WORD-MEANING VARIATION IN ENGLISH HAVE-SENTENCES: THE IMPACT OF COGNITIVE VS. SOCIAL FACTORS ON INDIVIDUALS’ LINGUISTIC CONTEXT-SENSITIVITY

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We investigate the role of two possible sets of factors, cognitive and social, in modulating an individual’s linguistic context-sensitivity: the capacity of a neurocognitive system to identify information in a communicative context that satisfies the meaning requirements of a given expression in that context. We assess whether the degree of contextual facilitation of an otherwise dispreferred reading of an English have-sentence is correlated with domain-general cognitive factors—by using the AUTISM-SPECTRUM QUOTIENT (AQ) to index an individual’s ‘autistic-like’ traits—and/or with social factors associated with gender expression—by using participants’ gender group.

Acceptability ratings \((n = 271)\) for a dispreferred but plausible locative reading were significantly higher only after the facilitatory context, suggesting that relevant context can modulate the acceptability of different readings of a have-sentence. Crucially, the degree of facilitation correlates with participants’ AQ scores, but not gender group, directly implicating cognitive variability in linguistic context-sensitivity differences, and leaving open the question of individual-level variability arising from social factors. Our findings are consistent with a model of language variation in which individuals with certain cognitive styles implement their grammatical knowledge at a larger ‘communicative scope’ than others, thereby inducing novel usage patterns of existing variants in their speech community.*

Keywords: sentence comprehension, contextual modulation, individual differences, meaning variation, cognitive style, autism quotient, gender

1. INTRODUCTION: INDIVIDUAL-LEVEL VARIABILITY IN LANGUAGE.

1.1. Motivating Questions. The way that individuals within the same speech community use language is systematic yet variable. Where does this variability come from? Boland et al. (2016) identify two sources for between-individual variability in language: INTERNAL, that is, features of an individual’s cognitive system, such as cognitive style, that undergird linguistic choices and processing, and EXTERNAL, that is, features of the communicative context, such as social dynamics.

The label COGNITIVE STYLE is used to refer to the generalized ways in which different individuals acquire and process information, which presumably emerge from variability in individuals’ underlying cognitive makeup (Kozhevnikov 2007, Kozhevnikov et al. 2014). One well-studied cognitive-style phenomenon relevant to language use is CONTEXT-SENSITIVITY. In its domain-general instantiation, context-sensitivity refers to the capacity of an individual for recognizing information relevant to the identification and interpretation of a given target. In cross-cultural psychology, this construct has been observed to correlate with behavioral differences between individuals from ‘Eastern’ and ‘Western’ cultures (Masuda & Nisbett 2001, Imada et al. 2013, San Martin et al. 2019), in cognitive psychology to correlate with behavioral differences between women and men.

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men (Bonanno & Burton 2013, Goubet & Chrysikou 2019), and in clinical psychology to correlate with behavioral differences between individuals diagnosed with AUTISTIC SPECTRUM CONDITION (ASC) and matched individuals without ASC (Mottron et al. 2000, Zilbovicius et al. 2006, Chawarska et al. 2012, Baez & Ibanez 2014, Palmer et al. 2015). In this latter domain, individuals with ASC have been shown to systematically exhibit less context-sensitivity than their matched neurotypical counterparts. This characterization falls in line with the well-established difficulties that individuals with ASC have with language use (American Psychiatric Association 2013), particularly in the case of pragmatic, or context-dependent, language (Pijnacker et al. 2009, Pijnacker et al. 2010).

By extension, systematic variability in linguistic behavior has also been found in individuals exhibiting so-called AUTISTIC-LIKE TRAITS, relative to individuals who do not display such traits (Stewart & Ota 2008, Nieuwland et al. 2010, Yu 2010, Xiang et al. 2013, Antoniou et al. 2016, Yoshimoto et al. 2017, Yang et al. 2018, Derrick et al. 2019, Lai et al. 2019). These two sets of findings show that autistic traits, clinical and subclinical, are correlated with generalized context-sensitivity as well as with certain aspects of context-dependent language.

Accordingly, we propose that the construct of LINGUISTIC CONTEXT-SENSITIVITY is a key contributor to variability in linguistic behavior. Hereafter, we define linguistic context-sensitivity as the capacity of a neurocognitive linguistic system to identify and integrate the information in the communicative situation prompted by the meaning requirements of a given linguistic expression in that situation. Accordingly, our primary research question is whether variability in the domain-general cognitive capacities that have been identified as autistic-like traits contribute to variability in linguistic context-sensitivity.

Secondarily, we question the role of gender in linguistic context-sensitivity. Gender group has been found to correlate with differences in ASC diagnoses and manifestations (American Psychiatric Association 2013, Parish-Morris et al. 2017), in context-sensitivity (Goubet & Chrysikou 2019), and in autistic-like traits in language (Yu 2010). Moreover, foundational work in the sociolinguistic variationist tradition has shown that gender group correlates with a variety of linguistic behaviors (Labov 1966, Trudgill 1972), though the mechanisms by which socially constructed gender directly contributes to linguistic differences—or instead reflects other social factors that generate linguistic differences—remains an area of active research (Eckert & McConnell-Ginet 2013, Talbot 2019). These patterns raise the question: do differences in gender group, or differences in behavior that are associated with gender group but originate from differences in other social factors, like position in an asymmetric social power structure, contribute to variability in linguistic context-sensitivity? These questions are the focus of our present work.

1.2. APPROACH. In order to address these questions, we first identify a linguistic construction that requires contextual information for its interpretation to serve as an explicit test of an individual’s context-sensitivity and also identify the indices for

1 We use the term ‘autistic-like traits’, established in the psychological literature, to refer to traits that have been clinically associated with ASC but are understood to manifest subclinically throughout the entire general population. This follows the perspective of the broader autism phenotype (Piven et al. 1997, Constantino & Todd 2003, Sucksmith et al. 2011, Braiten et al. 2018, among others), which takes all members of a speech community to fall along a continuum of exhibiting these traits, such that linguistic behavioral differences connected to constructs like mind-reading ability or context-sensitivity can be correlated with indices of these autistic-like traits.
autistic-like traits and for the social factors manifested through gender—two potential contributors to linguistic context-sensitivity. For the linguistic construction, we make use of English *have* in the context of the location-possession semantic domain. We presented participants with *have*-sentences in the NP-V-NP configuration whose degree of acceptability is modulated by the semantic content of the preceding context. Acceptability judgments for *have*-sentences with a locative reading, a reading that is available but typically dispreferred, have been shown to increase following relevant and facilitatory contextual information (Zhang et al. 2018). This increase in acceptability, that is, the difference between a target *have*-sentence following a supportive context versus the same target following a nonsupportive context, serves as a measure of linguistic context-sensitivity.

The variables indexing the potential sources of context-sensitivity are the AUTISM-SPECTRUM QUOTIENT (AQ) score, as the index of potential cognitive factors, and gender group, by participants’ self-report, as the index of potential social factors. We assess how each measure correlates with any changes in acceptability across individuals in the context-modulation paradigm, thereby indicating their respective degrees of impact on the comprehender’s ability to construe an interpretable semantic representation. If variability in cognitive factors is a source of variability in context-sensitivity, then participants with lower AQ scores will respond more to changes in the context; if the social factors manifested through gender are a source of variability in context-sensitivity, then we will observe a difference between gender group in the effect of context type (supportive versus nonsupportive) on the acceptability of the target sentence above and beyond the effect of the AQ.2

The remainder of our article is organized as follows: we first describe the two possible factors in linguistic variability under consideration, as well as the measures that have been used to index them (§1.3). Section 2 then outlines the properties of English *have*-sentences, the contextually modulated linguistic structure we make use of to elicit variability. The experimental study is detailed in §3, followed by the presentation of the findings. We conclude with a discussion of the ramifications of the results for our understanding of language use, variation, and, possibly, change.

1.3. Possible sources of variability.

Cognitive factors as indexed by ‘autistic-like traits’. One possible source for variability in linguistic context-sensitivity lies in the view that context-sensitivity is a function of cognitive style. In other words, it is possible that differences in domain-general cognitive dispositions lead to certain individuals being more context-sensitive than others. Kozhevnikov et al. (2014), in an interdisciplinary analysis of different cognitive styles, identify psychological dimensions as parameters for variability in cognitive style. We take three of them to be particularly relevant for context-sensitivity and list them here with the context-sensitive pole of the dimension preceding the context-insensitive pole of the same dimension: (i) integration versus compartmentalization: the ability to see atomic units composing into larger structures versus seeing units as individual

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2 It is true that the AQ has been shown to correlate with gender in that women as a group show lower AQ scores than men as a group do (see §1.3 for a discussion of these findings). Given this, it is expected that women as a group should show more context-sensitive behavior than men as a group, though in both cases the individual distributions are highly overlapping. However, what we investigate here is whether gender group captures variability above and beyond any variability captured by the AQ measure. Accordingly, we expect that if the AQ is the critical source of variability, its effect will manifest in the same way across the two gender groups.
entities; (ii) innovation versus adaptation: the tendency to question convention and propose novel approaches versus accepting established procedures for a task; and (iii) intuitive versus rule-based processing: the preference for flexible/pragmatic versus rigid/conventionalized information processing.

The psychological construct of context-sensitivity has also been explored in the ASC literature, as individuals diagnosed with ASC are widely reported to show lower sensitivity to context in experimental tasks than matched neurotypical peers. These tasks involve not only language processing (Brock et al. 2008, Pijnacker et al. 2009, Pijnacker et al. 2010) and language learning (Dörnyei 2005, Dörnyei & Ryan 2015), but also social attention (Zilbovicius et al. 2006, Chawarska et al. 2012, Baez & Ibanez 2014) and visual and music perception (Mottron et al. 2000, Palmer et al. 2015).

The predominant framework for accounting for these low context-sensitivity effects is the weak central coherence (WCC) account of ASC (Frith 1989, Frith & Happé 1994). The WCC account proposes that the source of the behavioral differences associated with ASC is not an inherent disability per se, but a cognitive style focused on local, rather than global, processing. A local processing style is understood as attending to and focusing on details/atoms first and foremost, while a global processing style is understood as attending to and focusing on overall configurations/gestalts first and foremost (Navon 1977, Kimchi 1992), aligning with dimension (i) from Kozhevnikov et al. 2014 above. Such a perspective can account for not only the sociocommunicative difficulties but also the heightened perceptual and ‘savant’ abilities associated with ASC (Happé 1997, Happé & Frith 2006). The enhanced perceptual functioning (EPF) account, an alternative to the WCC, also focuses on the idea of a local bias, though it attributes the bias not to a cognitive style, but to disproportionately enhanced abilities at the local, perceptual level (Mottron et al. 2006). Yet another view, detailed in Plaisted 2001, proposes that the inability to perform more global processes arises from an inability to generalize (i.e. recognize similarities across stimuli and structure pieces of information together), rather than from an asymmetric ability in or predisposition toward local processing.

