

## Revealing the workings of universal grammar

Around the middle of the previous century, Noam Chomsky noted and brought to the forefront the fact that while the input to children in any language is a finite set of utterances, children are able to arrive at an understanding of the language in their environment that permits them to create a potentially infinite amount of (grammatically speaking) 'legal' utterances. It was proposed that the language learner has some predefined biases that are universal in nature, which quickly guide the learner towards the correct grammar. These universal biases can be considered as part of the genetic endowment that allows humans to learn and use language, and this should be reflected in the structure of all human languages.

In the literature, there has come to be a kind of divide between two kinds of researchers, the 'universalists' and the 'emergentists' (to use the language of Lidz *et al* 2003). The 'universalist' researcher looks at the structure of languages and looks for common features that might be universal in nature. Armed with such a knowledge, she then tries to show that the infant language learner shows evidence of being aware (not necessarily *consciously* aware) of such universal features, and if and how such features are used to ease the language learning problem. The 'emergentist', on the other hand, looks primarily at the structure of the input that a language learner might receive. He then uses statistical methods to extract relevant information from the input, and looks for evidence that the language learner is sensitive to such statistical features of the input.

To put it another way, the 'universalist' is more interested in the internal, likely universal and innate computational structure of the language learner that distorts the linguistic input into a format that is easier for the human learner to learn. The 'emergentist' instead would like to ascribe only a minimal computational structure to the language learning system. General cognitive mechanisms, in this view, would diligently gather statistical information of the linguistic input they receive and organize it into a coherent linguistic percept (e.g. Tomasello 2000). In a sense, both the universalist as well as the emergentist believe that somewhere in the human mind, there are constraints which guide language learning. They differ in that a universalist would say that these constraints are part of the linguistic system itself, while the emergentists would hold that these constraints are part of general cognitive mechanisms. A recent paper by Lidz *et al* (2003), described a bit later, looks at a specific aspect of language learning called 'syntactic bootstrapping' for verbs, and provides compelling evidence that the language learner is not merely a statistical learning device, thus supporting a 'universalist' view.

Lidz *et al* (2003) look at a specific aspect of language, the meanings of certain words. The problem of mapping meanings onto words has a rich and long tradition, and as yet we do not have a clear picture of how such a mapping is achieved. However, once a child language learner has made some of the word-world mappings, that is, the meanings of some of the words have been learnt, it has been proposed that syntax could aid in gathering further meaning about novel words to be learnt. This is the 'syntactic bootstrapping' hypothesis.

The specific kind of words studied by Lidz *et al* (2003) was the verbs. A major division of the verbs is between the transitive and the intransitive verbs. The *intransitive* verbs talk about just one person (or animal, or thing), like the verbs 'run' or 'sleep', as in "Hari runs", or "Hari sleeps". Intransitive verbs are said to have only one *argument*. The *transitive* verbs, on the other hand, require two arguments. For example, the verb 'throw' requires two arguments, the thrower and the thrown as in "Hari throws the ball". The transitive-intransitive divide is interesting for yet another reason: transitive verbs (at least in English-speaking children) are interpreted as being causative, while intransitive verbs are not. For example, in "Hari runs", there is no causative event being denoted. But,

in “Hari throws the ball”, there is causativity being denoted, in that Hari is causing the ball to be thrown. It is not always true that transitive sentences are about causativity (see below), but this interpretation (transitive = causative) is thought to be an innate, universal bias. Note that *number of arguments* is not the same as *number of nouns* in a sentence. For example, in the sentence “the boy and the girl saw the building”, there are three nouns (the boy, the girl, the building) but the verb “saw” takes only two arguments (the noun phrase “The boy and the girl” and the noun phrase “the building”), and would be perfectly fine with just two nouns as in “The boy saw the building”. But for simplicity, we shall talk of the number of nouns in a sentence as being the same as the number of arguments of the verb in that sentence.

