIP). All included children in the present study were native Dutch speakers with no uncorrected vision or hearing difficulties. Non-autistic participants did not have any first-degree autistic relatives. Autistic children had a confirmed community autism spectrum disorder diagnosis as per DSM-5 criteria.

Table 1. Participant characteristics

	Autistic	Non-autistic	Test statistic	*p*-value[5]
Sample size	70	66	–	–
Biological sex	54 m, 16 f	38 m, 28 f	$X^2(1) = 5.9$	**.02**
Age in months[1]	47.3 (36.0 – 80.1)	45.9 (30.6 – 78.7)	$U = 1770$	**.02**
Maternal education[1,2]	3.00 (1 – 4)	3.00 (2 – 4)	$U = 2312.5$	.07
Ethnicity	3 Asian, 2 Black, 59 white, 3 more than one, 3 no info	61 white, 3 more than one, 2 no info	$X^2(2) = 5.122$	**.04**
SRS autism characteristics[1,3]	93.0 (18.0 – 151.0)	29 (8.0 – 70.0)	$U = 162$	**<.001**
Nonverbal cognitive abilities[1,4]	20.6 (3.5 – 31.3)	25.5 (19.0 – 35.3)	$U = 3476$	**<.001**
MSEL receptive language (RL)[1,4]	9.6 (0.6 – 17.2)	12.4 (8.3 – 18.0)	$U = 3408.5$	**<.001**
MSEL expressive language (EL)[1,4]	9.4 (0.8 – 15.8)	13.3 (8.4 – 17.3)	$U = 3710$	**<.001**
Mean length of utterance (MLU)[1]	2.8 (0.0 – 5.4)	4.0 (1.7 – 6.4)	$U = 3560.5$	**<.001**

Note: Median score (minimum score - maximum score).
[1]Group differences tested with Mann-Whitney U test because of non-normal distribution.
[2]1= lower education only, 2 = secondary education, 3 = non-university higher education, 4 = university-level higher education.
[3]Raw scores.
[4]Age equivalent scores divided by chronological age in years.
[5]Values of *p* printed in **bold** indicate that values are below the set α-level of .05.

In total 144 Dutch-speaking participants were enrolled in PIP. Four non-autistic participants were excluded, two because the children did not speak Dutch with their caregiver during the playtime interaction and therefore their data could not be transcribed, two because of a suspected neurodevelopmental disorder and data of one participant were lost due to technical difficulties. Three autistic children were excluded, two because they did not speak Dutch during the playtime interaction and one due to missing data. Minimally verbal autistic children were included ($n = 16$). This resulted in a final sample of 136 (n = 70 autistic, n = 66 non-autistic). An overview of detailed participant characteristics is provided in Table 1.

Written informed consent was obtained from participants' legal guardian prior to their participation in the study. All experimental protocols and procedures were approved by the designated Ethical Committees.

Measures

Autism characteristics

The level of autism characteristics was measured using the Dutch adaptation of the Social Responsiveness Scale Preschool (SRS-P) (Constantino, 2005; Roeyers et al., 2005). The SRS-P is a standardized parent questionnaire measuring autism traits in two-and-a-half to four-and-a-half-year-old youth. The test is well-validated. Total scores on the SRS-P were employed to characterize autism characteristics.

Structural language abilities

Structural language abilities were measured in two ways. Receptive and expressive language abilities were characterized using the language subscales on the Mullen Scales of Early Learning (MSEL) (Mullen, 1995). Scores were calculated by taking the age equivalent scores per scale and dividing them by the child's chronological age. Second, mean length of utterance in morphemes (MLU) was derived from a semi-spontaneous language sample between caregiver and child (see also language samples below).

Nonverbal cognitive abilities

Nonverbal cognitive abilities were indexed with the visual perception and fine motor skills scales from the MSEL (Mullen, 1995). Age equivalent scores of both scales were added together and divided by the child's chronological age in years to generate a composite score. An overview of mean scores per group can be found in Table 1.

Maternal education

Maternal education was used to characterize the sample but was not included in main analyses. Mothers filled out questionnaires regarding their highest level of education, which was a multiple choice question with answer options of lower education only (the equivalent of primary or middle school), secondary education (the equivalent of high school), non-university higher education and university-level higher education (i.e., bachelor's degree or higher).

