Defining Language in the Wake of
Primate Language Research

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Abstract

This text examines language as it is used in the animal language debate through pragmatic and structural linguistic perspectives on primate language research. The surge of primate language studies in America in the 1970’s generated a wave of public and academic interest in animal language that continues today in the form of ongoing primate research both in the lab and in the wild. These studies have forced the field to examine the way it conceptualizes language, as well as the current criteria with which we use to define it. I argue that the traditional linguistic approach to defining language, which measures language through surface level features, as can be seen in Hockett’s design features, cannot fully describe language, and instead must include a more pragmatic perspective in order to more accurately measure primate language. Finally I argue that the term language, as it has historically been used to describe only human language is useless, as its exclusivity ignores the gradient of the complexity of higher mental faculties across the evolutionary tree.

1 Introduction

From the domestication of dogs approximately 30,000 years ago (Saey, 2017), of horses 5,500 years ago (Wilfred, 2009), and the creation of the first zoo 5,000 years ago (Boissoneault, 2015), it is clear that the human interest in interacting with different species is deeply rooted in our natural history. Central to our interest in non-human animals is an interest in their communication abilities. It is impossible to understand
the cognitive abilities or social hierarchies of a species without an understanding of their system(s) of communication. It is undeniable that most animals have a system of communication which they use to communicate with members of their species, let alone with animals outside of their own species. It is common to witness examples of within species animal communication in daily life, for example when watching two domesticated dogs engaged in play, one is likely to observe an interaction that is abundant with communicative signals, such as “bowing”, turn taking, and a number of body language expressions (Bekoff, 2015). It is quite easy to discriminate whether the participants are enjoying themselves, whether one participant has transgressed, and when one participant demonstrates submission to the other. Backing up this anecdotal example is a wealth of literature on animal communication, containing evidence of complex communication systems across a multitude of different animals, insects, and even plants, from the the complex set of whistles, clicks, and screams with which dolphins use to communicate (Wilson & Usborne, 2013), to the bee’s “waggle dance” used to describe the location of a food source (King & Janik, 2013), and even to underground fungal networks which allow plants to transmit information via chemical exchange (Babikova et al., 2013).

Not only are non-human animals communicating within their own species’, they also communicate across species. We can see this in the sometimes-tumultuous relationship between a domestic cat and dog. Though their different species’ communication systems differ in many ways, there is a certain degree of information that is able to be transmitted across the species barrier. A study on the relationship between domestic cats and dogs living within the same household found that, in most cases, cohabitating dogs and cats were able to understand the body language of the other, even when the particular instance of body language had a different meaning between the two species’ typical communication systems (Feuerstein & Turkel, 2007). In other words, the results of this study suggest that dogs and cats living in the same household are able to understand the other’s body language, even when the meaning of a specific instance of body language has a different or even opposite meaning in the two species’ typical
communication systems. This is indicative of a considerable level of communication between species, despite differences between the two communication systems.

Interspecies communication is not just limited to non-human animals. The relationship between a dog and its owner is one that is often abundant with communication. One needs only to gaze into the eyes of a beloved family dog to intuit some degree of information, such as the emotional or attentional state of the animal. The range of messages that are able to be communicated between human and dog is surprising, given the obvious differences in intelligence, anatomy, and other variables. Beyond body language expressions, it is not uncommon for a domestic dog to be trained to perform a number of actions on vocal or gestural command, such as sitting, barking, or playing dead. Others, such as service dogs may be able to perform more complex tasks such as retrieving a remote control, or opening a refrigerator door. However, the communication within the dog to owner relationship is not one-sided. Dog owners often become attuned to the messages their dog convey as well, for example understanding when their dog would like to be let outside to play or use the bathroom, when their dog is requesting food, or whether their dog has a positive opinion of an approaching stranger.

However, in the same way that it is easy to perceive the communication systems within and between other species, each other, and ourselves, not all communication systems are created equal. While it is easy to recognize a domesticated dog’s ability to communicate with other dogs, other animals, and its owner, it just as easy to recognize that the extent of their communication abilities falls far short of that of humans.

It is clear that human language is the most complex system of communication in the animal kingdom, and this is to be expected, as the human brain, human intelligence, and human societal organization are all also unmatched by the other members of our evolutionary tree. Karl Marx argued that at the root of humanity is the ability to transform the raw materials around us, and one could argue we do the same with language. Humans have transformed the raw materials of grunts and vocalizations into
a complex system with rules that allow us to communicate an infinite number of complex messages and ideas, however abstract.

It is the pursuit of an understanding of this transformation that is at the heart of the study of linguistics. Until the mid 20th century, the field of linguistics was based on the study of the observable properties of human languages, and was therefore a descriptive science. In 1957 Noam Chomsky revolutionized the field by attempting to explain, rather than describe, the essential qualities of language, by situating his theories in a more biological perspective, and attempting to identify the universal qualities of language (Chomsky, 1957). Chomsky’s most famous concepts, generative grammar and deep structure, take a fairly mathematical approach to linguistics, conceptualizing the formulas which make up grammar. His mathematical approach is biological in the way it essentially begins to attempt to explain how the human brain is able to use language to produce an infinite number of sentences with an infinite number of meanings, without an infinite amount of “storage”. In other words, because storage in the brain is finite, and no person is able to learn the infinite number of possible sentences able to be created by a human language, the brain must rely on underlying structures, or a set of formulas that make up the “deep structure” of a language. Though this explanation is more biologically based than traditional structuralism, it does not attempt to locate the literal structures within the human brain that are responsible for language. As Chomsky points out in On Nature and Language, modern science is far from being able to draw such connections between the brain and its higher mental processes (Chomsky, 2002). At this moment in time we know a fair amount about the physiology of the brain, as well as about the patterns and structures found within and across the diverse array of human languages, but we know far less about the relationship between the two.

