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PERSPECTIVES

Autism, constructionism, and nativism

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The goal of this article is to provide a balanced assessment of the significance autism has for the scientific study of language. While linguistic profiles in autism vary greatly, spanning from a total absence of functional language to verbal levels within the typical range, the entire autism spectrum is robustly characterized by lifelong disabilities in intersubjective communication and persistent difficulties in adopting the perspective of other people. In that sense, autism constitutes a unique profile in which linguistic competence is dissociated from communication skills. Somewhat paradoxically, autism is often mentioned to underscore the importance of mind reading for language use and of intersubjective communication for the emergence of language. Yet experimental studies on pragmatics in autism indicate that many pragmatic processes unfold without adopting one's conversational partner's perspective. Moreover, the patterns of language acquisition and learning in autism represent a strong challenge to the central role constructionist theories assign to socio-communicative skills. Data on autism thus force a reconsideration of the a priori conceptual boundaries on language learnability that shape the foundational debates between constructionist and nativist linguistic theories.*

Keywords: autism, nativism, constructionism, statistical learning, mind reading, experimental pragmatics

1. Introduction. The last three decades have seen our understanding of autism sharply increase, in aspects ranging from behavioral to neurocognitive to biological. Scientific interest in language in autism is no exception to this welcome trend. A rapid search on the Scopus database, with keywords 'autism AND (language OR linguistic*)', yields a total of 9,039 publications between 1990 and 2019, with an estimated growth of 27.16 entries per year ($SE = 1.53$, $R^2 = 0.92$). Atypical language development and use is a core aspect of autism, as well as a major predictor of individual outcomes, and, as expected, most of this research is part of the ongoing effort to better delineate the clinical profiles of individuals on the autism spectrum. However, as more and more evidence becomes available from experimental and clinical studies, autism research also becomes increasingly important for more foundational debates about the nature of linguistic competence. In the current nosological definition of autism, the linguistic profile is included as a diagnostic specifier, which may span from a total absence of functional language to verbal levels within the typical range (American Psychiatric Association 2013). Nonetheless, and in spite of the significant heterogeneity that is otherwise inherent in the autism diagnosis, a consistent characteristic of verbal autistic individuals is that their linguistic knowledge and their use of language in context combines with lifelong difficulties in intersubjective perspective taking and communication.[1] This unique linguistic profile should prompt linguistic theory to distinguish matters of linguistic competence from the use of language in communication. More specifically, research on language in autism poses an important, but somehow overlooked, challenge for two related lines of thought that have considerable sway in con-

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[1] In line with the preferred usage of many individuals on the autism spectrum and of parents of children with a diagnosis of autism (Kenny et al. 2015), throughout the article I use 'autistic individual (or child)' rather than 'individual with autism' or 'individual with autism spectrum disorder'.

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temporary linguistics. The first is that intersubjective, socio-communicative skills are determining for acquiring language; the second is that these skills are indissociable from mind-reading abilities.[2]

A crucial premise of contemporary constructionist theories is that intersubjective language use underpins the acquisition of the structural properties of the child's native tongue. This idea is also rightly characterized as one of the most fundamental differences between these approaches and a rationalist, Chomskyan research program (Goldberg 2003, 2013). On the one hand, language use is seen as essential to the development of language, as the following quote aptly illustrates:

> all linguistic knowledge—however abstract it may ultimately become—derives in the first instance from the comprehension and production of specific utterances on specific occasions of use. (Tomasello 2000: 237–38)

On the other hand, in constructionist theories, using language in context is unambiguously seen as being dependent on the capacity to attribute complex mental states to other people—intentions about other people's beliefs or, at least, about what lies in their attentional focus:

> With regard to language in particular, the child has to understand a special class of intentions known as communicative intentions. Thus, a child might hear her father exclaim, 'Look! A clown!' To fully understand his linguistic behavior (with an eye toward reproducing it) she must understand that her father intends that she share attention with him to a particular object; that is to say, understanding a communicative intention means understanding precisely how another person intends to manipulate your attention … . It is only by understanding the communicative intention behind these funny noises that the child can learn how to use a particular linguistic expression appropriately when she has 'the same' communicative intention (towards someone's attention). (Tomasello 2000:238)

Constructionism heavily relies on classic Gricean reconstructions of human communication as a coordination problem, to which building a model of the speaker's mental states may provide an optimal solution (e.g. Grice 1957, Lewis 1979, Thomason 1990). However, constructionism also endorses the transposition of such Gricean reconstructions into a psychological theory, in which utterance interpretation is necessarily a (complex) exercise in mind reading (e.g. Sperber & Wilson 2002), and turns mind reading into the essential component of human language acquisition (see, for instance, Tomasello 2008:Chs. 3 and 4).

