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Extending familiar constructions: How autistic and non-autistic adults fill in the blanks

Nicole Cuneo & Adele E. Goldberg[1]

Princeton University

Abstract. Autistic individuals show group level differences in categorization tasks compared to non-autistic individuals, exhibiting a strength in detecting differences and a reduced tendency to flexibly generalize. The current work indicates that autistic individuals are challenged by a task that require extensions of familiar constructions in relatively novel ways, a challenge previously documented at the level of individual words. Study 1 provides a series of phrases that each contain a single blank slot, and participants are asked to choose which of four words best fits the slot. In key Flexible Extension trials, the target word only infrequently occurs in the phrase in corpus data, but it is more suitable than the other options. Results indicate that AS adults find it more challenging to flexibly extend familiar phrases in new ways than their non-AS peers, when performance is matched on trials that do not require flexible extensions.

A second study tests the extent to which autistic and non-autistic adults converge on the same prototype for familiar multi-word phrases by asking them to generate words to fill open slots. Results suggest that AS participants show less convergence (greater entropy) in the generation of fillers for open slots, when matched with non-autistic participants on education level and verbal fluency. Current results suggest that categorization differences are a subtle yet persistent difference that is relevant for phrasal patterns as well as words.

Keywords. Language; communication; autistic adults; usage-based approach; linguistics

1. Introduction. Autistic individuals are recognized to display certain differences in categorization tasks that require flexible extensions or generalizations. They tend to display a preference for sameness (American Psychiatric Association, 1994). Behaviorally, this manifests as a propensity for routine, special interests, and lower tolerance for uncertainty (for review see Petrolini et al., 2023). Perceptually, heightened attention to distinctions results in enhanced visual and auditory discrimination (Mottron et al., 2006; Eigsti & Fein, 2013), improved performance on visual search tasks (Dakin & Frith, 2005), and a tendency to perceive instances of a category to be more distinct rather than similar (Soulières et al., 2007).

The usage-based approach to language suggests the possibility that categorization differences may help explain certain challenges with language that are common among autistic individuals. The approach treats all linguistic categories, like other categories, as including prototypical and less prototypical instances and being flexibly extended in new contexts as the need arises (Jackendoff, 1983; Lakoff, 1987; Tomasello, 2003; Goldberg, 2003, 2006; Bybee, 2010). Because new information is related to prior information (e.g., Bayes, 1763; Vygotsky, 1986), linguistic categories are viewed as emerging from clusters memories within a dynamic ConstructionNet (e.g., Goldberg et al., 2004). That is, language involves flexible dynamic

[1] Department of Psychology, Princeton University, Princeton NJ USA (adele@princeton.edu) ORCID IDs: AEG: 0000-0001-8636-8890; Nicole Cuneo: 0000-0002-3028-0168

categories rather than rigid rules (Weissweiler et al., 2025). The usage based approach argues that we learn language by using it, gathering statistical information from our linguistic encounters and interpretations in context (Tomasello, 2003; Goldberg, 2003, 2006, 2019; Bybee, 2010; Kapatsinski, 2014; Diessel, 2019).

Evidence that categorization differences between autistic and non-autistic individuals exist at the level of words is reviewed in the following section.

1.1. REDUCED GENERALIZATION AND FLEXIBILITY AT THE LEVEL OF VOCABULARY AMONG AUTISTIC INDIVIDUALS. When provided with lists of words, autistic individuals have been found less likely to attend to semantic relationships among instances. For instance, Tager-Flusberg (1991) found that autistic and non-autistic participants recalled lists of unrelated words as well as lists of unrelated words, while non-autistics showed improved recall when the listed words were semantically related to one another. Another type of evidence for a difference in the formation of word-level categorization has been found in "false memory" tasks, in which participants hear a list of related words (e.g., *bed, rest, pillow, awake,* etc.), all associates of a \`gist' word that is not presented (here, *sleep*). Non-autistics are very likely to falsely believe they had witnessed the gist word (Roediger & McDermott, 1995), presumably because activation spread from the related words to the gist word, making it feel familiar. Yet autistic individuals are less likely to fall prey to false memories; instead, they tend to accurately recognize that the gist word as new (Beversdorf et al., 2000, Hiller et al, 2006, Wojcik et al 2018, Griego et al, 2019).

Recent work has also found that autistic individuals are less likely to attend to semantic relationships among multiple meanings of a single word. That is, most commonly used words in each language are associated with semantically distinct but related meanings. Such *polysemous* meanings can be distinguished from homonymous meanings of a word, which are unrelated semantically and far more rare. Non-autistic children and adults find it easier to learn polysemy than homonymy, an advantage that persists even a week after exposure (Floyd & Goldberg, 2021). Yet when groups of autistic and non-autistic children were exposed to several novel homonyms and several novel polysemous words, the two groups performed similarly on the homonyms, but only the non-autistic children displayed markedly better learning of polysemous words (Floyd et al., 2021). That is, the autistic group essentially treated homonyms and polysemous words alike, as if they did not recognize the intended relationships among the meanings of the novel polysemous words. This is not simply a developmental delay nor is it due to a lack of exposure, because related results hold for adults when required to extend the meanings of familiar words. In particular, Cuneo et al. (2024) compared 80 autistic adults with 80 non-autistic adults in a four-alternative choice paradigm (4AFC). Results showed that the autistic adults were less inclined to flexibly extend familiar words in new ways than the non-autistic participants, while the same group outperformed the non-autistics on novel word learning task that did not require flexible meaning extensions.

To summarize, prior work suggests that autistic individuals find it more challenging to recognize or make use of relationships among word meanings: they are less prone to false memories formed from generalizing across a set of related words; less advantaged by semantic relationships among word lists in memory tasks or by related meanings of a single word during learning; and less likely to extend familiar words in new ways. In each case, the autistic group's performance on another language task that did not involve semantic relatedness or generalization matched or exceeded the performance of the non-autistic group. Categorization differences in language tasks have been documented at the word level, but language involves more than just words. Learning and using language involves learning phrasal patterns that include lexically fixed idioms and more abstract constructions as well. The current work seeks to determine whether differences in flexible extensions (Study 1) and generalization (Study 2) are evident at the level of phrasal expressions.

1.2 IDIOMS AND GRAMMATICAL CONSTRUCTIONS. The idiom *bite the bullet* conveys a meaning that is different from the meanings of its individual words, as it means "to do something you've been avoiding." This particular idiom is lexically fixed insofar as near synonyms cannot be substituted, as illustrated by examples (1)-(2):

(1) ? *Chew* the bullet
(2) ? Bite the ammunition

Other constructions are more abstract and flexible, rather than fixed, although they tend to have prototypical instances. For instance, consider the English "double object" (DO) construction (as in examples (3)-(5):

(3) She gave him something.
(4) She kicked them the ball.
(5) He baked her a cake.