While arbitrating between theoretical accounts of ASC is not in the scope of our work, these findings provide possible explanations for largely overlapping bodies of evidence. In particular, the WCC and EPF accounts converge on the prediction that individuals with ASC will show greater impairment in their performance of linguistic tasks that demand an integration of linguistic input with the larger linguistic context, in contrast to linguistic tasks that do not demand such contextual integration. Reported evidence bears this prediction out. Nuske and Bavin (2011) tested narrative comprehension in children ages four to seven and found a performance asymmetry: whereas children with ASC and their age-matched typically developing controls score similarly on local-processing questions probing details and fact-based recall, the typically developing children show improved performance on global-processing questions probing main ideas and inferential processing. While the similar local processing scores, in terms of group means, would seem to support only the WCC, the ASC group showed much higher variability in their scores, which is not inconsistent with an EPF approach. This observation, in line with the well-known heterogeneity of ASC trait presentation, underscores the importance of characterizing individual-level variability in language behavior.

Crucially, and following the broader autism phenotype framework, the reconceptualization of ASC as the degree of ‘local bias’ in processing, as a gradient cognitive style rather than a categorical dysfunction, suggests the existence of a similar bias in nonautistic individuals in the population at large (Piven et al. 1997, Constantino & Todd 2003, Sucksmith et al. 2011, Bralten et al. 2018, among others). The broader autism...
phenotype framework takes characteristics of ASC to be subclinical manifestations of personality traits in the neurotypical population. Indeed, recent work has already characterized such a local-versus-global-processing bias difference in domains as diverse as face perception (Stevenson et al. 2018), object decision/classification (English et al. 2017, Gerlach & Poirel 2018), susceptibility to optical illusions (Chouinard et al. 2016), motor-control planning (Job et al. 2017), and predisposition to post-traumatic stress disorder symptoms (Hagenaars et al. 2016), all for neurotypical populations. Relevant to the present effort, one tool exists to carry out this cognitive style characterization, the AQ. This questionnaire measures the degree of autistic-like traits, as emerging from general cognitive dimensions of variability, in the general population (Baron-Cohen et al. 2001). The AQ comprises fifty items in which participants self-report agreement with ‘I-statements’ capturing the five principal categories of traits associated with ASC: attention to detail, attention switching, communication, imagination, and social skills (Baron-Cohen et al. 2001). We further detail the mechanics of this psychometric instrument in §3.3, but assert here that the utility of such a gradient tool allows for operationalization of gradience in autistic-like traits in the population at large.

As we see below, this setup for a context-sensitive cognitive style is supported by evidence from linguistic behavior. Specifically, the AQ has been used as a tool in language studies in neurotypical populations to index a context-sensitive cognitive style at all levels of linguistic use: phonetic, syntactic, and semantic/pragmatic. Because context-sensitivity decreases with a higher degree of autistic-like traits, low AQ scores are taken to indicate high context-sensitivity, while high AQ scores indicate low context-sensitivity. We note that the AQ may not necessarily manifest linguistic context-sensitivity in a uniform way, especially in light of the three possible cognitive dimensions of linguistic context-sensitivity from Kozhevnikov et al. 2014. To our knowledge, Stewart and Ota (2008) were the first to use the AQ in a linguistic task; they showed that in line with dimension (i) above, high-AQ (less context-sensitive) participants are less able to use lexical information in discriminating between ambiguous phonetic strings. They attribute this to a bias toward compartmentalization of acoustic and lexical information. No differences were found between high-AQ and low-AQ individuals in their baseline acoustic acuity or lexical access abilities, suggesting a dispreference for integrating these types of linguistic information (dimension (i)) or, in our view, an (unconscious) resistance to using contextual information in an auditory discrimination task (dimension (iii)).

Subsequently, Nieuwland et al. (2010) report a correlation between high AQ scores (lower context-sensitivity) and nonattenuated comprehension of pragmatically underinformative statements, suggesting that less context-sensitive participants are less affected by contextually infelicitous stimuli. Xiang et al. (2013) report an acceptability judgment pattern whereby high-AQ (less context-sensitive) participants exhibit less pragmatic interference than low-AQ participants in negative polarity item (NPI) licensing constructions—a computation involving a syntactic long-distance dependency; this effect, however, was not borne out in real-time processing measures. In both studies, the differences between AQ groups were attributed to a diminished ability to integrate world knowledge with lexical knowledge (connecting to dimension (i)) and a greater

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3 This perspective underlies the concept of neurodiversity, which reframes traits associated with ASC as a natural manifestation of brain variability to be valued, rather than as a manifestation of a disorder or a deficit to be cured or treated. As such, it mirrors the well-established positivity of biodiversity (Baron-Cohen 2017, den Houting 2019, among others).
focus on incremental word-by-word relations rather than more global, phrase-by-phrase relations (connecting to dimensions (ii) and (iii)).

These reports are cohesive in ascribing differences in using or being affected by contextual information between high-AQ (less context-sensitive) and low-AQ (more context-sensitive) individuals and are consistent with the aforementioned accounts of ASC traits. These findings also advance the view that differences associated with autistic-like traits are not necessarily deficits, in line with the broader autism phenotype and neurodiversity ideas: high-AQ (less context-sensitive) participants in the Xiang et al. 2013 study, for example, actually showed less ‘deficit’ in terms of the NPI interference effect.

In an examination at the phonetic level, Derrick et al. (2019) report that high-AQ participants show poorer multisensory integration abilities: that is, they used the ‘right’ contextual phonetic information at the ‘wrong’ time. Previously, Derrick et al. (2009) showed, for a general population, that a puff of air on the skin helps disambiguate /pa/, a syllable beginning with an aspirated voiceless bilabial stop, from a silent video of a person pronouncing /pa/ or /ba/, but only when the puff of air occurs between 50 and 100 milliseconds after the visible lip opening. High-AQ participants, however, used the air-puff information to disambiguate the target well beyond that time window, which suggests not necessarily a problem with multisensory integration itself, but rather not having acquired the typically narrow perceptual windows of integration in development (Derrick et al. 2019). This finding nuances the general claim that individuals with autistic-like traits are less able or unable to use contextual information by showing that these individuals have difficulty using the right information at the right time. Pijnacker et al. (2010) present corroborating event-related potential (ERP) findings that high-functioning adults with ASC show a delayed or less-automatic—but not categorically absent—contextualization effect during real-time sentence comprehension. This asynchrony in contextualization ability, not the contextualization ability itself, could, in fact, be the source of the differences described in the first three studies.

From these reports, we can identify at least three possible specific traits or mechanisms that may potentially underlie linguistic context-sensitivity: (i) the detection of variation (baseline perceptual acuity), (ii) the actual ability to make use of the variants, or (iii) the willingness to allow for noncanonical variants to guide downstream processing; these last two align with dimensions (ii) and (iii) from Kozhevnikov et al. 2014 above.

Closer to our focus, Yu (2010), using a phonetic contextualization task, was the first to report an interaction between gender group and AQ to index context-sensitivity. In this study, men and high-AQ women overcompensate and normalize coarticulation effects, while low-AQ women undercompensate for these effects, thereby allowing context-induced phonetic variants to persist and percolate through a speech community. Here, context-sensitivity is operationalized as the ability to allow for variation. These results nuance possibility (ii) above—the ability to make use of variants—into two possible submechanisms: the assignment of significance and therefore utility to variants, and the actual ability to use those variants. We interpret the undercompensation to indicate an assignment of potential significance to these otherwise predictable coarticulatory effects. That is, certain individuals leave open the possibility that these variants could hold meaning, socioindexical or not, and thus passively allow them into their phonetic repertoire.

In these findings and in the broader literature, however, the connection between gender group and AQ remains unclear. The AQ has been shown to correlate with gender group (Hurst et al. 2007, Pisula et al. 2013, Lai et al. 2015, Ruzich et al. 2015, Grove et al. 2016), in line with the clinical correlation whereby men are diagnosed with ASC at a
much greater rate than women (e.g. Baron-Cohen et al. 2011). While it could be the case here that gender group and AQ simply are capturing similar variability at different resolutions, the underlying causes for the ASC-gender incidence asymmetry remain an open question. One possible answer casts the gender-group asymmetry as just a methodological artifact of linguistic camouflage, a phenomenon whereby certain individuals, generally women, are able to mask the specific ASC-associated social or communicative behaviors that the diagnostic tools are targeting (Parish-Morris et al. 2017). To sum this up, while the documented relationship between gender group and ASC and expression of autistic traits is well reported, the actual mechanisms that underlie these correlations remain unspecified. In the following section, we describe further some possible explanations for the association between gender-group effects and linguistic behavior.

The main takeaway from the body of work discussed above is that the AQ questionnaire is a potentially effective tool for organizing individual-level variability in autistic-like traits and therefore represents a viable instrument to measure indicators of context-sensitivity in linguistic behavior. This support notwithstanding, those studies do not tell us the underlying cognitive dimensions of linguistic context-sensitivity, nor do they indicate how contextual information features in language use. So, the question remains: on the assumption that it has a nonlinguistic, cognitive basis, how should linguistic context-sensitivity be understood such that we are able to measure it during language use? An answer to this question will bring us closer to understanding the cognitive capacities involved in the language contextualization process and how individual-level variability in these capacities gives rise to variability in language behavior.