Language samples

Language samples were derived from a play session between the child and their caregiver. Sessions took place at the university and were videorecorded. Children and caregivers were given a standardized set of toys to play with that included building blocks, a children's book, a doll, a play tea set, miniature cars and a stuffed animal.

Play sessions took around 20 minutes per session. The first ten minutes of each session after researchers had left the room were transcribed. Thus, if the researcher was still in the room until two minutes into the session, the session from minute two to twelve would be transcribed. The video recordings of the child and their caregiver were transcribed verbatim and divided into utterances separated by breath pauses by two graduate students in clinical psychology and one in speech and language pathology. All intelligible utterances were manually transcribed. Elliptical answers (one morpheme answers to a direct child-directed question – for example, parent: "is that a dog?", child "yes") were excluded from analyses as they do not reflect structural child language abilities and artificially lower the mean length of utterance (Johnston, 2001).

Transcribers were blind to the diagnosis of the child and were specifically instructed to pay attention to hesitation markers and to differentiate between *uh* and *um.* The mean duration of the videos that students transcribed was 10.00 minutes. This duration did not

https://doi.org/10.1017/S0305000924000321 Published online by Cambridge University Press

differ between groups or between male and female participants. 10% of the recordings were transcribed by all three transcribers. Inter-rater reliability of MLU between the three transcribers as measured with intraclass correlation was .93. Transcribers were blind to the diagnosis of participants.

Quantification of hesitation markers

Hesitation markers were quantified similarly to previous studies (Irvine et al., 2016; Lawley et al., 2022): the total number of *um* and *uh* tokens were counted per participant as well as the total number of words overall. Then three measures of hesitation marker usage were calculated per participant: *um-rate* was calculated by dividing the total frequency of *um* by the total number of words; *uh-rate* was calculated by dividing the total frequency of *uh* by the total number of words and lastly an *um-ratio* was calculated by dividing the total number of *um* by the overall total number of hesitation markers (*uh* + *um*). This last number indicates the ratio *um* used compared to *uh*. For example, an *um-ratio* of 0.75, means that 75% of all hesitation markers used by the child were *um*s and 25% were *uh*s (Lawley et al., 2022).

Statistical analysis

All analyses were performed in R (R Core Team, 2022) with α =.05. The code used to analyze the data can be found in an R Markdown file in the supplementary materials.

Research question 1: Group differences

To answer our first research question, we assessed group differences with the Mann-Whitney U test as our data did not have a Gaussian distribution. In a second step, following previous work of Gorman et al. (2016) and Lawley et al. (2022), we employed a logistic mixed-effects regression per hesitation marker variable with a per-subject random intercept to inspect group differences while also taking into account potential influences of biological sex, age and nonverbal cognition. Logistic regression was utilized here as this technique does not assume normality or homoscedasticity in the residuals and can handle different numbers of observations per participant, as is the case here. In order to analyze the data, a data frame was created with one token (i.e., word) per participant per row, thus including multiple rows per participant. When the token was a hesitation marker, it was scored as a "hit" and when it was any other token, it was scored as a "miss". Thus, for example, for *uh-rate*, if the participant had said "*I saw an uh dog*", the tokens *I*, *saw*, *an* and *dog* would be coded as "misses" and *uh* would be coded as a "hit". This was done for *uh* and *um* separately, thus resulting in two different variables. For *um*-ratio, all tokens that were not hesitation markers were excluded and every *um* was coded as a "hit" and every *uh* as a "miss", replicating the approach of Lawley et al. (2022).

For each hesitation marker variable (*uh* versus other tokens, *um* versus other tokens and *uh* versus *um*), a separate logistic mixed-effects regression model was created with the binary "hit or miss" variable as dependent variable and diagnosis (autistic or non-autistic) as the primary predictor. Biological sex, chronological age, nonverbal cognitive abilities were included as potential additional predictors and a random intercept per subject was added. In addition to previous research, in a second step, interaction effects of the additional predictors with diagnosis were tested one by one. Thus, the initial model (model 1) was the same for all hesitation marker variables, but the final model differed depending on the best model fit. Model comparison was done using the Akaike Information Criterion (AIC), which estimates the quality of each model relative to another model considering the trade-off between model fit and complexity (Akaike, 1998). The model with the lowest AIC was chosen as the most parsimonious if the difference in AIC was at least two points (Burnham & Anderson, 2004). Interaction effects were included in the "final model" if they contributed to the model fit as shown by the AIC. Note that the AIC values on their own have no value and should only be interpreted in comparison to another AIC-value.