Many distinct verbs can and do appear in the DO construction (Levin, 1993). At the same time, the verb, *give* is particularly prototypical, as it accounts for 40-50% of all instances, with other verbs occurring far less frequently (Casenhiser & Goldberg, 2004; Goldberg et al., 2004). Relatedly, the meaning "give" is evoked by the DO construction, insofar as the construction generally implies realized, intended or metaphorical giving between an animate agent and an animate recipient (Green, 1974; Pinker 1989; Goldberg, 1995). That is, the DO construction is associated with "giving" even when used with verbs that don't necessarily imply transfer on their own, such as the verbs *kick* or *slip* (e.g., *kick him something; slip him something*). Another example is provided in (6a). *She got him something* implies that she procured something that she intends to give him, yet the verb *get* does not imply intended "giving" when appearing in any other "argument structure" construction (see 6b-f):

(6) a. She got him something.
b. She got something.
c. She got him into the car.
d. She got him to do something.
e. She got sick.
f. She got going.

Thus, the DO construction, and other argument structure constructions help determine "who did what to whom" (e.g., Goldberg, 1995; 2015). Non-autistic people are implicitly aware of the verb *give*'s special role in the DO construction insofar as they tend to respond with *give* when asked what a nonsense verb (*moop*) means in the DO construction (*She mooped him something*) (Ahrens, 1995; Goldberg, 1995; Johnson & Goldberg, 2013). The usage based constructionist perspective argues lossy instances of similar utterances to cluster together in memory, giving rise to a category that includes prototypical instances and a range of conventional extensions (Goldberg, 1995, 2019; Ninio, 1999; Tomasello, 2003).

2. Motivating the current studies. A considerable body of research has found that autistic individuals face certain challenges in language learning and use. Much work has focused on metaphorical, sarcastic, or other non-literal aspects of language, which we leave aside here (for reviews see e.g., Morsanyi et al., 2020; Lampri et al., 2024). Other work reports that autistic individuals are more likely to rely on memorized, verbatim utterances than non-autistic individuals (Prizant & Rydell, 1984; Dobbinson et al., 2003; Karmali et al., 2005; Perkins et al., 2006; Stribling et al., 2007; Valentino et al., 2012). To the extent that fixed phrases are relied upon, the fewer novel utterances we can expect.

Here we ask *why* autistic individuals are more prone to repeating verbatim phrases than non-autistic individuals. Building on work that has highlighted difficulties in flexibly extending words in novel ways (Tek et al., 2008; Wilson & Bishop 2020; Floyd et al., 2021; Didnar et al, 2023; Cuneo et al, 2024) here we examine group differences in how autistic and non-autistic adults use flexible grammatical constructions. We hypothesize that autistic adults will find it more challenging to extend familiar constructions in new ways, while matching non-autistics on accuracy of fixed phrases that do not require flexible extensions. Thus, Study 1 compares how easily autistic and non-autistic adults extend familiar grammatical constructions.

Study 2 tests the degree to which autistic and non-autistic individuals spontaneously generate the same consensus filler-word for familiar constructions (*e.g., She __ him something*). We hypothesized that verbal autistic adults would be less likely to converge on the same target word than non-autistic adults (e.g., *give* for the DO construction), thereby displaying more entropy on generated fillers at the group level. We reasoned that if autistic individuals form implicit clusters of verbs in argument structure constructions atypically or not at all, they will show less consensus when asked to provide a filler word for grammatical constructions.

2.1 PREREGISTRATION AND SUPPLEMENTAL INFORMATION. Design, sample sizes, exclusion criteria, and intended analyses were preregistered: https://researchbox.org/3809&PEER_REVIEW_passcode=SQRINZ. Please see Supplemental Information for a) details and links to the preregistrations, data and analyses (online resource 1); b) survey on terminological preference for our autistic participants (online resource 2); c) full models of preregistered model (online resource 3 and 5); d) and exploratory analyses (online resource 4 and 6).

Study 1: Flexible Meaning Extensions of Constructions. Study 1 directly tests the hypothesis that autistic individuals find it more challenging to flexibly extend familiar grammatical constructions in new ways. In a four-alternative forced choice task (4AFC), we asked participants to select which word best fills the constrained open slot in each of a series of phrasal constructions, presented one at a time. Four types of 4AFC trials were presented in randomized order for each participant.

Flexible Extension Trials. Flexible Extension trials are the key experimental condition. Participants are asked to select which word "fit best" in the open slot of a provided phrase. Table 1 displays the stimulus phrases, along with a *low frequency but plausible* target choice, and three unacceptable/implausible foil options. Options were presented to participants in randomized order. In order to select the target word, participants needed to essentially flexibly extend a familiar construction in a way that is plausible but unlikely to have been previously witnessed frequently, if at all. We hypothesized that autistic adults would find Flexible (low frequency) Extension trials more challenging than their non-autistic peers.

Stimulus phrase	Flexible (low frequency) extension	Foils (unacceptable/implausible)
She ___ him something	*knit*	*did, divided, caused*
It's ___ of you to say that	*noble*	*tall, new, first*
He ___ his way to the front	*muscled*	*glided, weighted, stopped*
She ___ it on the table	*propped*	*caused, affected, figured*
She drove him ___	*batty*	*glad, happy, irritated*
She ___ at him	*blinked*	*watched, lagged, excited*
She ___ the night away	*dreamed*	*attempted, looked, thanked*
How big of a ___ is it?	*win*	*freedom, beauty, agreement*
He ___ them into doing something	*bribed*	*told, promised, felt*

Table 1. Stimuli phrases, target filler and foils used in Flexible Extension (low frequency) trials.

Three other types of 4AFC trials were randomly interspersed: High-Frequency trials, intended to ensure familiarity with the phrases provided; Collocation trials, to ensure familiarity with collocations that do not require flexible extensions, and 'catch' trials, used to insure sustained attention to the task. Each is described below.

High Frequency (HF) (Control) Trials. The same nine stimuli phrases used in the Flexible Extension (low frequency) trials were repeated in High Frequency trials, now with four new fillers including a filler word that appears with high frequency in the phrase. Because participants cannot be expected to flexibly extend a construction that they are unfamiliar with, Flexible Extension LF trials are only included in the analysis when the same participant responded correctly to the corresponding HF trial. Thus, HF trials were included to confirm familiarity with the constructions used in the key Flexible Extension trials.

Stimulus phrase	Target	Foils
She ___ him something	*gave*	*snapped, skated, bent*
It's ___ of you to say that	*nice*	*short, sunny, glad*
He ___ his way to the front	*made*	*went, walked, stood*
She ___ it on the table	*put*	*caught, portioned, figured*
She drove him ___	*crazy*	*small, smothered, married*
She ___ at him	*looked*	*spoke, created, connected*
She ___ the night away	*slept*	*adapted, liked, checked*
How big of a ___ is it?	*deal*	*blue, happy, pact*

He ___ them into doing something	*tricked*	*realized, passed, changed*

Table 2. High-Frequency stimuli used to ensure participants' familiarity with each construction. For each phrase, the target word occurred with high frequency as a filler (according to COCA, Davies, 2008); foil options were all less acceptable or implausible.

Collocation Trials. Ten collocation trials included common phrases that prefer a particular filler word. For instance, the phrase *Once ___ a time* is nearly always filled by the target word, *upon* (98% of instances in the COCA corpus, Davies, [2008]); each of the three foil words on each trial were implausible or unacceptable (in this case: *on, atop, above)*.