Social factors as indexed by gender group. We include an exploration of gender in our investigation of linguistic context-sensitivity because of the reported gender-based effects in three of the relevant literatures: ASC and autistic traits (e.g. Yu 2010, Baron-Cohen et al. 2011, Parish-Morris et al. 2017), context-sensitivity (Bonanno & Burton 2013, Goubet & Chrysikou 2019), and language behavior (see Talbot 2019). While the implementation of gender as an experimental factor differs across these bodies of work, our position here is that the underlying human capacity for language is common to all individuals, regardless of their gender. Consequently, we take the existing findings involving gender-group differences in linguistic behavior to principally reflect social factors that manifest through gender. This follows the perspective described in Eckert & Labov 2017: given that (i) gender-based effects on a macrosocial scale typically center the culturally saliently binary male-female division, and that (ii) this distinction is already an abstraction over a number of performative practices, the correlation between any given variable and gender group is most likely to be an indirect correlation, through an intermediate, more salient variable typically associated with gender group (Ochs 1991). However, as the outward (and inward) manifestations of gender reflect a multitude of sociopsychobiological factors (Helgeson 2015, Polderman et al. 2018, Hyde et al. 2019), it remains an open question the extent to which gender-based differences emerge from social, psychological, or biological factors, or any combination thereof.4

4 As an example, we note specifically that while Yu (2010) suggests that a difference in biological capacity may contribute to the observed gender-group differences—namely, that women, as a group, may have a biologically based propensity to undernormalize for contextual variation, in contrast to men, as a group—the experimental setup is unable to really tease apart the possible factors underlying gender. For a discussion of distinct biological, social, and psychological factors as applied to a case of sound change, see Gordon & Heath 1998.
What are some of these social factors, and how do they connect to the relationship between gender and linguistic behavior? It has been proposed that an individual’s use of language is grounded, in part, in the social and cultural conditioning provided by the community into which an individual is born and where the individual develops. Specifically, gender category has been invoked as an organizing factor in an individual’s linguistic development (see Eckert & McConnell-Ginet 2013, Talbot 2019), due to the observation that the way children are socialized as speakers/producers and hearers/comprehenders in a speech community can vary in accordance with their gender identity. In cultures across the world, for example, there exist prescriptive divides in lexical items, grammatical constructions, and discourse practices for women and men based on sociocultural or religious norms: one notable case is Japanese joseigo ‘women’s language’ and danseigo ‘men’s language’, which comprise phonological, lexical, morphosyntactic, and conversational differences and are learned as early as ages three to six years old (Nakamura 2001).

Early work seeking to categorize the linguistic behaviors of women versus men attributed linguistic differences directly to gender (e.g. Furfey 1944) or possibly even sexual dimorphism (e.g. Gordon & Heath 1998); this operationalization of gender often targets, instead, the gender-normative behaviors that women and men are exposed to during childhood and are reinforced through their lifetimes (the ‘difference’ approach; see Tannen 1990, 1994, Eckert & McConnell-Ginet 2013, Kendall & Tannen 2015). Over time, the centrality of gender in linguistic organization has been further nuanced with the idea that an individual’s gender is not the only sociocultural source of variability in language. That is, to understand the relation between gender and linguistic behavior, gender must be contextualized within other factors like race and sexuality, two dimensions along which social power manifests asymmetrically across a speech community (Eckert & McConnell-Ginet 1999).

Later research on nonverbal expressions of gender have found that the performance of gender must be understood in the context of additional communicative factors like age, group size, task, power asymmetry, communicative (facial versus vocal) channel, and gender composition, which themselves modulate the expression of gender-normative behaviors (see LaFrance & Vial 2016). In fact, in the ‘dominance’ approach, so-called ‘gendered’ behaviors are taken to arise not solely from socialized (or psychobiological) differences at all, but also from the fact that gender groups typically occupy different positions within social structures, which inherently fall along power asymmetries (Eckert & McConnell-Ginet 2013). In this view, behavioral differences that surface as aligning with gender groups are crucially influenced by the different goals and resources available at each position or level within an asymmetric power structure. For the purposes of this study, we remain agnostic to the difference versus dominance perspectives of gendered language, and we take gender group, as an underspecified metric, to reflect the amalgam of social factors associated with gender expression.

The question here is whether those factors are connected to the variability in linguistic behavior that is associated with linguistic context-sensitivity: that is, with the cognitive capacity to identify in the communicative situation the information that meets the lexicosemantic requirements of a linguistic expression uttered in that situation. Our approach supports the perspective that human beings’ underlying capacity to produce and comprehend language may be mediated by social factors, resulting in behaviors that appear different when measured across any given social variable, such as gender, race, or sexuality. Crucially, it is not necessarily the case that any behavioral differences identified result from differences in capacity.
While we acknowledge the problematic nature of any categorization for gender that does not take into account the gradience of any given individual’s gender expression, particularly their participation in gender-normative or otherwise gendered linguistic behaviors, and in the absence of a continuous measure to organize gender as a gradient construct, we opt for a binary grouping that provides a conventional and informative starting place for exploring the relation of gender and context-sensitivity. Moreover, it offers a useful means of comparison to the documented patterns associated with gender group, particularly those of Yu 2010. With these limitations in mind, we adopt the binary grouping of gender as our index for the potential social bases of linguistic context-sensitivity.5 In what follows, we present the details of the linguistic construction that enables us to address our question.

2. Strategy: modulating context-dependent meanings. The interpretation of lexical have-sentences in English in the NP-V-NP form is said to be context-dependent because linguistic context alone can give rise to a variety of readings for the same syntactic string, ranging from incidental locative to both alienable and inalienable possessive (e.g. Myler 2016, Zhang et al. 2018, Zhang 2021). This construction is therefore useful in the investigation of linguistic context-sensitivity, because the context-dependent interpretation required for each ambiguous have-sentence directly impacts which reading is obtained. Specifically, the preferred reading for an NP-V-NP have-sentence is possessive; the locative reading is categorically dispreferred on its own and is made available only with context. In this way, a change in acceptability for the locative reading is a clear probe for context-sensitivity since it is a direct and exclusive result of contextual support. Accordingly, we can take the availability of each reading (indicated by a high or low acceptability rating), possessive or locative, to indicate the degree to which each individual is making use of the disambiguating contextual information provided.

In this section, we present a description of this have-construction and the conceptual infrastructure that underlies it, which in turn enables us to identify the role that context plays in its interpretation.

2.1. The location-possession domain. It is well known that the English verb have can express meanings of both predicative possession, as in 1, and location, as in 2 (Lyons 1967, Harley 1997, Sæbø 2009, Myler 2016).

(1) Sue has a bike.
(2) The tree has a bike near it.

This observation fits into a larger, well-studied crosslinguistic pattern where many languages encode the notions of location and possession using a single morphosyntactic form (Clark 1978, Freeze 1992, Stassen 2009, among others). This conflation, manifested as morphological syncretism, is attested in Indo-European, Finno-Ugric, Australian, Dravidian, African, Sino-Tibetan, and indigenous American languages (Aristar 1996, Heine 1997, Tham 2004). Such a widespread pattern of syncretism suggests that the meanings of location and possession are unified at the level of conceptual structure (Clark 1973, Jackendoff 1990, Clark 2004, Koch 2012).

The data in 3–5 illustrate a small sample of clear cases of how the same linguistic marker, typically a locative adposition, is used to express both incidental proximity (location) and ownership or control (possession) meanings across a variety of languages.

5 Ultimately, this first pass at connecting variability in the social factors that underlie gender expression to variability in linguistic context-sensitivity seeks to rule out this schematic operationalization of gender, with the larger intent of pursuing more enumerated measures for these social factors.
In such patterns, the arbiter of the final reading is often the animacy asymmetry between the two arguments (animate-inanimate versus inanimate-inanimate), rather than the explicitly pronounced marker of the locative-possessive relation itself (à-à, kade-kade, zai-zai). Such widespread crosslinguistic lexical conflation provides direct support for the idea that these locative and possessive meanings are conceptually connected, and in particular, that possession is a more-specified form of location, which has been referred to as ‘enriched location’ (Freeze 1992, Kayne 1993).

2.2. English have.

Conceptual semantics analysis. Following Pinker 1989 and Jackendoff 1990, we present the lexicalization of this conceptual connection in a lexicosemantic conceptual structure (LCS), which illustrates how different components of conceptual structure are connected in a single word meaning, that is, what must be understood for this meaning.

To start, we show the LCS of a prototypical locative relation (incidental proximity), which is represented, in 6, as an inherently transient situation of an event type. This LCS represents the meaning of an incidental proximity sentence as an ‘event at time $t$ of a thing being at a place’.

(6) LCS of incidental location (e.g. ‘The book is on the table.’)

