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Making sense of syntax – Innate or acquired?

Contrasting Universal Grammar with other approaches to language acquisition

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Abstract

Proponents of a Universal Grammar argue that humans are born with a dedicated language system that shapes and restricts the number of grammars found in human languages (Chomsky, 2005). It is essentially innate and has a genetic manifestation. Such an innate system is necessary because human grammars are too complex to be passed on through social interactions and probabilistic learning alone. However, this view is contested by a combination of emergentist approaches and a number of studies suggest that many of the core assumptions of Universal Grammar are either unnecessary or do not hold. Furthermore, this review will explore theoretical criticism of the Universal Grammar research programme.

Keywords: *Universal Grammar, Language Acquisition, Language Evolution, Poverty of Stimulus, Nativism*

Introduction

Learning to understand a language is a task of seemingly incredible complexity, which appears to be almost infinitely complex from an infant's perspective. But the fact that children are indeed capable of acquiring a complex, arbitrary language that makes extensive use of grammar to convey meaning, requires an explantion with regard to the developmental and evolutionary origins of the human language capacity. Put rather bluntly, why is it that a typically developing human infant can acquire language, but her pet kitten cannot? (Yang, 2004, p. 451) Currently, there are a number of different approaches that try to explain the processes used by infants to decipher language by acquiring new words and learning the grammar of their language. The predominant approach of the last 50 years has been that children have an innate sense for grammar and syntax, shared by all humans—a Universal Grammar (Chomsky, 2005). The Universal Grammar approach is part of Chomsky's generative view of language acquisition (cf. V. Evans & Green, 2006). Universal Grammar's nativist position developed out of a rejection of blank-slatevism, that resulted from Behaviourism. The Behaviourist perspective suggested that language could be learned through conditioning (Gould and Marler, 1986), yet formal linguists like Chomsky hold that linguistic structures are

too complex to be learnt by domain-general learning processes alone (Chomsky, 2005). Furthermore, a wide variety of languages investigated suggested that their syntaxes share common features and traits, even though they were not directly related. The Behaviourist view that linguistic acquisition was free and independent, whereas grammar could take any possible form, seemed refuted (Chomsky, 2005), and language acquisition seemed best explained by an innate Universal Grammar. However, this position has been challenged by a number of other approaches which, when combined, form a strong alternative to an innate syntax module, as predicted by Universal Grammar theorists. They attack the main arguments of Universal Grammar, mainly that (1) there is an innate language area in the brain responsible for syntax processing (2) which restricts the expression of possible grammars (this will lead to syntactical language universals) and (3) is genetically codified. Furthermore, (4) the stimulus presented in language acquisition is too poor to allow acquisition through interactional and social constrains (Hauser, Chomsky, & Fitch, 2002).

Language Universals

Universal Grammar is a biolinguistic approach to language acquisition and usage (Chomsky, 2005). The language model proposed by nativists is domain-specific; the cognitive processes underlying language processing differ qualitatively from other learning processes used by the child to understand the environment (Chater & Manning, 2006). According to this view the brain consists of different 'organs', or modules, of which one is responsible for syntactical features. However, current nativist models vary with regard to what is actually predisposed in language. Whilst early approaches to Universal Grammar predicted that all languages would share specific syntactical features, later revisions of Chomsky's theory argue that Universal Grammar would serve as a preselector for all the available grammars, and depending on the socio-lingual context, the appropriate syntaxes would be acquired by the infant (Yang, 2004; Chomsky, 2005). Hence, Universal Grammar restricts possible human syntaxes, but still allows room for variation. Thus, it is argued that children explore possible options and gradually tune it to the adults (Crain, Goro, & Thornton, 2006).