Catch Trials. Five catch trials were randomly interspersed, requiring participants to match a pattern provided: e.g., for the pattern *one, two, three, four, __, six*, where the target choice was *five.*

3. Methods

Participants. A total of 105 autistic (AS) adult participants, aged 18–69 and living independently, were recruited from the SPARK database (SFARI Base). As planned, participants were excluded if they did not self-identify as autistic (n = 15); accurate diagnosis was further indicated by a requirement that participants score 6 or above on the AQ-10, a standard assessment used to recommend further screening (n = 13); also excluded were participants who failed to respond correctly to at least 4 of the 5 catch trials (n = 3). This resulted in 74 AS participants' data to be analyzed (M = 31.5 years). Gender estimates, based on database proportions, are 49 participants identified as female and 25 as male. Participants identified their race/ethnicity as Asian (n = 1), Black (n = 3), White (n = 52), or mixed race (n = 8); 10 participants opted not to disclose their race/ethnicity.

We collected 74 non-autistic (non-AS) similarly (M = 44.4 years). A larger group of 89 participants were consented from Prolific and excluded if they self-identified as autistic (n = 11), scored above 6 on the AQ-10 (n = 3), or failed to respond correctly to at least 4 out of the 5 catch trials (n = 1). We estimated the gender of participants using Prolific (41 identified as female; 31 as male, 1 prefer not to say); participants identified as Asian (n = 1), Black (n = 1), white (n = 58), mixed race (n = 12), or opted out (n = 2)**.**

Procedure. Each participant responded to 33 trials in randomized order: 9 Flexible (low frequency) Extensions (Table 1), 9 High Frequency (HF) trials, 10 Collocation trials and 5 catch trials. As illustrated in Figure 1, each trial began with the question: "Which word fits best in the following blank? <stimulus>," followed by four randomly ordered sentences, each containing a different filler of the missing word. No time limit was imposed.

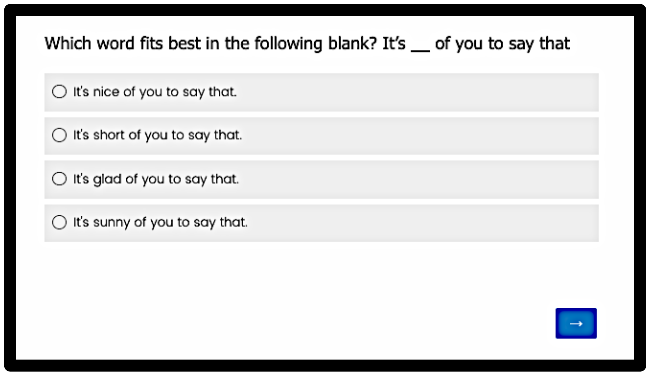

Figure 1: Example High Frequency trial (*nice* is the target, *short, glad* and *sunny* are considered incorrect).

4. Results.

High Frequency Trial Accuracy

Recall participants needed to respond correctly on the HF trial in order for their corresponding low-frequency (LF) trial accuracy to be included in the analysis. As shown in Table 4, more trials needed to be eliminated for AS participants than non-AS participants (β = -2.57, z = -3.54, $p < .001$). We return to this aspect of the data in study 2.

# of Trials Correct	**# of AS participants**	**# of non-AS participants**
2	1	0
3	0	0
4	1	0
5	2	0
6	6	0
7	9	1
8	5	7
9	50	66
Total	***74***	***74***

Table 4. Number of HF trials correctly responded to by participants in each group (ranging from 2 to 9 out of 9).

Pre-registered analysis. We predicted that AS adults would perform less accurately on Flexible Extension trials than the non-AS adults, while performing at least as well on Collocation trials. We first use the preregistered model to analyze the full data set (n = 74 AS; 74 non-AS). As planned, a generalized linear mixed effect model was created with accuracy as the output variable; AS status interacting with Trial Type (Flexible or Collocation), and education as fixed effects. Random intercepts and slopes were included for subjects and items. This model failed to converge (see SI for specifics), so we simplified to include only intercepts and slopes for AS status on items. Results are shown in

Figure 2. AS participants were significantly less accurate than non-AS participants ($\beta = -1.94$, $z = -4.63$, $p < 0.001$); Flexible (LF) Extension trials also negatively impacted performance ($\beta = -1.80$, $z = -2.49$ $p = 0.01$). The predicted interaction approached significance in the predicted direction ($\beta = 0.79$, $z = 1.91$, $p = 0.06$). In the AS group, 32% scored at ceiling on Flexible extension trials (24/74), while 61% of the non-AS did (45/74). Educational attainment positively predicted accuracy ($\beta = 0.10$, $z = 4.00$, $p < .001$), although there was no significant difference in years of schooling between groups ($M = 14.7$ years for non-AS; $M = 14.1$ years for AS).

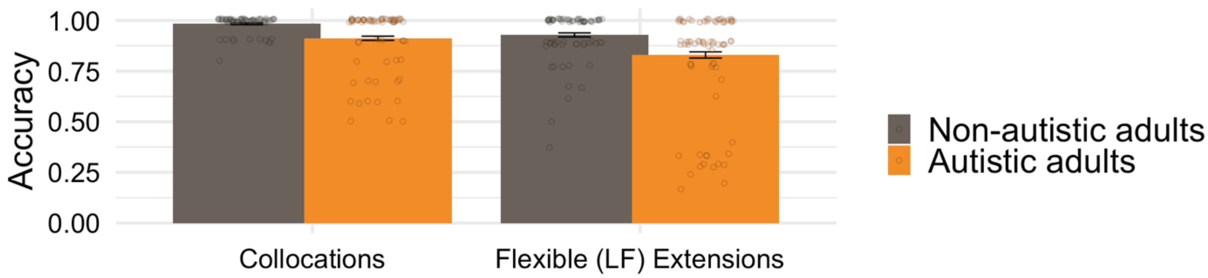

Figure 2: Performance of all participants ($n = 74$ AS; $n = 74$ non-AS) on Collocations and Flexible (Low Frequency) trials in study 1. The autistic group is represented by orange bars. Points represent individual participants' mean accuracy

Exploratory analyses: Matching collocation accuracy. Given the overall lower performance of the AS group, the marginal interaction and the unanticipated effect of education level on accuracy, in an exploratory analysis, we matched groups on familiarity with collocations in order to take a closer look at performance in the Flexible (LF) extension condition. The lowest cutoff yielding nonsignificant group differences on the collocations ($p > 0.05$) was 0.71, so we excluded participants who scored below this threshold to compare performance on Flexible (LF) extensions between the two groups, when matched on all criteria available to us.

Matched participants. The resulting sample consisted of 61 AS participants and all 74 non-AS participants. This sample was better matched insofar as there were no longer significantly more HF trials that needed to be eliminated for AS than non-AS participants ($\beta = -0.55$, $z = -0.43$, $p = 0.67$), and no longer any influence of education on accuracy ($\beta = -0.01$, $z = -0.05$, $p = 0.96$) in the generalized linear mixed-effects model with Flexible (LF) Trials as an outcome, autism status and years of education as fixed effects. The model includes random intercepts for subjects and random intercepts and slopes (AS status) for items. Given the differences in sample sizes, we weighted the influence of participants rather than excluding any additional data, with weights of 1.82 for non-AS and 2.21 for AS. In this better-matched subgroup, the AS group displayed significantly lower accuracy on the Fixed (LF) extension trials than their non-AS peers ($\beta = -1.01$, $z = -2.01$, $p = 0.04$).