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Event$_t$
  BE   THING   PATH
      AT           PLACE
    (the book)   (on) (the table)
```

Capitalizing on the crosslinguistic generalizations that possession can be understood as ‘enriched’ location (Lyons 1967, Kayne 1993, Koch 2012), Zhang et al. (2018) pro-
pose a unified LCS of possession simply by nesting the LCS of location in the standard LCS cause frame, as in 7, which represents the meaning of a causal situation as ‘Event$_1$ causes Event$_2$’.\(^6\)

\[\text{(7) LCS cause frame (e.g. ‘Event$_1$ causes Event$_2$’)}\]

\[
\begin{array}{c}
\text{CAUSE} \\
\text{ACT/GO/BE THING}_i \\
\text{EVENT}_1 \\
\text{ACT/GO/BE THING}_j \\
\text{EVENT}_2 \\
\text{SITUATION}
\end{array}
\]

The nesting of the location LCS into the cause frame, as in 8, creates a unified LCS for representing possession meanings. In this LCS, the possessor is the causal event$_1$ actor, and a possessee is the event$_2$ actor. This LCS therefore represents the meaning of possession (THING$_i$ has THING$_j$) as ‘something that THING$_i$ does causes THING$_j$ to be in a specific location’.

\[\text{(8) LCS of possession (e.g. ‘Sue has a book.’)}\]

\[
\begin{array}{c}
\text{CAUSE} \\
\text{ACT THING}_i \\
\text{BE (Sue)} \\
\text{PATH AT PLACE} \\
\text{SITUATION}
\end{array}
\]

Thus, at its core, a possession relation is the obligatory control of one entity (possessor) over another entity (possessee) and its location, again in line with the proposed ‘enriched location’ analyses of possession. Here, we follow the assumption that this is the lexico-conceptual representation stored as the meaning of have. It is this unified storage that allows have to express both the locative and possessive meanings, as the literature attests.\(^7\)

Crucially, the meaning interpreted (locative or possessive) depends upon the salience of the causal frame, which is foregroundable and backgroundable as needed depending on the context, and, in turn, determines the specific relation licensed by the unified LCS. That is, the degree of perceived causality in the have-sentence determines the degree to which a sentence may be interpreted as describing a locative or possessive relation. A high degree of perceived causality (which could be aided by an asymmetry in animacy between the two entities, i.e. animate-inanimate) results in a relation understood as more possessive, like control (e.g. a woman snaps her fingers and a dog runs

\(^6\) It is important to recognize that the conceptual function cause is not the same as the English lexical item cause. The conceptual function merely introduces a temporal ordering of two events, from which our innate, domain-general causal perception mechanisms produce varying degrees of the percept of causality.

\(^7\) Importantly, there are nonlocative/possessive meanings of have-sentences that could also be underlain by the temporal sequencing of two events encoded in the lexicosemantic conceptual structure proposed here, such as causatives—including both benefactives: The driver had the company car washed yesterday, and adversatives: The argument had me upset for a whole week—and passive/experiencer roles in light-verb constructions: Joe had an operation/accident/collision versus *Fanny had a kick/stab/punch/kiss at Gerry (Wittenberg et al. 2014). These meanings are not in the scope of the present study but are consistent with this treatment of English have.
up to her), whereas a low degree of perceived causality results in a relation understood as more locative, like proximity (e.g. a leaf falls to the ground and lands next to a fire hydrant). The upshot of this unified analysis of *have* is that the meaning of a *have*-sentence is underdetermined and fully specified only in context.\(^8\) The overall process of comprehending a *have*-sentence is thus a process of incremental disambiguation using context (Swinney 1979, Altmann & Steedman 1988, among others), and therefore rests upon the ability to ‘mine’ relevant linguistic information from the context, which is the ability in question for this study.

**Asymmetric context-dependence.** While both the location and possession relations are compatible with *have*’s word meaning, possessive readings of *have* provide more information about the relation between the two entities in a *have*-sentence. Specifically, for a sentence like *Sue has a car*, the informativeness comprises both the location situation of the two entities (e.g. *There is a car in Sue’s driveway*) and why such a location situation is taking place (e.g. *There is a car in Sue’s driveway because she owns it*). In contrast, locative readings of bare *have*-sentences are less informative and presumably less frequent as a result, as in 9.

(9) #The maple tree has a car.

We take this difference in informativity and associated infrequency to be the key factor in the well-attested dispreference for *have*’s locative reading. In other words, the dispreference for these bare locative *have*-sentences arises from them being less informative and less frequent, rather than being categorically ungrammatical (cf. Ritter & Rosen 1997, Harley & Jung 2015, Myler 2016).\(^9\) If so, to become salient, locative readings of bare *have*-sentences require stronger explicit contextual support.

For the dispreferred locative reading to become salient, the support for the possession relation must be weakened. Such weakening can happen when the inherent properties of the relata make the possessor-possessee relation less plausible, and a locatum-locative interpretation more plausible. Weakening of the possession relation leads to back-grounding of the causal segment of the meaning. The success of this back-grounding depends on how effectively the comprehender can mine the context (comprising the self-supplied omnipresent context and the explicit linguistic context) to determine the precise relation between entities in the sentence, using the degree of perceived causality. In other words, support for the dispreferred locative reading depends on the degree to which a comprehender can use context to determine the intended reading. Therein lies the interaction between linguistic structure, in the form of lexicalized meaning structure, and context-sensitivity.

Finally, the context-dependent nature of locative readings for *have*-sentences suggests that such interpretations demand increased comprehension effort, in the form of contextualization demands. The apparent dispreference therefore could result not from grammatical unacceptability or ungrammaticality, but from the contextualization effort.

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\(^8\) The analysis we present here, from Zhang et al. 2018, is one of many analyses for the meanings of English *have*-sentences proposed in the literature; we put forward this analysis because it presents a clear operationalization of the role of contextual information, a necessary framework for us to quantify the social and cognitive factors in variability in context-sensitivity. We note, however, that other analyses of *have*, such as the polysemy or homophony accounts, can also capture the semantic clustering patterns observed; these accounts, however, do not detail the precise role of context in modulating the readings of *have*-sentences, hence our choice of this analysis.

\(^9\) This ungrammaticality would arise from a missing locative-PP, which is claimed to be the sole source, rather than a conventionalized facilitator, of the locative meaning of a *have*-sentence.
that a comprehender must exert in order to construe a viable interpretation. This would mean that bare have-sentences with possessive interpretation (e.g. Sue has a car) are more acceptable than bare have-sentences with locative interpretation (e.g. The maple tree has a car) because they do not require as much contextual support.

The key pattern arising from this analysis is that the meaning of a have-sentence depends on the context. Specifically, locative have-sentences, which have lower informativeness, lower frequency, and higher contextualization demands and are thus dispreferred, as reflected in acceptability judgments, improve with relevant and facilitatory contextual information (Zhang et al. 2018). Individual-level variability in linguistic context-sensitivity—the degree to which comprehenders show this contextual facilitation—is hypothesized to be rooted in either cognitive factors, social factors, or a combination of the two. Directly below we present the study that tests this hypothesis.


3.1. Linguistic stimuli. Six sets of five sentences each were designed around a simple locative relationship expressed with have, as in 10. The have-sentence expressed an incidental proximity relation—the least constraining interpretation of location.10 The entities were selected from equivalent semantic fields such that none were biased toward a possession construal, and all were conceptually noncomposite enough to block any plausible containment reading.

(10) The maple tree has a car.

Each have-sentence was structured as a conjunction, with a context in the first conjunct and the critical target in the second, as in 11.

(11) [The motorcycle is under the pine tree]context and [the maple tree has a car]target.

In addition to locative, two other semantic context types were provided: possessive and attributive. The possessive context type presented an inalienable part-whole context, and the attributive presented a nonlocative, nonpossessive context. Additionally, two control contexts were provided: an identity context, to isolate the potential effect of identity priming, containing the same syntactic structures as the target sentence but different participants, and a nonsensical context, containing a contextually unacceptable conjunction such as or, so, because, or until.11 All context types are presented in Table 1.

<table>
<thead>
<tr>
<th>CONTEXT-TYPE</th>
<th>CONTEXT</th>
<th>CONJ</th>
<th>TARGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locative</td>
<td>The motorcycle is under the pine tree</td>
<td>and</td>
<td>the maple tree has a car.</td>
</tr>
<tr>
<td>Possessive</td>
<td>The pine tree has big branches</td>
<td>and</td>
<td></td>
</tr>
<tr>
<td>Attributive</td>
<td>The pine tree is very green</td>
<td>and</td>
<td></td>
</tr>
<tr>
<td>Identity</td>
<td>The pine tree has a motorcycle</td>
<td>and</td>
<td></td>
</tr>
<tr>
<td>Nonsensical</td>
<td>The motorcycle is under the pine tree</td>
<td>or</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Sample stimuli set.

3.2. Participants. Our participants comprised an in-lab sample and an online sample. For the in-lab sample, sixty-six native speakers of American English were recruited

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10 Incidental proximity presupposes no ontological or conventionalized relationship between the two involved entities: they are spatially co-located by pure chance or coincidence (e.g. a mirror and a cactus).

11 This context type is intended to show a categorical distinction between the dispreference for a locative reading of a have-sentence and the true semantic unacceptability of the nonsensical conjunction. This unacceptability arises from the infelicitous use of these conjunctions, which do not create the parallelism that and does. This lack of parallelism weakens the communicative intent of the entire utterance and therefore dissuades the contextualization operation that could otherwise facilitate the interpretation of the target.
from our university student body. All, by self-report, had no history of psychological illness, neurological disease, brain injury, or learning or reading disability, and had normal or corrected-to-normal vision. The data from sixty-one participants (thirty-five women and twenty-six men, ages eighteen to twenty-nine, mean = 20.10) from the in-lab sample were included in the analysis; data from the five others were excluded due to experimenter error.

Additionally, 247 native speakers of American English were recruited through Amazon Mechanical Turk (MTurk). All, by self-report and validation through language-screening questions, were determined to be native speakers of American English. Through MTurk filters, only participants with an IP address in the United States, a history of more than 1,000 successfully completed tasks, and a task-approval rate of greater than 90% were invited to participate. The data from 210 participants (102 women and 108 men, ages eighteen to sixty-eight, mean = 31.8) from the online sample were included in the analysis; data from the thirty-seven others were excluded because of missed attention questions, signifying that they were answering randomly, or failed language-screening questions. All participants consented to participate in accordance with our university Human Subjects Committee guidelines.

3.3. **Indices of variability.**