Chomsky’s theory of generative grammar was published as a response to B.F. Skinner’s *Verbal Behavior* published in 1957, which outlined a behaviorist view of language and linguistic, focusing on language as a social behavior that is reinforced or conditioned by the presence and response of a listener (Skinner, 1957). Skinner’s
publication of *Verbal Behavior*, and Chomsky’s (critical) Review of Skinner’s *Verbal Behavior* in *Language*, sparked a huge rift within the field that essentially boiled down to a “nature vs nurture” debate about the way language is manifested in the human brain (Chomsky, 1959). Though today it is widely understood that language is a product of both the environment and innate internal structures, there are two schools of thought on the way language is organized in the brain, namely the continuity and discontinuity theories. The continuity approach essentially asserts that the faculty of language is a product of general plasticity within the brain. In other words, this approach would explain the superiority of human language, in its complexity and communicative ability, as a result of a superior ability to learn and think, manifested across a number of structures within the brain that make up general intelligence, memory, and capacity to learn. The discontinuity approach on the other hand, is best exemplified by Chomsky’s “language organ” theory, which suggests that language is a result of a specific structure within the human brain that is specialised for language, and unique to humans. He would explain the superiority of the human language faculty as a result of this structure within the human brain, and its absence from those of non-humans (Ulbaek, 1998).

In this text, I will examine the ways which animal communication research, specifically chimpanzee language studies challenge the way the field of Linguistics has traditionally defined *Language*, and how opposing views on the importance of pragmatics versus structure, as well as on the way language skills are manifested within the brain shed light differently on the chimpanzee’s linguistic ability. In Section 2 I will briefly outline the evolutionary relationship between the human, chimpanzee, and Bonobo. I will also explain why it is difficult to locate specific qualities within evolution, and relate these concepts to the continuity and discontinuity theories of human language evolution. In Section 3 I introduce two different approaches to defining language, with Hockett and Chomsky’s theories focus on structure, and Hillix and Rumbaugh’s focus on the intent and content of the message and the cognitive abilities that are behind them. Finally in Section 4 I outline the primate language
research of the 1970's, its criticisms, and the current research which has followed. I discuss the promise which these studies have shown regarding the linguistic abilities of the chimpanzee, as well as the limits, and relate continuity and discontinuity theory as well as structural and pragmatic based inclusion criteria for language. I call for a definition of language that values pragmatics at least as much as structure, as cognitive ability is at the heart of what linguistic ability attempts to measure.

2 The Roots of Language in Human Evolution

The essential disagreement between the continuity and discontinuity theories is at which point in evolution human language began to develop. However, no matter how language is structured in the human brain, the human language faculty is necessarily a product of evolution. The continuity theory supports the idea that language is a product of general increased plasticity and intelligence in the human brain, which means that we should be able to see evidence of an increasing plasticity within the evolutionary tree. In other words, we should see then that our closest relatives also show higher intelligence and higher apt for learning and language. The discontinuity theory, on the other hand, believes that the human language faculty evolved only in the human brain, which would place its development after the modern human split from our shared relative to the chimpanzee.

While a number of theories exist surrounding the evolution of human language, they are widely disputed and answers to questions such as when and how humans first started using language vary greatly for two primary reasons.

The first reason we can’t definitively answer these questions is due to the nature of evolutionary research. The common ancestors between humans, chimpanzees and bonobos are thought to have split between five and seven million years ago. The chimpanzee and the bonobo split only approximately 1.5 to 2.5 million years ago (Prüfer et al., 2012). This timeline gives humans millions of years to potentially develop language separately from our chimpanzee relatives. However, it gives
chimpanzees and bonobos the same amount of time for their communication abilities to evolve separately as well. There is essentially no way for us to know exactly how language evolved short of travelling back in time and witnessing it ourselves. While the Chimpanzee and the Bonobo are our closest living evolutionary “relatives”, they in no way represent an early stage in human development, because they too have been evolving and changing since our shared ancestor began to evolve separately into what is now the modern human and the modern chimpanzee.

The second reason is due to the gradual nature of evolution and its products. It is difficult to pinpoint where language falls on the chronology of human evolution because it is difficult to pinpoint what exactly language is. The field of linguistics itself reflects this fact, as there still does not exist one generally accepted set of inclusion criteria. Further, the concept of the modern human is similarly difficult to define. Because of the gradual nature of evolution, we as a species have evolved very slowly and gradually over a long period of time, and so have our faculties. Though modern science roughly places the emergence of the modern human (homo sapien) around 200,000 years ago (Cann et al., 1987), it is somewhat arbitrary at which point we draw such classifications.

Despite these limitations, the Chimpanzee, being our closest relative, is both the best candidate for a better understanding of the history of the evolution of the human faculty of language, and the best candidate for animal acquisition of human language. In theory, the extent that a chimpanzee is able to acquire human language can tell us both what about the human faculty of language is unique, and may provide clues for where in the course of human evolution language may have emerged, or at least where certain properties that seem to be conducive to linguistic abilities may have developed. This is essentially the mission of the primate language research that captivated both academic and general audiences in 1970’s America. However, these studies, like any example of scientific research, are limited by methodological constraints which threaten to confound the integrity of the research and its findings. While this problem is not new to the scientific discipline, methodology is of particular concern in research
involving animals with the emotional, intellectual, and physical needs of the chimpanzee and with a concept as complex as language.