Research question 2: Relationships with autism characteristics and structural language

As our second research question focused on relationships between hesitation marker usage and structural language and/or autism characteristics in our autistic participants, only their data were analyzed here. We first assessed non-parametric Spearman correlations between hesitation marker usage (*uh-rate*, *um-rate*, *um-ratio*) and autism characteristics and language variables. Then, replicating the work of Gorman et al. (2016) and Lawley et al. (2022), mixed effects logistic regression was employed for *uh-rate*, *um-rate* and *um-ratio* as independent variables separately. Each binary hesitation marker variable was added into a separate model as the dependent variable with measures of expressive language (MSEL and MLU), receptive language (MSEL) and autism characteristics as potential predictors. Biological sex and chronological age were included in the model as control variables.

Research question 3: Signal or symptom hypothesis

To answer our third research question concerning the signal and symptom hypotheses, we made use of the results for our first and second research questions. Specifically, we aim to observe potential group differences between *uh* and *um* that could indicate that the two may have different underlying linguistic mechanisms.

Results

In total, the autistic group uttered 131 hesitation markers, of which 57 *um* (44%), and the non-autistic group uttered 268 hesitation markers, of which 119 *um* (44%). This comes down to an average usage of 1.9 hesitation markers per autistic participant and 3.9 hesitation markers per non-autistic participant during the recorded ten-minute speech sample. However, 31 autistic children (45%) and 10 non-autistic children (15%) in our sample did not use any hesitation markers at all. Additionally, 17 children never used the hesitation marker *uh*, but did use *um* at least once (n autistic = 10; non-autistic = 7) and 32 children never used the hesitation marker *um*, but did use *uh* at least once (n autistic = 17; n non-autistic = 15).

RQ1: Group differences in hesitation marker usage

Our first research question focused on potential group differences in filler use in Dutch speaking autistic preschoolers. Initial Mann-Whitney U tests show significant differences between autistic and non-autistic participants in the frequency of *uh-rate* (p = .001) and

https://doi.org/10.1017/S0305000924000321 Published online by Cambridge University Press

Table 2. Hesitation marker usage frequency per group

	Autistic	Non-autistic	U	p-value[1]
Uh–rate	0.006	0.008	3013	**.001**
Um–rate	0.005	0.006	3157	**<.001**
Um–ratio	0.21	0.37	3051.5	**<.001**

Mean and first and third quartile for *uh-rate*, *um-rate* and *um-ratio*.
[1]All p-values are below the set α-level of .05.

um-rate ($p < .001$) and *um-ratio* ($p < .001$), with autistic participants having significantly lower frequencies than non-autistic participants. All hesitation marker usage frequencies are summarized in Table 2.

Group differences while controlling for age, biological sex and nonverbal cognition

Uh-rate

In a second step, we investigated group differences while controlling for age, biological sex and nonverbal cognition. For *uh-rate*, the initial model including only main effects showed no significant results and had an AIC of 2473.4. Model comparison showed that interaction effects with age and/or biological sex (i.e., "model 2") did not significantly add to the model and therefore the initial model was chosen as it was deemed as the most parsimonious model. All parameters of the regression model are shown in Table 3.

Um-rate

As was the case for *uh-rate*, initially, no main effects (initial model) were present for *um-rate* (AIC = 2034.9). Here too, additional interaction effects (model 2) between chronological age, biological sex and diagnosis were examined and were shown not to add variance to the initial model. The initial model was therefore preferred. All parameters of the regression model are shown in Table 3.

Um-ratio

Lastly, for *um-ratio* (*uh* versus *um*), the model would not converge when nonverbal cognitive abilities were included. A model only examining diagnosis, chronological age and biological sex (initial model) yielded no significant main effects. Model comparison showed no significant interaction effects in model 2 and thus the initial model was preferred.