**Autism Quotient.** We use the AQ questionnaire as an index of the cognitive factors potentially underlying linguistic context-sensitivity. The AQ questionnaire is a self-administered scale used to determine the degree to which an adult of normal intelligence possesses traits typically associated with ASC (Baron-Cohen et al. 2001), hence ‘autistic-like’ traits. Although not intended as a diagnostic measure, it is used clinically and shows consistency in three important psychometric properties: test-retest reliability (Baron-Cohen et al. 2001), cross-cultural stability (Wakabayashi et al. 2006), and heritability (Hoekstra et al. 2007).

The fifty-item questionnaire has five component subscales, each drawn from a unique subset of ten questions: **attention switching (AS), attention to detail (AD), communication (CM), imagination (IM), and social skills (SS).** The scales are oriented such that higher scores signify more autistic-like traits (difficulty in attention switching, higher attention to detail, lower communicative ability, less imagination, and lower social skills). Among the linguistic studies using the AQ measure, the way the total AQ measure and its component subscales have been used is variable: Yu (2010) analyzed the total AQ along with four of the five subscales (AD, AS, CM, and IM), while Nieuwland et al. (2010) and Xiang et al. (2013) analyzed the CM subscale but found the same effect with different sets of subscales. Such variability in application of the AQ measure aligns with a body of factor-analysis research that has shown that the AQ subscales are not independent factors, that is, they do not measure distinct dimensions of variability (see English et al. 2020 for a summary of this work). Given the statistical collinearity among subscales as well as the intuitive conceptual overlap between them, we followed the more conservative approach, taken in Stewart & Ota 2008, Yoshimoto et al. 2017, Yang et al. 2018, Derrick et al. 2019, and Lai et al. 2019, and used only the aggregate, total AQ in the main analysis.12

Each item is phrased as a sentence in the first person (an ‘I-statement’); the participant chooses one answer among ‘strongly disagree’, ‘slightly disagree’, ‘slightly agree’, and

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12 In order to connect to the existing work showing subscale correlations, namely Nieuwland et al. 2010, Yu 2010, and Xiang et al. 2013, we include an analysis of the subscales in §5.4. There, we also include a descriptive analysis of the subscales within our study sample that mirrors the subscale nonindependence described in the AQ factor-analytic literature.
‘strongly agree’. Here, responses were coded on a four-point Likert scale (1–4), following Stewart & Ota 2008, Nieuwland et al. 2010, and Yu 2010, as both the degree and polarity of agreement bear meaning and thus should not be collapsed, as in the scoring system used in Baron-Cohen et al. 2001. Thus, total AQ scores range from 50–200.

Participants tested in-lab completed the questionnaire on paper; participants recruited online responded to the same questions through Qualtrics, an online survey platform. Both versions gave all questions and answer choices in the same order and orientation. For the online version, five ‘attention’ questions were spaced randomly throughout, asking participants to select a specific answer.

**Gender.** To connect to existing reports on the role of gender in language variability, namely Yu 2010, and in the absence of a widespread, gradient measure of the dimensions underlying gender identity, we used gender group as a binary category to index the social-factor sources manifesting through gender expression that potentially underlie linguistic context-sensitivity. This variable was collected using a free-response question, ‘What is your gender identity?’, and coded binarily. No other social factors, such as age or ethnicity, were tracked for the gender analysis.

### 3.4. Design.

In-lab participants sat in a quiet room and read sentences on a monitor presented using E-Prime 2.0 software (Psychology Software Tools 2012). Acceptability ratings and response times were collected on a keyboard. Each sentence was presented in two windows: the first showed the first conjunct (context), and the second showed the complete conjoined sentence (context and target). Participants were instructed to rate the acceptability of all the material on the screen; thus, the first rating evaluated only the first conjunct (context), while the second evaluated the entire conjoined sentence (context and target). The windows advanced with each input, but were capped at ten seconds for the first window and fourteen seconds for the second. The ratings for the context alone served to verify the participants’ attention, since these ratings were expected to be ceiling-level. Participants were given a scale of 1 to 7 (7 being the most acceptable) and no specific criteria for determining acceptability to ensure no disproportionate attention or bias toward certain features of the sentences over others. Table 2 gives an overview of the paradigm.

<table>
<thead>
<tr>
<th>CONTENT</th>
<th>MATERIAL</th>
<th>DURATION &amp; INPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context</td>
<td>The motorcycle is under the pine tree</td>
<td>10 sec or until rating (1–7)</td>
</tr>
<tr>
<td>Context + Target</td>
<td>The motorcycle is under the pine tree and the maple tree has a car.</td>
<td>14 sec or until rating (1–7)</td>
</tr>
<tr>
<td>Fixation</td>
<td>+</td>
<td>2 sec</td>
</tr>
</tbody>
</table>

**Table 2. Experimental procedure.**

Participants were given a practice run to acclimate to the testing environment, the keyboard input, and the text presentation. This practice contained no experimental items, but ten well-attested syntactically well-formed and ill-formed sentences (i.e. with consistently polarized judgments) to help the participants quickly orient to the scale and to assess participants’ attention, understanding of the rating system, and proficiency in English. Participants repeated the practice run until they scored 100%; no participant completed the practice run more than twice. Each participant saw all thirty items in a unique, pseudo-randomized order, mixed with seventy additional sentences of three unrelated types that served as fillers.

Online participants were presented with identical instructions as the in-lab version through the Qualtrics survey platform. The sentences were presented in the same man-
ner as outlined above, except that instead of pressing one of seven keys on the keyboard, the participants used their cursor to select one of seven radio buttons on-screen, which were presented in the same orientation as the in-lab version. Five attention questions were presented randomly among the thirty experimental items. Though no time limits were given, the average completion time for the study was comparable to the duration for in-lab participants. Before each session, participants were presented ten semantically complex English sentences (involving circumstantial metonymy or complement coercion constructions) and asked to explain the sentences’ meanings to validate the participants’ self-reported English proficiency.

4. Predictions. The two hypotheses regarding the cognitive and social factors in variability in linguistic context-sensitivity make distinct predictions. If the cognitive capacities underlying autistic-like traits are a contributing factor to linguistic context-sensitivity, then AQ scores should significantly correlate with intercomprehender variability in acceptability ratings of the target sentence in the locative context type. Alternatively, if the social factors that underlie or manifest as gender expression contribute to linguistic context-sensitivity, then the two gender groups should show a difference in ratings for the target sentence in the locative context type. Finally, if both factors contribute to linguistic context-sensitivity, AQ and gender group should show respective significant interaction effects with context type.

5. Findings.

5.1. Sample comparison. In order to evaluate the role of individual differences in context-sensitivity, we first compared the participant samples along the two variables of gender group and AQ. Both samples had roughly evenly divided gender groups. In terms of AQ, both groups showed similar profiles overall and within their gender groups; their descriptive statistics are presented in Table 3.

<table>
<thead>
<tr>
<th>SCALE</th>
<th>GENDER</th>
<th>MEAN</th>
<th>RANGE</th>
<th>SD</th>
<th>MEAN</th>
<th>RANGE</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTISM QUOTIENT (AQ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w</td>
<td>106.8</td>
<td>85–137</td>
<td>13.1</td>
<td></td>
<td>113.0</td>
<td>67–146</td>
<td>17.99</td>
</tr>
<tr>
<td>m</td>
<td>103.2</td>
<td>87–137</td>
<td>11.8</td>
<td></td>
<td>114.2</td>
<td>67–146</td>
<td>20.11</td>
</tr>
<tr>
<td>SOCIAL SKILLS (SS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w</td>
<td>19.84</td>
<td>12–31</td>
<td>5.02</td>
<td></td>
<td>21.91</td>
<td>11–38</td>
<td>6.64</td>
</tr>
<tr>
<td>m</td>
<td>18.86</td>
<td>12–29</td>
<td>4.51</td>
<td></td>
<td>23.69</td>
<td>11–38</td>
<td>7.27</td>
</tr>
<tr>
<td>ATTENTION SWITCHING (AS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w</td>
<td>24.64</td>
<td>18–32</td>
<td>3.24</td>
<td></td>
<td>25.21</td>
<td>15–34</td>
<td>4.63</td>
</tr>
<tr>
<td>m</td>
<td>24.86</td>
<td>21–30</td>
<td>2.51</td>
<td></td>
<td>26.44</td>
<td>15–34</td>
<td>5.38</td>
</tr>
<tr>
<td>ATTENTION TO DETAIL (AD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w</td>
<td>24.36</td>
<td>18–32</td>
<td>3.97</td>
<td></td>
<td>24.11</td>
<td>18–31</td>
<td>3.50</td>
</tr>
<tr>
<td>m</td>
<td>25.04</td>
<td>15–33</td>
<td>4.50</td>
<td></td>
<td>26.29</td>
<td>18–39</td>
<td>5.27</td>
</tr>
<tr>
<td>COMMUNICATION (CM)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w</td>
<td>23.79</td>
<td>17–29</td>
<td>3.56</td>
<td></td>
<td>26.06</td>
<td>18–37</td>
<td>5.22</td>
</tr>
<tr>
<td>m</td>
<td>26.62</td>
<td>15–33</td>
<td>5.04</td>
<td></td>
<td>26.50</td>
<td>18–39</td>
<td>5.31</td>
</tr>
<tr>
<td>IMAGINATION (IM)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w</td>
<td>19.18</td>
<td>15–26</td>
<td>3.75</td>
<td></td>
<td>18.12</td>
<td>12–24</td>
<td>4.17</td>
</tr>
<tr>
<td>m</td>
<td>17.84</td>
<td>12–27</td>
<td>4.06</td>
<td></td>
<td>19.74</td>
<td>12–27</td>
<td>4.12</td>
</tr>
</tbody>
</table>

Table 3. AQ descriptive statistics. Note: Means across gender groups for each sample are in boldface.

13 The sixty-one-member population from our university student body showed the same group means as the sixty-member population from the University of Chicago student body reported in Yu 2010.
While the in-lab women’s group mean appeared to be slightly lower than the others’, pairwise t-tests corrected using Holm’s method showed no differences between the groups in their mean AQ (ps > 0.7). Absence of significant differences in gender-group proportion or AQ profile for the in-lab group allowed us to analyze the two samples together as one.

5.2. Dispreference versus unacceptability. As a control measure, we first analyzed the effect of sensicality to ensure participants were paying attention successfully to the acceptability judgment task. A linear mixed-effects model was created using the ‘lme4’ package (Bates et al. 2015) in the R statistical computing environment (R Core Team 2018). The model was built using the fixed effect of sensicality (two levels: sensical (the locative, possessive, attributive, and identity context types) versus nonsensical (the nonsensical context type)), and as random effects, intercepts for subjects and items in addition to by-subject random slopes for the effect of sensicality. Statistical significance (p-value) was obtained by a likelihood ratio test of the full model with the effect in question against the null model without the effect in question. Instead of a priori trimming using a standard deviation threshold, outlying data points to the model fit were removed, following Baayen & Milin 2010.

Acceptability ratings, shown in Figure 1, revealed a significant main effect of sensicality ($\chi^2(1) = 42.2, n = 271, p < 0.001$), suggesting that participants attended and responded to the relation of the context to the target. They also indicate that the dispreference for the locative interpretation of a *have*-sentence is categorically distinct from the semantic unacceptability of the nonsensical context type.

![Figure 1. Mean acceptability ratings by sensicality. Error bars indicate the standard error of the mean.](image)

5.3. Contextual facilitation of locative *have*-sentences. For the main analysis, we analyzed the data from the four sensical context types for all subjects. A linear mixed-effects model was built using fixed effects of context type (four levels: locative, possessive, attributive, and identity), gender group (two levels: women and men), AQ (continuous factor), and the two-way interaction terms of context type and gender group as well as context type and AQ. As random effects, random intercepts were included for subjects and items in addition to by-subject random slopes for the effect of context type. Statistical significance was obtained in the same manner, through likelihood ratio tests; outliers were removed in the same way as well. To investigate the interaction effects, we used pairwise t-tests and linear regressions corrected for multiple comparisons using Holm’s method.
Acceptability ratings of the sentences with only the sensical contexts showed a significant main effect of context type ($\chi^2(3) = 101.2, n = 271, p < 0.001$). Pairwise $t$-tests show that the ratings, presented in Figure 2, for the target sentence after the locative context type were significantly higher than the ratings for the target sentence after all other contexts (all $p$s < 0.001).