The key hypothesis at the root of contemporary constructionist models is thus that language acquisition is fundamentally constrained by cooperative communication, rooted in the ability to adopt other people's mental states. However, language in autism constitutes a major difficulty for this constructionist (or empiricist, if you wish) hypothesis, as data from autism warrant neither the assumption that language use is intrinsically linked with mind reading nor that language acquisition is grounded in language use. In the first section of this article, I briefly survey recent experimental literature on autism which provides strong evidence that many areas of pragmatics are based on egocentric processes, independent of THEORY OF MIND. The first conclusion linguists should draw from data on autism, then, is that using language is partly independent of one's ability to understand one's interlocutors' minds or to adopt their perspectives. That being said, early engagement in intersubjective communicative interaction is clearly decisive for (typical) language acquisition. However, as discussed in the second section of this article, at least some autistic individuals learn language in a noninterac-

[2] In this article I interchangeably, and in a theoretically agnostic way, use the terms 'theory of mind' and 'mind reading' to refer to the cognitive ability to attribute mental states to other people.

tive way. Autism thus appears to falsify the assumption that the acquisition of linguistic knowledge is a priori impossible without intersubjective communicative interaction. A complex but far-reaching issue that I broach in the last section of the article is the extent to which the data from autism can be accommodated in nonnativist theories. Many linguistic theories include usage-based components that are couched in terms of domain-general statistical mechanisms, independent of intersubjective communication or, for that matter, of language. However, all of these theories require some kind of upstream constraint on such distributional learning: some authors posit an innate universal grammar (Culicover & Jackendoff 2005, Yang 2016), but those who reject nativism usually ground usage-based linguistic learning in cooperative communication (e.g. Goldberg 2003, 2013, Tomasello 2008, Christiansen & Chater 2016a).

2. Language use without mind reading. Around 70% of individuals on the autism spectrum do eventually reach functional language (Anderson et al. 2007, Wodka et al. 2013, Kim et al. 2014), but pragmatic disabilities—which are out of step with the developmental level of phonological and morphosyntactic skills—represent a lifespan hallmark of autism, as even fully verbal autistic children and adults experience difficulties in all areas of language use that require adapting to one's conversational partner's perspective. Furthermore, recent literature on pragmatics in autism, surveyed in this section, indicates that context-dependent comprehension of language in autistic individuals remains limited to an 'egocentric' perspective by the difficulties in mind reading that are inherent in the autism diagnosis (for detailed discussions, see Kissine 2012, 2016, Andrés-Roqueta & Katsos 2017, Geurts et al. 2020).

Let me start with metaphor comprehension, which emerges, across studies, as impaired in autism (Kalandadze et al. 2019). Interestingly, the extent to which metaphor comprehension is impaired in autistic individuals is predicted by language level and, more specifically, by lexical knowledge, rather than by theory of mind (Adachi et al. 2004, Norbury 2005a, Kalandadze et al. 2016). At its core, understanding a metaphor boils down to flexible lexical interpretation (e.g. Glucksberg 2007, Carston 2012). Some metaphors probably require more advanced mind-reading abilities to be understood than others (Lecce et al. 2019), but there is nothing inherent in metaphor interpretation that would make it inaccessible to autistic individuals with a deficient theory of mind. Autistic individuals are able to use linguistic context to resolve lexical ambiguities (Norbury 2005b, Brock et al. 2008, Hahn et al. 2015), and it is therefore plausible that context-sensitive activation processes allow them to reach metaphoric interpretations without necessarily engaging in reasoning about the speaker's communicative intentions. However, the fact that autistic—and, probably, nonautistic—people may process metaphor without using theory of mind does not entail that such an 'egocentric' pragmatic processing is always optimal. Adopting the speaker's perspective—making hypotheses about their communicative intentions—provides particularly valuable cues as to the direction in which metaphoric interpretation should unfold (Wearing 2010). It is therefore not surprising that, in spite of performing the same as neurotypicals in decontextualized metaphor tasks, autistic participants may also report significant difficulties in understanding figurative language in everyday conversations (Hermann et al. 2013).

In the same vein, autistic children and adults can use context to understand indirect requests (Kissine et al. 2012, Kissine et al. 2015, Deliens et al. 2018). However, such conversational inferences can be correctly reached simply because the linguistic content makes certain assumptions accessible, without necessarily reasoning about the speaker's communicative intentions (Jary 2013, Kissine 2013, Ruytenbeek 2017, Ruy-

tenbeek et al. 2017). Several independent studies have also found that autistic participants derive quantity implicatures to the same extent as neurotypicals (Pijnacker et al. 2009, Chevallier et al. 2010, van Tiel & Kissine 2018). But again, it is likely that autistic individuals' derivation of quantity implicatures both does not involve mind reading and is less accurate in more complex cases that require reasoning about the speaker's epistemic state (Hochstein et al. 2018, van Tiel & Kissine 2018).

