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How literacy acquisition changes L1 grammatical knowledge

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Abstract: Literacy, the ability to read and write, is a relatively recent cultural invention, however, it has profound effects on cognition, and emerging studies also show that it may influence the mental representations of grammar among native speakers. This contradicts the widely-held assumption that all individuals within an L1 community acquire the same grammar unconsciously. The emerging studies indicate that the availability of a writing system, alongside nonverbal reasoning (i.e., reasoning and problem solving skills), and metalinguistic skills fostered by literacy, contributes significantly to ultimate language attainment. Recent scholarship suggests that illiterate individuals exhibit large individual differences in linguistic knowledge and how well they abstracted various grammatical forms, challenging the notion of uniform grammar that is thought to be achieved successfully across native speakers. This article reports on the state-of-the-art of illiteracy-grammar studies and reevaluates this hypothesis by investigating the impact of literacy on L1 grammar knowledge among illiterate speakers and makes suggestions for future studies.

Keywords: illiteracy, linguistic knowledge, ultimate language attainment, individual differences, grammar

1 Introduction

One of the received wisdoms in linguistics has been the idea that all native speakers of their respective L1s uniformly and successfully acquire the same grammatical knowledge despite differences in linguistic experience. The convergence hypothesis has been implicitly or explicitly supported, or assumed by linguists with a generativist background without providing much evidence for it (e.g., Chomsky 1975; Seidenberg 1997; Nowak et al. 2001; Birdsong 2004: 83; Bley-Vroman 2009: 179; Crain et al. 2009: 124; Lidz and Williams 2009: 177; Guasti 2017; Rizzi 2017: 102; Yang et al.

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2017; Wu 2020: 176; Crain and Thornton 2021: 349; Birdsong 2021). Often, convergence is mentioned as one of the main arguments in favor of universal grammar. It should be noted that linguists from usage-based background have also taken this for granted although usage-based approaches readily predict individual differences in linguistic experience (see Dąbrowska 2017 for a discussion).

Some readers might argue that not all (generativist) linguists share this perspective. While that may be the case, it does not change the fact that this argument has been an important pillar of universal grammar or generativist approaches. Firstly, recent scholarship cited above suggests that this viewpoint remains pertinent. Secondly, Scholz and colleagues (2024: Section 1.3) assert that generativists "are extremely impressed with the idea that very young children of almost any intelligence level, and just about any social upbringing, acquire language to the same high degree of mastery". Furthermore, some linguists propose "I, along with Chomsky and many other generativists, am convinced that UG does exist on theoretical and empirical grounds…" such as the fact that "all language learners converge on the same grammar even if they are exposed to different input" (Wu 2020: 175-176). In light of this, currently, it appears as if some linguists may take this belief as a fact rather than testing it, and it may be implicitly (or explicitly) assumed within generativist approaches.

Interestingly, some generativist linguists suggest that there should be individual differences in L1 grammar knowledge (Kayne 2000; Yang et al. 2017). However, such differences in grammatical knowledge are attributed little theoretical significance and are believed to be quite minimal. Chomsky (1975) asserts that these differences are marginal and "can be safely ignored across a broad range of linguistic investigation" (1975: 18). Newer postulations of generativist perspectives suggest that "the developmental trajectories of parameters are determined by the quantity of disambiguating evidence along each parametric dimension" (Yang et al. 2017: 116), yet implicitly claim that speakers converge on the same grammar. Thus, although it looks as if there is room for individual differences in performance in generativist views, more work is needed to make these views more cognitively plausible.

Recent reviews (Dąbrowska 2012, 2015, 2018; Kidd et al. 2018) and experiments (Chipere 2001; Dąbrowska 2018; Street 2020; Dąbrowska et al. 2022; Gedik 2024) show that adult L1 speakers of a language may represent the same grammar knowledge differently and even produce this language at different mastery levels, as a result of differences in education or print exposure. Considering that human cognition differs substantially on an individual level almost in every area (Gruszka et al. 2010), it is plausible to anticipate individual differences in native language attainment, too. These differences are quite considerable and theoretically quite important because they help us reimagine what competence (in the Chomskyan sense) or

underlying unconscious grammatical knowledge might be. If native speakers show individual differences in their grammatical mastery, what is competence, really?