3 Defining Language

Language is as difficult to define within the field of linguistics as it is to pinpoint in human evolution. While it is likely most would agree that on a spectrum of exclusivity, communication, language, and human language would move from least to most, respectively, the exact boundaries of each term are not universal within the field of linguistics.

3.1 Human Language

For obvious reasons, the parameters of human language are important to define in the pursuit of an understanding of the human language faculty. The most prominent structuralist definition of human language comes from Charles Hockett’s design features, however, these are contested particularly by researchers who take a more evolutionary approach to linguistics.

3.1.1 Hockett’s Design Features

Hockett was a structural linguist, whose work includes a set of design features intended to describe the traits that separate human language from other animal communication systems. Though they are not without their weaknesses, his design features have stood the test of time well; most attempts to define human language today at least draw from Hockett’s list of design features. Originally, Hockett proposed a set of 13 design features in his 1960 publication of The Origin of Speech, but he later added an additional three in his 1966 text The Problem of Universals in Language. In these publications, Hockett uses language and human language interchangeably, exemplifying the common held belief that language is unique to humans (and therefore a distinction between the two terms is unnecessary). Most of
the design features can be found to at least some extent in various animal communication systems, but no system except human language has been found to contain every feature. For this reason, in this text I use Hockett’s design features as an example of a definition for human language and not language. Hockett’s 16 design features are as follows (Hockett, 1960) (Hockett, 1966):

1. Vocal/Auditory

   This design feature is fairly straightforward; Hockett believed an important feature of human languages was the use of the vocal and auditory channels.

2. Broadcast Transmission and Directional Reception

   The directionality Hockett is referring to in regards to this parameter is the way that human language is produced with aim, and this aim is perceivable to the receiver. For example, when we speak, we speak with a specific audience in mind, and we usually direct our speech at this person(s) by orienting our mouth towards them. Similarly, when we hear spoken language, we are usually able to perceive from which direction it came.

3. Rapidly Fading

   The sound waves that transmit spoken language rapidly fade; once they are transmitted, if they are not perceived, the message is lost. Unlike written language, which it is clear Hockett excludes from human language, speech cannot be perceived after its sound waves are gone.

4. Interchangeability

   In the absence of impairment, all adult speakers of a language have equal ability to transmit and receive any message. There are no messages that are exclusive to only some members, as in ant colonies, for example, in which a queen may be able to transmit chemical messages that others biologically cannot produce.
5. Total Feedback

In the absence of impairment, the transmitter is a recipient of their own transmission.

6. Specialization

The function of the action must be communicative and not a biological function. In other words, the purpose of speech is to communicate, and does not serve another biological function.

7. Semanticity

The symbols within a language must have (symbolic) meaning. Words within human language are symbols for things or ideas.

8. Arbitrariness

The symbols are arbitrary in form. The relationship between the words themselves, and the things to which they refer, is random. There is nothing about the word dog which connects it to the concept of a dog except that we have agreed that this is its meaning in English.

9. Discreteness

Human language is comprised of discrete units. Words in human languages are made up of a discrete number of sounds.

10. Displacement

Language can refer to things that are not present. This feature allows them to refer to abstract concepts, as well as items that are simply out of view of the members of a conversation.

11. Productivity
The discrete units of a language may be used to create an infinite possible number of messages. The finite number of sounds that can be produced by the human vocal tract, and the smaller set of these which a particular human language may be comprised of, can be combined in an infinite number of ways to create new words, which themselves can be combined into an infinite number of combinations to create an infinite number of meanings.

12. Traditional Transmission

Language is acquired through some combination of biology and environment. We acquire the ability to have and use language biologically, while we require modelling, teaching, and other environmental inputs in order to acquire it. However, we are not born with any kind of complete use of human language.

13. Duality of Patterning

Language is composed of a system of phonology mapped onto a system of grammar. It is made up of sounds which follow a complex set of rules in order to create meaning.

14. Prevarication

The content of a message can be false or illogical. It is not impossible to say something that isn’t true or even possible.

15. Reflexiveness

Language can be used to communicate about anything, including itself.

16. Learnability

A speaker of a language can learn another language. Once someone has learned one human language, they have the ability to learn another.
3.1.2 Criticisms of The Design Features