4. Discussion of study 1. We hypothesized that AS adults would find Flexible (LF) extension trials particularly difficult and the exploratory analysis indicates that they do. At the same time, a good deal of individual varation is evident in our full samples. A sizable proportion of autistic individuals showed good skill in flexibly extending the familiar constructions, with 32% scoring at ceiling on Flexible extension trials. At the same time, nearly twice as many non-AS partcipants performed at ceiling on these trials (61%).

The full AS group performed less accurately overall. They made more errors in the High Frequency condition than the non-AS group. And our pre-registered analysis showed autistic adults underperformed on both Collocations and Flexible (LF) Extensions. Results also demonstrated that education positively predicted accuracy across the board. A marginal interaction suggested the AS group performed especially poorly on the Flexible Extensions, as predicted. This led us to better match the two groups in an exploratory analysis on a subsample of participants that did not differ significantly on their performance on collocations. We then ran the same analysis on all remaining participants.

This subset of 61 AS participants better matched the full non-AS group in two ways beyond their performance on collocations. They no longer made more errors on the High Frequency fillers and there was no longer any effect of education on accuracy (while the two groups remained matched on education level).

As planned, for Flexible extension trials to be included in the analyses, we required that the same participant provided an accurate response on the corresponding high-frequency trial, to ensure that participants were familiar with the constructions that needed to be extended.

Results on the better matched groups, showed the AS participants performed less accurately on Flexible (low frequency) extensions. This was hypothesized, since Flexible Extension trails required participants to flexibly extend familiar expressions in order to identify a plausible but low-frequency filler word in a four-alternative-forced choice task. Thus, the exploratory analysis is consistent with the hypothesis that autistic individuals find it more challenging to extend familiar linguistic constructions than their non-autistic peers, when matched on accuracy on collocations, familiarity with the constructions, and education level. It thus extends previous work that had focused on autistic adults' ability to flexibly extend word meanings (Cuneo et al., 2024), as current evidence indicates that autistic participants find it more challenging than well-matched non-autistic peers to extend familiar phrasal patterns in new ways.

5. Motivation for study 2. Challenges generalizing or flexibly extending linguistic categories may stem from several sources. It could be that categories are represented the same way among AS and non-AS adults, and that autistic individuals are less inclined to use language in novel ways due to a general avoidance of novelty. As aspect of the results in the full sample of AS participants in study 1 leads us to an alternative hypothesis. Recall that the full group of AS participants found it more challenging to accurately choose the high-frequency target word from among unacceptable or implausible foil options than their non-AS peers. Although this effect was eliminated in the better-matched subset of participants used in the exploratory analysis, it is possible that the 4AFC task used in study 1 facilitated performance by reducing accessibility demands: participants in study 1 only needed to recognize the best option in a 4AFC task.

In study 2, we ask participants to *generate* fillers for open slots. Of particular interest is whether AS and non-AS participants spontaneously converge on the same first word when filling in a blank (e.g., "She ___ him something"). Groups were matched and binned by education level. We also include a measure of verbal fluency to determine whether any differences are due to general fluency effects rather than an ability to generate prototypical fillers. If AS adults are less likely than their non-AS peers to generate the same filler word while showing equivalent (or stronger) verbal fluency, it will be taken to indicate that the two groups may represent categories differently. In particular, insofar as the generation of prototypical instances of categories indicates a "center of gravity" among exemplars, we hypothesize that a reduced tendency to access and produce the most prototypical filler word would indicate that categories that are less tightly clustered around prototypical instances.

Support for the idea that prototypical instances may be less accessible to autistic individuals comes from the domain of conceptual and perceptual categories. Autistic children have been found less likely to produce prototypical exemplars when asked to name instances of a category (Dunn et al., 1996). Similar effects have been extensively studied in the visual domain (for review, see Vanpaemel et al, 2021). Thus, we predict that autistic participants will show a reduced tendency to spontaneously produce prototypical fillers of grammatical constructions in comparison to their non-autistic peers, when matched on education level and verbal fluency.

Study 2: Accessibility Of Prototypical Instances. Study 2 asks participants to generate slot-fillers for eight instances of familiar, semantically constrained constructions (see Table 5).

She __ him something.
It's __ of you to say that.
He __ his way to the front.
She __ it on the table.
She drove him __.
She __ at him.
She __ the night away.
He __ them into doing something.

Table 5: Stimuli used in Study 2.

It investigates whether autistic adults are as likely as non-autistic adults to converge on the same filler words for each phrase. We reasoned that if autistic individuals form implicit clusters atypically or not at all when representing a category of key words appearing in a construction, they will show less consensus on the first filler word they produce, since the first word tends to be semantically prototypical and highly frequent. We therefore analyzed the extent that each group, binned by education level, converged on same word, for each construction; we also used the more sensitive measure of entropy (variability) among first choices in both groups. Finally, we analyzed whether the highest consensus words appeared among the top three words produced by both groups, to determine whether both groups are implicitly aware that the most prototypical filler was appropriate, even if one group was less likely to produce it as the first filler. Given the findings of educational attainment in Study 1, participants were grouped and recruited at different education levels as a rough proxy for exposure to written language. A phonological verbal fluency task served as an additional metric of verbal fluency.

6. Study 2 Methods

Participants

A new group of 80 AS adults (between 18 to 69 years old: M = 37.6) were recruited through the SPARK database and prescreened as for study 1: they had to have been diagnosed with autism be living independently; and score 6 or above on the AQ-10, a standard assessment used to recommend further screening. Twenty of the autistic adults had education up to high school (hereafter, HS); 30 attended 1-4 years of college (College); and another 30 had earned a master's degree or higher (Masters). The gender of participants is estimated to be 54 identifying as female; 26, as male, based on proportions in our database of SPARK participants (a coding error prevented us from collecting this information). Autistic participants reported their race as Asian (3), Black or African American (3), White (61), Mixed Race (9), or Other (4).

We also recruited 80 non-autistic participants on Prolific in the same age range (M = 42.1), after exclusions for a diagnosis of autism or scores of 6 or higher on the AQ-10. Non-autistic participants were prescreened in order to match the education level bins of the autistic group using criteria supplied by Prolific: 20 HS; 30 College; 30 Masters. Forty-eight identified as female, 32, as male. Non-autistic participants reported their race as Asian (4), Black or African American (13), Hawaiian or Pacific Islander (1), white (60), and mixed race (2).

Stimuli

Experimental stimuli are provided in Table 5. The consensus fillers for each stimuli were determined by AS status, further divided by (three) education levels each, for a total of 6 groups.

Procedure

The experimental task and phonological fluency measure were presented in counterbalanced order across participants, in each group, to avoid differences based on potential fatigue effects. In the experimental task, participants were presented with 8 phrases, each containing a missing key word (see Table 5), one at a time in randomized order. For each, participants were asked to generate as many words as possible to fill in the blank appropriately. Participants who produced fewer than 3 filler words per phrase were excluded, as a way of ensuring that we included only participants who were familiar with the phrase as an instance of a productive pattern, rather than an idiomatic exemplar.

The phonological verbal fluency measure simply asked participants to name as many words that began with the sound /s/ or /l/ as possible in one minute.

