Genetics of Language

(Roadmap to minimalist language)

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Abstract

The paper intends to zoom in and find a uniqueness in human language by narrowing down the range of cognitive domains to human computational mind having a property of recursion which is exclusively unique to human and not in any other species in animalia kingdom.This notion of recursion is the centrality of the paper. There has been an opposition to the notion of recursion being only unique to human and the paper makes an attempt to reply to such arguments using experimental findings from modern neuroscience. The existing controversies over the proposed minimalist language and its future remains open to the future of modern neuroscience and modern physics.

Introduction

What is so unique about human when compared to non-human is the former's ability to not only think but also think what other member of its own species thinks and this notion of thinking about the thinking of the other is not present in non-human according to the present empirical scientific observations. There have been experiments and findings trying to discover what is so unique in human and its uniqueness would not have been possible without language used. Language which is centrally linked, needs to be searched to grasp the minimal uniqueness which is only present in human and not in non-human. The search for finding such a minimal uniqueness which is recursion, is the fundamental Chomksyan approach of dealing with language, supporting Cartesian uniqueness for human which is different from non-human. The recent published work of Miyagawa and Piraha controversy are also necessary to be tackled to know whether recursion remains only exclusively to human or not and if not, the features which are not exclusive can be removed from the features of the recursion, and in the process, the domain of recursion pertaining to human will get shrunk in which the remainder will be the minimalist program of placing uniqueness to language which is only specific to human and not to any other species other than human.

Problems of mind , language and human

The Cartesian mind-body dualism is the base which grows to the division of human and non-human and the separating quality between the two is language which though is still debated. The notion of mind can be understood by human via human language, thus there is a need of trinity of mind, language and human. The unity of mind and human with language being a centrality ,which is also Descartes' three ideas is the foundation of searching the uniqueness of language which is specific to human only.

The issue is not majorly to study mind but language and for this, human which has many cognitive systems needs to be subjected to many areas of discipline such as biolinguistics, archaeology, biophysics, linguistics , biochemistry, genetics, evolutionary biology ,etc. to know the minimal features of language which are available only in human species and not in any other species including the species near to homo-sapiens in evolutionary line too. While trying to zoom down to the least minimal domain of language, mind is required and there would be many cognitive systems as well as bio-neurological systems coming in between mind and minimal domain of language, the task is also to remove such cognitive systems and any other external systems, so that the search goes down to the internal minimal zone of unique language of human. But, how shall the process of zooming down to the minimal zone be done ?

Task of finding minimalist language

Human mind is unbounded which is also primarily due to unboundedness of its language used. The ability to produce unbounded language from a bounded set of lexicons is ascribed to its capable recurring computational mind. When unboundedness of language used is narrowed down to minimalist language where other cognitive systems are removed, then the minimalist language which is closed to grammar comes. The strategy of finding the minimalist language can be charted out by setting up a null hypothesis that recursion which is feature of FLN (Narrow Faculty of Language) is exclusively unique in language for human species.

The 5 strategic steps to minimalist language

- **(i)** Identify 'language'
- **(ii)** To identify language , study 'language' to find out its preliminary parts
- **(iii)** To move to mind from (ii) , apply Cartesian criterion
- **(iv)** Identify minimal language
- **(v)** Apply Duhem-Quine thesis to (iv) to expand and understand the domain like music.

(i) Identify language

To know what a language is is not trying to understand like music as universal language or mathematical physics as language of physics but to ascribe generative grammar in the language which is governed by some set of rules of grammar. Language is not necessarily for communication but largely and ordinarily understood for communication and hence, there is a notion of FLB (Broad Faculty of Language) and FLN (Narrow Faculty of Language) by Chomsky. The notion of language here in (i) is a broad concept of maximal (ordinary) language or FLB and not minimalist language or FLN which is searched for.

(ii) To find preliminary parts of language

To find preliminary parts of language , BAL (Broad Architecture of Language) is required and BAL gives a flow chart of BDL (Basic Design of Language) in the form of major set of lexicons with its minor set called array which further gets classified into PHON (phonology) and SEM (Semantic Structure) . PHON gives SM (Sensori-motor System) while SEM gives CI (Conceptual Intentional).

From BAL ,it is known that lexical items do not have sound and concept.