These differences as a result of reading may not surprise readers who are familiar with such research. If anything, other linguists have criticized generativist approaches as well as the convergence hypothesis (Pullum et al. 2002; Dąbrowska 2012). However, one interesting question to pose is: if reading is influential, how is L1 grammatical knowledge shaped in the absence of literacy? After all, illiteracy is not a rare phenomenon. To the researcher's knowledge, there exist no studies evaluating the convergence hypothesis from the perspective of studies conducted with illiterate participants. A discussion of this has important methodological outcomes for language research (see Section 3).

Defined as the inability to "both read and write a short simple statement on his (her) everyday life" (UNESCO 2008), roughly one billion people around the world have been reported to be illiterate. Although writing is a recent cultural invention, there is evidence that it reshapes the brain in profound ways and appears to establish denser neural connections (Dehaene et al. 2015). Therefore, there are new frontiers to be explored with important theoretical implications for cognitive sciences.

There are several other reasons why literacy is an important factor to consider in first language acquisition studies. Written and spoken modalities significantly differ in quality, rendering literacy an important steppingstone to receive higher quality input. There is evidence that written language contains more types and tokens of a given construction and contains more constructions that are otherwise infrequent in spoken language (e.g., Roland et al. 2007). For instance, object relative constructions occur more frequently in written language than they do in spoken language, and this appears to be true cross-linguistically (Dąbrowska et al. 2022; Gedik (under review); Roland et al. 2007). Other complex structures that follow this asymmetry are passives, clefts, and complex noun phrases to name a few, at least in English and Turkish as far as testing goes. Additionally, this broader range of types and tokens can also be processed more quickly during reading than through purely oral exposure, as proficient readers tend to read faster than they listen. For example, according to *Duden: Grammatik* (2022, 10th edition, p. 905), in German, spoken language typically conveys about 120 words per minute, whereas reading speeds start at 200 words per minute or more.[1]

Unsurprisingly, literacy and print exposure have significant effects on ultimate L1 acquisition. Dąbrowska (2021) proposes the "training wheels hypothesis," suggesting that literacy may reduce cognitive overload by providing speakers with more opportunities to experiment with complex structures that are less common in spoken language using a written medium. This hypothesis is supported by

1 I would like to thank the anonymous reviewer for this reference.

studies showing that literacy can enhance phonological short-term memory, particularly for nonce-words (Reis and Castro-Caldas 1997). Dąbrowska (2021) argues that these factors contribute to increased vocabulary growth and improved processing of complex sentences. Additionally, literacy is linked to improved metalinguistic abilities, such as attention to linguistic form, which correlates with better grammatical comprehension in L1 (Dąbrowska 2018). Overall, the "training wheels hypothesis" posits that literacy serves as a cognitive aid, facilitating the acquisition and practice of more complex structures than would otherwise be possible. Therefore, in a way, one could argue that literacy allows speakers to become more explicitly aware of their implicit language related knowledge by means of experimentation.

In this vein, the realm of cognitive psychology and related disciplines, it is essential to critically examine the conventional pieces of wisdom, particularly the overrepresentation of participants from WEIRD societies in our studies and the overgeneralizations made based on this Blasi et al. 2022. However, an often-overlooked aspect of this discussion is the role literacy plays in our studies, even within WEIRD populations. Even in WEIRD countries, non-WEIRD samples can be found in the form of illiterate individuals (see Dąbrowska et al. 2022 for a study with illiterate speakers in Spain, or see Scholes and Willis 1987 for illiterate speakers in the USA).

This article reports the findings of literacy acquisition on grammatical knowledge in illiterate or ex-literate speakers and how these findings help us rethink competence in linguistic theory. The results and discussions are important because they contribute to our understanding of linguistic theory, raise important points about methodological advancements, as well as tell a cautionary tale about overgeneralizations made in cognitive sciences based on WEIRD samples.

2 Illiteracy and grammatical knowledge in L1 speakers

Research on how literacy acquisition changes phonological and semantic knowledge as well as vocabulary knowledge has been previously established (e.g., Stanovich and Cunningham 1992; Kosmidis et al. 2004; Serniclaes et al. 2005; Durgunoglu et al. 2012). However, studies examining the effects of literacy acquisition on grammar in L1 are surprisingly rare and quite recent (Dąbrowska et al. 2022; Dąbrowska et al. 2023; Gedik (under review)) despite the theoretical implications such studies hold. Here, we focus on the relationship between literacy and how it influences the representation of grammatical structures in the minds of L1 speakers.

