Investigating Ithkuil: Exploring the Space between Linguistic and Cognitive Expression

Michael G. Phillips
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Abstract

Ithkuil is a constructed philosophical language created by linguist John Quijada. The primary purpose of this language is to test the assertion that humans process more cognitive information than is overtly expressed by natural human languages. As such, Ithkuil's grammar is extremely complex, but the language is theoretically designed to be a human-usable language which allows speakers to express deeper levels of human cognition. In this paper, I investigate what concepts of cognitive science and cognitive linguistics motivate the architecture of the language, as well as how these concepts present themselves linguistically throughout the language. Finally, I discuss what makes a language optimal by comparing Ithkuil with natural languages.

Introduction

Most constructed languages are created for the purpose of fiction or art, such as Klingon or Elvish. One may be inclined to think, then, that constructed languages have nothing new to teach us about language or cognition. This is because any linguistic patterns such as assimilation or elision that are found in constructed languages have simply been designed to mimic the properties of natural languages, and have not arisen on their own. However, there exists a subclassification of constructed languages known as experimental languages. These are languages which are purposefully designed for linguistic research, often studying the relationship

between language and cognition. One of these languages is Ithkuil, created by linguist John Quijada over the course of more than three decades. In his introduction to "A Grammar of the Ithkuil Language", Quijada states:

> "The findings of cognitive science and cognitive linguistics since the 1980s show that human cognition gives rise to and processes far more information than is overtly expressed by natural human languages. Theoretically, it should be possible to design a human-usable language that overtly expresses more (or "deeper") levels/aspects of human cognition than are found in natural human languages" (Quijada 2012).

This is precisely the assertion that the Ithkuil language sets out to test. But there is an underlying assumption at work here that natural languages are limiting as well as riddled with ambiguity, polysemy, vagueness, inexactitude, arbitrariness, redundancy, and so on, and that it is theoretically possible to create a language void of these characteristics, or at least a language which minimizes their effects on language. There are a number of ways in which one might set out to create a language of this kind, and Ithkuil is only one example of such a language. Ithkuil is able to accomplish this via its incredibly complex system of morphology. Unlike natural languages, the grammatical categories of Ithkuil are not based on those traditionally found throughout the world's languages. Instead, the language derives its method of categorization and word formation from concepts found in Cognitive Science and Cognitive linguistics. The work of cognitive linguists such as Richard Langacker, George Lakoff, Len Talmy, and Gilles Fauconnier most directly influence the language (Quijada 2012).

For Quijada, reading *Metaphors We Live By* by George Lakoff and Mark Johnson was something of a revelation. He thought that perhaps he could create a language which could do that which Lakoff and Johnson argued natural languages can't do: for its speakers to precisely identify what they mean to say (Foer 2012). Instead of people hiding behind metaphors and word play, this language would force the true intentions of human cognition to the surface, embedded in the structure of the language. But John Quijada is not the first person to attempt the creation of such a language, at least not entirely. While Ithkuil is unique in that it focuses on cognitive expressivity, another popular artificial language known as Loglan has been in the process of creation for over 50 years. In 1955, James Cooke Brown set out to test the Sapir-Whorf hypothesis by creating a language based on the rules of predicate logic; he hypothesized that speakers of this language would become more logical thinkers (Cowan 1997). The Sapir-Whorf hypothesis would continue to be tested by a multitude of artificial languages, but these efforts are considered generally unsuccessful, as only a weak version of the Sapir-Whorf hypothesis is general accepted today (Blutner 2009).

But Ithkuil does not posit that its speakers will become "more cognitively adept" overtime. Rather, Quijada simply means to take our present abilities of cognitive processing and express them at a higher level of specificity. But this goal raises some ultimately significant questions:

Why don't natural languages already express our deepest levels of human cognition? Why did languages not evolve so that there could be a perfect correspondence between language and cognition? The answers to these questions are open, but the answers are revealing concerning the nature of human languages. Perusing these questions is therefore a worthwhile endeavor in addition to studying the language itself.