The most obvious aspect of Hockett’s design features that has not withstood progress within the field of linguistics is his exclusion of sign languages. We know today that sign languages parallel spoken languages in every measure of complexity and linguistic validity. Of the 16 features, the ones that are the most blatantly exclusive of sign languages are the Vocal/Auditory Channel, Broadcast Transmission, Rapidly Fading, and to some extent Arbitrariness features. The validity of Sign Languages tells us that the Vocal/Auditory Channel feature is simply incorrect. Perhaps modality is still an important feature of language, but we must at the very least now include signing as a modality in order for this feature to remain valid. Both the Broadcast Transmission and Rapidly Fading features are exclusive in their focus on the speech modality. Both features remain valid when conceptualized with signing in mind. In sign languages such as ASL, the signer and the audience have directionality, in that the signer orients their signing towards the person in mind, and the recipient perceives this directionality. In sign, it is light waves not sound waves which are rapidly fading in the Rapidly Fading feature. Finally, the Arbitrary feature is an interesting one when considering sign language. The only cases in spoken languages that violate this feature tend to be onomatopoeia and sound symbolism. Onomatopoeia are words such as noise words, in which the pronunciation of the word is meant to imitate the sound it is referring to. For example, the word “woof” in English is meant to imitate the sound of a dog barking. Sound symbolism refers to the way that certain sounds have been found to refer to similar ideas across languages. For example, many languages use the [i] vowel sound to indicate smallness. We see this in the English words “teeny”, or “wee”, Greek’s “ mikros”, or suffix “-ito” in Spanish. The Arbitrariness feature is violated in sign languages in signs that have a high degree of iconicity, which is common in sign languages. One experiment found that native-ASL signers were able to identify matching sign and image combinations faster when the sign had a degree of iconicity, suggesting that the relationship between meaning and form can speed lexical retrieval. The validity of Sign Language, as well as the findings of this study suggest
that Hockett’s Arbitrariness feature is more likely a result of speech modality than it is a true measure of the validity of a language (Thompson et al., 2009).

The largest criticism Hockett’s design features have received is from evolutionary linguistics who argue that his focus on the superficial qualities of language ignores deeper more important aspects of language such as the underlying cognitive, social, and motor abilities that are necessary for language production. In their criticism of Hockett’s design features, evolutionary linguists Wacewicz and Żywczyński point out that the Hockett’s exclusion of sign language and the signing modality exemplifies his focus on the means of communication rather than content (Wacewicz & Żywczyński, 2015).

While it is important to acknowledge their shortcomings, Hockett’s design features do provide an concrete, albeit limited way to define human languages, and therefore provide a tool with which to measure or compare non-human animal communication systems. However, as exemplified by Wacewicz and Żywczyński’s critique of Hockett, it is crucial to examine the data from studies of animal communication both in the lab and the wild through their content (social, cognitive, and otherwise), as well as the superficial qualities which may or may not resemble human language through the design features.

3.2 Language

The inclusion criteria of language are largely undecided among the research community. While the general study of linguistics isn’t greatly affected by the lack of consensus, the animal language question can not be answered without a clear definition. For this reason, most participants in the animal language debate provide their own inclusion criteria. However, the constantly changing nature of the definition takes away from the true purpose of the term which is to measure linguistic complexity and validity.

Despite these discrepancies, researchers at opposite ends of the animal language debate, Noam Chomsky, and research duo Hillix & Rumbaugh, provide surprisingly
similar definitions for language. Chomsky has never wavered in his argument against animal language, citing his theories on the existence of a language organ within the human brain that is responsible for language, and is unique to humans. In *Syntactic Structures*, he offers the following definition for language (Chomsky, 1957):

...I will consider a language to be a set (finite or infinite) of sentences, each finite in length and constructed out of a finite set of elements. All natural languages in their spoken or written form are languages in this sense, since each natural language has a finite number of phonemes (or letters in its alphabet) and each sentence is representable as a finite sequence of these phonemes (or letters), though there are infinitely many sentences. Similarly, the set of 'sentences' of some formalized system of mathematics can be considered a language.

The definition Chomsky provides is surprisingly succinct, given his belief that humans are the only animals capable of language. In his definition, he touches on two of Hockett’s design features: discreteness and productivity, both of which he claims are true of mathematics and probably computer code, which according to this definition, are both examples of language.

Hillix & Rumbaugh, primate language researchers who are firm in their belief that non-human apes can produce language, provide a different definition for language. In 2004 Hillix and Rumbaugh defined language as follows in their text *Animal Bodies, Human Minds* (Hillix & Rumbaugh, 2004):

Language is an agreed-upon system of signals that represent things, events, feelings, ideas, intentions, and actions on the environment of other organisms. The signals must symbolize something beyond themselves and fulfill a useful (pragmatic) function by coordinating
the activities of organisms. The meanings of the signals comprising a language are shared, at least in part, by the individuals in the group using the language.

Of Hockett’s design features, this definition offered by Hillix and Rumbaugh touches only on semanticity. However, they also mention pragmatics, a concept outside of Hockett’s design features. Pragmatics, as defined by Hillix and Rumbaugh, is concerned with the usefulness of language, which offers a behaviorist perspective of language. They write that pragmatics involves “the relationship between producers and receivers of symbols” (Hillix & Rumbaugh, 2004).

While Hillix & Rumbaugh’s requirements for language show a concern for the deeper intention and cognition behind communication, Chomsky’s definition focuses on structure, and the property of generation. These two definitions provide two very different perspectives on language, which can be seen in the different conclusions they draw about primate language research.

4 Primate Language Research

Primate language studies are a phenomena that took off in the 1970’s with chimpanzees and other apes being taught various forms of “language”. The research was inspired by behaviorist theory on the human language faculty, which posited that human language was a social phenomenon, occurring as a result of the human environment. In order to test this theory, researchers attempted to raise chimpanzees from infancy in a household environment, in order to compare the course of language acquisition (or lack thereof) to that of typical language development in the human child. This kind of research initially began in the early 20th century, with attempts to teach chimpanzees and other apes spoken English, and quickly moved on to languages which utilized different modalities such as modified sign language, physical lexigrams, and computerized lexigrams in order to circumvent the limitations of the
chimpanzee vocal tract. While researchers were not able to successfully teach primates to produce speech, project Washoe, the first study to use sign language, was astonishingly successful. Following this success, was a plethora of new primate language studies, testing the efficacy of different methodologies, different language modalities, and different strategies to control for confounding variables. Each of these studies have been met with scrutiny and heavy criticism, largely due to the difficulty of controlling for variables in the life of an animal with as complex physical and emotional needs as a chimpanzee, as well as the difficult nature of quantifying language. Primate language research today is fueled by a drive to address these criticisms, improve methodology, and answer new questions about the nature of language, human language, and non-human primate cognition.