Finally, autistic individuals, even those with structural language levels within the typical range, are known to struggle with irony (Happé 1993, Kaland et al. 2002, Martin & McDonald 2004). This is to be expected, given that irony usually involves keeping track of multiple perspectives, which pile up on each other (e.g. Bryant 2012). In a discrimination task, in which ironic items are associated with a distinctive intonation contour (while nonironic ones are uttered in a neutral tone of voice), autistic participants do perform above chance (Wang et al. 2006, Chevallier et al. 2011, Colich et al. 2012). However, when ironic stimuli are not systematically associated with distinctive prosody, contextual incongruence, or facial expression, Deliens et al. (2018, experiment 2) found that autistic participants perform at chance in identifying the meaning intended by the speaker. Interestingly, the same autistic participants appear to have no difficulties in interpreting requests cast in an indirect way (Deliens et al. 2018, experiment 1), which confirms that unlike irony interpretation, some indirect speech acts may be grasped from an egocentric perspective. Likewise, van Tiel et al. (2021) provide evidence that while autistic adults may use strategic deception, they do so by relying on compensatory, cognitively costly learning strategies, which do not involve mind reading. This dissociation between preserved egocentric pragmatic processing and impairment in areas that require perspective shifting is unlikely to be explained away in terms of a deficit in lexical knowledge or morphosyntax, as autistic and nonautistic participants in Deliens et al. 2018, van Tiel & Kissine 2018, and van Tiel et al. 2021 did not differ on verbal (and nonverbal) IQ measures.[3]

There is no dispute that both form and content typically need to be tailored to the communicational context and to one's interlocutor. Nor would it make sense to deny that linguistic structure contains referential and cohesive devices—such as connectives or discourse markers—geared toward optimizing the processing of one's verbal production by the audience. Such aspects of language use are precisely those that remain problematic even for highly verbal autistic individuals. Scarce use of referential expressions, difficulties in constructing a coherent narrative or avoiding redundant messages, and, more generally, poor tuning in to conversational dynamics have consistently been attested in autistic children and adults (e.g. Baltaxe & D'Angiola 1992, Eales 1993, Fine et al. 1994, Surian et al. 1996, Colle et al. 2008, Diehl et al. 2008, Asp & de Villiers 2010, Baixauli et al. 2016, Geelhand et al. 2020).[4]

Claiming that language can be wielded from an egocentric perspective does not entail, then, that mind reading is not required for much of our successful communication. Incidentally, nor do I claim that attributing communicative intentions to other people

[3] I am not denying that some individuals on the autism spectrum may also have impaired morphosyntax (e.g. Ambridge et al. 2015), even though areas of strength in purely syntactic processing have been attested in autism (Eigsti & Bennetto 2009, Janke & Perovic 2017), including at a young age (Tovar et al. 2015).

[4] Some proponents of the social motivation theory of autism (Chevallier et al. 2012) speculate that in autistic individuals pragmatic processing is rooted in theory of mind, but appears deficient due to lack of motivation to engage in intersubjective communication (see Chevallier et al. 2011, Chevallier et al. 2014). However, experimental data clearly show that while the determining factor in autistics' performance is whether the pragmatic task requires adopting somebody else's perspective, no clear motivational factors seem to emerge (see van Tiel & Kissine 2018, Kissine 2019 for critical discussion).

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should necessarily be a cognitively effortful process—at least for nonautistic individuals (see Geurts & Rubio-Fernández 2015 for a lucid discussion). While relying on mind reading in conversation may be effortless for many people, it is indisputably challenging for autistic individuals. The point is that when autistic individuals use and interpret language in context, they do so without projecting themselves in the minds of their conversational partners.

3. Language learning in autism. The data from autism discussed in the previous section show that, however important intersubjective, shared intentionality may be for efficient conversation management, it is not inherent in context-based, pragmatic interpretation processes. Now, it could be that even though adopting other people's perspectives is not always required to use language, without an innate disposition for cooperative interaction and shared intentionality, language cannot be acquired in the first place. Clearly, such a view should, at the very least, be able to account for the linguistic profiles of verbal autistic individuals who combine functional structural language with lifelong difficulties in adopting other people's perspectives.

If, as presupposed by constructionist theories, acquired language structures gradually emerge from interactional experience of form-meaning pairs, one should expect language skills in autism to be negatively correlated with the strength of interaction symptoms. On this conception, in sum, when (and if) language emerges in autism, its acquisition should essentially follow the same route as in typically developing children, gradually overcoming difficulties in processing social stimuli. Unfortunately, as discussed just below, current evidence for such a hypothesis is rather weak. Moreover, there are a few case studies in autism that strongly suggest that communicative interaction is not even required for language to emerge.