The emergentists’ claim is that, given that some verbs are initially learnt (by a mechanism that we can keep unspecified for now) in which the number of nouns in a sentence is a good indication of transitivity, a novel verb would be inferred as being transitive if it had two arguments, while it would be inferred as being intransitive if it had only one noun or argument. How transitive sentences would be linked to causativity is not immediately apparent. Other general cognitive mechanisms are expected to make this link. The universalist proposal on the other hand is that there is an innate bias in the language system to infer transitivity from the number of nouns in a sentence, and to interpret transitivity as causativity. Given that in real languages it is not always the case that transitivity implies causativity, the universalists’ proposal makes interesting predictions about the pattern of mistakes that language learners might make.

In order to show the effects of innate biases that a language learner might bring to the language learning problem, a nice test case would be an instance of a language in which there is a conflict between a hypothesized universal bias and a statistical cue. As mentioned before, transitive verbs are associated with causativity, and since argument number is a good predictor of transitivity, argument number should be a good predictor of causativity. However, in the Dravidian (South Indian) language Kannada, there is a verbal affix (a sound sequence that is attached to the root verb) “*is*” that is always associated with causativity. For example, “The crocodile raises the horse” would be “*moSale kudure-yannu eer-is-utt-ade*” (literally, crocodile horse-(object) rise-cause-tense-number).

The presence of the “*is*” is thus an excellent statistical cue for causality, probably more so than simply argument structure. This is because, while argument structure is certainly a good indicator of causativity, it does not always imply causativity. For example, while “The crocodile lifts the horse” has the transitive verb “lifts” and is about causation, the same is not true of the verb “see” in “The crocodile sees the horse”. Here, the meaning of the sentence is not that the alligator causes the horse to see. In Kannada, while the verb is transitive and has two arguments, because of the lack of causation, it does not contain “*is*”, as in, “*moSale kudure-yannu nooD-utt-ade*” [literally, crocodile horse-(object) see-tense-number].

Lidz *et al* (2003) used a paradigm modified from Naigles (1993), in which known verbs are used in new contexts, to see if the meaning of the verb drives the overall comprehension of the sentence or it is the usage that drives overall comprehension. To illustrate, a sentence like “Noah comes the elephant to the ark” is interpreted as “Noah *brings* the elephant to the ark” by little children, because the frame of the sentence (transitive) induces the meaning *bring*, rather than the meaning *come*. With the Kannada children, Lidz *et al* (2003) used old verbs either in new frames, or with the causative particle “*is*”, or both, and asked the children to act out the sentence they had heard. What they found was that young (three-and-a half year-old) children made causative interpretations almost exclusively for sentences with the transitive structure, and were not very much influenced to infer a causative interpretation because of the presence of the verb affix “*is*” alone. They did the same test with Kannada adults, and found the opposite pattern of results: Kannada adults are very sensitive to the precise meanings of the verbs, and are strongly influenced by the presence of the verb affix “*is*” in giving a causative interpretation.

The authors interpret their findings as favouring a universalist view. That is, child learners of Kannada, even after three years of exposure to the language which has a very strong statistical cue to causativity, still almost exclusively rely on argument structure like English-learning children do. Adults, on the other hand, seem to have got past their initial biases, and go more by what they know about the language they speak. These results support the view of language as a biological object, which is initially driven by innate predispositions.

**References**

- Lidz J, Gleitman H and Gleitman L 2003 Understanding how input matters: verb learning and the footprint of universal grammar; *Cognition* **87** 151–178  
Naigles L 1990 Children use syntax to learn verb meanings; *J. Child Language* **17** 357–374  
Tomasello M 2000 Do young children have adult syntactic competence; *Cognition* **74** 209–253

MOHINISH SHUKLA  
*Cognitive Neuroscience Sector,  
International School for  
Advanced Studies (SISSA),  
via Beirut 9,  
34014 Trieste, Italy  
(Email, shukla@sissa.it)*