

Grammars and Human Languages

There is some (though far from conclusive) evidence that grammars are fundamental to the human experience. Grammars are ancient. The first known grammars were developed in India for Sanskrit about 600 years before the Christian era. That predates most of what we consider to be the foundational ideas of science or mathematics or philosophy.

In their book *Why Only Us: Language and Evolution* (2016, The MIT Press) Robert Berwick and Noam Chomsky discuss what they call *The Basic Property of Language*: It is a finite computational system producing an infinite number of expressions, each with a unique internal representation (in terms of thought) and external representation (in terms of spoken words).

Construction of expressions in a language makes use of an operation that Berwick and Chomsky call *Merge*, which takes two expressions and combines them into a new, larger, hierarchically structured expression.

The distinctive element of Merge is that it forms hierarchical expressions. This is how abstraction works: we can take a set of properties, merge them into one item, and use that as one element of a larger expression. "The quick brown fox" is one element, even though it is described by 4 words.

Berwick and Chomsky say that all known human languages make use of Merge and no known animal communication systems (including bird songs, bee dances, and even sign languages learned by chimps from humans) do so.

You can say to a chimpanzee "Get the ball." or "Get the big, red ball." but not "Get the ball that was in the box yesterday." Merge is what allows us to take a complete expression "This ball was in the box yesterday" and package it as a descriptor in a more complex expression. Animals can process lists of descriptors, such as "big, red" but only humans seem to be capable of processing hierarchical expressions.

Merge produces hierarchical structures and we can visualize those graphically as trees. For any particular language grammars can be used to describe the way Merge operates for that language.

In Paris one might ride "le vélo bleu;" in New York she would ride "the blue bicycle." Merge forms the hierarchical thought; the grammar determines how this thought can be expressed in French or English. We are born with the ability to use Merge; we spend our early years learning a grammar (possibly multiple grammars for multiple languages) so we can express our thoughts and understand the expression of others' thoughts.

There thus seems to be a particularly intimate connection between grammars and human languages.

Note that in this accounting the central role of language is in internal thought rather than in external communication with others. Merge is an operation that forms abstract thoughts and seems to function in the same way for all humans. It is just the grammar that differs from one language to another.

Hierarchical languages don't appear to have been available even to other humanoids. According to Berwick and Chomsky, the human brain's ability to use the Merge operation seems to have evolved about 150,000 years ago (which is quite recent on an evolutionary scale). Neanderthals separated from humans 400,000 to 600,000 years ago and we have no artifacts that indicate the Neanderthals were capable of abstract thought.