3.1. Language acquisition and joint attention in autism. Difficulties in attending to and processing social information are already emerging as a robust behavioral manifestation of autism toward the end of the first year of life (e.g. Elsabbagh & Johnson 2010, Jones & Klin 2013, Zwaigenbaum et al. 2015). In comparison with their typically developing peers, infants later diagnosed with autism appear to look and smile less at people, to rarely gaze in the direction of a human voice, even when called by their name, and to almost never produce sounds or babbling directed at another person (e.g. Osterling & Dawson 1994, Baranek 1999, Maestro et al. 2002, Clifford & Dissanayake 2008). Retrospective analyses of home videos, as well as parental reports, indicate that, between one and two years of age, autistic children display significantly less attention-sharing behaviors than typically developing children or children with other developmental delays. For instance, infants later diagnosed with autism rarely switch their eyes back and forth between an adult and some object they find interesting or point at an object to draw the adult's attention to it (Stone & Lemanek 1990, Clifford & Dissanayake 2008). Consistent with these reports, eye-tracking studies suggest that during the first two years of life, autistic children tend to spend less time looking at the eyes and the mouth regions of speaking faces (Campbell et al. 2013, Jones & Klin 2013, Chawarska et al. 2015).

Acquisition of structural language in autism is also atypical, both quantitatively and qualitatively. In at least 50% of autistic children, expressive language appears with a considerable delay, usually after the age of three, and around 30% of autistic individuals never achieve functional verbal communication at all (Anderson et al. 2007, Wodka et al. 2013, Kim et al. 2014). These linguistic deficits resist a reduction to a comorbid condition, a form of developmental language disorder, distinct from a 'core' sympto-

matology of autism (Boucher 2011). The current consensus is rather that the causal origins of atypical language development in autism are at least partly inherent in the sociopragmatic properties of the disorder itself. Precocious and persistent difficulties in attending to and processing social information are then likely to impact language acquisition in autism.

As alluded to in the introduction, constructionist approaches to typical and atypical linguistic development assign a central role to the capacity to share a common ground with one's interactional partners. The most conspicuous early manifestation of such shared intentionality is the ability to respond to social cues, such as gaze direction or pointing, to establish joint attention (e.g. Farroni et al. 2002, Luyster et al. 2008, Tomasello 2008, Csibra 2010). In a sense, language development delays and deficits in autism underscore the importance of sociopragmatic factors for language acquisition. Low sensitivity to social information in the early stages of the life of an autistic child certainly has a cascading effect on the acquisition of language. However, lifelong interactional and pragmatic disabilities are robustly attested across the otherwise greatly heterogeneous autism spectrum. And, as argued in the previous section, when autistic individuals use and interpret language in context, they most probably do so without adopting their interlocutor's perspective. Early-onset sociopragmatic deficits likely cause language delays, but a very different explanation may be needed in order to understand how verbal autistics eventually DO acquire language.

Many experimental studies have sought to causally link joint attention and language in autism by implementing some version of the discrepant labeling task (Baldwin 1993). Such paradigms feature two novel objects, one of which is labeled by the experimenter. The condition of interest is when a new label is provided while the object in the attentional focus of the experimenter is different from the one to which the child is attending. Typically developing children between eighteen and twenty-four months usually associate the new label with the object the experimenter is looking at, even though this is not the object in their own attentional focus (for a review, see Tomasello 2008:158–61). By contrast, many authors report that autistic children tend to associate the new label with the object they, and not the experimenter, are attending to, thus proving unable to share attention with the adult to acquire new words (Baron-Cohen et al. 1997, Preissler & Carey 2005, Parish-Morris et al. 2007, Luyster & Lord 2009, Akechi et al. 2011, Akechi et al. 2013).[5] However, a noticeable but seldom acknowledged feature shared by all of these studies is that autistic children are matched by vocabulary levels to the comparison groups. If anything, then, this literature indicates that while autistic children may not rely on joint attention to acquire new words, they may reach a receptive vocabulary comparable to that of children who do so.[6]

Some retrospective analyses do suggest that, in autistic children, lower social impairment or better joint-attention skills correlate with later language levels (Wodka et al. 2013, Yoder et al. 2015). But in a significant number of other large longitudinal or prospective studies, socio-communicative variables do not systematically predict language outcomes, especially once nonverbal IQ is factored in (Anderson et al. 2007, Bennett et al. 2015, Ellis Weismer & Kover 2015, Thurm et al. 2015). In this connec-

[5] For conflicting or more nuanced results, see Norbury et al. 2010, Gillespie-Lynch et al. 2013, and McGregor et al. 2013.

[6] It is also important not to overestimate the importance of joint attention in typical language development, where it is mainly limited to early stages of the acquisition of nouns (Akhtar & Gernsbacher 2007, Tsimpli 2013).

tion, it is interesting to observe that the most prominent intervention programs are currently grounded in constructionist models of typical language acquisition and prioritize joint attention or social communication in the hopes of enhancing linguistic development (Dawson et al. 2010, Green et al. 2010). Improving an autistic child's socio-communicative and joint-attention abilities can clearly have beneficial consequences for the child's interaction skills. Yet when it comes to predicting the acquisition of vocabulary and morphosyntax, there is no unambiguous evidence that intervention techniques specifically targeting joint-attention skills have an effect on language outcomes (Rogers et al. 2019, Sandbank et al. 2020).