In what follows, I analyze Ithkuil in two parts. The first part focuses on the concepts throughout Cognitive Science and Cognitive linguistics that motivate different parts of the languages morphology, syntax, and semantics. The purpose here is to see exactly if and how Ithkuil is capable of expressing deeper levels of human cognition, as its creator claims. The second part discusses the nature of language and cognition, that is, the limitations of language, as well as the characteristics that John Quijada believes make language inefficient. The purpose here is to consider how Ithkuil should be viewed among the public domain, as well as discuss how we should view the relationship between language and cognition.

I. Cognitive Science/Linguistics and Ithkuil's Grammar

First, it is important to look at various aspects of Ithkuil's grammar that are inspired by concepts found in Cognitive Science and Cognitive linguistics, in order to see how these subjects influence the language's architecture. Information concerning the language's phonology and orthography will not be looked at. Rather, the main linguistic aspects of interest are the language's morphology, syntax, and semantics. Each of the following sections consists first of the concept that inspires a given aspect of the Ithkuil language, followed by how that concept is manifested within the language.

Consider the following phrase in Ithkuil:

Qi'êlafs âmmul âhiogwokstatükai íxi'asa açt^{h}u pštâ'at.

Despite simply looking visually and phonetically complicated, this sentence does not have a direct translation into any natural language. The words are composed of affixes belonging to many different grammatical categories unique to the Ithkuil language. The best possible (mis)translation of this text would be:

> "As the woman held still, the boy ran from a position above, ahead of, and to the right of her relative to the direction of the sunrise-to-sunset vector, a plane perpendicular to it, and the axis of gravity, toward a position still above, but behind and to the left of her relative to the same directional vector, perpendicular plane and gravitational axis, as I was watching them from below, behind, and to the right of her relative to the same vector, plane, and axis." (Quijada 2012)

Therefore, before one can hope to grasp any aspect of Ithkuil's grammatical categories, it is important to first know how words are formed, although covering every single grammatical category would be nonsensical. In Ithkuil, there are only two parts of speech, which results in two word types: formatives and adjuncts. Formatives can function both as nouns and verbs, as Ithkuil does not recognize a formal distinction between the two. If a concept can be physically reified, then the formative will represent a noun. Otherwise, if the root of the formative is conceptually activized as an event (walking, running, etc…), then the formative will represent a verb. Adjuncts, on the other hand, can be thought of as words which work alongside formatives to give additional adjacent or conjunctional meaning. The part of speech of focus here is formatives. Ithkuil is a very agglutinative language, meaning that most of the meaning of the language is derived from affixes which are attached to the formatives and adjuncts.

Cognitive Semantics and Grammatical Categories

As conceptualized by Leonard Talmy in his two-volume set entitled *Toward a cognitive semantics*, cognitive semantics views language in terms of conceptual domains, namely space and time, motion and location, causation and force interaction, and attention and viewpoint. Besides identifying such fundamental parameters for language's structure of conception, Talmy also identifies a host of semantic categories, among them being something he calls "plexity". Plexity is a category for identifying a quantity's state of articulation into equivalent elements. When the quantity involved is matter, then there is a direct correlation between "plexity" and the grammatical category "number", where one such element of a quantity is called "uniplex" and more than one is called "multiplex". However, plexity can account for such enumeration not only for physical manifestations (nouns) but also for instantiations of events, which the traditional category of number cannot do. Plexity, then, would seem better suited for Ithkuil, as Ithkuil formatives can represent nouns or verbs conceptually, and as such enumeration would need to be handled by a category which can account for either manifestation.