RQ2: Relationships between hesitation marker usage and language and autism characteristics

Spearman correlation analyses showed significant moderate associations between both receptive and expressive language and all hesitation marker variables. We found no significant correlations between any of the hesitation marker variables and autism characteristics. All correlation coefficients and significance values are shown in Table 4. Next, mixed-effects logistic regression for all hesitation marker variables was employed in the autistic group.

https://doi.org/10.1017/S0305000924000321 Published online by Cambridge University Press

Table 3. Regression parameters

	Uh-rate (*uh* vs. other tokens)				*Um-rate* (*um* vs. other tokens)				*Um-ratio* (*um* vs. *uh*)			
	Initial model		Model 2		Initial model		Model 2		Initial model		Model 2	
Predictors	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
(Intercept)	–5.12	.29	–6.14	1.07	–5.01	.54	–5.43	1.18	–.97	1.20	–.83	1.23
Diagnosis (autistic group as reference)	–.35	.27	.83	1.14	–.35	.32	.96	1.95	–.51	.47	–.64	.54
Chronological age	<.01	.004	.03	.02	–.01	.01	<.01	.03	.02	.03	.02	.03
Biological sex (female group as reference)	–.14	.26	–.17	2.07	–.30	.30	–.99	2.32	–70	.47	–.83	.54
Nonverbal cognitive abilities	<–.01	.004	<–.01	<.01	<–.01	<.01	<–.01	<.01	–	–	–	–
Diagnosis * sex (autistic females as reference)[1]			–9.59	7.51			–10.08	12.12			.49	1.03
Diagnosis * age[1]			–.03	.03			–.03	.04			.03	.06

Note: Model 2 was the most parsimonious model for all hesitation marker variables.
[1]Only significant interaction terms in the final model were included.

Table 4. Intercorrelations between variables – Autistic participants

	1.	*p*	2.	*p*	3.	*p*	4.	*p*	5.	*p*	6.	*p*
1. *Uh–rate*												
2. *Um–rate*	.18	.14										
3. *Um–ratio*	.01	.92	.93	**<.001**								
4. Autism characteristics	<–.01	.99	.07	.61	.04	.79						
5. MSEL receptive language	.46	**<.001**	.24*	**.04**	.28	**.01**	–.20	.06				
6. MSEL expressive language	.41	**<.001**	.28*	**.03**	.28	**.01**	–.24	**.04**	.89	**<.001**		
7. MLU	.37	**.02**	.35**	**.003**	.38	**.001**	–.20	.12	.80	**<.001**	.83	**<.001**

Note: Table shows correlation coefficients and exact p-values. Values of *p* printed in **bold** indicate that *p*-values are below the set α-level of .05

Uh-rate

For *uh-rate*, our model showed that after controlling for age and sex, language was not significantly related *to uh-rate.*

Um-rate

Neither structural language nor autism characteristics were significant predictors for *um-rate* in our autistic sample after controlling for chronological age and biological sex.

Um-ratio

No significant results were observed for structural language abilities or autism characteristics after controlling for age and sex for *um-ratio.*

Discussion

In this paper, we examined hesitation marker usage in Dutch-speaking autistic and non-autistic preschoolers. We examined three hesitation marker variables: *uh-rate*, *um-rate* and *um-ratio*. Previous work has focused on either older children or adults, while much less is known about the development of hesitation marker usage in preschool children. One study of Lawley et al. (2022) indicated an *uh-rate* of .017 for non-autistic participants (with a mean age of eight years old and an age range between four and fifteen years old) and .005 for autistic participants (with a mean age of ten years old and the same range as non-autistic participants). In comparison, for our much younger preschool-aged participants, we observed an *uh-rate* of .008 for non-autistic participants and .006 for autistic participants. Thus, our results show that although hesitation markers are rare occurrences in the preschool-age, some children of this age do already use *uh* and *um* in their spontaneous speech. As we observed a correlation between language abilities and hesitation marker usage, it is likely that children use more hesitation markers as their language abilities grow with age. It remains unclear if a "language effect" (Dutch versus English)

https://doi.org/10.1017/S0305000924000321 Published online by Cambridge University Press

also played a role in these lower frequency rates or if the results can entirely be attributed to a younger age of our participants. After all, hesitation marker usage has not yet been examined in preschool-aged English-speaking children, making disentangling language and age effects difficult.

For our first research question, we examined group differences between autistic and non-autistic participants in their hesitation marker usage. When comparing hesitation marker variables between the two groups, we found significant differences between the autistic and non-autistic participants, with the autistic participants using less hesitation markers. However, after controlling for age, sex and nonverbal IQ, no significant differences remained present. The initial group differences were likely driven by an overall lower use of hesitation markers (i.e., autistic children used 131 hesitation markers and non-autistic children 268, despite being slightly smaller in sample size).