This finding is consistent with the pattern regarding context type reported in Zhang et al. 2018: context successfully facilitated the locative reading of the target sentence, resulting in higher ratings for the target sentence but only after the locative context type.

5.4. Sources of context-sensitivity: cognitive factors, social factors, or both? Crucially, significant interaction effects from the mixed-effects model indicate the presence of individual-level variability along the dimension of context-sensitivity. The same mixed-effects model revealed a significant two-way interaction of context type and AQ ($\chi^2(4) = 10.7, n = 271, p = 0.030$), while the two-way interaction of context type and gender group was not significant ($\chi^2(4) = 2.72, n = 271, p = 0.61$).

In order to understand the individual-level variability in the ratings, we started by unpacking the context type and AQ interaction. Linear regression models showed significant correlations between AQ and the ratings for the locative context type ($\beta = -0.007, t = -2.7, p = 0.007$) and the possessive context type ($\beta = -0.006, t = -2.5, p = 0.011$), indicating that higher AQ scores (which index lower context-sensitivity) correlate with lower ratings in the relevant context types, in line with the predictions; the attributive and identity context types did not correlate with AQ scores ($p$s > 0.4). That is, the higher an individual’s AQ score, the less they are able to use relevant context to facilitate the otherwise dispreferred locative interpretation of the ambiguous target have-sentence; conversely, individuals with lower AQ scores (which index higher context-sensitivity) appear better able to use the relevant context to help interpret the ambiguous target.

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14 A referee asks us about a three-way interaction. While we did observe a significant three-way interaction, this interaction was driven by a gender-group difference in the identity context type, one of the control conditions, rather than by the experimental context types. Accordingly, we take this interaction to be indicative of a gender-group variability outside of the scope of the intended context-type manipulation, and do not consider it further in the analysis.
verage acceptability ratings for the locative context type as a function of AQ score are shown in Figure 3.

![Figure 3](image_url)

**Figure 3.** Mean ratings for the locative context type as a function of the AQ.

In order to visualize the interaction effect of context type and the AQ more clearly, and in light of the small effect size of the continuous AQ factor, we binarized the ratings using the median AQ score of the full sample ($Mdn_{AQ} = 112$) resulting in a high-AQ group ($n = 137, M_{AQ} = 124.8$) and a low-AQ group ($n = 134, M_{AQ} = 99.0$). The model with the categorical AQ factor instead of the continuous AQ factor revealed an even greater significant interaction between context type and the AQ ($\chi^2(5) = 31.9, n = 271, p < 0.001$). The resulting interaction plot is presented in Figure 4. Pairwise $t$-tests revealed a significant effect of AQ group (low versus high) for the locative ($p = 0.0098$) and possessive context types ($p = 0.016$) but not for attributive ($p = 0.63$) or identity ($p = 0.65$).

![Figure 4](image_url)

**Figure 4.** Interaction plot between context type and AQ group (high versus low). Error bars indicate the standard error of the mean. Asterisks indicate a significant effect of AQ group within each context type at the $p < 0.05$ (*) or $p < 0.01$ (**) level.

Within the possessive context type, we observe a significant difference between the low- and high-AQ groups ($p = 0.016$), while no such difference is found within the attributive context type ($p = 0.63$), even though the ratings for both context types are sim-
ilarly low. The contrast between the possessive and attributive context types suggests that only low-AQ comprehenders are sensitive to the relevance of the context to the semantic domain in question, since the locative and possessive contexts describe the relationship between two entities, while the attributive context provides detail about one entity alone.

The contrast between the locative and possessive context types suggests that within the two relevant contexts, only the locative context type facilitates the intended reading of the bare *have*-sentence; crucially, this facilitatory effect is observed only for the low-AQ (more context-sensitive) group, as the high-AQ group’s locative ratings were not statistically distinct from the low-AQ group’s possessive ratings (*p* = 0.72).

This finding bears out our prediction regarding the cognitive factors of linguistic context-sensitivity: the AQ, but not gender group, correlates with the degree to which comprehenders are able to use contextual information. This asymmetry suggests that, at least in the present linguistic task, context-sensitivity connects to cognitive predisposition(s); social factors, as manifested through gender group, by contrast, do not appear to capture any intercomprehender variability in the task.

In the following section, we present, as a slight detour, a further exploration of the AQ finding, with an analysis of its component subscales that is undertaken in the context of the broader factorial-structure limitations of the AQ questionnaire. We invite readers who are not specifically concerned with the statistical independence and validity of these subscales to bypass this section and continue with the principal narrative regarding individual-level variability in linguistic context-sensitivity in the discussion section.

**Further exploration of the AQ subscales.** In light of the small effect of the total AQ measure, and in order to connect these findings to the existing literature, we further explore, in two parts, the key AQ correlation by capitalizing on the five component subscales. First, we briefly summarize the factorial structure of the AQ, which casts into question the psychometric validity of the subscales as measures of independent dimensions of variability. Second, we detail the correlations observed with the subscales, connecting them to previous linguistic work involving the AQ measure.

While the AQ’s overall consistency across populations is well established, the independence of its five component subscales—its factorial structure—is less reliable. Austin (2005) was the first to investigate its internal consistency and found that for a nonclinical sample of 337 individuals, a factor analysis supported a three-factor solution, comprising ‘social skills’, ‘details/patterns’, and ‘communication/mindreading’; Hurst et al. (2007) replicated the three-factor solution in a separate nonclinical sample of 1,005 individuals. Of particular interest in both studies is the fact that although the three-factor solution generally supports three of the five original subscales, the loadings are crossed: individual items from all five subscales contributed to each of the three factors. Hoekstra et al. (2008) conducted a similar factor analysis on both general and clinical populations in Dutch, comprising 1,416 individuals, and found support for a two-factor analysis: ‘attention to detail’ (comprising only the original AD subscale) and ‘social interaction’ (comprising the other four subscales: SS, AS, CM, and IM). Subsequent factor analyses (Stewart & Austin 2009, Kloosterman et al. 2011, Russell-Smith et al. 2011, Lau, Gau, et al. 2013, Lau, Kelly, & Peterson 2013, Grove et al. 2016), summarized recently in English et al. 2020, further corroborate these patterns.

Even within our study population, the nonindependence of the five subscales is clear. Figure 5 shows the correlations between each of the AQ subscales for our study sample. While the individual correlations between SS versus CM and SS versus AS seem to be the strongest, these data are generally supportive of the two-factor analysis reported in
Hoekstra et al. 2008, which isolated AD as ‘attention to detail’ and groups SS, AS, CM, and IM as ‘social interaction’. Among linguistic studies, Yu (2010) analyzed, in addition to the aggregate AQ measure, four of the five subscales (AD, AS, CM, and IM), but residualized AS and CM by SS in order to eliminate collinearity; Nieuwland et al. (2010) used the CM subscale but found identical correlations with the total AQ and the SS and AS subscales; and Xiang et al. (2013) used only the CM subscale, but found an identical effect with the SS subscale. These treatments add further weight to the non-independence of these subscales, particularly between SS and CM. Indeed, numerous items from these two scales seem to be intrinsically intertwined: items such as ‘Other people frequently tell me that what I’ve said is impolite, even though I think it is polite’, ‘I enjoy social chit-chat’, or ‘I’m often the last to understand the point of a joke’, which are categorized as CM, could easily be classified as SS, and vice versa for ‘I enjoy meeting new people’ or ‘I am a good diplomat’.

There are two methodological takeaways from these findings; the first is that the five AQ subscales do not identify independent dimensions of variability, so finding correlations with a given subscale over another is not necessarily identifying systematic patterns in the data. The second is that the labels for the subscales are not necessarily grounded in the dimensions of variability that they do capture; they appear more as indicators to possible domains of variability yet to be formally defined. Consequently, we do not take the CM subscale, for example, to be a straightforward or exclusive measure of variability relating to language capacity. Instead, we take it as a subscale that involves some, but not all, aspects of language use relevant to linguistic context-sensitivity. This said, it may still be productive to explore the AQ findings from the main analysis beyond the total measure and to look into the correlation patterns of the five component AQ subscales. This also allows us to connect our findings to existing work involved in this level of analysis. We turn to this additional analysis directly below.

In Table 4, we present the details of identical mixed-effects models as described earlier, but with each of the five subscales replacing the total AQ measure as a fixed effect and without the effect of gender. Statistical significance was obtained in the same manner—

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**Figure 5.** Correlations between the five component subscales of the AQ across our sample (n = 271). Density plots are shown for each subscale along the diagonal. AD: attention to detail, AS: attention switching, CM: communication, IM: imagination, SS: social skills. Correlation coefficients are shown above the diagonal; asterisks indicate a significant correlation at the $p < 0.001(***$) level.
by comparing the model with the interaction term in question against the corresponding model without it. Due to the observed collinearity, the models were run separately.

<table>
<thead>
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<th>EFFECT</th>
<th>AIC</th>
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<th>df</th>
<th>p</th>
</tr>
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<td>—</td>
<td>—</td>
</tr>
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<td>3</td>
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<td>4</td>
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<td>4</td>
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<tr>
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<td>19782</td>
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</tr>
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<td>4</td>
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<tr>
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<tr>
<td>Context type * IM</td>
<td>19780</td>
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<td>4</td>
<td>0.072</td>
</tr>
</tbody>
</table>

Table 4. AQ subscale model comparison.

First, we note that the model comparison reveals, in addition to the significant interaction between context type and the total AQ measure, a statistically significant interaction between context type and the AD subscale. Linear regression models show that the interaction effect of context type by AD is borne out by the ratings for only the locative context type ($\beta = -0.039, t = -2.5, p = 0.014$)—the context type where context-sensitivity is maximally demanded. The AD subscale did not correlate significantly with ratings for any other context type ($ps > 0.3$).

Second, while the AD subscale significantly correlated with the acceptability ratings, it alone accounts for less variability than the total AQ measure, even though the other subscales’ interactions were not independently significant. We take the discrepancy in the variability captured between the AD subscale and the total AQ measure to indicate that the total AQ measure is the more robust one, suggesting that there is additional explanatory power to be had within all fifty items of the measure.