In Ithkuil, enumeration and quantification are primarily handled by three related grammatical categories: configuration, affiliation, and perspective. For plexity, the category of interest is configuration. There are nine configurations in Ithkuil, but the two that most directly correlate with Talmy's conception of "plexity" are: the uniplex and duplex. The uniplex configuration is essentially the same as Talmy's version, and signifies a single holistic act or state. For nouns this can be thought of as "the singular" (a tree, a person, an incident, etc…). For formatives that conceptualize actions (verbs), this can be thought of a single "act" (to eat a pear, to be a tree, to become a person, etc…). The duplex configuration, not much unlike the dual

category of traditional grammar, indicates plurality of two things, but as a related binary set. This configuration is primarily used for items which are in some way related or complimentary (eyes, ears, a two-volume set). For verbs, there must be some manifestation of complementary "halves" that takes place among the action. Quijada's example is "the single down-then-up cycle of swinging a hammer". Another example is "to breathe", as one must inhale, then exhale. Note that the duplex is a kind of multiplex category in that it is for more than one, but the multiplex also manifests itself as other categories in Ithkuil, which are explained again later. Also note that these categories can account for enumeration in nouns and verbs (various manifestations) which traditional natural language categories do not do, as Talmy notes with "plexity".

Prototype Theory and the Nomic Perspective

Prototype theory, simply put, can be thought of as a set where certain elements (or "members") of the set are more central than others. Prototype theory was formulated by psychologist Eleanor Rosch, who is interested in linguistics as well as systems of categorization. In her 1978 publication entitled *Principles of Categorization*, she defines prototypes as "those members of a category that most reflect the redundancy structure of the category as a whole" (p. 12).

Ithkuil utilizes this factor of "central redundancy" to categorize general concepts through the grammatical category of perspective. In Ithkuil, perspective is the closest morphological category to number and tense. With respect to perspective, we are primarily interested in not only how many of something there are, but how objects or actions manifest themselves overtime (hence the relation with grammatical tense). In correlation with prototype theory, the perspective we are most interested in is the nomic perspective. Assumedly, by using the nomic perspective,

we mean to refer to a concept that exists in some form, and will continue to exist in some form. Essentially, the nomic perspective is used to refer to a general concept or archetype, which then represents all members or instantiations of a configurative set throughout space and time. It is through this archetypical reference that we discuss general concepts. For the categories which the nomic perspective is able to refer to, there is assumedly members of that category (or "set") which are more central than others (rivers, dogs, constellations, etc…).

Fuzzy Set Theory and the Multiform Configuration

Fuzzy sets are sets which allow its elements to have varying degrees of membership. The concept of a fuzzy set was introduced by Lotfi Zadeh in 1965. In traditional set theory, elements either exist within the set or they don't in a binary way. In contrast, a fuzzy set allows for its elements to be partial members, as part of a gradual system. As Zadeh describes it, "More often than not, the classes of objects encountered in the real physical world do not have precisely defined criteria of membership" (p. 2). Thus, Ithkuil posits a grammatical category for classifying objects in this way.

The best grammatical category in Ithkuil for implementing fuzzy set theory is the multiform configuration. Whereas other categories of configuration have some overlap with traditional grammatical categories (such as uniplex and singular), the multiform may be the most difficult to understand, as there is absolutely no Western linguistic equivalent manifested in natural languages. The multiform is used to describe objects that may belong to a set as members, but to varying degrees. For example, the Uniplex for tree would describe "a single tree", but the Multiform would mean something like "a group of what appears to be trees" or "a

group of tree like objects" (think of a graded system where 0 is not tree-like at all and 1 is certainly a tree, where most elements of the set would fall somewhere in the middle). This configuration may be used to describe a jungle thicket. In general the multiform is used to describe things that have a somewhat chaotic or uneven assortment, consistent with the graded flexibility of fuzzy sets.

Conceptual Metaphors and the Representational Context

Metaphor can be defined in two ways: the traditional sense, and the conceptual metaphor sense as formulated by George Lakoff and Mark Johnson in their book *Metaphors we live by*. In the traditional sense, a metaphor is simply a figure of speech, where one thing is described or said to be some other unrelated thing. As a conceptual metaphor, a metaphor can be thought of as the understanding of one idea of a particular domain in terms of another domain. The first example presented in *Metaphors we live by* is "Argument is War". We see this in our language: 'he attacked my point of view', 'she defended all her weak points', etc… But beyond this, there is a non-linguistic component to metaphor, that is, the understanding of argument as war is central to our conception of what argument is. As Lakoff and Johnson remark, if we thought of "argument as a dance", than not only would the linguistic metaphors be different, but the underlying conception of argument must also be different. It is for this very reason that despite Ithkuil's attempts at eradicating metaphor outside of the representational context, Lakoff says that Quijada has somewhat missed the point, due to this non-linguistic nature of conceptual metaphors. In a sense, it is impossible to remove metaphor entirely.