None of this, of course, is to deny the significance of the link between language and sociopragmatic factors. Better language skills allow more opportunities for meaningful interaction, which may further foster language development. But a significant proportion of autistic children also end up acquiring structural language IN SPITE OF the persisting interactional, sociopragmatic difficulties. It is possible, therefore, that these children take a route to acquiring language that does not relate to its intersubjective function. And, as we will see now, important (though somewhat overlooked) data from autism rather strongly suggest that language can be acquired in a noninteractive way.

3.2. NONINTERACTIVE LANGUAGE LEARNING IN AUTISM. Active child-directed interaction, as opposed to passive exposure to linguistic input, has long been acknowledged as a crucial factor in language acquisition. Early evidence came from hearing children whose deaf parents extensively exposed them to radio and television in the hopes that they would acquire speech. Despite this passive exposure to spoken English, these children exhibited severe language delays (Sachs et al. 1981). Later on, a landmark experimental study revealed that while American infants were capable of acquiring phonological categories of Mandarin Chinese from live exposure to speakers of the language, no such acquisition resulted from watching comparable video recordings (Kuhl et al. 2003, Lytle et al. 2018). Such data are crucial for constructionist models, according to which shared communicative experience allows language structures to be gradually induced as a direct result of the shared nature of this experience.

A recent study, however, indicates that noninteractive language acquisition from television does occur in some autistic children. In Kissine et al. 2019 we thoroughly documented five cases of Tunisian autistic boys ranging from five to ten years old who spontaneously and productively used the standard, noncolloquial variety of Arabic. Such a linguistic profile is very intriguing because Tunisia, like most Arabic-speaking communities, is inherently diglossic: a vernacular, colloquial variety is used in everyday interaction, while the significantly distinct Standard Arabic is reserved for very formal, mostly written settings. Importantly, before (or unless) protracted and explicit instruction takes place at school, children fail to master Standard Arabic, whether at the level of comprehension, production, phonology, or morphosyntax (Amayreh 2003, Saiegh-Haddad et al. 2011, Khamis-Dakwar et al. 2012, Leikin et al. 2014). Yet the autistic children in Kissine et al. 2019 displayed a striking proficiency in Standard Arabic: they productively and correctly used phonemes, case marking, complex negation forms, and verbal moods that characterize Standard Arabic but are nonexistent in the Tunisian colloquial variety. As Standard Arabic is never used in everyday communication, learning this variety had no communicative purpose for these children. Furthermore, the only exposure to this variety from which this learning could have stemmed is noninteractional. Many cartoons and television programs that are broadcast across the Arabic-speaking world are in Standard Arabic. Given their young age, this is the only

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possible source from which the autistic children described in Kissine et al. 2019 could have learned Standard Arabic.

While the diglossic context of Tunisia renders noninteractional language learning more apparent, the same phenomenon may also occur but be less visible in nondiglossic environments. A study in progress in our lab is currently documenting profiles of autistic children who acquire a foreign language, not used in their environment, from exposure to the internet. It is too early to report quantitative data on such 'YouTube bilinguals', but one of the profiles we have documented so far may be worth briefly mentioning here. B is a twelve-year-old autistic boy, with a nonverbal IQ slightly below the norm (67 on Leiter-3; Roid et al. 2013), who attends primary school in French (in the French-speaking part of Belgium) and whose familial environment is exclusively French-speaking. B has an intense interest in watching videos in English on the internet. In spite of the fact that none of his caregivers reported ever using English with him, B insists on speaking only English with his parents, siblings, and schoolmates. B's competence in French and English—sentence comprehension, sentence production, sentence repetition, morphology—was formally assessed using the same standardized scale (CELF-V; Wiig et al. 2013a,b). While delayed for his chronological age, B's scores are identical in French and English, which strongly suggests that B's noninteractive learning of English unfolded on par with his acquisition of French.

To the cases just evoked one can also add EV, an autistic Bulgarian girl who, by the age of nine, reached impressive mastery of German exclusively from passive exposure to television programs (Vulchanova et al. 2012). Another extensively described language savant with autistic traits, Christopher, demonstrated an exceptional ability to learn new languages from limited exposure and with a preference for written input (Smith & Tsimpli 1995, Smith et al. 2011). Interestingly, both EV and Christopher seemed to enjoy the experience of learning a new language for its internal structural properties, rather than for the communicative potential it could offer, and both acquired foreign language morphological paradigms with a striking ease.