7. Results

Verbal fluency. Verbal fluency was analyzed with a linear mixed model in which the number of words generated was the outcome, group and education, as interacting fixed effects, and random intercepts for participants. The intermediate level (College) was the reference level for education in all analyses. There was no effect of Autism status on verbal fluency ($ß$ = -0.73, z = 1.24, p= 0.22). Participants with at most a HS education were marginally lower than those with some College ($ß$ = -1.13, z = -1.72, p = 0.087). There was no difference in verbal fluency between those with some College or Masters ($ß$ = 0.67, z = 1.12, p = 0.27).

Consensus on participants' top choice was measured in three related ways. As preregistered, we first simply consider whether each group, divided into bins by education level, tended to produce the same consensus word, for each stimulus. We separately analyze each group by item, and then by proportion of items for which each participant provided the consensus word. Finally, we use a more sensitive analysis of entropy (disorder), which can only be calculated at the group level.

Consensus reached across items, for each group subdivided by education level. To predict the extent to which subgroups chose the same most common word in their subgroup (the *consensus* *word*). Subgroups were determined by autism status and education bin: As described in the Participant section, bins included participants with at most a High School education (n = 20 AS; n = 20 non-AS), some College (n = 30 AS; n = 30 non-AS), and master's or above (n = 30 AS; 30 non-AS). As planned, a linear mixed effect model was created with the proportion of consensus across items as the outcome variable. Group (AS or non-AS) and education level were fixed factors, and random intercepts and slopes were included for items. This analysis revealed that HS education showed a marginally negative effect on consensus (β = -0.07, t = -1.91, p = 0.06), (see SI for full model), but no effect of autism (β = -0.05, t = -1.31, p = 0.20).

Given the influence of HS education on verbal fluency and on consensus, we next performed exploratory analyses with the HS group excluded. The same linear mixed effect models were run on the remaining 60 autistic adults and 60 non-autistic adults, who all had at least some college education. This shows significantly lower degree of consensus for the autistic group (β = -0.05, t = -2.47, p = 0.02) and no effect of education bin (College vs Masters) (β = 0.01, t = 0.58, p = 0.57). The difference in consensus by item is depicted in Figure 3.

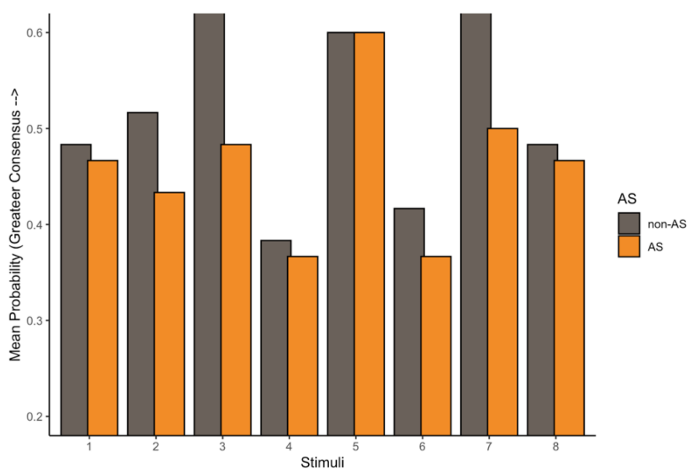

Figure 3: Comparison of non-autistic (brown) and autistic (orange) groups in probability of choosing the consensus word on each stimuli (x-axis) for all participants with at least some college education.

Entropy. Entropy scores were normalized to facilitate comparison across items so that entropy ranged from [0, 1]. To predict the entropy of the first word produced, a linear mixed effect model was created with group (AS or non-AS) and education bin as interacting fixed factors, along with random intercepts and slopes (for group) on items.[2] As in study 1 and in the consensus analysis of study 2, we see a main effect of education level: participants with education up to HS had

[2] Each subgroup of participants tended to produce the same word most frequently, for each construction, with the exception that autistic participants favored *nice* and non-autistic participants favored *kind* in *It's __ of you to say that.* Both adjectives are highly frequent options in corpus data (Davies, 2008) and are near synonyms. Since *nice* and *kind* were the top two most frequent words in all groups, we do not consider this difference meaningful.

higher entropy (more disordered responses) than the rest of the sample: ($\beta = 0.06$, $t = 2.07$, $p < 0.05$). There was no main effect of autism status ($\beta = 0.03$, $t = 1.00$, $p = 0.32$). We next performed an exploratory analyses with the HS group excluded. The same linear mixed effect model was run on the remaining 60 autistic adults and 60 non-autistic adults, who all had at least some college education, divided into subgroups by education level and autism status. This analysis revealed marginally higher entropy for the autistic participants compared to their non-autistic peers ($\beta = 0.03$, $t = 1.83$, $p = 0.08$).

Proportion of consensus for participants, across items. The analysis just described calculated consensus at the group level, so it did not allow us to look at the data by participant. We therefore also tested the proportion of agreement as a binary factor on whether the consensus word was produced across items, for each of the 120 participants with above HS education. A generalized linear model was used to predict proportion of participant consensus, with fixed effects of group and education level. This analysis allows us to treat education as a gradient factor. Random intercepts were included for subjects and items. Gradient education level was not predictive ($\beta = -0.01$, $z = -0.18$, p = 0.86). The model shows a marginally lower degree of consensus for autistic participants ($\beta = -0.29$, $z = -1.75$, $p = 0.08$).

Analysis of top three words. The previous analyses focused on the first word produced by each participant for each item. We additionally analyzed the first three words produced by each participant to see whether the consensus word was produced among participants' top three words, including only participants with at least high school education. To this end, we applied the same models—consensus by participant and entropy (by group). Neither of the models showed a significant influence of autism status. A linear mixed-effects model at the group level assessed entropy: ($\beta = -0.01$, $t = -1.33$, $p = 0.20$). A generalized linear mixed effect model at the participant level assessed consensus ($\beta = -0.04$, $z = -0.48$, $p = 0.63$).

8. Discussion of study 2. We hypothesized that the autistic individuals' categories may be less tightly clustered around prototypical instances in comparison to non-autistic adults. This predicted that groups of autistic individuals would be less likely to spontaneously produce the most prototypical fillers for familiar constructions. The preregistered analyses tested a binary factor for choosing the highest consensus word on each item for both groups, subdivided into three levels of education. We also ran a group analysis using entropy scores as a more sensitive measure of the degree of variation (higher entropy) in first responses at the group level. No difference in consensus or entropy between AS and non-AS groups were detected when the full set of 160 participants was considered. Results did show a general influence of education level, with those with at most HS education displaying less consensus in their productions of slot-fillers and correspondingly marginally higher entropy than participants with more years of education. This group is likely to have had less experience with written language, which would afford them less opportunity to learn conventional formulations (see also Dabrowska, 2004). Also relevant is this subgroup's marginally lower verbal fluency, which may have made it somewhat more challenging for them to access the most conventional fillers in the experimental context (Goldberg & Ferreira, 2022). The HS groups (20 AS and 20 non-AS) were also smaller in size than College (30 AS; 30 non-AS) or Master's (30 AS; 30 non-AS), which may have made consensus harder to detect.