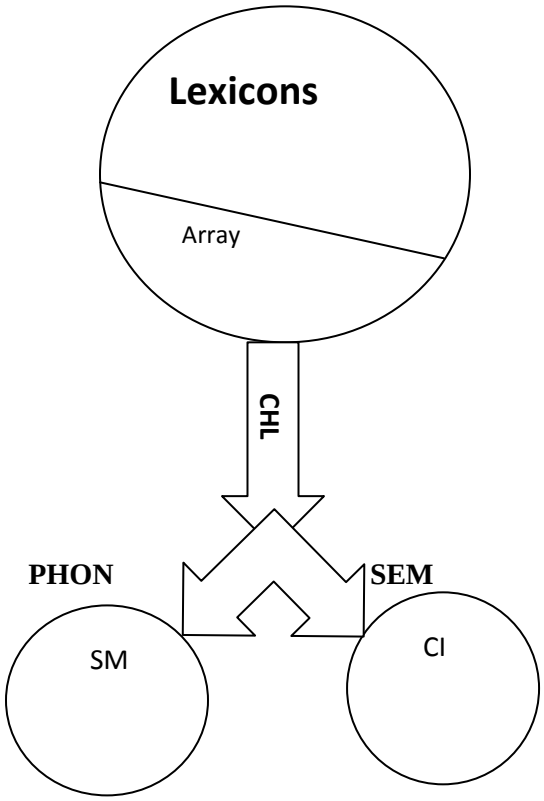

Fig. BAL (Broad Architecture of Language)
[CHL : Computational Human Language]

(iii) To move to mind from (ii) , apply Cartesian criterion

The application of Cartesian criterion is the crux of the five strategic steps as this criterion will ensure the uniqueness to human species. The encroachment by features of non-human species to BAL forces to find a narrow based theory of language which can not be encroached by none other than the language of human, so that , generalization could be done which though is complex. Language is not seen per se but always with something from outside and this notion of FLB when gets shrunk by encroachment methodology, gives the only remainder which is the minimalist language or FLN. Thus, the obtaining of FLN which is governed by recursion becomes the exclusive uniqueness to human species ,and this is the result of the application of Cartesian criterion.

The broad concepts of cognitive systems like reactions to stimuli, sensory systems, peripheral nervous systems, etc. may have commonality among living species in animalia kingdom but there is a unique feature of mind in human which is not present in non-human species and that is the ability to think about the thinking of conspecific which is recursion like 'X of X' ,or 'X of X of X of …' .The recursion is possible in computational mind in human which is not there in any other species. Thus, to move to mind from language , not only recursion is required but also in the process of the move, the notion of CHL (Computational Human Language) comes with a fundamental of computational system in human brain, hence in the making of theory of mind, computational mind executing recursion which ultimately makes the application of Cartesian criterion possible ,thereby giving a result of only humanely unique language , and this result is nothing but the minimalist language of Chomsky.

(iv) Identify minimal language

The identification of minimal language or narrowing FLN to recursion as a null hypothesis is essential to bring the uniqueness of human language. To identify minimal language , FLB has to be removed , other cognitive systems have to be taken away, encroachment methodology has to push the FLB to FLN or recursive generative grammar or minimal language which gives the result of computational mind of human.

The basic property of minimalist language is the presence of recursion, hence the minimalist language is recursive.

(v) Apply Duhem-Quine thesis to (iv)

The notion of an argument like music being universal language can be sorted out by applying Duhem-Quine thesis to the existing minimal language. Such application helps in resolving the conditions which are not exclusive to human as they are found in other non-human species and instead of changing the paradigm of recursion to a new one, the non-exclusive conditions or properties are removed when

falsified , thus , the recursive minimalist language though may get further minimized but still retain its minimal recursion. Thus , Duhem-Quine thesis proves that language which is recursive is exclusively unique in human species only.

Domain Specificity

Chomsky's approach of minimalist language also cuts down the range of cognitive domains to a narrow mind theory of human in which evolutionarily specified learning is replaced by innateness in child's language acquisition which is also possible not due to Darwin's evolution of natural selection but due to its innate character. The innate character minimally is linked with recursion of computational mind. Chomsky believes in removing external system which is in periphery to examine language which is at the core of the language. The external system means SM + CI while the internal system means the lexicons and computational system.

Domain Specificity is a modern cognitive science revolution which determines the uniqueness in human species in case of language through recursion. In evolutionary time scale of millions of years, 100 thousands years back, human language has started and in such a long time of millions of years, in non-human world, animal species like birds, insects and lower animals or mammals have rich expression (rich PHON system) but poor CI (poor SEM system) and as the time scale grows , the arrival of chimpanzees shows that they (chimpanzees) have poor expression (poor PHON system) but rich CI (rich SEM system), the interesting scientific observation in between the lower mammals and higher mammals in these two cases shows asymmetry but further interesting observation is the arrival of homo-sapiens which breaks the asymmetry by showing both rich PHON and SEM systems. This change in the animalia kingdom might be due to a genetic mutation which is an abrupt change or an evolutionarily adapted slow change (which is ruled out by Chomsky) or the enlargement of brain's size. By looking such phenomenon, it can convince that human language is unique and its minimalist language has to be exclusively unique too. Domain Specificity ensures that human language is unique because of its unique human mind which is different from non-human species and this uniqueness is the recursion which is possible due to computational mind.

