

Language as a Biological Construct: On the Intrinsic Variability and Selection of Language

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Abstract: Language is a biological entity; a genetically transmitted trait; an innate capacity that every human is born with. Assuming that this Chomskian view of a “genetic” Language is true, through this working paper, I hope to elaborate and expand the definition of Language by outlining the characteristics conferred to it due to its nature as a biological trait. I propose, firstly, that there is intrinsic variation among Language(s) inherited by individuals in a population; secondly, that Language is susceptible to natural and social selection - and finally, I will conclude by discussing some advantages afforded to Language by being invested in and transmitted through a biological or genetic scaffold. By revisiting and reanalyzing Language/ Universal Grammar from a biological/ genetic lens, I hope to supplement and expand the boundaries of how Language is defined.

0. Introduction: Language as a Biological Entity

Language is one of the many forms of communication: it an instrument for expressing our ideas and thoughts; a systematic method of delivering an intended message. It is a symbolic system in which the intended idea, that has a meaning attached to it, is coded and characterized through a representational system that resides in the cognitive realm or the Chomskian Language Faculty (Chomsky 1968), of the speaker and then is realized and exchanged between speakers through their articulatory and auditory interfaces (Saussure et al. 1983). Language is a semiotic system – it is a set of Sausurrian Signs (Saussure et al. 1983) in which a speech sound is arbitrarily (except in onomatopoeia) mapped to a particular meaning. These signs are laid upon a set of grammar rules or structural guidelines, that Chomsky calls Universal Grammar, that determine how the Signs can be put together to transmit the message.

“Universal grammar is part of the human genetic inheritance, a part of the biology rather than psychology.”

-Noam Chomsky, *Language and Mind*, 1968

More importantly, Language is a biological entity. It is a genetically transmitted trait; an innate capacity that every human is born with. Assuming that this Chomskian view of a “genetic” Language is true, through this thought experiment, I attempt to decode and analyze an established linguistic theory from a purely biological perspective. I hope to revisit Chomsky’s theory of Universal Grammar, as a theory in true sense of the word: as a plausible, and potentially refutable explanation for an observation/ series of observations.

I will elaborate and expand on the definition of Language by outlining the characteristics conferred to it because of its nature as a biological trait. I propose, firstly, that even though Universal Grammar, or a Chomskian, genetic Language, is *invariable and universal* in that it is a trait shared by all speakers and users of Language (and language(s)!), it is intrinsically and inevitably *variable* in nature because it is a biological trait. Genetic variation produced by the

human process of sexual reproduction, differences in the ontogeny of lexical development in young children, and differential manifestation of the genetic disorder Specific Language Impairment among members of affected families, provide clues to suggest that indeed every Language user inherits different versions of Language.

Secondly, if Language is indeed a variable, biologically “inherited attribute”, it is, like all other biological traits, acted on by the forces of selection. Both “Darwinian” evolutionary forces act on Language users, and the “Saussurian” social forces act on Language itself, making it a dynamic, animate entity. Language, by providing superior communicative ability to its users, perhaps allows the human race to propagate and dominate by generating a superior fitness advantage in the struggle for survival.

Lastly, I conclude by discussing some advantages that are afforded to Language as an entity transmitted through a genetic scaffold. Harboring Language in DNA allows for a risk-free and secured transmission method to future generations and reduces the collective social responsibility to maintain Language – as long as humans propagate, at least some form (however pruned, modified or elaborated) of Language will exist too.

Chomsky’s “Universal Grammar” and “Language” will be used interchangeably throughout this working paper – both refer to the abstract semiotic framework of rules and guidelines that all languages are based upon, and is acquired by every individual through a genetic transmission system.

1. Language as an Inherently Variable, Biological Trait

Assuming that the Chomskian view of a “genetic” Language is true, even though Universal Grammar, or Language is invariable and universal in that it is a trait shared by all speakers and users of language(s), it is intrinsically and inevitably variable in nature because it is a biological trait. Genetic variation produced by the human process of sexual reproduction, differences in the ontogeny of lexical development in young children and differential manifestation of the genetic disorder Specific Language Impairment among members of affected families are some clues that suggest that every Language user inherits different versions of Language.

All of us inherit Language, but all of us do not inherit identical versions of Language. Every Language user inherits different versions of Language. In the same way as Cook and Newson describe Chomsky’s Language through drawing the following parallel -

“All human beings have eyes, but some are brown, some are blue, some green”.
(Cook & Newson 2007)

It is very likely that Language, like a large proportion of biological traits, is a variant, polymorphic trait in the population, and the following arguments will help us understand why.