Although most often metaphors (in the linguistic sense) cannot be constructed using Ithkuil, Quijada has reserved a special category known as the representational context for

discussing things metaphorically. Context, in addition to configuration, is another morphological category, and there are four subcategories for context: existential, functional, representational, and amalgamate. In the representational context, formatives are constructed as symbols, metaphors, and/or metonyms. It is assumed once the representational context is used that the formative word in question is serving as a substitute for some concept that is associated with it. Quijada gives the example of 'The orchestra is playing', which when using the representational context affix means that the sentence has a metaphorical meaning, such as 'life is a symphony'. Therefore, even though the grammatical categories of Ithkuil are generally too cognitively concise to leave room for metaphor, there are special reserved categories for handling such figurative speech.

Gestalt Psychology and the Coherent/Composite Configurations

Before one can understand Gestalt Psychology, it is important to know what a "gestalt" is. In its simplest definition, a gestalt can be thought of as an organized whole that is perceived as more than the sum of its parts. As Riccardo Luccio states in his paper *Gestalt Psychology and Cognitive Psychology* (2011) "When an observer is presented a perceptual field and he looks at it in an absolutely natural way, without any effort or scrutiny, the field segregates itself in different perceptual units, constituted by the elements present in the field, which tend to aggregate themselves according to certain factors" (p. 97). Therefore, Gestalt Psychology can be thought of as a theory of mind which holds that the mind forms a central "whole" from the summation of parts, and that the mind has self-organizing tendencies.

In Ithkuil, the main categories for handling gestalts grammatically are the coherent and composite configurations. The coherent configuration is used to refer to multiple elements that

are connected or mixed in some way with one another to form an emergent coherent entity. Like most grammatical categories for Ithkuil, there is no natural language equivalent for this category. Examples include a bookcase, a web, a xylophone, etc… The composite is similar to the coherent, except that the members are not required to be physically similar to one another, as long as they some way still form some kind of conceptual whole. For example, the root for "tree" in the composite would most likely be "forest" (a multitude of similar yet different trees, forming a conceptual whole).

Cognitive Grammar and a Note on Syntax

Traditionally when people think of cognitive grammar, they think of Richard Langacker and his conceptualizations concerning the subject. One important aspect of cognitive grammar is that it does not posit underlying structures to grammar as the traditional structural and generative approaches do. For example, take these two sentences from Langacker's *Introduction to Cognitive Grammar:*

(a) Bill sent a walrus to Joyce.

(b) Bill sent Joyce a walrus.

As Langacker reasons, "Cognitive grammar does not posit abstract deep structures, and neither sentence is derived from the other—they are claimed instead to represent alternate construals of the profiled event. (a) and (b) differ in meaning because they employ subtly different images to structure the same conceived situations" (p. 14). So Langacker laid the groundwork for a principle in cognitive linguistics known as iconicity, particularly the sequential order principle which remarks that the temporal/sequential order of events described in one's speech is mirrored in a series of corresponding images in the interpretant/listener. Therefore, sentences with

different word order result in different meaning, which corresponds with Langacker's conceptualization of "grammar as image".

While Langacker's cognitive grammar and the sequential order principle of iconicity are found in natural languages, Ithkuil does not display nor require iconicity. This is because of Ithkuil's morphological structure and grammatical categories, which is sufficient for expressing distinguishing goals, sequences, and cause-and-effect relationships. This should be mentioned for two reasons: (1) A language which lacks iconicity due to its morphological capabilities is a reflection of the extreme conciseness accomplished by said morphology. (2) Ithkuil is presumably the only language to contain grammatical categories so sufficiently concise that the property of iconicity can be omitted.