Because of these differences, we conducted exploratory analyses on the 120 participants who had at least some college education. Here the autistic group showed significantly less consensus on their top choices than their non-autistic peers and a related marginal increase in entropy. That is, in this subset, matched autistic participants were less likely to produce the same word first, and their responses overall were correspondingly marginally more variable in comparison to their non-autistic peers. We see a similar marginal effect of autism when consensus was determined at the individual level, which allowed us to include random intercepts for participants, and education as a gradient factor. These exploratory analyses conceptually replicate the finding in Study 1, where the autistic group as a whole made more errors on the four alternative forced choice task involving High Frequency fillers (recall Table 1). Taken together, these results underscore modest but consistent challenges in accessing the prototype across *both* forced-choice and free-response tasks. The difference is not likely to stem from a lack of understanding that the consensus word was appropriate in the provided expressions, since the analyses of the top three words generated showed no differences between groups. Verbal fluency was also not different between the groups in the final analysis. If, as hypothesized, autistic participants do not attend to semantic relatedness to the same extent as non-autistics, the categories that autistic individuals use to access the most prototypical filler may be less tightly connected and therefore less easily accessible. At the same time, we recognize that the difference is only evident when the HS participants were excluded.

9. General Discussion and Conclusion. The current two studies are the first to experimentally test whether autistic adults differ from non-autistic adults in their ability to generalize and extend language patterns beyond the level of word meanings. In both studies, when relatively large groups of participants are well-matched (on collocations in study 1) and verbal fluency and education (study 2), the predicted influences are evident: autistic individuals were challenged when required to flexibly extend familiar constructions (study 1) and were also somewhat more challenged in identifying prototypical instances of familiar constructions (studies 1 and 2).

Study 1 was designed to compare autistic and non-autistic adults' skill on flexible extensions of grammatical constructions. We reasoned that the low-frequency fillers would generally require flexible extensions, predicting that autistic participants would struggle when only a low-frequency filler was offered, along with three options that were inappropriate. Our planned analysis revealed that autistic groups performed worse across the board, with more years of education resulting in better performance and only marginally weaker performance on the low-frequency extensions. Because groups did not differ significantly on years of education, we decided to anchor performance on collocations with the goal of exploring the marginal interaction and potentially eliminating the influence of education on accuracy. The resulting groups were better matched: there was no longer a difference in identifying the high frequency fillers and no influence of education on performance.

In this subgroup of participants, autistic adults *were* significantly less accurate on the Flexible (LF) extension trials than the non-autistic adults. That is, autistic participants demonstrated greater difficulty with flexible extensions, when well-matched with non-autistic peers. This extends prior research that had identified difficulties in novel meaning extensions at the word level (Cuneo et al., 2024), by testing whether autistic adults have difficulty extending meaning grammatical constructions as well as words, even in four alternative forced choice tasks which restrict potential options to a limited set.

Study 2 was motivated by the unanticipated finding in study 1 that the full sample of autistic adults was less accurate in identifying prototypical (high frequency) instances of familiar patterns in the four alternative forced choice task. While this effect was eliminated in the subgroup that was better-matched, we reasoned that the four alternative forced choice task may obscure potential subtle differences between groups. Study 2 therefore used a free-response task to examine the extent to which subgroups of autistic and non-autistic groups, binned by education level, converged on the same first words when supplying filler words for grammatical constructions. We emphasize that the difference in accessing consensus fillers of familiar constructions is indeed fragile: lower education level (and/or verbal fluency differences) obscured any difference in the autistic group in study 2. Only when groups were matched on having attended some college in an exploratory analysis did we see the predicted effect on group consensus: autistic individuals were less likely to converge on the same consensus word than non-autistic peers; in this group there was no difference in verbal fluency. We also note that the consensus word was just as likely to be included in participants' top three responses by autistic and non-autistic adults alike. We take the combination of results to suggest that the most prototypical fillers of constructions are available to autistic adults but may be less accessible.

The current findings are consistent with our hypothesis that autistic adults face subtle but persistent challenges in generalizing phrasal constructions: flexible extensions of grammatical constructions seem to be particularly challenging, and the prototypical instances of constructions appear to be less accessible. But this is just a first step toward better understanding the nature of generalizations of grammatical constructions by autistic individuals. It is important and relevant because language is composed of more than individual, isolated words: grammatical constructions play a crucial role in language and require generalizations and flexible extensions. While much of the autistic language literature focuses on individual words and concepts, the current work focuses on language beyond the level of individual words.

To be sure, not all autistic adults showed evidence of finding either task challenging. In our samples of autistic individuals who live independently, nearly a third performed at ceiling in study 1 when required to flexibly extending familiar constructions, and a comparable proportion selected the consensus word first, for each phrase, in study 2. Further work is required to look at individual differences. We were limited in our ability to do so here, because different groups of people participated in the two studies. Nonetheless, group-level differences are detected when education level is matched, shows no influence, and is in fact quite high (including at least some amount of college).

Any differences in generalization or flexible extensions carry implications for everyday communication, where generalization and flexible language processing is essential. Language use demands flexibility, particularly in "good-enough" production and comprehension: Speakers rely on listeners' inferential skills to interpret incomplete or imprecise expressions (Ferreira et al., 2002; Goldberg & Ferreira, 2022; Ferreira & Patson, 2007). In this process, both speaker and listener must adaptively navigate meaning, bridging the gap between what is said and what is intended. For instance, imagine you're at a lunch, and someone says, *Please pass the cup*, but only coffee mugs are on the table. To accurately understand the request, the listener must rely on the speaker's intention (they want the mug) rather than focusing on the less precise word choice, *cup*. In fact, people often speak in a "good-enough" manner, sometimes prioritizing ease of word retrieval over precision (Koranda et al., 2022). In other words, people may select words that are more accessible, even if slightly less accurate, influenced by factors such as priming or frequency. This tendency affects both individual words and grammatical constructions.

From a constructionist perspective, language is learned through usage and shaped by flexible patterns rather than rigid rules. Speakers must adapt as they encounter and interpret new contexts and new meanings. The framework encourages us to consider how language flexibility interacts with autistic traits, especially in tasks that require extending or reinterpreting meaning. Challenges with flexible extensions may impact overall language proficiency in the autistic community, given that language frequently involves subregularities that allow flexible generalizations. Closer examination of strengths and weaknesses in language among autistic individuals could hardly be more critical. Language development is usually delayed in autistic children (e.g., Reindal et al., 2023; Clarke et al., 2024) and communication skill remains an ongoing challenge for many autistic adults (LeGrand et al., 2021).

While non-autistic individuals are recognized to cluster similar instances of constructions together in overlapping memory traces (e.g., Goldberg, 2019), verbal autistic individuals may cluster instances less tightly and instead rely more on individual memories of specific instances. In a paper documenting autistic adults' reflections on their language skills, one autistic adult shared, "I think I am fortunate that I've memorized so many idioms and metaphors that I'm able to do an instant translation in my head" (Cummins et al., 2020), suggesting that memorization may serve as a compensatory strategy. For individuals with more diffuse clustering patterns, as indicated among autistic adults in the current studies, "good-enough" language processing may present particular challenges, especially in aligning with non-autistic conversational expectations.

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Author Contributions

Both C and G contributed equally to the Conceptualization, Data Curation, Formal Analysis, Methodology, Visualization, and Writing–Review and Editing. C wrote the first draft of the manuscript, while C and G authors discussed the results and collaborated on the final manuscript.