Third, AD is the only subscale within our sample ($n = 271$) to show a significant effect, in contrast to the findings in Nieuwland et al. 2010 ($n = 31$), Yu 2010 ($n = 60$), and Xiang et al. 2013 ($n = 91$)—the three reports in the literature that explore the subscale correlations—which show effects of SS, AS, and CM. All three caution, however, that since these subscales are highly correlated in their samples, their effects cannot be isolated. We take this distribution in fact to align with the takeaway from both the existing factor analyses and our own subscale correlation pattern (Fig. 5) in which SS, AS, CM, and IM are highly correlated with each other but not AD. Such a distribution suggests, at least, a two-factor solution in which the AD subscale and some combination of the SS/AS/CM/IM subscales are indexing two dimensions of variability within the AQ. While the discrepancy between our subscale correlations could be due to the nature of the tasks in each study, we note two overlaps that connect our findings to the existing work: (i) Yu (2010) reports a correlation with the AD subscale in line with ours, and (ii) in our sample, the total AQ provided a better model fit than the AQ alone, suggesting that the non-AD components of the AQ (i.e. some combination of the SS/AS/CM/IM subscales) did indeed contribute explanatory power, in line with the findings from all three reports above.

Overall, we take this pattern of results to bolster the use of the AQ measure in its entirety as an index of variability impacting linguistic behavior, particularly relating to individual comprehenders’ linguistic context-sensitivity. However, we also take this subscale pattern to be critically indicative of the need for a quantitatively derived factorial structure for the AQ measure. Such a tool could elucidate not only the possible subcomponents of linguistic context-sensitivity, but also the cognitive operations implicated therein.
6. Discussion. Our results support the hypotheses that comprehenders’ linguistic context-sensitivity plays an integral role in lexico-conceptual composition: (i) the findings are consistent with a conceptual connection between location and possession that have lexicalizes, (ii) despite being dispreferred, the locative interpretation of a bare have-sentence can be made salient through linguistic context, and (iii) within a given speech community, the ability to extract relevant content from context is variable across individuals and correlated with their AQ scores.

Directly below, we discuss the ramifications of understanding linguistic context-sensitivity as rooted in cognitive variability across individuals, as well as the role of context and conceptual structure more generally in language variation.

6.1. Linguistic context-sensitivity as measured by the AQ questionnaire. The principal finding from the present study is that the AQ measure, as an index of a cognitive source of variability in linguistic context-sensitivity, correlates with the degree to which comprehenders show a contextual-modulation effect in our linguistic contextualization task. That is, individual-level variability in autistic-like traits correlates with variability in the degree to which individual comprehenders are able to identify and use relevant contextual information to facilitate the locative reading of the target have-sentence, which requires attenuating the salience of the causal segment in the unified location-possession lexicosemantic conceptual structure.

This result not only adds to the existing body of work showing that AQ is indeed targeting some dimension of the cognitive system, but also bolsters the findings that the cognitive capacities implicated in autistic-like traits likely contribute to linguistic context-sensitivity, as the critical task in our study involved direct, intentional contextualization on the part of the comprehender.

We note here, however, that the AQ measure, while significantly correlated with acceptability ratings, accounts for only a small portion of intercomprehender variability. The three components for evaluating a correlation—effect size, effect significance, and effect meaningfulness—can vary independently from one another (Hemphill 2003). One well-cited example is the correlation of \( r = 0.03 \) between taking aspirin and preventing heart attack, which bears outsized meaning for society at large—that is to say, effects must be evaluated in context. To do so, we offer two possibilities for discussion: one regarding the goodness of the AQ as a proxy for cognitive variability underlying linguistic context-sensitivity, and another regarding the overall, potentially small, role of cognitive variability in contributing to linguistic context-sensitivity.

The first is that we recognize the inherent limitations set by our experimental tools. Though it seems clear that the AQ is targeting one or more aspects of the cognitive system, it has yet to be shown conclusively what domain of the cognitive system these dimensions lie in. One possibility is that linguistic context-sensitivity, as indexed by the AQ, is rooted in working memory, as working memory has been shown to correlate positively with selective attention and inhibition of distracting information (Engle 2002, Lavie et al. 2004). Yu et al. (2011) tested both working memory and the AQ in a task parallel to that reported in Yu 2010 and found that higher working memory correlated with lower AQ. This finding is consistent with the hypothesis that context-sensitivity involves the ability to store more contextual information for processing at a given time. Another possibility is that the AQ indexes a multitude of cognitive factors, some of which are more related to context-sensitivity than others. Mathematical evidence for this lies in the AQ’s well-reported subscale collinearity and factor cross-loading, as described in §5.4. Additional evidence lies in the fact that a number of items in the AQ, such as ‘I enjoy meeting new people’, seem related to context-sensitivity in a less direct way than items
such as ‘I find it easy to “read between the lines” when someone is talking to me’ or ‘I often notice small sounds when others do not’; this observation is supported by English et al. (2020), who describe over twenty different AQ-trait constellations that result in the same total AQ score, since different configurations of subscale scores can add up to the same total. By using the aggregate AQ measure exclusively, we are inherently limited in characterizing the subset of AQ-trait constellations that more directly connects with context-sensitivity, resulting in a restricted ability to explain variability in a given data set. Future use of the AQ and linguistic behavior must consider statistically supported subsets of the AQ items that are linguistically principled, rather than the total measure.

The second is that the larger goal for this work is to identify possible sources of the variability that has been observed in linguistic behavior in order to nuance our understanding of the language faculty in context. Incorporating factors that can explain systematic differences in linguistic behavior between individuals strengthens existing work on the systematic commonalities in linguistic behavior. Our work is but one instance of the broader effort to incorporate variability as an intrinsic part of the system, rather than exclude it conceptually or mathematically as ‘noise’. Accordingly, we do not expect any single measure to capture all of the variability in such a complex system, which is known to be rooted in a multitude of cognitive, social, and other factors. Moreover, correlation effects interpreted as meaningful can be variable across paradigms, questions, and domains (Bosco et al. 2015), in contrast with the widely used benchmarks from Cohen 1988.

We take our finding to be indicative of a direct connection between factors already hypothesized to be related, which contribute to an individual’s cognitive style and their linguistic behavior—specifically, the way they identify information in the communicative context to satisfy the requirements of a linguistic expression in that context. It is possible, however, that there is a third explanation for the small effect size: the correlations observed here and in the existing linguistic AQ literature are spurious. Although we mention this because it is a logical possibility, we do not suspect this to be the case on the grounds of two main bodies of evidence. The first is that the effect, though small, is consistent in a variety of linguistic behaviors involving context-dependence across different domains of language, namely sound, morphosyntax, and meaning. The second is that the subscale analysis, in tandem with the factor-analysis work, shows that subsets of the items in the AQ—the emergent two-factor solution—show more nuanced correlations with the linguistic behavior in question than the total AQ does, suggesting that streamlining a quantitatively heterogeneous measure like the total AQ results in an improved measurement of a real effect. Accordingly, of the three possible reasons detailed above for the small effect size, we conclude that the AQ measure is indexing a real effect of cognitive factors underlying linguistic context-sensitivity, but the precise formulation of the measure must be further improved. Future work must continue refining both the methodological instruments and our conceptual models in order to make more precise our understanding of the relationship between variability in domain-general cognitive factors and variability in how individuals use language.

6.2. Social bases of linguistic context-sensitivity. We did not find that binary gender group—our index of the potential social factors manifesting through gender category that contribute to linguistic context-sensitivity—played a role in capturing variability in this task. We certainly do not take this to be an indication that sociocultural factors play no role in modulating linguistic context-sensitivity—indeed, absence of evidence cannot be treated as evidence of absence. Given that we expect sociocultural fac-
tors to be implicated in linguistic context-sensitivity, we see at least three possible explanations for the lack of effect in the current study: one of manifestation, one of resolution, and one of relevance.

As previously discussed, gender appears to be a much broader construct, with numerous contributing factors; operationally, gender-based effects can be modulated by many features of a communicative context: gender composition, racial composition, and number of participants, among others (Anderson & Leaper 1998, LaFrance & Vial 2016). These factors of the social context are known to interact with gender and, crucially, can magnify or attenuate the expression of gender-normative behaviors; for example, Bailey and LaFrance (2017) show that different types of gendered and gender-neutral wording of questions can modulate gender-based effects like androcentrism. It could be the case that the lack of cues in our paradigm that elicit so-called gendered linguistic behaviors could have attenuated any manifestation of gender-associated social factors potentially present.

It could also be the case that gender group and the AQ in this study indexed overlapping variability between individuals; however, due to the binary nature of the tool, it had less explanatory power than the continuous AQ factor, especially given that the AQ scores across gender groups were statistically indistinguishable. Thus, it remains an open question the extent to which the gender group and AQ indices overlap as contributing factors to context-sensitivity. Our observation here is that when gender is construed as a binary variable, they do not.

The relationship between binary gender group and a social basis of linguistic context-sensitivity is not one to one; while identifying a gender-group effect would have directly supported the idea that social factors play a role in linguistically context-sensitive behavior, failing to find an effect does not rule it out, for at least two reasons. First, binary gender group is an inherently limited way to represent the gradient and dynamic expression of gender; a lack of gender-group effect could result from using this categorical predictor for a gradient phenomenon. Second, gender group represents only one set of social factors that could give rise to linguistic behavior. This leaves open the possibility that a lack of gender-group effect does not mean that social factors are not at play in linguistic context-sensitivity, but rather that other social factors that connect with variability but are not addressed here may be impacting context-sensitive linguistic behaviors.

Future research will benefit from utilizing high-resolution and psychosocially grounded metrics for quantifying gender as the gradient and dynamic social construct that it is; such measures would better identify the degree to which the social factors associated with gender contribute to individual-level variability in linguistic context-sensitivity. These tools would be particularly relevant to the field of psycholinguistics, which probes the unconscious, automatic processes that underlie real-time language use. Better measures of gender in tandem with psycholinguistic tools could elucidate the extent to which social factors permeate and are intertwined with the presumably universal processing mechanisms in the mind/brain.