II. Language Optimality

In the first section, we saw how Ithkuil embeds many concepts relevant to Cognitive Science, including plexity, cognitive semantics, prototypes, gestalts, and metaphors (as well as a lack of iconicity). Note that this is not at all a complete list of the concepts which can be found in Ithkuil, but a few primary selections for describing its architecture. That being said, one may wonder if a language such as Ithkuil, even with all its cognitive conciseness and specificity should even be desirable. Why aren't there any natural languages like Ithkuil? Before this question can be answered, another question must first be asked: What makes a language optimal? In order to answer this question, let's look at a few key factors: language evolution, the role of ambiguity, and the limitations of human language.

Language Evolution

The origins and evolution of natural language in humans is less known about than one might think, as linguists have only really begun to study this topic in the past few decades. An article entitled *The Mystery of Language Evolution* states that "all modeling attempts have made unfounded assumptions, and have provided no empirical tests, thus leaving any insights into language's origins unverifiable" (Chomsky, Hauser, Yang, et. al, 2012). Generally, most people assume that language developed naturally in order to allow for better communication among humans, which would in turn make tasks such as hunting and gathering easier and more accomplishable. However, as Chomsky, Hauser and Fitch state in their publication *The Faculty of Language: What is it, Who has it, and How did it Evolve?* (2002), "We consider the possibility that certain specific aspects of the faculty of language are "spandrels"—by-products of preexisting constraints rather than end products of a history of natural selection. This possibility, which opens the door to other empirical lines of inquiry, is perfectly compatible with our firm support of the adaptationist program." (p. 12).

This view of language as a byproduct creates a diminutive outlook on human language. If language is simply a byproduct, how can it be efficient for human communication? Due to the nature of natural languages, we know that Quijada is right in claiming that natural languages are riddled with ambiguity, illogic, redundancy, arbitrariness, etc… Perhaps these (debatably undesirable) characteristics are the result of language's natural production as a by-product. Ithkuil on the other hand has been carefully constructed and planned with elements of cognition in mind. It allows us to categorize and conceptualize things in ways that correlate with findings in Cognitive Science. When one considers the evolution of language versus the purposeful

construction of language, it seems that while natural human languages have arisen from a natural state to be *sufficient* for communication, artificial languages such as Ithkuil, which strive for a maximum level of cognitive conciseness are able to be *efficient* for communication. But when a language is efficient in one sense, are there consequences wherein which said language is less efficient in terms of other characteristics? In order to test this, we must look at a concrete example: ambiguity.

Ambiguity

Due to its complex derivational morphology, Ithkuil lacks ambiguity. The level of cognitive conciseness required to form proper sentences restricts room for ambiguous language. From this, a question arises: what consequences does this have? There are two identifiable consequences, one of a linguistic nature, and one of a non-linguistic nature.

In terms of linguistics, the Ithkuil language can be observed to contain minimal ambiguity, but this is only due to its complicated morphology. Unlike most artificial languages, it is almost impossible to intuitively form full sentences in Ithkuil, because one must strive to formulate the most correct (and least ambiguous) phrase possible, which may mean considering over 18 grammatical categories for each word, and obtaining the appropriate affix to formulate the word (of which there are thousands). As Foer says in *Utopian for Beginners*, "To attempt to translate a thought into Ithkuil requires investigating a spectrum of subtle variations in meaning that are not recorded in any natural language. You cannot express a thought without first considering all the neighboring thoughts that it is not" (Foer, 2012). Therefore, although the language is successfully more efficient than natural languages in terms of cognitive descriptiveness, the morphology protracts the efficiency of actually producing functional sentences at a rate which humans can handle.