The lack of robust group differences differs from previous research in older-aged English-speaking populations between four and fifteen years old (e.g., Gorman et al., 2016; Lawley et al., 2022). Moreover, in both the autistic and non-autistic group, *uh* versus *um* ratios were reversed in Dutch compared to English. While English-speaking participants (especially non-autistic participants) favored *um* over *uh* when using a hesitation marker (e.g., Lawley et al., 2022), Dutch-speaking participants showed the reversed pattern and preferred *uh* over *um*. This finding is in line with previous research concerning hesitation marker usage in Dutch (Swerts, 1998), and further confirms the notion that hesitation marker usage is language specific, underscoring the importance of cross-linguistic research (de Leeuw, 2007). This language difference also carries consequences for linguistic theory building surrounding hesitation markers, as these cross-linguistic differences imply that the choice of hesitation marker is contingent on a linguistic (or cultural) preference rather than an involuntary, automatic occurrence. This in turn further supports the signal hypothesis, in which hesitation markers are seen as deliberate signals to support communication (Clark & Fox Tree, 2002).

Extending beyond previous research, we examined interaction effects of age, biological sex and nonverbal IQ with diagnostic group for hesitation marker usage, although we did not find any significant effects. Although sex differences have previously been described, these differences were driven by an increased use of *uh* of male autistic participants (Parish-Morris et al., 2017). In our data, however, the *um-ratio* does not reflect such interaction. That we did not find an effect of age is likely thanks to our relatively strict age range involving only preschool-aged participants, rather than taking together participants from different developmental stages.

In our second research question, we examined correlations between hesitation marker usage and autism characteristics and structural language abilities. Our data showed significant associations between all hesitation marker variables and language abilities, both receptive and expressive (using both standardized testing and a natural language sample). In previous work examining older English-speaking children there are mixed results for associations between language and autism characteristics and *um-rate* and *um-ratio*, while no associations were found for *uh-rate* (Gorman et al., 2016; Irvine et al., 2016; Lawley et al., 2022). That we identified significant associations for *uh-rate, um-rate* and *um-ratio* may further illuminate cross-linguistic preferences in the selection of hesitation marker usage. Specifically, previous studies investigated only English-speaking populations who used *um* more often than *uh*. In our Dutch speaking population however, *uh* is more often used than *um*, which may be why we do find significant associations with language. Moreover, there are large age differences between our study and previously

https://doi.org/10.1017/S0305000924000321 Published online by Cambridge University Press

published work and this may play a role in the development of hesitation marker usage. Developmental differences are therefore also perceivable and are likely present especially in the preschool to the school-aged period and beyond, given the great heterogeneity in language abilities in the early developmental period (Pickles et al., 2014). This may also explain differences between our results and previous results, which are focused on school-aged children.

Lastly, our third research question examined the function of hesitation markers, specifically by exploring the signal versus symptom hypothesis. Previous work has established mostly evidence for the signal hypothesis of hesitation markers, indicating that hesitation markers are intentional linguistic features facilitating listener comprehension (Clark & Fox Tree, 2002).

Data from the current study do not provide conclusive support for either the signal or symptom hypothesis. For example, we observed similar results for *um-rate, um-ratio* and *uh-rate*, which does not support different underlying linguistic mechanisms, but also does not contradict it. After all, differences between *um-rate* and *uh-rate* would indicate that perhaps the choice of hesitation marker is not entirely unvoluntary, but an absence of these differences does not necessarily indicate that hesitation markers are unvoluntary speech symptoms. We did find a preference for the hesitation marker *um* over *uh*, which is the reversed preference than has been described in English-speaking children, but it is too early to tell if this cross-linguistic difference is meaningful in distinguishing between the signal and symptom hypothesis, or if it is merely the result of phonological preferences per language.