6.3. Contextual modulation of English have-sentences. A unified analysis of the location-possession conceptual structure associated with English have-sentences underlies the prediction that comprehenders’ sensitivity to the conceptual connection between location and possession would be experimentally visible in the form of higher ratings to the target sentence only after the locative context, as compared to after the nonlocative contexts (Zhang et al. 2018). We assume here that this conceptual connection is what makes it possible for the prototypically possessive verb have to express a
locative relation at all, and additionally, one that is facilitated by relevant context. Our results are consistent with this prediction, which was borne out in the main effect of context type, whereby ratings of the target sentence increased only after the locative context type.

The effect of the locative context type was categorically distinct from the effect of the other semantic contexts; the possessive and attributive context-type ratings were not significantly different from each other. Furthermore, participants were sensitive only to the relevant relational features of the context. The identity context type, with an identical syntactic structure, did not improve the ratings for the target have-sentence.¹⁵

These patterns also shed light on the role of context in language processing by leveraging the LCS for have in which the salience of the causal Event₁ depends on the perceived causality in the situation. The relatively higher informativity of the possessive reading—captured with the additional causal frame—leads to an asymmetry in preference relative to the locative reading, which requires backgrounding of the causal frame to become available. What comprehenders must do to enable the dispreferred locative reading is reduce the salience of the causal frame, a process that is facilitated by relevant contextual information.

The fact that comprehenders are able to do this contextualization nuances our understanding of what ‘acceptability’ means. In this case, locative readings of bare have-sentences are taken to be dispreferred due to lower frequency. This lower frequency could have emerged over time due to an increased demand for contextualization, which is effortful. Alternatively, the dispreference could be directly due to the increased demand for contextualization: comprehenders will not exert this contextualization effort unless otherwise necessary, though individual degrees of context-sensitivity would modulate this tendency. Overall, this linguistic setup is consistent with the view that there is more than one reason why a linguistic structure could be found less acceptable, even in relative terms. Future work could consider this possibility when using unacceptability as a condition, measure, or property of a linguistic study.

6.4. Ramifications for language variation and change. One reason why such variability is important to understand is in the context of language variation and change. Findings have shown that context-sensitive individuals can be linguistic innovators that proliferate variation and lead trajectories of change. Yu (2010) was the first to identify cognitive differences that could lead to variation and change; in the domain of sound, he found that the most context-sensitive individuals (in his sample, low-AQ women) could seed ‘deviant’ variants into the speech community by permitting or even sanctioning the persistence of contextually induced variation. It remains to be understood whether these same context-sensitive individuals are the ones who propagate these variants, consciously or not, through the speech community, potentially leading to widespread diachronic change. Other accounts have also sought to incorporate cognitive factors in the dynamics of how synchronic variation may lead to diachronic change. Jäger and Rosenbach (2008), for example, propose asymmetric priming (a situationally emergent cognitive principle) as a source of unidirectional grammatical change and examine evidence from the well-attested unidirectional space-to-time and phonological

¹⁵ We note that this finding has direct implications for our assumptions about the lexical representation of English have; at issue are analyses that determine locative interpretations without overt locative prepositional phrases to be unacceptable (Ritter & Rosen 1997, Myler 2016, among others). While our results directly challenge the existence of such restrictions, discussion of the implications lies beyond the scope of this work.
reduction paths; similarly, Deo (2015) proposes a game-theoretic framework in which speakers employ different synchronic variants under different communicative demands (e.g. optimizing communicative success, linguistic economy/parsimony, and informational salience), to the end that certain variants will take on categorical functions, leading to grammaticalization of forms in a unidirectional fashion. Neither of these schematic proposals, however, accounts for the role of individual differences in producing synchronic variability in production and comprehension.

To our knowledge, our results are the first to show that the AQ can quantify differences that could lead to variation and change in the domain of meaning. We found that the most context-sensitive individuals (low AQ, regardless of gender group) were better able to contextualize semantic variants of have-sentences than their high-AQ counterparts. This finding suggests that the synchronic variation which exists in the use of have-sentences could be due, in part, to a subset of the speech community that is better able to contextualize the more demanding locative readings. While the location-possession connection is known to underpin diachronic trajectories of meaning change in adpositional expressions across the world’s languages, English have does not appear to exhibit a diachronic trajectory, as locative and possessive meanings are both seen as far back as the fifteenth and sixteenth centuries (have; OED online). Our contribution is to show that individuals with certain constellations of cognitive capacities, as reflected in their AQ scores, can play a key role in the synchronic variation of have-sentences in a speech community.

6.5. Linguistic context-sensitivity. In light of the findings altogether implicating context-sensitivity as a dimension of variability in linguistic behavior, we want to better understand the cognitive capacities or traits that underlie linguistic context-sensitivity, again defined as the overall capacity of a neurocognitive linguistic system to identify and integrate the information in the communicative context prompted by the meaning requirements of a given linguistic expression in that context. Here, we revisit the possible components of linguistic context-sensitivity described in §1.3. The first is perceptual acuity, which could lead to enhanced detection of variation in ambiguous stimuli. Another is an increased recognition of useful or informative information in the context. Here, assigning meaning, or even simply meaningfulness, to variants is the key switch between recognizing differences and using those differences to tailor their use for different situations. A third possibility is that context-sensitive individuals are more tolerant of or flexible in adopting variants and their consequent differences in sound or meaning; that is, context-sensitivity could highlight the willingness to allow for contextual modulation, in conjunction with or independent from the ability to detect or ascribe meaning to variants.

Our study does not arbitrate between these possibilities; it could be the case that one or more of them give rise to the observed context-sensitivity effects. However, since our task involved an active contextualization effort, it seems to suggest that the AQ operationalizes at least the latter possibilities, rather than the former, more passive, baseline sensitivity. Additionally, in the same way that we understand gender to be either a contributor to variability or a manifestation of other underlying factors associated with that variability, we can also draw a distinction between what our autistic-like trait correlation is highlighting: purported cognitive capacities that give rise to context-sensitive behaviors, or alternatively, context-sensitive behaviors that emerge from other possible cognitive capacities. Future work that better accounts for the precise task involved as well as these and other potential component capacities or behaviors that contribute to
context-sensitivity must be undertaken to situate the broad cognitive notion of context-sensitivity as a capacity or behavior, linguistic or domain-general, in the mechanics of the cognitive system.

One methodological takeaway from our results is that future linguistic comprehension studies involving context would benefit from a cognitively based parameter measuring context-sensitivity. Notice that without it, a group-level analysis could be potentially misleading: while the main effect of our study shows a clear and significant distinction in the ratings between the locative context type and the other context types, thereby allowing the inference that this was true for all participants, this was not the case. The AQ measure allowed us to see that the main effect of context type was being carried in fact by only a subset of the study sample, a subset that could be independently characterized as more context-sensitive (lower-AQ). Had individual differences in context-sensitivity not been accounted for in this study, the conclusion from this finding would have generated different consequences for our understanding of contextualization ability and its potential role in variation. Therefore, we believe it to be relevant and, in our view, very fruitful that work involving any sort of contextual modulation account for this parameter of individual differences, not only to better understand the role of cognitively rooted and socially rooted variability in linguistic behavior, but also to allow for more precise models of linguistic structure and processing.

7. Conclusion. The findings presented in this study support the idea that the cognitive capacities associated with autistic-like traits contribute to linguistic context-sensitivity, in that variability in participants’ ability to access relevant contextual information correlates with their AQ scores. From this perspective, intercomprehender variability is not entirely random; it results at least partially from the varying cognitive capacities of the comprehender to recognize a communicative intention in conjunction with the lexical meanings present and to search effectively and efficiently for relevant disambiguating information in the context. If true, this approach to individual-level variability would not only lead to a more linguistically principled and ecologically valid model of synchronic variation but also have direct implications for our understanding of diachronic change at all levels of linguistic representation.

REFERENCES


Antoniou, Kyriakos; Chris Cummins; and Napoleon Katsos. 2016. Why only some adults reject under-informative utterances. *Journal of Pragmatics* 99.78–95. DOI: 10 .1016/j.pragma.2016.05.001.


Baron-Cohen, Simon; Michael V. Lombardo; Bonnie Auyeung; Emma Ashwin; Bhismadev Chakrabarti; and Rebecca Knickmeyer. 2011. Why are autism spectrum conditions more prevalent in males? PLoS Biology 9(6):e1001081. DOI: 10.1371/journal.pbio.1001081.


Boland, Julie E.; Edith Kaan; Jorge Valdés Kroff; and Stefanie Wulff. 2016. Psycholinguistics and variation in language processing. Linguistics Vanguard 2(s1).3–12. DOI: 10.1515/lingvan-2016-0064.


HAGENAARS, Muriel A.; Iris M. Engelhard; and Peter Putman. 2016. Eye for detail: Local versus global visual processing style predicts the development of re-experiencing after analogue trauma. *Journal of Experimental Psychopathology* 7(3).391–403. DOI: 10.5127/jep.052215.


Hyde, Janet Shibley; Rebecca S. Bigler; Daphna Joel; Charlotte Chucky Tate; and Sari M. van Anders. 2019. The future of sex and gender in psychology: Five challenges to the gender binary. *American Psychologist* 74(2).171–93. DOI: 10.1037/amp0000307.


Kozhevnikov, Maria; Carol Evans; and Stephen M. Kosslyn. 2014. Cognitive style as environmentally sensitive individual differences in cognition: A modern synthesis and


Parish-Morris, Julia; Mark Y. Liberman; Christopher Cieri; John D. Herrington; Benjamin E. Yerys; Leila Bateman; Joseph Donaher; Emily Ferguson; Juhi


Pisula, Ewa; Rafał Kawa; Łukasz Szostakiewicz; Izabela Łucka; Magdalena Kawa; and Agnieszka Rynkiewicz. 2013. Autistic traits in male and female students and individuals with high functioning autism spectrum disorders measured by the Polish version of the autism-spectrum quotient. *PLoS ONE* 8(9):e75236. DOI: 10.1371 /journal.pone.0075236.


Polderman, Tinca J. C.; Baudevintje P. C. Kreukels; Michael S. Irwig; Laurenb Beach; Yee Ming Chan; Eske M. Derks; Isabel Esteva; Jesse Ehrenfeld; Martin Den Heuer; et al. 2018. The biological contributions to gender identity and gender diversity: Bringing data to the table. *Behavior Genetics* 48.95–108. DOI: 10.1007 /s10519-018-9889-z.


Ruzich, Emily; Carrie Allison; Bhismadev Chakrabarti; Paula Smith; Henry Musto; Howard Ring; and Simon Baron-Cohen. 2015. Sex and STEM occupation predict autism-spectrum quotient (AQ) scores in half a million people. *PLoS ONE* 10(10):e0141229. DOI: 10.1371/journal.pone.0141229.