4.1 The Emergence of Chimpanzee Language Research in the 1970’s

The first notable chimpanzee language studies were the Kelloggs in the 1930’s with chimpanzee Gua, and in the 1950’s, the Hayes, with chimpanzee Viki. In both cases the chimpanzees were raised in the home environment, and in the case of the Hayes, Gua was raised alongside the Hayes’ own infant son (Mihalicek & Wilson, 2011). Both projects revolved around the goal of teaching a chimpanzee human speech, and both were eventually abandoned. This goal, unbeknown to these early researchers, is an impossible one, as the chimpanzee vocal tract does not allow the animal to create anywhere near the quality or variety of sounds necessary for human speech (Hillix & Rumbaugh, 2004). In order to circumvent this problem, Beatrix and Allen Gardner decided to attempt to teach a chimpanzee a modified form of American Sign Language in 1966. Their success with chimpanzee Washoe sparked the ensuing surge of similar primate language research in the 1970’s, which has lead to the field of primate language research that continues today.
4.1.1 The Gardners & Washoe

When Washoe was brought to Nevada at approximately 10 months of age after being purchased in 1966, Beatrix and Allen Gardner designed a life for her that was minimally confining and rich in social interaction. She was raised in a trailer home and backyard, and given a staff of young researchers to entertain her and provide her with linguistic enrichment through natural daily interactions. In order to aid her language acquisition, strict signing-only rules were enforced in order to prevent any exposure to spoken English that could impede her progress with signing. Methods of teaching included modelling, and in the early stages of the study, hand-shaping, with tickling as positive reinforcement. By the end of the initial 2 year project Washoe had learned over 30 signs which she could use spontaneously and appropriately. After learning just 8 to 10 signs, she began to string them in 2 or more sign phrases (Gardner & Gardner, 1969). By the end of her life in 2007, Washoe was reported to have learned over 250 signs and had many recorded instances in which she created her own novel combination of her signs. Upon examination, these results meet many of Hockett’s design features. The first six of Hockett’s design features are all closely related to the modality of a language, and are less relevant to the relationship between speaker and language. We already know that signing is as valid as speech linguistically, and does meet each of these six features (Vocal Auditory, Broadcast Transmission, Rapidly Fading, Interchangeability, Total Feedback, and Specialization) with the exception of Vocal Auditory, for which Hockett was simply wrong to believe that human languages only utilized the speech modality. For the rest of the features, though many are related to the language itself, independent of the speaker (or signer), I will analyze them only through Washoe’s use of them, as it is not Sign Language that is under investigation, but Washoe’s use of it (or at least use of a modified version of American Sign Language). For this reason, along with the first 6 features, Arbitrariness and Discreteness, along with the first 6 signs do not need to be examined further. The relationship between the signs and their meaning is an implicit feature of sign language (though it is true that the arbitrariness of this relationship tends to be stronger
for speech than sign), and even if Washoe’s signs were simply memorized “tricks”, the relationship would still be arbitrary. Discreteness is true of Washoe’s signing as the hand shapes which make up any sign language are a discrete set, coming from a discrete set of possible discernable handshapes. The most significant features to Washoe’s vocabulary of signs, and spontaneous creation of novel combinations are Semanticity and Productivity. The feature Semanticity asks whether Washoe’s use of sign was a product of a deeper understanding of the use of words as symbols or referents to items in the real world. Productivity asks whether she uses an internalized set of rules for the structure of her sign combinations that allow her to use structure to modulate meaning. Her comfortable, frequent, and often unprompted use of signs suggest that the answers to both of these questions could be yes, however, her limited vocabulary, and limited instances of word combination are less promising. However, these are not the only features Washoe’s use of sign met or approached. When Washoe was given an infant chimpanzee to raise, she began to teach signs to her son to the surprise of her experimenters (Mihalicek & Wilson, 2011), showing evidence of the feature of Tradition, which Hockett used to describe the transmission of language through parent-child interaction. Another interesting feature indicated by Washoe’s use of language is prevarication, or the ability to make a false assertion. In other words, Washoe may have learned how to lie. Though no formal studies have examined Washoe’s use of language for deception, Roger Fouts provides several anecdotal accounts of Washoe lying, for example, when asked who made a mess, responding that it had been an experimenter, and not in fact, herself (Fouts, 1997). Her ability to blame a non-present researcher also signifies an ability to use the feature of Displacement, or to refer to things that are not immediately present. The final three features are Learnability, Reflexiveness, and Duality of Patterning. In regards to Learnability and Reflexiveness, it is simply not definitively specified in the literature reviewed for this text whether Washoe has ever been taught another language, or whether Washoe had ever been able to hold a conversation about language itself. Duality of Patterning, or the mapping of a phonology onto a grammar, like
Productivity, is inconclusive. While Washoe’s two word utterances are not promising in terms of productivity, or the potential for an infinite number of messages to be created from the finite set of symbols that make up Washoe’s vocabulary, nor are they promising for Duality of Patterning, the possibility for Washoe to be using some kind of grammar is not completely unreasonable. The Gardners’ work with Washoe was revolutionary, being the first of its kind to find such promising results.