As in all studies, some limitations of the present work need to be acknowledged. First, although the autistic group scored significantly lower on all language measures, they still obtained relatively good scores on receptive language and had a relatively high MLU, which is not reflective of the entirety of the autism spectrum. Second, an important limitation is that we did not include any measures of social language or pragmatic language, which may be able to detect potential different functions of *uh* and *um*. This study was a retrospective analysis of data collected as part of a European study that did not include pragmatic language measures, which is why we were unable to include such measures. Moreover, perhaps children are more likely to utter hesitation markers when they are challenged to use more complicated sentence structures than they typically do. In this case, a narrative task or a task with an unfamiliar examiner rather than a close caregiver may be more successful in eliciting hesitation markers than the naturalistic setting that we have provided here. Lastly, although a ten-minute language sample is typically deemed sufficient to give a reliable overview of preschool-aged children's language abilities (Guo & Eisenberg, 2015), it is not known if this also holds for less-frequently occurring language events like hesitation maker usage. Longer language samples may give additional insights in the future.

One strength of this investigation was the smaller age range compared to samples included in previous work, which makes our results less subjective to developmental differences within the study sample. That our results included an interaction effect with age even within this limited age-range only underscores the importance of investigating age as a variable in future investigations. We also included MLU from caregiver-child interaction, a measure of spontaneous structural language ability that is natural to the child and thus ensures ecological validity of our language variable. Language samples collected during parent-child interactions generally result in more utterances and higher language performance than samples collected during standardized measures such as the ADOS (Kover et al., 2014).

Lastly, while this study focused on Dutch, which is a language closely related to English, future work should examine hesitation marker usage in children speaking languages further removed from English and Dutch to gain a deeper understanding of hesitation marker usage across different languages.

Conclusion

We examined hesitation marker usage in autistic and non-autistic Dutch-speaking preschoolers. Although initial results showed group differences in hesitation marker usage between autistic and non-autistic participants, these results were rendered insignificant after controlling for chronological age, biological sex and nonverbal cognitive abilities. We also showed that hesitation markers usage is related to structural language abilities, both expressive and receptive. We found interesting cross-linguistic differences between our Dutch-speaking sample compared to previous work in English-speaking participants, such as a preference for *um* over *uh* rather than vice versa. These results cannot give a conclusive answer whether hesitation markers are involuntary symptoms of difficulties in speech planning (symptom hypothesis) or if they are rather more voluntary communicative tools (signal hypothesis) and more research is therefore needed.

Supplementary material. The supplementary material for this article can be found at http://doi.org/10.1017/S0305000924000321.

Acknowledgements. The results leading to this publication have received funding from the Innovative Medicines Initiative 2 Joint Undertaking under grant agreement n° 777394 for the project AIMS-2-TRIALS. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and EFPIA and AUTISM SPEAKS, Autistica, SFARI. Any views expressed are those of the author(s) and not necessarily those of the funders (IHI-JU2).

We thank Laura Kiekens, Lara Demanet and Kevser Kaymak for their help with transcribing the Belgian language samples. We also want to express our gratitude to Grace Lawley for providing additional details concerning data processing and data analysis used in the paper of Lawley et al. (2022). This ensured that we utilized the same approach here. Lastly, we thank all included families for their participation in PIP.

References

Akaike, H. (1998). Information Theory and an Extension of the Maximum Likelihood Principle. In E. Parzen, K. Tanabe, & G. Kitagawa (Eds.), *Selected Papers of Hirotugu Akaike* (pp. 199–213). Springer New York. https://doi.org/10.1007/978-1-4612-1694-0_15

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders: DSM-5 (5th edition).* American Psychiatric Publishing, Inc.

Arnold, J. E., **Fagnano, M.**, & **Tanenhaus, M. K.** (2003). Disfluencies signal theee, um, new information. *J Psycholinguist Res*, **32**(1), 25–36. https://doi.org/10.1023/a:1021980931292

Brennan, S. E., & **Williams, M.** (1995). The feeling of another's knowing: Prosody and filled pauses as cues to listeners about the metacognitive states of speakers. *Journal of Memory and Language*, **34**, 383–398. https://doi.org/10.1006/jmla.1995.1017

Burnham, K. P., & **Anderson, D. R.** (2004). Multimodel Inference: Understanding AIC and BIC in Model Selection. *Sociological Methods & Research*, **33**(2), 261–304. https://doi.org/10.1177/0049124104268644

Cardillo, R., **Mammarella, I. C.**, **Demurie, E.**, **Giofrè, D.**, & **Roeyers, H.** (2021). Pragmatic Language in Children and Adolescents With Autism Spectrum Disorder: Do Theory of Mind and Executive Functions Have a Mediating Role? *Autism Research*, **14**(5), 932–945. https://doi.org/10.1002/aur.2423