A study by Dąbrowska and colleagues (2022) investigates the differences in comprehending Spanish subject and object relatives in illiterate and literate L1 Spanish speakers. Such structures have been studied extensively in various languages for the difficulty they pose on speakers. The underlying assumption in the study was because subject relatives are quite frequent in spoken language, illiterates should perform near or at ceiling in a task that tests this construction, whereas illiterates may not perform at ceiling with object relatives in the same task. To find out, Dąbrowska and colleagues (2022) recruited 20 participants that were attending level 1 and 2 literacy courses in Spain, and 15 late-literates who were attending level 3 literacy courses. Late-literates were reported to be able to read longer texts, whereas level 1–2 participants could only read simple words and short sentences. Finally, they had 14 age-matched control participants with a BA degree.

To eliminate the effects of poor working memory in the absence of a writing system, Dąbrowska and colleagues (2022) used a picture matching task to tap into grammatical knowledge (see Figure 1 for an example stimulus from Gedik (under review)). This task was simple in design, with participants matching the sentence they heard with one of the two pictures. Furthermore, the participants could ask to rehear the sentences as many times as they needed. The researchers also measured participants' problem solving and reasoning skills (which we refer to as nonverbal reasoning for ease of reference) by using the Raven's Colored Progressive Matrices, as the role of nonverbal reasoning appears to be important in L1 acquisition in adulthood (Dąbrowska 2018). Raven's Colored Progressive Matrices is a nonverbal reasoning test designed to assess abstract reasoning and problem-solving abilities. It consists of pattern-completion tasks where participants select the correct piece to complete a visual matrix, making it suitable for individuals with varying levels

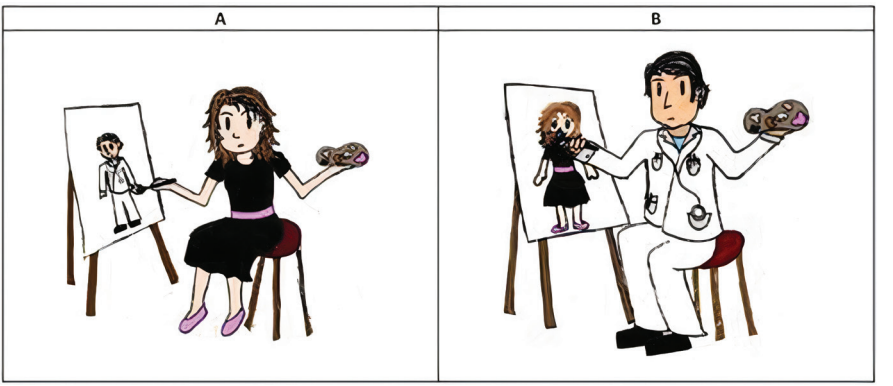

Figure 1: An example pair of stimuli used in picture selection tasks. The accompanying test stimulus: kadının doktoru çizeceğini biliyorum (I know that the woman will draw the doctor).

of language proficiency. The "colored" version is specifically adapted for younger children, older adults, and individuals with cognitive impairments, featuring more accessible and visually engaging items.

Dąbrowska and colleagues (2022) report that while all participants performed near or at ceiling on subject relatives, there was a decreasing rate of accuracy on the subject relatives, with high literates getting 13.6/16, late literates 10.5/16, and low-literates at 8.2/16. While high-literates were at ceiling, late and low-literates showed many individual differences in performance, some performing in the same range as high-literates. Their statistical analyses showed that higher nonverbal reasoning scores were associated with higher comprehension scores, which resembles the findings for literate speakers (Dąbrowska 2018). As they note, nonverbal reasoning is confounded with literacy to some extent, as the number of years spent in formal schooling contributes to the development of both nonverbal reasoning and print exposure.

In a different study, Dąbrowska and colleagues (2023) tested the same participants on nonce verb conjugation in Spanish. They measured the morphological productivity of the participants on nonce verbs in the Spanish past tenses (preterite and imperfect). The design of the task invited participants to conjugate these nonce verbs in two aspects, and three numbers. The task was administered orally. The results are similar to that of the previous study explained here. High literates outperformed late literates, and late literates outperformed low literates on overall accuracy. In the opposite order, there was an increasing amount of non-target responses. Again, interestingly, some illiterate speakers performed in the same range as literate speakers but overall as a group they showed more individual differences in performance than literates.