In terms of non-linguistic characteristics, is the general underlying concept of ambiguity always a bad thing? One of the problematic assumptions of Ithkuil is that such properties are an issue or error of language, rather than a feature of language. An article published in MIT News entitled *The advantage of ambiguity* noted some recent work by linguists: "…these linguists point to the existence of ambiguity: In a system optimized for conveying information between a speaker and a listener, they argue, each word would have just one meaning, eliminating any chance of confusion or misunderstanding. Now, a group of MIT cognitive scientists has turned this idea on its head." (Finn, 2012). Essentially, these linguists and cognitive scientists state that despite the fact that people often see ambiguity as a problem for communication, context has strong disambiguating power. This is advantageous, because it allows you to reuse small, easy words for different things in different contexts over and over again. Consider the word "mean", which can be a verb, such as in 'That's not what I mean', and an adjective, as in 'He was very mean to me'. Therefore, languages are able to utilize context so that they can reuse easy words, making ambiguity less of a problem and more of a feature.

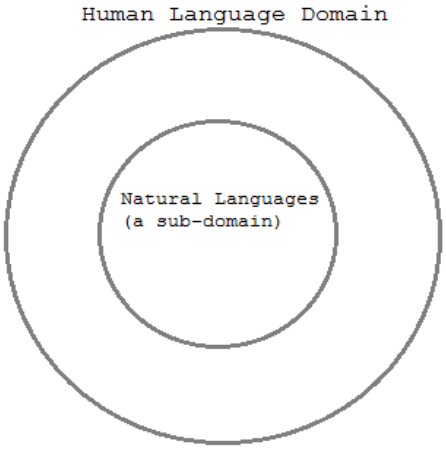
After examining both Ithkuil and natural languages with respect to ambiguity, natural languages seem to utilize ambiguity as an advantageous feature, whereas Ithkuil has avoided ambiguity, and as a result contains a highly complex morphology that makes communication difficult. Therefore, Ithkuil may seem more efficient in terms of cognitive expression, but natural languages seem to be more efficient in terms of balance, where balance is the ability for humans to both have ambiguity in their natural languages, as well as have cognitive mechanisms for handling said ambiguity without it being problematic.

Limitations and Domains of Language

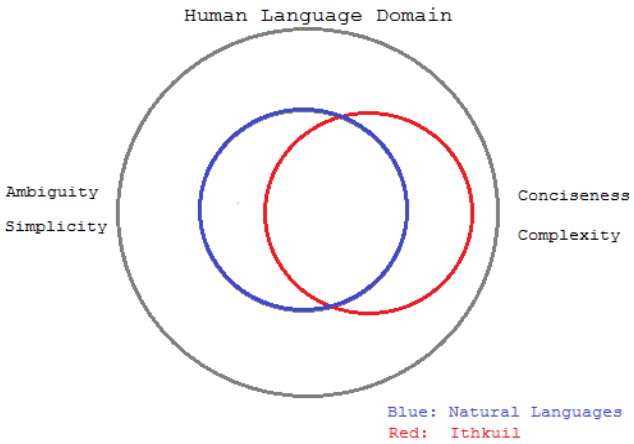
The limitations of language define a domain within which all human languages presumably exist, natural or otherwise. Presumably, the hypothetical "most optimal language" for human beings exists within this domain (as a sub-domain), as the language should be human-usable. Therefore, defining this domain can help us understand what makes a language optimal. In this section, I first briefly bring to light some limitations of human-usable languages, followed by an answer to the (open) question: what makes a language optimal? One limitation of all languages are the limited articulation of phonemes. That is to say, there is a limit to what sounds humans can produce, in terms of physical articulation and auditory production. This often termed "the speech banana", that is, the area within which all human speech phonemes fall on an audiogram (Ross, 2004). Another limitation to language is the philosophical term "qualia". A qualia can be thought of as an instance of conscious experience, yet are ineffable (color, pain, tastes, etc…). No artificial language created could ever suddenly allow the expression of qualia, including Ithkuil. A final limitation of language is that which it can successfully signify. Consider a description such as "a sad girl, crying, looking downward bleakly" with an image of this same description. For most people, we'd assume that the actual image would be much more emotionally provoking than the description, and so there is a definable limit to that which the descriptions of language can provoke.