1.1 Sexual Reproduction and its Ability to Generate Genetic Variability

Firstly, genetic variability is an inescapable byproduct of the genetic transmission system through which we propagate (Freeman et al. 2013). Humans reproduce through the process of sexual reproduction and the characteristic feature that separates it from other forms of reproduction is its ability to introduce genetic variation at the individual level as well as at the population level. Genetic variance is introduced during sexual reproduction by the processes of crossing over, independent assortment of homologous chromosomes and random meeting of a

sperm and egg to form the embryo itself (Freeman et al. 2013). It is this genetic variance that makes many biological traits polymorphic, and it is likely that Language is also one of them.

Biologically, every trait is a phenotype, a physical quality or representation that is determined by a genotype, a gene or a collection of genes, which are pieces of DNA that encode hereditary material (Freeman et al. 2013). Every gene is also represented by a collection of alleles, or variable versions of the gene (Freeman et al. 2013). Assuming that Language, like many biological traits, is polymorphic in nature- that Language is encoded by more than one gene, and that these gene are polyallelic- the processes that underlie meiosis, egg and sperm, formation, is the first of the many processes that introduces genetic variability of a trait at the individual level.

During meiosis, segments of homologous chromosomes randomly shuffle and recombine with each other, introducing variability in the allelic library representing a gene (Freeman et al. 2013). Once homologous chromosomes recombine, more genetic variation is introduced when our genetic material is duplicated and then halved, in a random, arbitrary manner to form gametes -sperm and egg (Freeman et al. 2013). Thus, the process of meiosis that underlies sperm and egg formation already sets us up for variation in our traits even before an embryo is formed.

More genetic variation is introduced when male and female gametes combine together to form the embryo that is not a clone of the parents. Some random sperm, (with random male parental genetic information) combines with some random egg (with random female genetic information) to form a genetically unique, biologically distinct, variant human being (Freeman et al. 2013.). A person, thus, inherits a random combination of half of the parents' alleles, not all possible alleles of a gene (Freeman et al. 2013). Many alleles, including those encoding Language, may be variant in this individual when compared to another individual (Freeman et al. 2013. 2013). In light of these genetic processes, it is likely that every person must inherit a different version, a different allele-set of genes that encode Language. Furthermore, an inherent risk of mutagenesis during every step of sexual reproduction complicates the picture even more, increasing the propensity of additional extrinsic genetic variation.

In conclusion, sexual reproduction, the mode of transmission of the biological trait we know as Language, introduces genetic variability at the individual level that many biological traits share.

1.2 Differential “Starting Lines” in the Race of Lexical Development

The second clue that points towards variability in Language between individuals is provided by differential trajectories of language acquisition in children. According to Chomsky, infants are, at birth (before they are exposed to any primary linguistic data), in their native S0 (“S Zero”) state. Language competence at the S0 state consists only of the biologically endowed Universal Grammar –

“Universal grammar is a part of the genotype specifying one aspect of the initial state of the human mind”.

(Chomsky 1968)

Thus, assuming that this fact is true and that the rate of increase in language competence is proportional to the amount of “primary linguistic data” (Chomsky 1968) a child is exposed to, it would not be incorrect to assume that if children had identical UGs/ Languages, and they were placed in environments with identical linguistic exposure, their language ontogeny would also be

identical. If two cars start at the same start line and travel at the same speed during the entirety of a race, it is inevitable that they will arrive at the finish line together too.

Likewise, if we were born with identical UGs and raised with identical linguistic exposure, all of us would utter our first word by the age x , our first phrase at age y and so on and so forth. But, even if children are raised in an almost identical linguistic environment (for e.g., siblings)– they grow up in a shared language speaking community, go to the same school, are raised by parents of similar ages, races, socio-economic statuses and parenting styles- they will differ in their trajectories of how and when they reach a linguistic milestone such as uttering their first words, or formulating their first questions. Convention would argue that such differences in Language development are due to environmental influences since one cannot control for differential linguistic exposure; I propose instead that these ontological differences may be due to differences in the version of Language one inherits.

Since the Chomskian School of thought also asserts that language competence is not controlled or influenced by cognitive development (Pinker 1994), a lag in language skill development may not be due to decreased cognitive development. This suggests that children who utter their first words earlier in the trajectory may have begun their journey at a “starting line” closer to the finish line of “full” language competence than the children who develop their lexicon at a later stage. This measure of where the “starting line” is drawn, in my opinion, is the biologically endowed property of Language, and a variation in how far away from “full linguistic competence” this journey of attaining knowledge of language begins, changes the child’s pattern of early lexical development. Thus, this observation also may suggest that different versions of Language exist in the population – some that are closer to the finish line of “full Language competence” and some that are not.