Their statistical analyses suggest that there were no interactions between group and aspect, implying that the imperfect and preterit may be equally frequent in spoken language. Although nonverbal reasoning was significantly correlated with supplying the target response, there were no interactions between group performance and nonverbal reasoning, contrary to what Dąbrowska et al. (2022) found. However, this is not surprising as high literates tend to have higher nonverbal reasoning and this soaks the variation in statistical analyses. Dąbrowska and colleagues (2023) propose that this difference in nonverbal reasoning between the two studies might be a result of the task demands, with inflecting a verb requiring less attention and pattern recognition than mapping semantic relations onto a complex sentence structure.

In a similar fashion to Dąbrowska and colleagues (2022), Gedik (under review) ran a picture matching task with illiterate Turkish L1 speakers, as well as a picture-based sentence elicitation task to produce complex structures (see Table 1 for example structures tested in the picture matching task, other similar tasks by Dąbrowska and colleagues use similar structures in respective languages). As

Table 1: Structures assessed in Gedik (under review).

Condition	Example in Turkish (English)	Pictures
Control	Çocuk hemşireye dokundu (the boy touched the nurse)	Left: boy touching nurse Right: nurse touching boy
Passive	Kadın adam tarafından yakalandı (the woman was caught by the man)	Left: woman catching man Right: man catching woman
Subject relative	Kadını çizen adamı gördüm (I saw the man who drew the woman)	Left: woman drawing doctor Right: doctor drawing woman
Object relative	Doktorun yaraladığı hemşireyi gördüm (I saw the nurse that the doctor injured)	Left: nurse injuring doctor Right: doctor injuring nurse
Her-structure	Her elma bir kapta (every apple is on a plate)	Left: three plates, each containing an apple plus an extra apple Right: three plates, each containing an apple plus an extra empty plate
Bir-structure	Bir kalem her kutuda (a pen is in every box)	Left: three boxes, each containing a pencil plus an extra box Right: three boxes, each containing a pencil plus an extra pencil
Nominalization	Kadının doktoru çizeceğini biliyorum (I know that the woman will draw the doctor)	Left: woman drawing doctor Right: doctor drawing woman

reported in Gedik (under review), written Turkish appears to contain roughly 2.5 times more subject relatives, 5 times object relatives, and 2 times more passives than spoken language. Using the colored progressive matrices, Gedik (under review) measured the nonverbal reasoning skills of 30 illiterate participants with an average schooling of 2 years, and 27 literate participants with at least a BA. As a proxy and continuous measure of literacy, Gedik (under review) tested how many real and nonce words participants could read in 1 minute, which were then computed into a composite score. However, Gedik (under review) used group membership as the final measure over the reading measure for three reasons: 1) reading and group are strongly correlated at .91 (which results in multicollinearity), 2) the reading measure measures two different things in these groups: in illiterates potentially the speed at which orthographic encoding/decoding happens and reading fluency in literates, and 3) determining real effects of writing only requires speakers to have been exposed to written language for many years, whereas our illiterate participants had been learning literacy for roughly 7 months on average. While comparable results were obtained when group and reading were swapped in regression analyses, Gedik (under review) used group as the main predictor.

Descriptive statistics suggest that literate participants performed more accurately on the picture selection task, with fewer individual differences. In a similar fashion, some illiterate speakers performed in the same range as literates but overall they showed many individual differences as a group, although they were close to ceiling on control conditions. Interestingly, different constructions correlated with nonverbal reasoning scores differently, possibly suggesting that constructions require differing levels of nonverbal reasoning, potentially as a result of various levels of semantic mapping onto chunks or scenes. Object relatives correlated the strongest, followed by passives and subject relatives. Omnibus regression analyses suggest that in the absence of literacy, illiterate participants with higher nonverbal reasoning could still provide the target responses, regardless of the structure tested. Group and nonverbal reasoning each accounted for 33% of the variance in the dataset. This finding, the fact that nonverbal reasoning or literacy made independent contributions was previously observed in Dąbrowska (2018) and suggests that language comprehension requires some level of problem solving to map semantic relations onto linguistic constituents by means of drawing analogies from generalizations (e.g., Goldwater 2017). Doing this arguably requires knowing syntactic relations and knowledge of these structures.