These are just a few limitations to language, but enough to illustrate the fact that human-usable languages are not conceptually limitless, rather, there are boundaries which define a domain, and within that domain, all languages exist. The domain in question can be conceptualized a few different ways, such as a circular diagram which represents a set. Everything within the set is within the domain of human language, including natural and

artificial languages as sub-domains. Everything outside the set is said to be unobtainable by language, such as the previously described limitations (qualia, signification, phonemes, etc…). This conception results in the following graphical representation:



Let's utilize this graphical domain to revisit the notion of ambiguity. As we observed, as the conciseness of a language increases, the ambiguity decreases, however, the morphological complexity/descriptiveness increases. On the other end of the spectrum, if a language was totally ambiguous, it would most likely have extreme morphological simplicity. Therefore, we can put these features on the appropriate ends of the graphical domain, and this tells us where to place natural languages and where to place Ithkuil:



Obviously, Ithkuil (in Red) ends up existing as a sub-domain that is closer to the concise side of the domain, and further away from the "ambiguity, simplicity" side. Natural languages (in blue) on the other hand, as we said before, are more central as they are able to strike more of a balance between conciseness and ambiguity, and therefore complexity and simplicity. Utilizing this domain to balance out these features and limits of language, I'd argue that natural languages end up being more optimal, because their centrality among the domain reflects the fact that they are better able to handle all features in a balanced/equal manner, whereas Ithkuil's advantages also creates disadvantages. This is only one take on the matter, however, and the question of what makes a language optimal is still open.

Conclusion

In this paper, I studied Ithkuil in two parts. The first part was dedicated to studying the underlying concepts of Cognitive Science and Cognitive linguistics found throughout Ithkuil's morphology, syntax, and semantics. Through this investigation, we found that the complex grammatical categories of Ithkuil require a level of conciseness beyond that of natural languages, and that Ithkuil has a more complex morphological descriptiveness. The second part focused on the practicality of a language like Ithkuil, considering what determines an "optimal characteristic" of a language, and what the "ideal language" would look like. Based on the conclusions of ambiguity in language, I created a conceptual graphic which visually represented the domain of language, and posited that natural languages are optimal, since they arise from a state of linguistic balance.

So what conclusions can be drawn concerning the relationship between linguistic and cognitive expression? For the time being, I sustain that this question is still very much open, but by studying languages like Ithkuil, we see the advantages implementing certain features (such as cognitive conciseness) while also creating disadvantages (such as higher morphological complexity, to an almost unusable degree). Perhaps this indicates that just because a language could theoretically express some deeper cognitive idea, the adequacy of natural languages is more ideal for its factor of comprehensibility.

References

Blutner, R. (2009) *What is the sapir whorf hypothesis?* <http://www.blutner.de/color/Sapir-Whorf.pdf>

Chomsky, N. (2002) *The faculty of language: what is it, who has it, and how did It evolve?* Science's Compass Review.

Cowan, J. (1997*) The complete Lojban language*. Logical Language Group Inc.

Finn, E. (2012*) The advantage of ambiguity*. MIT News.

Foer, J. (2012) *Utopian for beginners.* The New Yorker.

Hauser MD, Yang C, Berwick RC, Tattersall I, Ryan MJ, Watumull J, Chomsky N and Lewontin RC (2014) The mystery of language evolution. Front. Psychol. 5:401. doi: 10.3389/fpsyg.2014.00401

Lakoff, G., & Johnson, M. (1980) *Metaphors we live by*. University of Chicago Press.

Langacker, R. (1986*) Introduction to cognitive grammar*. Stanford University Press.

Luccio, R. (2011) *Gestalt Psychology and Cognitive Psychology*. Humana.Mente Journal of Philosophical Studies

Quijada, J. (2012). *A grammar of the Ithkuil language*. Lulu Enterprises, Inc.

Rosch, E. (1978). *Principles of categorization*. Hillsdale, NJ: Lawrence Erlbaum.

Ross, M. (2004) *The Audiogram explanation and significance*. Hearing Loss Association of America.

Talmy, L. (2000). *Toward a cognitive semantics*. Cambridge, Mass.: MIT Press.

Zadeh, L.A. (1965) *Fuzzy sets Information and Control* 8 (3): 338-353