In support of this argument Crain et al. (2006) point to the linguistic continuity hypothesis, according to which there are certain grammatical constructs common to all languages. Whilst some are correct in some languages, children would initially use these constructs even in languages that do not have these features. Through social learning and imitation they would discard such false constructs over time. At the same time, there are some possible constructs which are logically sound (i.e. can be deduced from experience) but are not used by children. Crain et al. (2006) have found evidence for such patterns in a comparison of children's language errors in German, English, and Italian 'why' questions as well as disjunctions in child Japanese. Thus it was found that one third of native English-speaking children in the sample inserted an extra-medial 'wh-' word in long-distance questions ("What do you think what pigs eat?", p. 32) which is very similar to the structure actually used in German. There is similarity of false why-question inversion (e.g. "Why that's not your sandwich?", p. 35) and the question structure in other languages, for example Italian. Furthermore they found that Japanese children interpret Syntactic Subsets in a way that English speakers do, but that is not used in adult-Japanese (Crain et al., 2006). Thus the current minimalist paradigm is an advance over the previous approaches to Universal Grammar. Instead of expressing clear rules for grammar, the minimalist paradigm suggests that rules are of an abstract nature. Earlier Universal Grammar approaches were much more specific in their syntactical predictions (cf. N. Evans & Levinson, 2009).

In fact, N. Evans and Levinson (2009) argue that any universals are over-generalisations. They note that Universal Grammar theorists overlook the enormous linguistic diversity. Currently there are 5000–8000 different human languages, of which only 10 % are described in grammar and dictionary, and it is estimated that there have existed 500,000 human languages over time. However, claims on linguistic

universals can only be based on the restricted sample of languages that have been studied (N. Evans & Levinson, 2009). Hence N. Evans and Levinson (2009) argue that no inferences can be drawn from so little data. Neither can we assume that linguistic universals are independent of human culture. Thus, a recent phylogenetic reconstruction of linguistic traits suggests that variations in word order are better explained by lineage-specific linguistic evolution (Dunn, Greenhill, Levinson, & Gray, 2011). Linguistic universals are therefore more like cultural artefacts, rather than being codified in the human genome. Furthermore, there is only very little data from isolated languages, some of which lack even simple features of morphology, or do not use adverbs and adjectives. Others have features like ideophones, positionals and coverbs (N. Evans & Levinson, 2009), unknown to Indo-European languages. Therefore, N. Evans and Levinson (2009) argue that humans are "the only known species whose communication system varies fundamentally in both form and content." [p. 431]

The Poverty of Stimulus Argument

According to the nativist view of Universal Grammar, these achievements would be impossible without an innate and Universal Grammar: The language stimuli that children are exposed to are simply too noisy and incomplete to allow for reliable understanding of language through induction. Thus, much of the support for an innate Universal Grammar is drawn from the observation that children are exposed to impoverished language stimuli. Whilst Universal Grammar allows for probabilistic and social learning to acquire language-specific rules, it states that this would not be possible without an innate knowledge of the syntactic and phonological structure (Yang, 2004; Chomsky, 2005). Furthermore, defenders of the poverty of stimuli argument state that parents do not give corrective feedback on grammatically false utterances, particularly in early childhood (Brown & Hanlon, 1970). However, recent studies by Strapp, Bleakney, Helmick, and Tonkovich (2008), Saxton (2000), Saxton, Backley, and Gallaway (2005) present evidence that there is in fact considerable, albeit indirect, negative feedback if a child uses the wrong grammar. Thus Strapp et al. (2008) found that children learnt irregular forms of artificial verbs and noun plurals through negative evidence, and interestingly there was an interaction of word form and age: In 3 year old infants, negative evidence proved to be more effective for noun plurals, whilst 5 year olds used it for verbs more than nouns. This gives compelling evidence that negative evidence exists, and stimuli are not as impoverished. Although this does not refute the poverty of stimuli argument altogether, it is weakened considerably since it no longer falsifies theories arguing against an innate syntactical structure.

The poverty of stimulus argument is also questioned by Chater and Christiansen (2009). They distinguish two kinds of inductive learning: (1) N-induction, the ability to understand a seemingly arbitrary external world, and (2) C-induction, the ability to co-ordinate with others. Whilst the former does indeed pose an impoverished stimulus to the child, the latter only requires the child to do as others do. The necessary skills for C-induction do not need to reside in a 'central grammar organ' but are to be found in innate social skills. They further elaborate that N-induction is fairly stable, whilst C-induction shows high variability and depends on the cultural context.