Clark, H. H., & **Fox Tree, J. E.** (2002). Using uh and um in spontaneous speaking. *Cognition*, **84**, 73–111. https://doi.org/10.1016/S0010-0277(02)00017-3

Clark, H. H., & **Wilkes-Gibbs, D.** (1986). Referring as a collaborative process. *Cognition*, **22**, 1–39.
Constantino, J. N. (2005). *Social Responsiveness Scale-Preschool Version for 3-Year-Olds, Research Version*. Western Psychological Services.
Corley, M., & **Hartsuiker, R. J.** (2011). Why Um Helps Auditory Word Recognition: The Temporal Delay Hypothesis. *Plos One*, **6**(5), e19792. https://doi.org/10.1371/journal.pone.0019792
Corley, M., **MacGregor, L. J.**, & **Donaldson, D. I.** (2007). It's the way that you, er, say it: hesitations in speech affect language comprehension. *Cognition*, **105**(3), 658–668. https://doi.org/10.1016/j.cognition.2006.10.010
de Leeuw, E. (2007). Hesitation Markers in English, German, and Dutch. *Journal of Germanic Linguistics*, **19**(2), 85–114. https://doi.org/10.1017/S1470542707000049
Eigsti, I.-M., **de Marchena, A.**, **Schuh, J.**, & **Kelley, E.** (2011). Language acquisition in autism spectrum disorders: A developmental review. *Research in Autism Spectrum Disorders*, **5**, 681–691. https://doi.org/10.1016/j.rasd.2010.09.001
Ellawadi, A. B., & **Ellis Weismer, S.** (2015). Using Spoken Language Benchmarks to Characterize the Expressive Language Skills of Young Children With Autism Spectrum Disorders. *Am J Speech Lang Pathol*, **24**(4), 696–707. https://doi.org/10.1044/2015_ajslp-14-0190
Ferreira, F., & **Bailey, K. G. D.** (2004). Disfluencies and human language comprehension. *Trends in Cognitive Sciences*, **8**, 231–237. https://doi.org/10.1016/j.tics.2004.03.011
Fox Tree, J. E. (2001). Listeners' uses of um and uh in speech comprehension. *Memory & Cognition*, **29**(2), 320–326. https://doi.org/10.3758/BF03194926
Gernsbacher, M. A., **Morson, E. M.**, & **Grace, E. J.** (2016). Chapter 70 - Language Development in Autism. In G. Hickok & S. L. Small (Eds.), *Neurobiology of Language* (pp. 879–886). Academic Press. https://doi.org/10.1016/B978-0-12-407794-2.00070-5
Goldman-Eisler, F. (1968). *Psycholinguistics: experiments in spontaneous speech*. London: Academic Press. http://lib.ugent.be/catalog/rug01:001260386
Gorman, K., **Olson, L.**, **Hill, A. P.**, **Lunsford, R.**, **Heeman, P. A.**, & **van Santen, J. P.** (2016). Uh and um in children with autism spectrum disorders or language impairment. *Autism Res*, **9**(8), 854–865. https://doi.org/10.1002/aur.1578
Guo, L.-Y., & **Eisenberg, S.** (2015). Sample Length Affects the Reliability of Language Sample Measures in 3-Year-Olds: Evidence From Parent-Elicited Conversational Samples. *Language, speech, and hearing services in schools*, **46**(2), 141–153. doi: https://doi.org/10.1044/2015_LSHSS-14-0052
Irvine, C. A., **Eigsti, I. M.**, & **Fein, D. A.** (2016). Uh, Um, and Autism: Filler Disfluencies as Pragmatic Markers in Adolescents with Optimal Outcomes from Autism Spectrum Disorder [Article]. *Journal of Autism and Developmental Disorders*, **46**(3), 1061–1070. https://doi.org/10.1007/s10803-015-2651-y
Johnston, J. R. (2001). An alternate MLU calculation: Magnitude and variability of effects. *Journal of Speech, Language, and Hearing Research*, **44**, 156–164. https://doi.org/10.1044/1092-4388(2001/014)
Kelley, E., **Paul, J. J.**, **Fein, D.**, & **Naigles, L. R.** (2006). Residual language deficits in optimal outcome children with a history of autism. *J Autism Dev Disord*, **36**(6), 807–828. https://doi.org/10.1007/s10803-006-0111-4
Kover, S. T., **Davidson, M. M.**, **Sindberg, H. A.**, & **Ellis Weismer, S.** (2014). Use of the ADOS for assessing spontaneous expressive language in young children with ASD: a comparison of sampling contexts. *Journal of speech, language, and hearing research: JSLHR*, **57**(6), 2221–2233. https://doi.org/10.1044/2014_JSLHR-L-13-0330
Landa, R. (2000). *Social language use in Asperger syndrome and high-functioning autism*. The Guilford Press. http://doi.org/10.1007/s00787-008-0701-0
Lawley, G., **Bedrick, S.**, **MacFarlane, H.**, **Dolata, J.**, **Salem, A.**, & **Fombonne, E.** (2022). "Um" and "Uh" Usage Patterns in Children with Autism: Associations with Measures of Structural and Pragmatic Language Ability. *Journal of Autism and Developmental Disorders*. https://doi.org/10.1007/s10803-022-05565-4
Levelt, W. J. M. (1989). *Speaking: From intention to articulation*. The MIT Press.
Levinson, S. C. (1983). *Pragmatics*. Cambridge University Press. https://doi.org/10.1017/CBO9780511813313.
MacFarlane, H., **Gorman, K.**, **Ingham, R.**, **Hill, A. P.**, **Papadakis, K.**, **Kiss, G.**, & **van Santen, J.** (2017). Quantitative analysis of disfluency in children with autism spectrum disorder or language impairment [Article]. *Plos One*, **12**(3), 20, Article e0173936. https://doi.org/10.1371/journal.pone.0173936
Maclay, H., & **Osgood, C. E.** (1959). Hesitation Phenomena in Spontaneous English Speech. *WORD*, **15**(1), 19–44. https://doi.org/10.1080/00437956.1959.11659682