Compliance with Ethical Standards

This study was approved by the Princeton University Institutional Review Board (IRB #4951). All participants provided informed consent prior to participation. There are no conflicts of interest related to this study.

References

Ahrens, Kathleen V. 1995. *The mental representations of verbs*. University of California, San Diego.

American Psychiatric Association. 1994. *Diagnostic and statistical manual of mental disorders* (4th ed.). American Psychiatric Association.

Bayes, Thomas. 1763. An essay towards solving a problem in the doctrine of chances. By the late Rev. Mr. Bayes, F. R. S. communicated by Mr. Price, in a letter to John Canton, A. M. F. R. S. *Philosophical Transactions of the Royal Society of London*, *53*, 370–418. https://doi.org/10.1098/rstl.1763.0053

Beversdorf, David Q., Brian W. Smith, Gregory P. Crucian, Jeffrey M. Anderson, Jocelyn M. Keillor, Anna M. Barrett, John D. Hughes, Gretchen J. Felopulos, Margaret L. Bauman, Stephen E. Nadeau, & Kenneth M. Heilman. 2000. Increased discrimination of "false memories" in autism spectrum disorder. *Proceedings of the National Academy of Sciences of the United States of America*. *97*(15), 8734–8737. https://doi.org/10.1073/pnas.97.15.8734

Bybee, Joan. 2010. *Language, Usage and Cognition*. Cambridge University Press. https://doi.org/10.1017/CBO9780511750526

Casenhiser, Devin & Goldberg, Adele E. 2004. Constructional fast mapping. *In Annual Meeting of the Berkeley Linguistics Society*, 447–455.

Clarke, Elaine B., James B. McCauley, Amy Lutz, Marina Gotelli, Stephen J. Sheinkopf, & Catherine Lord. 2024. Understanding profound autism: Implications for stigma and supports. *Frontiers in Psychiatry*. *15*, 1287096. https://doi.org/10.3389/fpsyt.2024.1287096

Cummins, Clare, Elizabeth Pellicano, & Laura Crane. 2020. Autistic adults' views of their communication skills and needs. *International Journal of Language & Communication Disorders*. *55*(5), 678–689. https://doi.org/10.1111/1460-6984.12552

Cuneo, Nicole, Sammy Floyd, & Adele E. Goldberg. 2024. Word meaning is complex: Language-related generalization differences in autistic adults. *Cognition*, *244*. 105691. https://doi.org/10.1016/j.cognition.2023.105691

Dabrowska, Ewa. 2004. *Language, Mind and Brain: Some Psychological and Neurological Constraints on Theories of Grammar*. Edinburgh University Press.

Dakin, Steven, & Uta Frith. 2005. Vagaries of visual perception in autism. *Neuron*, *48*(3). 497–507. https://doi.org/10.1016/j.neuron.2005.10.018

Davies, Mark. (2008–) The Corpus of Contemporary American English (COCA): 520 million words, 1990-present. Available online at http://corpus.byu.edu/coca/.

Diessel, Holger. 2019. Chapter 3: Usage-based construction grammar. In E. Dąbrowska & D. Divjak (Eds.), *Cognitive Linguistics—A Survey of Linguistic Subfields* (pp. 50–80). De Gruyter Mouton. https://doi.org/10.1515/9783110626452-003

Dindar, Katja., Loukusa, Soile., Leinonen, Eeva., Mäkinen, Leena., Mämmelä, Laura., Mattila, Marja-Leena., Ebeling, Hanna., & Hurtig, Tuula. (2023). Autistic adults and adults with sub-clinical autistic traits differ from non-autistic adults in social-pragmatic inferencing and narrative discourse. *Autism*, *27*(5), 1320–1335. https://doi.org/10.1177/13623613221136003

Dobbinson, Sushie , Perkins, Mick & Boucher, Jill. 2003. The interactional significane of formulas in autistic language. *Clinical Linguistics & Phonetics*, *17*. 299–307. https://doi.org/10.1080/0269920031000080046

Dunn, M., Gomes, H., & Sebastian, M. J. (1996). Prototypicality of responses of autistic, language disordered, and normal children in a word fluency task. Child Neuropsychology, 2(2), 99-108.

Eigsti, Inge-Marie, & Deborah A. Fein. 2013. More is less: Pitch discrimination and language delays in children with optimal outcomes from autism. *Autism Research*, *6*(6). 605–613.

Ferreira, Fernanda, Karl G. D. Bailey, & Vittoria Ferraro. 2002. Good-enough representations in language comprehension. *Current Directions in Psychological Science*, *11*(1). 11–15. https://doi.org/10.1111/1467-8721.00158

Ferreira, Fernanda, & Nikole D. Patson. 2007. The ‘good enough’ approach to language comprehension. *Language and Linguistics Compass*, *1*(1–2). 71–83. https://doi.org/10.1111/j.1749-818X.2007.00007.x
Floyd, Sammy, & Adele E. Goldberg. 2021. Children make use of relationships across meanings in word learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *47*(1). 29–44. https://doi.org/10.1037/xlm0000821
Floyd, Sammy, Charlotte Jeppsen, & Adele E. Goldberg. 2021. Brief report: Children on the autism spectrum are challenged by complex word meanings. *Journal of Autism and Developmental Disorders*, *51*(7). 2543–2549. https://doi.org/10.1007/s10803-020-04687-x
Goldberg, Adele E. 1995. *Constructions: A Construction Grammar Approach to Argument Structure*. University of Chicago Press. https://press.uchicago.edu/ucp/books/book/chicago/C/bo3683810.html
Goldberg, Adele E. 2003. Constructions: A new theoretical approach to language. *Trends in Cognitive Sciences*, *7*(5). 219–224. https://doi.org/10.1016/S1364-6613(03)00080-9
Goldberg, Adele E. 2006. *Constructions at Work: The Nature of Generalization in Language*. Oxford University Press.
Goldberg, Adele E. 2015. Compositionality. In *The Routledge Handbook of Semantics* (pp. 419–433). Taylor and Francis Inc.
Goldberg, Adele E. 2019. *Explain Me This: Creativity, Competition, and the Partial Productivity of Constructions*. Princeton University Press.
Goldberg, Adele E., Devin M. Casenhiser, & Nitya Sethuraman. 2004. Learning argument structure generalizations. *Cognitive Linguistics*, *15*(3). 289–316. https://doi.org/10.1515/cogl.2004.011
Goldberg, Adele E. & Fernanda Ferreira 2022. Good-enough language production. *Trends in Cognitive Sciences*, *26*(4). 300–311. https://doi.org/10.1016/j.tics.2022.01.005
Green, Georgia M. 1974. *Semantics and Syntactic Regularity*. Indiana University Press.
Griego, A. W., Datzman, Jared, Estrada, Steven M., & Middlebrook, S. S. (2019). Suggestibility and false memories in relation to intellectual disability and autism spectrum disorder: A meta-analytic review. *Journal of Intellectual Disability Research*, *63*(12), 1464–1474. https://doi.org/10.1111/jir.12668
Hillier, Ashleigh., Campbell ,Heather, Keillor ,Jocelyn, Phillips ,Nicole, & and Beversdorf, D. Q. (2007). Decreased false memory for visually presented shapes and symbols among adults on the autism spectrum. *Journal of Clinical and Experimental Neuropsychology*, *29*(6), 610–616. https://doi.org/10.1080/13803390600878760
Jackendoff, Ray. 1983. *Semantics and cognition* (pp. xiii, 283). The MIT Press.
Johnson, Matt A., & Adele E. Goldberg. 2013. Evidence for automatic accessing of constructional meaning: Jabberwocky sentences prime associated verbs. *Language and Cognitive Processes*, *28*(10). 1439–1452. https://doi.org/10.1080/01690965.2012.717632
Kapatsinski, Volya. 2014. What is grammar like? A usage-based constructionist perspective. *Linguistic Issues in Language Technology*, *11*(1). https://aclanthology.org/2014.lilt-11.2/
Karmali, Irfa, R. Douglas Greer, Robin Nuzzolo-Gomez, Denise E. Ross, & Celestina Rivera-Valdes. 2005. Reducing palilalia by presenting tact corrections to young children with autism. *The Analysis of Verbal Behavior*, *21*(1). 145–153.