Social approaches may be based on innate principles, too. But these are much more general than a Universal Grammar (Seidenberg, 1997). Furthermore, a concept of language acquisition though social interactions can be found in other species as well (Goldstein & Schwade, 2009; Kuhl, 2004). For example, since cowbirds do not grow up with members of their own species they were assumed to have an innate predisposition for species-specific song. However, this assumption no longer holds: They acquire song through feedback from female partners. If cowbirds are not exposed to other birds, they will not acquire full song (Goldstein & Schwade, 2009). Similar reports come from deaf and hearing-impaired infants, who develop different babbling to children who do not have hearing impairments (Goldstein & Schwade, 2009).

A central part in the debate for and against a Universal Grammar is whether or not a child is

capable of deducing a grammatical structure from the input. However, proponents of a social view of language acquisition suggest that social cues give sufficient infant-directed speech certain properties that facilitate language learning (Uther, Knoll, & Burnham, 2007; Goldstein & Schwade, 2009; Saxton, 2000; Saxton et al., 2005; Kuhl, 2004). A comparison of infant-directed speech and foreigner-directed speech by Uther et al. (2007) has shown that they both share features, such as vowel-hyperarticulation, which are important in making sense of language, whilst differing in pitch and rated affect, and these are thought to satisfy children's socio-emotive needs. Thus they accommodate the shared linguistic need of both groups, whilst differing in social-emotive needs. Unfortunately, while Uther et al.'s study looks at word acquisition, a comparative approach to the similarities of grammatical features has not yet been done. Additional evidence that child-directed speech has characteristics that support a child's language acquisition is presented by Brodsky, Waterfall, and Edelman (2007) who emphasise the importance of partial repetition of phrases by parents. Parents use a high number of phrase repetitions when interacting with a child. Repetitions alone would not give sufficient variation of input. However, parents offer the child a series of *variation sets* by repeating utterances with small changes, leading to changes in the syntactical structure but not the content. For example (taken from Brodsky et al., 2007, p. 2):

> You got to push them to school.
>
> Push them.
>
> Push them to school.
>
> Take them to school.
>
> You got to take them to school.

Such variations would be ideal for the child's word and syntax acquisition process. And indeed, Küntay and Slobin (1996) found that they make up 20% of child-directed speech in Turkish. In an analysis of children's speech, it was found that there is a high correlation with parents' variation sets and subsequent language and syntax use in children (Brodsky et al., 2007). In a quantitative analysis of 'motherese', Brodsky et al. (2007) were able to construct an algorithm capable of acquiring a relatively high-coverage of generative grammar. Such probabilistic models achieve 54% precision on Mandarin and 63% on English, with an approximate recall of 30% for both—using child-directed speech as an input (Waterfall & Edelman, 2009). Based on these findings, Waterfall and Edelman (2009) suggest that some of the grammatical features are simply more common because they are more readily acquired by probabilistic learning processes. Taken together, this evidence suggests that social interactions play a major role in language acquisition, a view for which early approaches to Universal Grammar only left little room (Chomsky, 2005). This is different to recent revisions of Universal Grammar theory, which consider social input as part of the 'tuning' process used by children to choose the right grammar from the ones that are available. Hence, whilst these social-interactional findings reduce the necessity for Universal Grammar, they do not refute it either.

Evidence from Language Evolution

Universal Grammar is assumed to be expressed through genes. A distinct linguistic system would have evolved through natural selection; for example, favouring a mutation that led to the rewiring of neural networks to accommodate basic syntactical structures (Chomsky, 2005). Criticism comes from Chater and Christiansen (2009) who argue that—given the short timeframe of language evolution—the development of a genetically codified language module is improbable. Unlike dedicated systems like the visual-perceptive system, a genetically encoded Universal Grammar would require much more complex mutations. Even though nativist approaches highlight the similarities and shared features of different languages across all spectra, languages are too variable to allow for the evolution of a Universal Grammar. In the words of Christiansen, Chater, and Reali (2009), the observed variability would pose "a moving target" [p. 221] for natural selection. This makes an account that stresses slow, gradual evolution unlikely, whilst a gene-culture co-evolutionary account would favour general learning rules over linguistic