4.1.2 The Premacks & Sarah

Though their primate language research began at approximately the same time as that of the Gardners, the Premacks used very different research methods. While the Gardners’ belief that language was best measured through open-ended “dialogue” was evident in their research, the Premacks preferred to study chimpanzee Sarah’s language through controlled interactions, designed to test her knowledge or language competency. Rather than relying on sign language as the Gardners had, the Premacks created a “language” using plastic chips with arbitrary shapes, each of which represented a different English word. These chips could be rearranged on a magnetic board to create “sentences”. This method of language allowed the Premacks to control the size of the lexicon Sarah was allowed to draw from during the creation of a “sentence”, whereas in any given interaction between the Gardners and Washoe, Washoe had an entire vocabulary at her disposal. The training of Sarah began with teaching her to associate one tile with its meaning, apple. Upon the placement of this tile on the language board, Sarah would receive an apple to eat. Next, she was given two words, APPLE and BANANA, and learned to discriminate between the two, being rewarded with the fruit if she placed the correct one on the language board. Following this was the introduction of verbs such as GIVE, which needed to be combined as GIVE APPLE in order to receive an apple treat. The rest of Sarah’s training followed suit, and was often limited to just 4 hours per day. Perhaps the most interesting of the Premack’s achievements with Sarah was Sarah’s ability to classify objects and
relationships. For example Sarah was able to learn to differentiate sameness between pairs, identifying a pair of apples as being similar to a pair of bananas, and different from a banana and apple pair. Sarah’s use of grammar was also promising, with evidence of her understanding if/then statements, transmitted to her through language tiles (Hillix & Rumbaugh, 2004).

In regards to Hockett’s design features, what sets the Premacks’ findings apart from Washoe are Modality and Duality of Patterning. While the Gardners modified an existing language (ASL) in their study with Washoe, the lexical tile system used by the Premacks is one step further removed from traditionally accepted modalities of human language. However, Hockett’s vocal auditory channel is outdated in its exclusion of the signing modality, and one could argue that, even including signing, it remains too exclusive. Written language, for example, does not meet Hockett’s inclusion criteria. Nevertheless, the criteria for language is more relevant to primate language studies than human language, as it is clear in the case of Washoe, for example, that even when raised in a “human” environment, language acquisition does not reach the level of an adult human. In their definitions of language, neither chomsky nor Hillix & Rumbaugh pay any attention to modality, opting instead to focus more on either structural and generative or pragmatic and semantic properties. Finally, while Sarah’s combination of tiles on the language board, and ability to understand complex grammatical structures (such as if/then statements) is suggestive of some degree of duality of patterning, though it is difficult to determine whether tile order is indicative of true deep structure, or is a product of conditioning, and therefore occurs on a surface level.

4.1.3 Terrace & Nim

The feelings excitement and fascination that surrounded the primate language research of the 1970’s after Robert Terrace published an article denouncing his own work with chimpanzee Nim. Unlike most of the preceding studies, the Terraces raised Nim as one would a human child. By the age of 4, Nim had acquired at least 125 signs, and like the other signing or lexigram-arranging chimpanzees before him, had begun
to combine them, which bode well for the success of the project and for Nim’s ability to use “language”. However, it was through a review of the tapes from the study, which had been filmed extensively that Terrace changed his mind about the success of the project. Nim’s signing lacked many important aspects of language such as turn taking, evidence of grammar, or spontaneous signing. It was these important qualities which lead Terrace to reconconsider a project which he had previously deemed successful. Similarly to preceding subjects, such as Sarah or Washoe, it was Nim’s large vocabulary and word combinations that inspired the perception of his language proficiency. However, the greatest obstacle to these studies are understanding whether these behaviors are indicative of the deeper features of Semanticity and Productivity that seem to be essential to genuine language use. What is interesting is that the behaviors (or lack thereof) which lead Terrace to suspect that project Nim was a failure are cognitive/social ones and not strictly linguistic ones. Turn taking and spontaneous signing are both crucial to what Hockett intended to do when he created his design features, yet neither are design features themselves. While many of Hockett’s features seem to be designed to separate biological and instinctive animal behaviors from those which are indicative of deeper cognitive function, such as semanticity (the understanding of words as symbols), none of his features except Traditional Transmission, address the cognitive or social aspects of language. Even Traditional Transmission does not attempt to define language as an intent to communicate. When Terrace identified turn taking and spontaneous signing as indicators of language which Nim did not meet, he indicated these features as being necessary to language offer as measures of language is what they say about authentic intent to communicate. When someone’s language has turn taking, it shows that they are interested in both receiving and transmitting messages, which indicates a deeper conceptualization of how language works and what its purpose is. In the same way, spontaneous signing shows an intent as well as desire to communicate, which is something that differentiates true language use from trained surface level behaviors, the latter of which being what Terrace ultimately ended up declaring was true of
Nim’s behavior. Terrace reached the conclusion that Nim’s signing was not indicative of deeper symbolic meanings but a series of language-resembling behaviors which had been conditioned through positive reinforcement. Terrace published his findings, denouncing his work, and casting a skeptical shadow on the studies that had come before.