Koranda, Mark J., Martin Zettersten, & Maryellen C. MacDonald. 2022. Good-enough production: Selecting easier words instead of more accurate ones. *Psychological Science*, *33*(9). 1440–1451. https://doi.org/10.1177/09567976221089603

Lakoff, George. 1987. Cognitive models and prototype theory. In *Concepts and conceptual development: Ecological and intellectual factors in categorization* (pp. 63–100). Cambridge University Press.

Lampri, Stella, Eleni Peristeri, Theodoros Marinis, & Maria Andreou. 2024. Figurative language processing in autism spectrum disorders: A review. *Autism Research*, *17*(4). 674–689. https://doi.org/10.1002/aur.3069

LeGrand, Kaya J., Lisa Wisman Weil, Catherine Lord, & Rhiannon J. Luyster. 2021. Identifying childhood expressive language features that best predict adult language and communication outcome in individuals with autism spectrum disorder. *Journal of Speech, Language, and Hearing Research*, *64*(6). 1977–1991. https://doi.org/10.1044/2021_JSLHR-20-00544

Levin, Beth. 1993. *English Verb Classes and Alternations: A Preliminary Investigation*. University of Chicago Press. https://press.uchicago.edu/ucp/books/book/chicago/E/bo3684144.html

Morsanyi, Kinga, Dušan Stamenković, & Keith J. Holyoak. 2020. Metaphor processing in autism: A systematic review and meta-analysis. *Developmental Review*, *57*. 100925. https://doi.org/10.1016/j.dr.2020.100925

Mottron, Laurent, Michelle Dawson, Isabelle Soulières, Benedicte Hubert, & Jake Burack. 2006. Enhanced perceptual functioning in autism: An update, and eight principles of autistic perception. *Journal of Autism and Developmental Disorders*, *36*(1). 27–43. https://doi.org/10.1007/s10803-005-0040-7

Ninio, Anat. 1999. Pathbreaking verbs in syntactic development and the question of prototypical transitivity. *Journal of Child Language*, *26*(3). 619–653. https://doi.org/10.1017/s0305000999003931

Perkins, Michael R., Sushie Dobbinson, Jill Boucher, Simone Bol, & Paul Bloom. 2006. Lexical knowledge and lexical use in autism. *Journal of Autism and Developmental Disorders*, *36*(6). 795–805. https://doi.org/10.1007/s10803-006-0120-3

Petrolini, Valentina, Marta Jorba, & Agustín Vicente. 2023. What does it take to be rigid? Reflections on the notion of rigidity in autism. *Frontiers in Psychiatry*, *14*. https://doi.org/10.3389/fpsyt.2023.1072362

Pinker, Steven. 1989. *Learnability and cognition: The acquisition of argument structure.* The MIT Press.

Prizant, Barry M., & Patrick J. Rydell. 1984. Analysis of functions of delayed echolalia in autistic children. *Journal of Speech and Hearing Research*, *27*(2). 183–192. https://doi.org/10.1044/jshr.2702.183

Reindal, Lise, Terje Nærland, Bernhard Weidle, Stian Lydersen, Ole A. Andreassen, & Anne Mari Sund. 2023. Structural and pragmatic language impairments in children evaluated for autism spectrum disorder (ASD). *Journal of Autism and Developmental Disorders*, *53*(2). 701–719. https://doi.org/10.1007/s10803-020-04853-1

Roediger, Henry L., & Kathleen B. McDermott. 1995. Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *21*(4). 803–814. https://doi.org/10.1037/0278-7393.21.4.803

Soulières, Isabelle, Laurent Mottron, Daniel Saumier, & Serge Larochelle. 2007. Atypical categorical perception in autism: Autonomy of discrimination? *Journal of Autism and Developmental Disorders*, *37*(3). 481–490. https://doi.org/10.1007/s10803-006-0172-4

Stribling, Penny, John Rae, & Paul Dickerson. 2007. Two forms of spoken repetition in a girl with autism. *International Journal of Language & Communication Disorders*, *42*(4). 427–444. https://doi.org/10.1080/13682820601183659

Tager-Flusberg, Helen. 1991. Semantic processing in the free recall of autistic children: Further evidence for a cognitive deficit. *British Journal of Developmental Psychology*, *9*(3). 417–430. https://doi.org/10.1111/j.2044-835X.1991.tb00886.x

Tek, Saime, Gul Jaffery, Deborah Fein, & Letitia R. Naigles. 2008. Do children with autism spectrum disorders show a shape bias in word learning? Autism Research, 1(4). 208-222.

Tomasello, Michael. 2003. *Constructing a language: A usage-based theory of language acquisition* (pp. viii, 388). Harvard University Press.

Valentino, Amber L., M. Alice Shillingsburg, Daniel Conine, & Nicole M. Powell. 2012. Decreasing echolalia of the instruction "say" during echoic training through use of the cues-pause-point procedure. *Journal of Behavioral Education*, *21*(4), 315–328. https://doi.org/10.1007/s10864-012-9155-z

Van Paemel, Wolf, & Janine Bayer. 2021. Prototype-based category learning in autism: A review. *Neuroscience and Biobehavioral Reviews 127*. 607-610.

Vygotsky, Lev. 1986. *Thought and Language*. MIT Press. https://mitpress.mit.edu/9780262720014/thought-and-language/

Weissweiler, Leonie., Mahowald, Kyle., & Goldberg, Adele E. (2025). Linguistic generalizations are not rules: Impacts on evaluation of LMs. *arXiv preprint arXiv:2502.13195*.

Wilson, A. C., & Bishop, D. V. M. (2020). Judging meaning: A domain-level difference between autistic and non-autistic adults. *Royal Society Open Science*, *7*(11), 200845. https://doi.org/10.1098/rsos.200845

Wojcik, D. Z., Díez, E., Alonso, M. A., Martín-Cilleros, M. V., Guisuraga-Fernández, Z., Fernández, M., Matilla, L., Magán-Maganto, M., Díez-Álamo, A. M., Canal-Bedia, R., & Fernandez, A. (2018). Diminished false memory in adults with autism spectrum disorder: Evidence of identify-to-reject mechanism impairment. *Research in Autism Spectrum Disorders*, *45*, 51–57. https://doi.org/10.1016/j.rasd.2017.11.001