McGregor, K. K., & **Hadden, R. R.** (2020). Brief Report: "Um" Fillers Distinguish Children With and Without ASD. *J Autism Dev Disord*, **50**(5), 1816–1821. https://doi.org/10.1007/s10803-018-3736-1

Mullen, E. M. (1995). *Mullen Scales of Early Learning*. American Guidance Service, Inc.

Parish-Morris, J., **Liberman, M. Y.**, **Cieri, C.**, **Herrington, J. D.**, **Yerys, B. E.**, **Bateman, L.**, **Donaher, J.**, **Ferguson, E.**, **Pandey, J.**, & **Schultz, R. T.** (2017). Linguistic camouflage in girls with autism spectrum disorder [Article]. *Molecular Autism*, **8**, 12, Article 48. https://doi.org/10.1186/s13229-017-0164-6

Pickles, A., **Anderson, D. K.**, & **Lord, C.** (2014). Heterogeneity and plasticity in the development of language: a 17-year follow-up of children referred early for possible autism. *J Child Psychol Psychiatry*, **55**(12), 1354–1362. https://doi.org/10.1111/jcpp.12269

R Core Team. (2022). *R: A Language and Environment for Statistical Computing*. In R Foundation for Statistical Computing. http://www.r-project.org

Roeyers, H., **Thys, M.**, **Druart, C.**, **De Schryver, M.**, & **Schittekatte, M.** (2005). *SRS Screeningslijst voor autismespectrumstoornissen*. Hogrefe.

Swerts, M. (1998). Filled pauses as markers of discourse structure. *Journal of Pragmatics*, **30**, 485–496. https://doi.org/10.1016/S0378-2166(98)00014-9

Wieling, M., **Grieve, J.**, **Bouma, G.**, **Fruehwald, J.**, **Coleman, J.**, & **Liberman, M.** (2016). Variation and Change in the Use of Hesitation Markers in Germanic Languages. *Language Dynamics and Change*, **6**(2), 199–234. https://doi.org/10.1163/22105832-00602001

Cite this article: Mues, M., Demurie, E., Erdogan, M., Schaubroeck, S., Krol, M., Goodwin, A., Buitelaar, J., Loth, E., & Roeyers, H. (2025). *Uh* and *um* in autism: The case of hesitation marker usage in Dutch-speaking autistic preschoolers. *Journal of Child Language* **52,** 1063–1079, https://doi.org/10.1017/S0305000924000321