3.3. The significance of noninteractive language learning in autism. The case studies discussed in the foregoing should not be relegated to some kind of linguistic *Kunstkammer*. The prevalence of autism, in one form or another, may exceed one child in seventy (Christensen et al. 2016, Christensen et al. 2019); among these children, around 60% end up acquiring functional structural language (Wodka et al. 2013, Kim et al. 2014). As yet, there is no estimate of the extent to which language acquisition in these individuals is noninteractive. The absence of a clear link, discussed in §3.1, between joint attention and language outcomes in autism strongly suggests that language is acquired in a noninteractive way in many more autistic individuals than currently documented (for a defense of this view from the perspective of early intervention, see Mottron 2016, 2017). To be sure, one could argue that the way language is learned by the autistic individuals described above is intrinsically distinct from the neurotypical pathway to language. However, it is highly implausible and scientifically questionable to posit two drastically different neurocognitive mechanisms for a skill as complex as language acquisition.

Language learning in autism unquestionably displaces the conceptual boundary on linguistic learnability endorsed by constructionist models. Both quantitative and case studies discussed in this section indicate that the impetus to engage in communicative exchanges with others is not the only possible motivational factor for acquiring language. These data also unambiguously show that language structures may be acquired without

the support of an intersubjective communicative experience. In this respect, language acquisition in autism is clearly an important challenge for constructionist models.

4. Autism and the nativism debate in linguistics. Studying language learning in autistic individuals—in whom the apprehension of linguistic stimuli is mediated by an inherent sociopragmatic disability—can illuminate one of the deepest theoretical divides in the field of linguistics. Contrary to constructionist models, which posit that an innate drive to communicate allows language structures to be gradually induced from communicative experience (Tomasello 2008), Chomskyan nativist approaches hold that essential aspects of linguistic knowledge are innate. For nativists, early linguistic input is crucial, but its role is limited to activating one among the few structural possibilities this innate competence allows (e.g. Chomsky 2000, 2005, Berwick & Chomsky 2016). Both approaches assign a central role to early linguistic interaction, but whereas in constructionist models a precocious impetus to engage in intersubjective communication is a prerequisite for the emergence of linguistic structures, in nativism its role is limited to drawing the child's interest toward linguistic evidence. In a slightly alternative formulation, in theories of the latter brand, the primary role of linguistic input is to provide the learner with evidence for the structural features of the language, while theories of the former brand emphasize sociopragmatic interaction and joint-attention processes, from which meaning-form pairings emerge. The remainder of this section is devoted to assessing the extent to which data from autism may be invoked as evidence for nativism.

4.1. Statistical learning. There is currently no clearly formulated account of how noninteractive language learning in autism may unfold, but it is instructive to consider which ingredients such an account could include. Exceptional abilities are well documented in individuals with autism, albeit mostly in nonlinguistic domains, such as calendar calculation, absolute pitch, or graphic memory (Pring 2005, Mottron, Lemmens, et al. 2006, Howlin et al. 2009, Mottron et al. 2009). These savant skills in autism are usually explained in terms of preferential attention to detail, enhanced processing of local structural properties, and a superior capacity to detect and analyze domain-specific, systematically recurring patterns (Happe & Frith 2006, Mottron, Dawson, et al. 2006, Baron-Cohen et al. 2009, Pellicano & Burr 2012, Mottron et al. 2009, Mottron et al. 2013). It is therefore plausible that those autistic individuals who learn language outside of any interactional frame do so by relying on a superior sensitivity to structural properties in processing language input. In fact, this explanation has been suggested both for EV (Vulchanova et al. 2012) and for Christopher (Tsimpli et al. 2017).

Since the seminal studies on probabilistic acquisition of word boundaries in infants (Saffran et al. 1996), a rich body of experimental work has highlighted the importance of statistical learning in language acquisition. Statistical learning should most probably be thought of as a domain-general capacity to detect the distribution of structural properties, which applies but is not limited to the processing of linguistic input. Even though the exact nature and scope of the role played by statistical learning in language acquisition remains an open question, probabilistic extraction of structural regularities is likely to play an important role in language development (Siegelman & Frost 2015, Frost et al. 2019, Siegelman 2020). Using slightly different methods, two relatively recent meta-analyses concluded that there is an absence of impairment in implicit statistical learning in autism (Foti et al. 2015, Obeid et al. 2016). Language delays in autism are thus not associated with an impaired ability to induce the structural properties of the linguistic input (probably in contrast to developmental language disorder; see Haebig et al. 2017, Lammertink et al. 2020).

Along with joint attention and shared intentionality, usage-based linguistic theories put great emphasis on probabilistic and associative learning mechanisms (e.g. Goldberg 2003, 2006). The data from autism that have been discussed in the foregoing could be integrated within these models by assigning more weight to probabilistic mechanisms over joint attention. It could be that, because of the unavailability of socio-communicative cues, at least some autistic individuals learn language exclusively by relying on probabilistic, associative processes. Such a compensatory strategy could, of course, be facilitated by the hypersystematizing, enhanced processing of local structural properties that are independently attested in autism.