Using a picture-based sentence elicitation task, Gedik (under review) measured the production skills of illiterate L1 Turkish speakers. The task tested for the subject and object relatives, and passives in Turkish. There were six pictures for each construction (3 constructions x 6 trials = 18 trials, and 18 control stimuli). The results showed that both literate and illiterate speakers produce subject relatives with the most accuracy, followed by object relatives, and passives. However, literate speakers outperform illiterate speakers in producing the target structures, with illiterate speakers producing the target constructions significantly less. Gedik and Dabrowska (2024) argue the availability of a writing system provides several benefits, one of the important factors being the frequency advantage. They also argue that the contexts in which these complex structures are used may not arise if speakers avoid interacting with strangers (i.e., situations where the speaker and the listener share relatively little knowledge and interlocutors are aware of this). Illiterate speakers may avoid interacting with strangers at least based on the personal testimonies of several illiterate speakers in Gedik (under review) and Fingeret (1983). Another advantage of the act of literacy is that when writing a text, the writer needs to realize and acknowledge the fact that the reader does not share the same knowledge as the writer, and this may increase the need to be more explicit. As such, following a construction grammar perspective (e.g., Goldberg 2006), if a social context to use a construction does not arise, speakers will have a more difficult time mapping the form to the meaning, and may map to the most basic sentence structures, or attempt to paraphrase them (using a passivized

subject relative clause instead of an object relative clause) when required to produce them (Gedik and Dabrowska 2024).

In terms of production skills, daily conversations almost never take place in decontextualized situations or include decontextualized sentences. If anything, there is always a narration, in which a wide range of constructions are used to convey various meanings. Oral narration requires discourse organization, that is, a speaker needs to know how to put ideas together coherently that would meet the communicative needs of the linguistic situation (i.e., interlocutor, context, topic and so on). This is true for written language as well. Learning how to read and print exposure are thought to foster and increase discourse organization, as one of the purposes of reading and reflecting on the material read is interpreting authors' discourse (Roth et al. 2002). But beyond this, learning to read and write also improves cognition in general (Dehaene et al. 2010), especially working memory, which might be arguably important for discourse organization or narration.

Eme and colleagues (2010) further investigated the oral narrative skills of French L1 functional illiterates. Functional illiteracy indicates the lack of written language abilities, even after having had formal education. Eme and colleagues used a variety of picture elicitation, using pictures from a commonly known colored comic strip. Fifty-two participants were given these pictures at once and were asked to tell the story picture by picture. The output was coded for length (number of words/clauses), lexical diversity (type-token ratio), morphosyntactic errors (conjugation, gender, determiners among others), syntactic complexity (mean length of clauses, number of complex clauses such as passives, verb complements, relatives, adverbial clauses, and coordinated clauses), narrative schema (following the story sequentially), referential cohesion (total number of referential devices), and evaluative categories (such as mental talk, intensifiers, qualifiers among others).

Their results show that when compared against the control group (literate adults), except for lexical diversity, on all other indices the illiterate group performed significantly worse. The analysis of narrative schema, referential cohesion and evaluative categories revealed that illiterate speakers had a looser oral narrative in comparison to the control group used fewer or incorrect referential devices, and used less mental talk (i.e., X thought that Y did Z). Illiterate speakers also omitted causal relations between events and characters.

2.1 Interim discussion & an important note

At first glance, these findings suggest that the availability of a writing system improves our overall grammatical knowledge in our native language. Clearly, learning to read and write is only half the story. It takes many years of exposure

to written materials as well as interactions with highly literate speakers/activities for grammar to be influenced. Although comprehension of complex syntax may require years of literacy and exposure to written materials (e.g., Scholes and Willis 1987), it appears that this lack of experience in comprehension can be compensated with above average nonverbal reasoning skills up to a certain extent. Production of complex syntax, on the other hand, requires a more complicated entanglement of multiple factors such as education and nonverbal reasoning skills, for which there is more suggestive evidence from the production task of Gedik (under review).

An immediate effect of learning literacy on language production skills may not be observed as quickly because of the socio-cognitive demands of the social circles illiterate participants may be situated in. That is, people who read less or who are illiterate may be more likely to be in social circles where demands for complex syntax may not arise as often (see Gedik (under review) for a discussion, see also Gedik and Dabrowska in prep, and Gedik and Dabrowska 2024). As such, following a construction grammar perspective (e.g., Goldberg 2006), if a social context to use a construction does not arise, speakers will have a more difficult time mapping the form to the meaning due to a lack of experience.