1.3 Variation in a Genetically Transmitted Language Trait?

The third, and perhaps a more convincing clue that supports Language as a variable trait at the population level comes from the scientific study of Specific Language Impairment. SLI is a disorder characterized by difficulties in language development that are not caused by cognitive disabilities, brain damage or physical impairment of the articulatory apparatus (Bishop, 1996). Those who suffer from SLI may experience a spectrum of symptoms such as delay in speaking, inability to use complex grammatical structures, inability to parse complex language patterns and may have vocabularies that are compromised in quality, quantity or both (Bishop 1996).

Bishop’s studies from 1996 and 2002 firmly support that SLI is a genetic disorder. Through observed familial inheritance patterns in pedigree analyses (Bishop 2002) and high concordance in twin studies (Bishop 1996), Bishop suggests that there is a strong genetic component in the etiology of SLI. This conclusion is important for two reasons – one, it reaffirms that Language is a biologically inherited trait, and secondly that not everyone inherits the same version of Language. I propose that people who suffer from SLI also inherit a version of trait called Language – but the allele(s) that they inherit differ from the allele(s) of Language a person not suffering from SLI inherits.

Bishop discusses this pedigree analysis of the KE family (Figure 1), where SLI affected individuals are represented by the shaded boxes, we can see firstly, that this genetic disease runs in families – this horizontal transmission pattern suggests heritability- and secondly, that not all members of the family are affected by SLI. Given the assertion that SLI is caused by genetic factors, one would assume to see all, if not most members of the family affected by SLI – which we do not.

The differential Language competence of members of the same family reflects my proposition that every person inherits a different version, a different set of alleles, of the trait of the some gene or genes called Language. There are at least two different versions (perhaps even more) of Language – ones that causes SLI and ones that do not, and depending on which version of Language the person inherits, he or she may or may not suffer from SLI, as suggested in the pedigree depicted in Figure 1 (Bishop 2002). The genotype responsible for SLI phenotype is a variant of the genotype that codes for non-impaired Language development, and this also holds true vice-versa, the genotype responsible for normal Language development is a variant of the alleles that code fro SLI. Thus, every person in the family inherits the trait we know as Language – all of them can communicate; but the degree to which they can communicate using Language depends on which version of Language they inherit. Since the etiology of SLI has been characterized by a strong genetic component, it is not surprising to conclude that the inheritance of Language(s) (ones that cause SLI vs. ones that do not) is controlled and executed by differences in transmission of genes encoding Language. Thus, Language is an inherently variable, biologically transmittable entity.

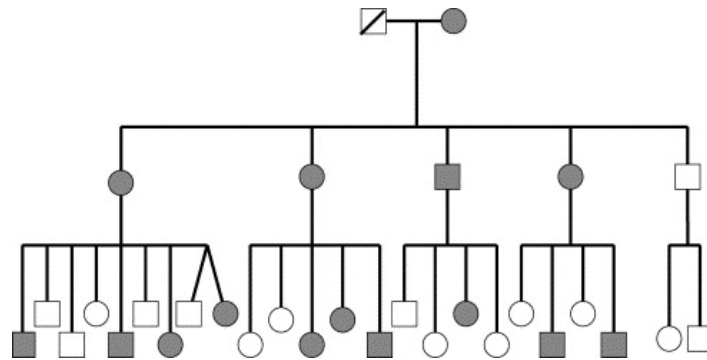


Figure 1. Pedigree of the KE family. Females shown as circles and males as squares. A line through a symbol indicates deceased. Shaded figures are affected with speech and language disorder (taken from Bishop 2002).

In light of the arguments presented above, it is without very likely that, like Cook and Newson reaffirm, “like other inherited attributes, this” (UG/ Language) ”does not rule out variation between individuals” (Cook and Newson 2008).

2. Language and its susceptibility to the forces of Selection

If Language is indeed a variable, biologically “inherited attribute”, the first question I asked to myself as a biologist was: So what? What are the consequences of Language being a variable heritable biological trait?

The most important consequence of Language having different versions of itself distributed in the population is that it allows the forces of selection – a systematic process that promotes preferential representation of a trait in a population – to act on it.

Selection is a process of modifying the distribution of a trait in a population. It is a regulatory process – a non-random, systematic procedure of changing the representation of variation in the population. Selection is like a process of sieving: only those versions of a trait that pass through the filter of *time and context* move on to be represented in future populations. Selection keeps the variables in the population in a dynamic, ever-changing and moldable state.

I hypothesize that Language may be selected upon by two distinct forces - the Darwinian or Chomskian evolutionary forces and the “Saussurian” social forces- that act on it to change the distribution of variation of Language within the population. As long as there are different forms of Language, some forms will be better suited for their environment than others, making Language as an entity disposed to the pruning and selection processes that affects every other biological entity and/or social entity. Language thus becomes dynamic; It becomes susceptible to change over time.