The unavailability of socio-communicative feedback may prompt autistics to exploit some learning pathways to a greater extent than their typically developing peers do. Carving phonological categories out of the acoustic stream is an essential step toward language (e.g. Kuhl 2004), which could be partly determined by the statistical frequency of cooccurrence of certain sounds in infant-directed speech (Vallabha et al. 2007). However, in typical language development such distributional learning is supplemented by communicative, referential intentions.[7] In autism, referential bootstrapping of language learning is clearly compromised by poor social orientation. It is therefore likely that autistic children should rely, to a greater extent than their typically developing peers, on probabilistic learning—or on other bottom-up mechanisms nonspecific to language, such as audiovisual integration (see e.g. Robertson & Baron-Cohen 2017, Stevenson et al. 2017, Righi et al. 2018, Kissine et al. 2021)—to acquire phonological and word boundaries.

Christiansen and Chater (2016b) emphasize that rehearsing previously heard linguistic material can help to reanalyze it and, in this way, can facilitate the chunking of new sequences of speech. Interestingly, intense echolalic repetition of a limited number of previously heard linguistic segments—often excerpts from cartoons or internet videos—is extremely widespread in autism. Such delayed echolalia may serve a variety of communicative functions, unrelated to the compositional meaning of the echoed linguistic sequence (Prizant & Rydell 1984). More importantly for the present discussion, though, echolalia also often transitions to more compositional and productive language (Gernsbacher et al. 2016, Mottron 2016, 2017). Phonological categories can be modeled as density distributions over a parametric (acoustic and articulatory) space, which are gradually shaped by perception-production loops (Pierrehumbert 2003). Typically developing children acquire these categories, to an important extent, by mirroring and then adapting the phonological templates used by adults in interaction with the child (Vihman & Croft 2007). A reasonable hypothesis is that in autistic children, for whom verbal interaction is often challenging, delayed echolalia constitutes a noninteractional opportunity to induce phonological categories from iterated perception-production loops.

4.2. Third factors. Two important and intertwined theoretical consequences arise at this stage. First, language learning in autism appears to vindicate the famous but often derided claim by Chomsky that communication is not the primary function of language. Second, a crucial question is whether in the absence of access to social, intersub-

[7] The classic example is that of the acoustic variability between dental [d̪] and retroflex [ɖ] voiced stops, which in Hindi accompanies different referential intentions (e.g. [d̪al] 'lentils' vs. [ɖal] 'branch'), but corresponds in English to nonphonological coarticulatory variation (e.g. [d̪ɑl] in *this doll* vs. [ɖɑl] in *your doll*). The intersubjective experience of language as a communicative tool is thus essential for helping Hindi-speaking infants learn the contrastive function of the [d̪]-[ɖ] opposition (Yeung & Werker 2009).

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jective cues, the way autistics learn language can be exclusively explained in terms of domain-general learning skills. To better grasp these two issues, it may be helpful to frame the discussion against the three factors with which Chomsky (2005) associates linguistic knowledge.

- Language-specific genetic endowment
- Experience
- Cognitive factors not specific to language

The content of the first factor varies across different instantiations of nativism and is fairly frugal in the latest version of Chomsky's model of language (Chomsky 1995, Hauser et al. 2002). In constructionist, usage-based models, the first factor is, by hypothesis, defined as vacuous, so that cognitive mechanisms determining for language acquisition are necessarily included within general-domain factors of the third type.

In constructionist theories, joint attention, mind reading, and the early drive toward intersubjective communication are viewed as domain-general skills, whose role is posited to be essential for language development. From the perspective of the nativist program, such socio-communicative skills also clearly belong to third factors, but with a more modest role, on par with, say, executive functions. Poor executive functioning will without doubt compromise language acquisition and functioning. Yet as important as it is for language, to the best of my knowledge, no theory holds that executive functioning is the core ingredient that makes human language what it is. Data from autism indicate that the role of socio-communicative and mind-reading skills in language acquisition should be characterized in similar terms: even though the cognitive skills required for perspective taking and intersubjective communication are impaired, many individuals with autism manage to learn language in a noninteractive way and use it from an egocentric perspective.[8]

Christiansen and Chater (2016a:Ch. 2) contrast two types of learning: C-induction, 'acquiring the ability to co-ordinate with others', and N-induction, 'acquiring the ability to understand and manipulate the natural world' (p. 69). They propose that language acquisition is an instance of C-induction—and hence is intrinsically communicative. However, in the case of at least some autistic individuals, language learning would instead belong to N-induction, as it amounts to detecting the underlying structure of what, from the learner's perspective, are noncommunicative stimuli. A particularly illuminating aspect of Christiansen and Chater's distinction between C- and N-induction is that it cuts across the nativist/empiricist divide. Some instances of C-induction are clearly innate, such as the dance of honeybees, and some aspects of N-induction are learned, such as the location of edible food in some environments or food-preparation techniques in chim-