However, literacy acquisition – at least in WEIRD countries – does not happen in a vacuum and is not a unidirectional process. The relationship between literacy and linguistic knowledge is much more complicated for several reasons and teasing the effects of *only* literacy may be very difficult. The following have been discussed by Dąbrowska (2021) under what she calls the "training wheels hypothesis". First, illiterate speakers may not have the opportunity to attend formal schooling due to patriarchal or other reasons. This creates an important difference in cognitive skills between literate and illiterate speakers, which we need to consider in research studies. Second, literacy acquisition improves cognition (i.e., working memory), which improves language skills, which improves literacy skills, which in turn improves language skills and so on: a positive feedback loop (e.g., Cunningham and Stanovich 1998). Third, literacy provides more exposure to language: written language contains more lexical and syntactic diversity than spoken language. Fourth, literacy improves metalinguistic awareness, the extent to which speakers can reflect on the internal structures of language. It is very difficult to tease apart if the poorer performances of illiterates are due to not having been exposed enough to particular constructions or to not being able to benefit from having access to any knowledge of written forms when compares against literate speakers (or a combination of both – which might be the more likely case). Therefore, when we examine the relationship between literacy acquisition and complex grammar, we need to acknowledge that in an ideal world these factors are all entangled and we can only make approximations for each factor using R^2 values. These findings inform certain formulations in our linguistic theory.

Despite these warnings, the simplicity of the tasks explained above rule out extra-linguistic factors (e.g., working memory, engagement, task understanding). Illiterate speakers show many individual differences in these tasks tapping into grammatical knowledge. Thus, one important conclusion we can draw from these studies with illiterate speakers is that literacy and its concomitant effects change the very nature of the underlying linguistic knowledge (i.e., competence). Moreover, one could argue that literacy helps native speakers become more explicitly aware of the implicit rules they know about their native languages (via metalinguistic awareness, reading and writing language). For example, a (illiterate) speaker may be able to comprehend or produce a structure correctly (i.e., by conforming to the current conventions of the speech community) without being able to explain the inner-workings of the structure metalinguistically. But, as previous studies suggest (see Dąbrowska 2020 for a discussion), literacy (as well as institutions that provide explicit instruction of the language under question) improves metalinguistic awareness broadly speaking, and arguably becoming aware of linguistic structures may facilitate understanding how a particular structure works.

This has profound implications for linguistics. If universal grammar has innate parameters available to every L1 speaker, why do illiterate speakers show at chance or below chance performance on core grammatical structures like passives Gedik (under review)? These findings tell us a cautionary tale of why we need to rethink the convergence argument as a supporting pillar of universal grammar.

3 Implications for linguistic theory and linguistics as a field

Before we move towards the theoretically interesting questions below, we first need to address the competence-performance issue in light of our foregoing discussion. We would anticipate that all native speakers would demonstrate consistent proficiency in comprehending and using their L1 if Universal Grammar (UG) served as a template for language. In fact, native speakers of a particular language probably share hundreds or perhaps thousands of structures. It is inaccurate, though, to assert that all L1 speakers' grammatical knowledge is consistent based just on the performance in the assessments given to highly literate people. Here, the crucial issue is not only the difference between competence and performance, but also the definition of competence. According to Miller and Weinart (1998), written language is characterized by the structures that are frequently employed to support the idea of uniform competence. However, children mostly learn spoken language in the

early years of language acquisition, which is very different from written language. The debate also makes this discrepancy clear.

Additionally, formal education gives native speakers different levels of exposure to literacy practices, explicit language instruction, and reading, all of which influence language production. For instance, Dąbrowska (1997) discovered that L1 English speakers' understanding of noun phrases was impacted by schooling and the experiences that go along with it, such as reading and explicit instruction. What generativists refer to as "competence" seems to improve when linguistic knowledge is explicitly taught or analyzed, indicating that external factors do influence it. This begs the question of where performance and competence should be distinguished. It might not be helpful to make a strict difference between the two.

Based on our discussion here, a broader definition of competence could incorporate both internal (like nonverbal reasoning skills) and external (like literacy, education, and experience) components. From a usage-based perspective, on the other hand, if exposure and pattern recognition are the main drivers of language acquisition, then statistical learning—the capacity to identify patterns and draw conclusions from them—may be the only intrinsic process at play. This implies that competence is modified by input and experience, making it intrinsically flexible, but it does not abolish the competence-performance divide.