4.2 Controversies in Early Research

Terrace was not the only critic of the early primate language studies. The two essential questions at the heart of the scrutiny of the methods and findings of chimp language studies is the deeper meaning underlying semanticity, and the understanding of a grammar system which allows productivity. In other words, when Washoe uses signs, is she using a set of arbitrary symbols and rules to communicate an abstract concept, or is she simply performing a learned behavior in the hopes of receiving a reward? Noam Chomsky argues that the latter is the case. Chomsky is cited in an interview, when asked whether he believed singing chimps were using language, as having responded (Varghese, 2013):

Humans can fly about 30 feet, that's what they do in the Olympics...Is that flying? The question is totally meaningless. In fact the analogy to flying is misleading because when humans fly 30 feet, the organs they're using are kind of homologous to the ones that chickens and eagles use.

In other words, Chomsky does not believe signing or lexigram-using chimps to be using language, because he believes these linguistic-appearing behaviors are completely surface level, devoid of any of the necessary internal structures that give language meaning.
4.3 Recent Research on Primate Language

Though the initial public excitement surrounding primate language studies was quelled with Terrace’s findings as well as a number of prominent anti-primate language figures, such as Chomsky, primate language research, as well as general animal language research, is a field which has quietly marched on. Though the most prominent primate studies of the 1970’s occurred in the home or lab setting, today there is a wide variety of primate research happening both in and outside the lab. While studies taking place in the lab allow us to control for more variables, and easier quantify and understand the “language” output of our subjects, research in both the wild and the natural habitat allow us to approach an understanding of the full range of non-human primate language abilities, as well as learn more about the way language may have evolved in humans.

4.3.1 In the Lab

Perhaps the most successful primate chimpanzee of the 1970’s in acquiring “language” in the lab was the Rumbaugh’s Kanzi. Kanzi, unlike the other subjects of the Rumbaugh’s research, learned lexical items through observing his mother Matata in training sessions rather than being formally trained himself. Upon realizing the extent of his knowledge from these observations, they began to expand his vocabulary through “dialogue” rather than reinforced training. Kanzi went on to show an apt for two “word” utterances, either a combination of two lexical items, or a combination of a lexical item and a sign. Of the 13,000 utterances recorded over a 4 month period, 723 were two-element combinations (excluding those which had been either immitated or elicited by researchers). In combination with his use of the lexicon, it was common for researchers to communicate with Kanzi in English particularly in cases where a sentence was too complex to be communicated using the lexicon. In 1993, Rumbaugh and research associate put Kanzi’s English to the test in a study which compared
Kanzi’s ability to respond to English instructions for simple tasks with a two year old human child names Alia. During the experiment, an experimenter would give short English commands, of varying styles (e.g. *Take the telephone outdoors, Put some milk in the water, or Can you take your collar outdoors?*) and the subject would receive a score based on their completion of the action, and whether or not the command needed to be repeated. The command needed to be repeated only 20% of the time for Kanzi, and 17% for Alia. After a trial period in which the experimenter was present in the room (244 trials for Kanzi, 180 trials for Alia), the experimenter gave commands from out of sight of the subject. In total, Kanzi was presented with 653 sentences, and Alia 587. Most of the sentences were constructed such that the participant would need an understanding of syntax in order for them to be completed correctly. For example, in sentence *Put some milk in the water*, the positions of *milk* and *water* in the sentence are crucial to the event that is being instructed. In total, the two scored similarly, with Kanzi being correct 74% of the time, and Alia on 65%, or excluding the cases in which an experimenter had to intervene, Kanzi being correct 59% of the time, and Alia 54%. While this study used only simple sentence structures, its implications for at least a rudimentary understanding of syntax within the chimpanzee are promising. (Kako, 1999). Kanzi’s performance on tasks whose meaning relies on an understanding of syntax is promising for Hockett’s Productivity feature.

Comparing great ape intelligence and linguistic ability does not end with the Kanzi and Alia study. A study from earlier this year at Japan’s Primate Research Institute at Kyoto University compared chimpanzee and human children in their ability to learn rock-paper-scissors, in order to assess differences in the ability to learn and use a circular relationship rule (Gao et al., 2018). All participants were trained using a touch screen computerized training program, in which participants were presented images of two hands, each making one of the rock-paper-scissor hand shapes, and were rewarding upon selecting the correct “winning” hand shape. The study found that, while children tended to correct their wrong selections after 1 trial, chimpanzees tended to take several wrong answers before changing their behavior. Further, while
children performance in the three separate sessions (one for each of the rock-paper-scissors relationships), while children performed with equal accuracy on each, chimpanzees had a much harder time on the third session, suggesting that it was much more difficult for them to conceptualize the full circular relationship. Of the human children, accuracy greatly increased at age 4, suggesting that this is the age when the ability to understand a circular relationship develops. In total, the chimpanzee scores on the task most closely resembled those of the 4 year old human children. These results are interesting in that they are fairly consistent with primate language research. The apt for language that chimpanzees display in the lab is often consistent with that of a young (human) child, however, while children keep developing their language ability continuously into adolescence, the chimpanzee tends to stop at around the ability of a human toddler. The fact that this study found the chimpanzee’s grasp of an abstract concept as complex as a circular relationship to most closely resemble that of a 4 year old is in support of a positive view of the chimpanzee’s linguistic abilities, as well as of Hillix & Rumbaugh’s perspective on the importance of the cognitive and pragmatic aspects of language when assessing language skill. However, while the chimpanzee’s skill resembled the 4 year old child most closely, the chimpanzees had greater difficulty grasping the concept than the human children, which implies that there are some implicit cognitive differences. This result is fairly intuitive, because there are several million years separating chimpanzee and human evolution, and there are likely many aspects of the human brain that function at a level of greater intelligence than that of the chimpanzee.