[8] Hinzen et al. (2020) recently argued that autism—especially in nonverbal individuals—constitutes a counterexample to Chomsky's refusal to see communication as the primary function of language. Hinzen et al. insist that the absence of language in autism (almost) universally cooccurs with intellectual disability (note that gaining a precise idea of the general intellectual level in nonverbal autistic individuals is notoriously difficult; see, for example, Bishop et al. 2015, Tager-Flusberg et al. 2016, Courchesne et al. 2019) and claim that nativism should predict that such individuals could 'be linguistic thinkers, while language is only missing externally' (Hinzen et al. 2020:13). That language should not be equated with communication does not affect the obvious fact that for language acquisition to unfold—or, in less theory-neutral terms, for the linguistic faculty to become instantiated as a particular language in the learner's mind—the learner has to be able to process linguistic stimuli, which necessarily represent the externalization of somebody else's language. This ability is certainly dependent on nonverbal IQ, which, incidentally, is the most robust predictor of language outcomes in autism (Anderson et al. 2007, Ellis Weismer & Kover 2015, Thurm et al. 2015, Brignell et al. 2018, Pecukonis et al. 2019).

panzees and gorillas (2016a:71). It is therefore possible for constructionist models to accept that language acquisition is, or may be, an instance of noninteractive learning—of N-induction—without necessarily conceding that linguistic knowledge is underpinned by language-specific acquisition mechanisms.

More precisely, language learning in autism forces constructionists to posit that in the absence of top-down communicative feedback, probabilistic and associative mechanisms still allow the acquisition of structural language. But this is a consequence that rather heavily shifts the burden of proof toward constructionist models. Statistical learning is clearly a third factor in the nativist program (e.g. Lidz & Gagliardi 2015, Yang 2016). For the linguistic input to determine the direction in which the grammar of a language learner will develop, the learner has to be able to detect regularities in the linguistic input and to chunk it in structurally meaningful units. Therefore, assuming that the core linguistic faculty is intact and that there is sufficient linguistic input, nativism clearly allows for language learning in autism to unfold in a noninteractive way. Given language-specific genetic endowment, the structure of the linguistic input—independent of how and why it is used—may provide enough evidence for an autistic individual to build one's own internal language competence.

By contrast, in order to accommodate data from autism, constructionist models have to show that the weight of statistical, associative learning processes in language learning is sufficient to dispense with the idea of any kind of innate mechanism specific to language. In the case of autistic language learning, such a deflationary position would require that, without any socio-communicative bootstrap and without any innate, specifically linguistic predisposition, language acquisition be modeled as fully unsupervised statistical learning, in which most of the lowest-level parsing of the acoustic stream occurs without any kind of top-down guidance. For instance, Christiansen and Chater (2016a:Ch. 5) review an impressive array of experimental and computational studies that indicate how different aspects of linguistic structure may be acquired by integrating multiple distributional cues. However, in none of these experimental paradigms or simulations does learning start from scratch, viz. from a nonparsed acoustic stream, and go all the way up to morphology and syntax (cf. also Goldberg 2006:Chs. 4–6). Furthermore, the whole suite of multicue-integration learning mechanisms put forth by Christiansen and Chater (2016a) is explicitly situated within a framework where language acquisition is viewed as a solution to a coordination problem, as an instance of C-induction. Conversely, some nativist models assign a central place to usage-based or probabilistic mechanisms, but complement them with an innate universal grammar component (e.g. Culicover & Jackendoff 2005, Yang 2016). The challenge for nonnativist theories, then, is to show that noninteractive language acquisition in autism can be modeled in terms of fully probabilistic learning, with no reliance on a priori defined phonological features, word boundaries, parts of speech, or hierarchical relations and no (or very minimal) access to the form-meaning pairings intended by the speakers of the linguistic input.

5. Conclusion. Once relegated to the backstage of phonology and morphosyntax, pragmatics has been brought to the fore of linguistics by the considerable progress that has been made in understanding the cognitive mechanisms that underlie language use. As pragmatics was becoming a cognitive science in its own right (see Noveck 2018), however, also growing was the temptation to link—and, to some extent, reduce—the core aspects of language to communication. Language in autism invites a critical examination of linguistic theories that put mind reading at the core of language use, and lan-

guage use at the source of linguistic knowledge.

The study of the way autistic individuals acquire and use language should not be confined to some periphery of 'serious' linguistics. The prevalence of autism is far from negligible; therefore, verbal autistic individuals represent an important subset within the variety of instantiations of human language. Careful investigation of linguistic profiles in autism is crucial for better mapping the heterogeneity of the autism spectrum or for predicting individual developmental trajectories and outcomes. But taking language in autism seriously may also bring linguistic theory a step closer to answering foundational questions about the nature of linguistic competence.

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