With that in mind, it might be beneficial for future studies to shift their focus towards examining predictors of attainment separately for literate and illiterate groups, as well as considering longitudinal studies with illiterate populations. This is because typically literate speakers as a group exhibit higher IQs and greater metalinguistic skills alongside many years of literacy. This presents a methodological hurdle in attributing observed differences solely to literacy. Moreover, a cautious approach to literate versus illiterate comparisons is warranted as it may perpetuate a view of illiteracy as a deficiency. While results often show poorer performance among illiterates, this discrepancy is frequently observed with grammatical structures they may have encountered less frequently. Thus, we need to acknowledge (at least) two issues: 1) the combined effects of literacy on grammatical knowledge provide sound evidence against the convergence hypothesis, but 2) we currently do not know if it is only the acquisition of a writing system that is responsible for heightened language skills, or rather an entanglement of various factors such as acquiring literacy, education, improved cognition, exposure to complex language among others. Theoretically, we would propose the latter since the effects of learning to map orthographic symbols to sounds would only fully explain phonological awareness and accuracy on phonological tasks, since such tasks require knowing the mapping.

These considerations have theoretical importance as to how we define the underlying construct of competence among L1 speakers. Is competence innate

and uniform as generativists would suggest? Or are there external factors that influence it? If competence of a language among L1 speakers is not uniform, how do we accommodate this shift in our language theories? If universal grammar was at work, and assuming it did not exclude illiterate speakers for some unknown reason, would we not expect them to perform at ceiling on core structures in a very simple task design? In light of our findings, we suggest that operations like recursion (for complex NPs for instance) or merge may be subject to external factors such as quality and quantity of exposure and the entangled effects of literacy, although merge and recursion are considered to be hallmarks of the mental grammar or innate principles. Newer versions of generativist approaches should address why access to written language can influence universal grammar. If the answer is positive following the research they conduct, they should consider how *universal* universal grammar is.

These findings do not mean that universal grammar does not exist: one could argue for it on other grounds. However, one of the main arguments used to support universal grammar (i.e., convergence) appears to be based on false premises. Therefore, newer postulations of generativist frameworks should rethink this by testing these arguments with non-WEIRD populations.

Theoretical considerations for language acquisition and linguistic theory have largely been based on WEIRD samples, leading to false overgeneralizations. This selection bias has been driven by the ease of access to data and established research infrastructure within these societies. Addressing this imbalance necessitates a concerted effort by linguists to diversify our research scope. Inclusion of samples from a broader range of linguistic, cultural, and socio-economic backgrounds is crucial. A significant avenue for enriching linguistic research is through studying the linguistic knowledge of illiterate speakers, which constitute a substantial portion of the global population. This segment offers insights into orality, gesture-based communication, and non-standard language structures, further rectifying the WEIRD bias prevalent in linguistic theories. We believe such studies would enrich any language theory.

While individual differences in linguistic knowledge are readily predicted as part of usage-based approaches (e.g., Bybee 2010), in practicality only very few researchers have investigated or addressed the existence of such individual differences, as Dąbrowska (2017) criticizes. Similarly, usage-based approaches emphasize the importance of domain general cognitive abilities for language learning (e.g., Langacker 2008). However, very few studies research the connection between nonverbal reasoning, which is arguably a domain general cognitive ability manifested as pattern detection and prediction.

While this article critiques the overgeneralizations often found in generative linguistics, it is essential to contextualize these critiques within broader

methodological concerns. Generative approaches have historically provided valuable insights into linguistic universals; however, their reliance on WEIRD samples highlights a significant methodological gap. Addressing this gap requires moving beyond the generativist framework to embrace research that incorporates diverse populations and cognitive profiles. This shift ensures that linguistic theories are grounded in the full range of human linguistic experience rather than a limited subset.

In light of the foregoing discussion, we propose several frontiers where further research with illiterate speakers is needed to advance language theories. The following list of research questions is not exhaustive but highlights key areas for methodological and theoretical exploration:

1. **The role of metalinguistic skills in illiterate speakers**: How much do metalinguistic skills predict linguistic knowledge alongside nonverbal reasoning and literacy skills in both illiterate and literate speakers? Incorporating linguistically sensitive measures of metalinguistic skills is crucial for addressing this question.
2. **Communication efficiency**: Literate speakers can encode a great deal of information in a short period of time. How much do illiterate speakers differ, and what does this tell us about shared grammar? Methodologically, studies could leverage oral communication tasks to compare efficiency across literacy levels.
3. **Replication studies across languages and societies**: Further studies investigating the relationship between illiterate speakers and linguistic knowledge must prioritize cross-linguistic and cross-cultural comparisons. This approach ensures the generalizability of findings and reduces biases stemming from single-language studies.
4. **Longitudinal studies on literacy effects**: When do literacy effects in illiterate participants become observable in comprehension or production skills? Longitudinal designs are critical for capturing these dynamic changes.
5. **Narrative quality**: Humans have told stories regardless of their ability to read and write. How does literacy acquisition affect narrative quality broadly speaking? Researchers could explore oral storytelling tasks to understand how literacy influences narrative structure and content.
6. **Metaphor comprehension**: Does literacy influence metaphor comprehension at all? Speakers use metaphors in daily language as well as in written texts. Studies should include both oral and written modalities to investigate this relationship.
7. **Language intuitions**: How does literacy change how we think about language? There is some very suggestive evidence showing that highly literate speakers may be more likely to view written texts as more naturalistic, conversation-like piece of language than excerpts from spoken language (Dąbrowska 2016).

These research questions will further shed light on the intricate relationship between literacy, cognition, and language skills, and help cognitive scientists to better understand the "chicken or the egg" question. Without answering these questions, a complete picture of L1 acquisition is likely to remain incomplete, since much of what we study as 'language' in linguistics is heavily influenced by traditions and conventions in written language (Linell 2005). These endeavors may also help to revise some of the data collection practices. For instance, using images to elicit narratives may need to be revised on cultural or socioeconomic factors (i.e., using the image of a mummy may not be readily understood by some illiterate speakers). Similarly, to what extent speakers learning to read and write meaningfully engage with literacy skills may be an important confounding variable in longitudinal studies, where researchers would need to be careful.

While criticisms of generative approaches remain relevant, this article's primary contribution lies in its methodological implications. Specifically, addressing WEIRD biases through research with illiterate speakers provides a unique opportunity to revise how we think about uniformity in L1 knowledge. The lack of such diversity in current research methods undermines our ability to develop truly universal models of language acquisition and use. Expanding the methodological toolkit of linguistics to include diverse populations is not merely a corrective measure but a necessary step for advancing the field.

Given that all human beings differ in minute ways in their cognition (Gruszka et al. 2010), linguistic theories must move beyond the deadly sin of ignoring individual differences (Dąbrowska 2017) especially as a result of literacy-related differences. Addressing the methodological limitations imposed by WEIRD biases, particularly through research with illiterate speakers, offers an unprecedented opportunity to enrich our understanding of language. Linguistics, as a cognitive science, must embrace diversity to build theories that reflect the full range of human linguistic experience.

4 Conclusion

The prevailing notion within linguistics that all native speakers of a language inherently share the same grammar, known as the convergence hypothesis, has been recently challenged by emerging research on the effects of literacy on linguistic knowledge. Historically, linguistic theories have been shaped by overgeneralizations based on samples primarily drawn from WEIRD societies. However, a growing body of evidence from studies involving illiterate speakers is reshaping these assumptions and shedding light on the complex relationship between literacy, cognitive abilities, and linguistic aptitude. Illiteracy, affecting

a significant global population, serves as a critical avenue for diversifying linguistic research and refining our understanding of language acquisition and cognition.

Investigations into the linguistic knowledge of illiterate individuals reveal that the availability of a writing system, alongside nonverbal reasoning and metalinguistic skills fostered by literacy, contributes significantly to ultimate language attainment. These findings challenge the uniformity assumed by the convergence hypothesis and emphasize the importance of considering individual differences in linguistic acquisition, even within literate populations. As linguists strive to overcome the WEIRD bias, studying illiterate speakers provides a unique perspective on orality, non-standard language structures, and communication dynamics. By exploring this understudied dimension of linguistic diversity, the field can rectify the limitations of overgeneralizations made based on WEIRD samples and enrich our understanding of the intricate interplay between literacy, cognitive mechanisms, and grammatical knowledge.

Moving forward, it is imperative to question conventional wisdom in linguistic theory and extend our investigations to non-WEIRD samples. By embracing these challenges and investigating the nuances of linguistic knowledge within diverse populations, linguistics can evolve into a more inclusive and comprehensive discipline, capturing the richness and complexity of human language across the spectrum of cultures, experiences, and abilities.

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