Many other interesting studies on chimpanzee communication and psychology have been completed in lab conditions. One such example being another study from Kyoto University, which found evidence of distance specific referential gestures in an experiment with 8 chimpanzees who were tested individually over a course of 10 test sessions and 5 control sessions, occurring once per day. In the experiment, the chimpanzee would observe through a partition as an experimenter entered the room and placed a piece of banana on one of two tables, one near to the chimpanzee and one
far. Once this experimenter left, a second experimenter would enter the room, at which point the subject would begin to exhibit request behaviors either vocal or gestural in nature. Every chimpanzee was given the piece of fruit within 15s of their first request behavior, no matter the nature, so that the experimenters were not conditioning for a certain behavior. Videotapes of the behavior were later coded. Analyses found that chimpanzees produced more gestures than vocalizations in the presence of the experimenter, and more vocalizations than gesture alone in the control conditions (in which there was no second experimenter), suggesting that they took the presence of another individual into account. The chimpanzees produced intentional and communicative signals, rather than just signals associated with food. Further, the chimpanzees’ signals changed depending on the placement of the fruit on the “near” or “far” table, gesturing at significantly higher hand heights and greater frequency of large mouth openings than small ones in the “far” condition. Interestingly, they also used significantly more large mouth openings in the “far” condition, than small mouth openings in the “near” condition, suggesting that the chimpanzee may feel the need to include more locative information for a far referent (Gonseth et al., 2017). This study is the first to suggest such abilities in the chimpanzee, and are promising in terms of the chimpanzee’s communication abilities.

4.3.2 In the Natural Habitat

While lab conditions provide the opportunity to observe primates in situations we could never find in the wild, studies that occur in conditions that at least mimic the natural habitat (either in the wild, in zoos, or sanctuaries), allow us to peer into the communication system that is natural to these animals. They can also address interesting questions in the similarities or discrepancies in abilities we may find in naturally occurring communication systems versus those that are created and instructed by humans in the lab. It is possible that we may find greater complexity in their naturally occurring systems, as a system designed by a researcher is not likely to be able to take advantage of the entirety of a chimpanzee’s natural ability, however it also
may be possible that some aspects of language in the lab may not be found in chimpanzee communication in the wild.

One study which followed the integration of two separate chimpanzee social groups in the Zurich zoo found that the two groups, which had had referential food grunts for ‘apple’ that were different in acoustic structure, merged the two separate acoustic structures over the course of three years. However, the merge did not begin until social bonds had begun to form, suggesting that the previous belief that the acoustic structure of chimpanzee vocalizations are dependent on emotional state, is false. The implications for control of acoustic structure is an increased potential for the communicable potential of chimpanzee vocalization (Watson et al., 2015).

Another interesting study of natural ape communication is one that found evidence of future-planning in Orangutans (Schaik et al., 2013). The study analyzed 1,169 Orangutan long calls, given by 15 different flanged males, collected over 320 days of data collection. The study found that the direction in which a flanged male emitted the last long call of the day was a predictor for the direction the group would travel the following day, up to 22 hours later. These findings suggest the possibility of future planning in great apes, which is of great intellectual significance.

5 Implications

Given the current research, it is clear that we have not yet found evidence of language use in non-human primates that satisfies Chomsky’s structural requirements. Though there are some promising findings, such as the Premacks’ work with Sarah, this example falls far short of the structural complexity of human language. However, the pragmatic perspective shows more promise. While primate semantics and pragmatics also fall far short of that of human language, as we are able to use language to communicate messages that are more abstract, more complex, and we derive more usefulness from it, most if not all primate language subjects described above were able to accumulate a vocabulary of symbolic items, and were able to use them to attain desired outcomes, for example Sarah’s GIVE APPLE. Further, current research both
in the wild and in the lab only highlight the depth of the cognitive abilities of the chimpanzee, or in the case of Schaik et al.’s paper, the Orangutan.

Like all life on earth, we are merely products of evolution. Every human faculty is deeply rooted in our evolutionary history, just as every human faculty is physically manifested in neuronal structures within the human brain. As is the unfortunate lesson of Terrace’s failed project Nim, when it comes to language behaviors, what we observe at the surface level cannot encapsulate what is going on at a deeper level. In the same way, the surface features of language, are necessarily rooted in a deeper psychological systems. Because the compartmentalization of the natural world is a human phenomenon, perspectives on language must include structure, pragmatics, and biology if they hope to capture the reality of the faculty.

Even in the case that non-human primate instances of language fall short of that of human language, which is absolutely the case; the very nature of the term requires its exclusivity to humans, language is a useless term if it seeks to describe the same criteria as human language.

At the root of the animal language debate are questions about our own evolution, about the nature and evolution of language itself, and about the quality of consciousness of non-human animals. The label of language tells us nothing if it does not provide information that helps approach these questions. Whether we call what a chimpanzee does inside or outside of the lab language or not is irrelevant; the title we give it does not change the reality of the complexity that exists within their cognitive or linguistic abilities. The inclusion criteria for language is arbitrary. However, I would argue that to allow ourselves to broaden the inclusion criteria would open the door for a deeper and more pragmatic understanding of language.
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