Null Hypothesis

The null hypothesis of the project to reach minimalist language is : FLN = recursion

If FLN = recursion is wrong , then recursion is found in many cognitive domains ,hence it no more becomes unique and exclusive to human ,then Chomsky's approach of minimalist language goes.
If FLN = recursion is wrong is wrong, then arguments against Chomsky's minimalist language will go.

The hypothesis : FLN = recursion has been criticized by the findings of talking Neanderthals who were different species from Homo Sapiens ,though their (Neanderthals) language does not show a strong recursion. The search for language of Neanderthals could be the search for language of Proto (a fictitious species just existed before homo sapiens in an evolutionary line) called proto-language. DNA findings and archaeological evidences have also brought the link between Homo Sapiens and Neanderthals closer and the closeness might be due to interbreeding but they are considered to be of two different species but again, interbreeding between two different species is not biologically feasible in a natural way, hence, the closeness is developed but the natural biological interbreeding between the two is still searched for and if that becomes possible, then either the two were the sub-species of the same species or would there be some external biological factors for the sexual reproduction to be possible.

'FLN = recursion' hypothesis is also heavily criticized by the Piraha controversy in which Daneil Everett says that Piraha language lacks recursion but Everett's hypothesis is heavily criticized as non-scientific. Jan-Wouter Zwart says that recursion is to be understood in terms of derivational layering and not in terms of embedding and in this way, he argues that Piraha language has recursive grammar in terms of derivational layering.

The recent published work of Shigeru Miyagawa which conveys that human language syntax can be shown as made up of two layers which are E (Expression) and L (Lexical) layers and it also further concludes that E layer which is found in bird's songs and L layer in non-human primate calls, together in parallel make up a bi-layered composition which forms syntax of human language, gives a strong signal of non-uniqueness of human language as its unique recursion seems missing in this work.

Chomsky's reply in the above issues which attack the null hypothesis is from his recent work in which he cites neurological observations i,e. at neural level , Brodmann area (BA) 44 and the posterior superior temporal cortex (pSTC) supports core syntactic computations and the premotor cortex (PMC) and the STC assists the sensory-motor interface. BA 45 in the inferior frontal cortex and portions of the temporal cortex support semantic process. Human language which has a fixed neural architecture, is indeed a strong scientific evidence for uniqueness of recursion in human language and to show that recursion is uniquely linked to human brain which is different from non-human brain, he also cites another scientific observation from recent artificial grammar studies investigating key differences between animals and humans by using two types of strings: ABABABABAB… and ABABABABAB….

Chomsky's notion of human language as a result of multiple 'merge' operations to form hierarchical structures, may provide a problem of merge between the E and L levels of Miyagawa which are independent to each other.

Conclusion

The rejection of null hypothesis will bring up the debate of continuity versus discontinuity debate and there could be a possibility of Darwinism (Darwin's Mistake by Penn could burry Continuity

thesis of Darwinism) coming back against Domain Specificity but the findings of neurological brain science in modern world due to the advancement of neuroscience and its technology have enabled Cartesian criterion to be strengthened which is also shown in Chomsky's neural architecture of language ,thereby conforming the unique recursive human language. As like Chomsky opening his scientific findings open to the future neuroscience and the advancement of modern physics, and understanding the lack of synchronous relation between Quantum Mechanics and String theory and also between Theoretical and Experimental Physics to understand nature of either particle or string as of now, I have to wait for the future neuroscientists , physicists ,chemists and biolinguists to give a scientific finding either to accept or reject or evolve the null hypothesis.

References

(i) Lai, J. (2013). *The learnability of center-embedded recursion: experimental studies with artificial and natural language* (Doctoral dissertation, Department of Cognitive Psychology, Faculty os Social and Behavioural Sciences, Leiden University).

(ii) Mukherji, N. (2010). *The primacy of grammar*. MIT Press.

(iii) Johansson, S. (2013). The Talking Neanderthals: What do Fossils, Genetics and Archeology Say?. *Biolinguistics*, *7*, 35-70.

(iv) Everett, D. L. (2007). Cultural constraints on grammar in Piraha: A reply to Nevins, Pesetsky, and Rodrigues (2007). *Online: http://ling. auf. net/lingBuzz/000427*.

(v) Zwart, J. W. (2011). Recursion in language: A layered-derivation approach.*Biolinguistics*, *5*(1-2), 043-056.

(vi) Miyagawa, S., Berwick, R. C., & Okanoya, K. (2013). The emergence of hierarchical structure in human language. *Frontiers in psychology*, *4*.

(vii) Penn, D. C., Holyoak, K. J., & Povinelli, D. J. (2008). Darwin's mistake: Explaining the discontinuity between human and nonhuman minds. *Behavioral and Brain Sciences, 31*(2), 109-129.

(viii) Berwick, R. C., Friederici, A. D., Chomsky, N., & Bolhuis, J. J. (2013). Evolution, brain, and the nature of language. *Trends in cognitive sciences*,*17*(2), 89-98.