From the biological perspective, selection, or natural selection to be more precise, is described as the process through which traits that confer higher fitness, or a survival advantage are passed down and preserved in the population more readily. It is possible that Natural selection acts on Language just like does on any other biological trait. Just like Darwin’s finches some of which have short beaks and some of which have long beaks, language too has forms with “short beaks and long beaks”. When the drought comes and hard-shelled nuts become the only source of food, only those finches, or rather language forms, with sturdy long beaks capable of cracking through tough nuts will survive. Just like the finches, I hypothesize that different forms of language too avail differential survival capacities for language users in the population. Those linguistic communities whose Language affords them a better chance to survive and propagate, populate the next generations more favorably. Thus, natural selection acting on Language is becoming a proxy for the sustenance for the human race, by allowing selection of forms of Language that allow increased fitness, or the propensity to survive and reproduce.

In addition to Darwin’s Natural selection, there is yet another type of selection, social selection, that I believe also acts on the variable phenotypes of language. Social factors such as prestige, number of speakers, geographical spread, migration and language contact etc. also shape the characteristics of the Saussurian social Language to optimize and reset its parameters to suit the needs of its users. Language thus, through both natural and social selection is constantly being optimized to a form that enhances survival of our race, and the social relevance of Language in the linguistic community.

Given that natural and social selection are selecting Language to be the “most efficient tool for communication” and a proxy for the sustenance of the human race, one would be inclined to think that the version of language that allows humans to have a higher propensity to survive and/or be the right fit for social pressures, would be one that is evolving into a “better” version of itself- a language that is evolving into a superior, ultimate form.

But do not be misled! Through natural and social selection, Language is not necessarily becoming a “better” version of itself in the traditional sense of the word – Language is not evolving to facilitate more complex syntactic structures or complicated grammatical constructs or increasing its generative capacity. Instead, it is simply changing into a form (or rather, forms) that confers an increased capacity for effective communication to its users. Selection is shaping Language into its most robust, efficient and effective form that facilitates the exchange ideas in a language circuit (Saussure et al. 1983), which might be by simplifying, or complicating its semiotic framework. Furthermore, selection works on variable forms of Language to create the “best version(s)” of itself in its (their) own specific and contextual linguistic and sociocultural environments. The best version in one context might not be favorable in another linguistic context. Even though both social and biological selection pressures on Language seem to be going down divergent paths, they end up at the same intersection: the end result is that the

selected Language enhances the ease and effectiveness of communication for its particular speakers-hearers who deploy Language in their specific linguistic communities.

Furthermore, it could be possible that Language is being shaped and optimized over time to enhance our viability. Perhaps Language was encoded in our genetic backgrounds to produce genetically variable forms, that allowed there to be multiple permutations of the Language trait so that we, as a population, could adapt to any environment, and any new context and still be able to use Language to communicate. From this perspective, Language as a biological trait evolved to allow the human race to propagate - Investing Language into biologically transmittable units of information seems to be essential for our survival.

3. Language as a Biological Trait: Efficiently Packaged and Self-Sustainable

There are further advantages that are conferred to Language by biologically encoding it in deoxyribonucleic acid (DNA): massive amounts of information, the entire expanse of cognitive manifestation and processing framework of Language, can be packed into miniscule amounts of physical material – submicroscopic pieces of nucleic acids. A socially derived language would depend on the collective memories and abilities of its speakers, which without surprise, is grossly restricted in capacity in comparison. This secure investment of Language in our genes allows for a cohesive, collective and insured manner of sustaining Language and transmitting it to all human speaker-hearers. It allows human society to enjoy minimal collective responsibility and almost no effort needed to keep Language alive– as long as humans reproduce, the trait will be passed on since every human is innately endowed with Language. A biologically encoded Language is, thus, intrinsically self- sustained and self-renewing. When compared to socially derived language that has to be kept alive by a considerably larger amount of people through social interactions and imitative behaviors, a biologically derived language reduces collective social responsibility and burden.

As long as we reproduce, Language will be maintained; and as long as Language is variable among members of the population, the survival advantage afforded by natural selection will allow us to procreate our offspring and thereby, Language. This system produces a symbiotic, mutually beneficial relationship between Language and *Homo sapiens* – Language depends on the propagation of the human race to survive; and the human race enjoys the survival advantage afforded to it by Language.

4. Conclusion

In conclusion, Language is an inherently variable biological entity that affords *Homo sapiens* (and possibly other species) an advanced, customized and sophisticated system of communication. Different versions of Language exist in the population – it is this variation on which natural and social selection work to select for versions that afford its users a survival advantage. The genetic scaffolding that Language rests on also allows for a risk- free and secured transmission method to future generations and reduces the collective social responsibility to maintain Language – as long as humans propagate, at least some form (however simplified or sophisticated) of Language will exist too.

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