specificities (Christiansen et al., 2009). Instead of a dedicated system that developed through natural selection, it is more likely that the reverse holds: Language has adapted to predating constraints posed by the brain, neural networks and already existing learning structures. The process of grammar development would be one of cultural evolution within biological constraints (Christiansen et al., 2009; Christiansen & Chater, 2009; N. Evans & Levinson, 2009). There is the possibility that there were initial heuristics used to parse language input which were adapted over time, but these are no constrains like the ones predicted by Universal Grammar.

Support for a general learning processes comes from a study by Saffran, Pollak, Seibel, and Shkolnik (2007) who replicated an earlier study by Marcus, Johnson, Fernandes, and Slemmer (2004). Using triad-sequences of stimuli, the original study found that while 7-month old infants were able to generalize linguistic stimuli, they failed to do so for shapes and non-linguistic sounds, like geometric shapes. However, Saffran et al. (2007) were able to show that infants are indeed capable of doing so, but may categorise stimuli differently and thus may not be perceiving the stimuli presented by Marcus et al. (2004) as sequences. However, when presented with stimuli they know well and show interest in (for example, dogs and cats), they are indeed capable of distinguishing between these sequences. Nevertheless, these triads correspond to very simple, finite-state grammars only, and further research is necessary to generalize these findings to more complex syntaxes.

Conclusion

From the evidence considered in this review, it seems unlikely that the theory of hard-coded Universal Grammar holds. The criticism voiced in N. Evans and Levinson (2009) is even more fundamental: They argue that specific approaches to Universal Grammar are already falsified by the variability observed or have become so general that they escape possible falsifications. But, according to Popper (1963/2002), a scientific hypothesis must be potentially falsifiable in order to be considered scientific. However, as N. Evans and Levinson (2009) state, "Chomsky's notion of Universal Grammar (UG) has been mistaken, not for what it is–namely, the programmatic label for whatever it turns out to be that all children bring to learning a language – but for a set of substantial research findings about what all languages have in common" [p. 430]. Its current character is therefore not of explicative value, but descriptive only.

Children show many instances of statistical and social learning in other instances of language acquisition. This shows that they are indeed capable of using these devices appropriately and drawing correct inferences. Thus, the necessity for an innate Universal Grammar for explaining how children acquire language is low. This does not rule out the possibility that there are indeed some innate features of language, but it is more likely that these originate from cognitive, socio-interactional and probabilistic constrains (Seidenberg, 1997; N. Evans & Levinson, 2009). Tomasello (2009) argues that these could potentially fulfil the criteria for a very broad concept, but that historically the term Universal Grammar requires biological manifestations of syntax of one sort or another: "It is not the idea of universals of language that is dead, but rather, it is the idea that there is a biological adaptation with specific linguistic content that is dead." (Tomasello, 2009, p. 471)

Based on Imre Lakatos' epistemological approach (Lakatos & Feyerabend, 1999), one could argue that in its beginnings the Universal Grammar approach was a *progressive* research programme that sparked new debates in the field of syntax acquisition and exposed weaknesses in previous research (Chomsky, 2005). However, currently the Universal Grammar programme offers little new input to the debate of how grammar is acquired, and one could argue that it is a *degenerating* research programme. Its explanative value regarding language acquisition is limited and well-contested by other approaches. At the same time one of its key concepts—shared syntactical features—shows greater variability than predicted. Attempts to resolve these problems have watered down the potential falsifiability and predictability of its hypotheses (N. Evans & Levinson, 2009). But at the same time,

combinations of evolutionary, socio-interactional and probabilistic approaches have not been able to explain the full picture either. Whilst combinations of probabilistic and social learning, as well as evolutionary accounts, are promising, there is not yet a consistent framework that explains language acquisition as a whole, as well as the role each of these models play within the whole system.

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