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Toward a further understanding of the extensibility of sign languages

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TOWARD A FURTHER UNDERSTANDING OF THE EXTENSIBILITY OF SIGN LANGUAGES

by

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This thesis, submitted by Jason Hopkins in partial fulfillment of the requirements for the Degree of Master of Arts from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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Signature Jason D. Hopkins

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ABBREVIATIONS

ASL	American Sign Language
KSL	Kenyan Sign Language
RTT	Recorded Text Test

ABSTRACT

Sign language video recordings have limited extensibility when compared with live, face-to-face communication by signers. In an effort to improve the extensibility of video recordings this study explores the possibility of leveraging a common meaning negotiation technique, depictional signing, to increase understanding of recorded texts. In an effort to gauge the understanding of depictional signing compared to lexical signing a Recorded Text Test was devised using two texts, one with a high number of visual depictions, the other with a high number of lexical signs. While a comparison of the results of the two tests did not substantiate the hypothesis for reasons that appear to have introduced spurious results, the comparisons of the two styles of signing within each story did confirm the hypothesis.

CHAPTER 1

INTRODUCTION

It is quite natural for Deaf people from different sign language communities to get together in face-to-face situations and rapidly overcome their language barriers to achieve an acceptable level of understanding. Most anyone who has attended an international gathering of Deaf people has observed this. This is not a new phenomena, but was documented as far back as 1880. In Stokoe's work (1960:11) on American Sign Language, he quoted Dr. Cesare Magarotto and Mr. Dragoljub Vukotic, authors of a paper in 1880: “During the numerous meetings and international congresses held these last ten years, the deaf-mutes of different countries and continents have been able to hold conversations on different topics with the sign language, understanding each other without the least help of an interpreter.” How is this possible?

1.1 Negotiation skills

Deaf people are in a language contact situation all day, every day. Most Deaf people have hearing parents and hearing children, some have hearing spouses. It is not uncommon for the parents of Deaf people to never learn a sign language. Deaf children grow up struggling to understand and to be understood. These situations cause them to develop skills enabling them to negotiate meaning. Many Deaf people interact with those

who have the barest of acquaintance to sign language. Their goal is to gain understanding and to be understood using whatever means necessary for communication.

1.2 The basis for negotiation of meaning

For negotiation of meaning to take place, both parties must have some areas of knowledge in common, for example, shared backgrounds and experiences or similar languages. In Sperber and Wilson's relevance theoretic terms these contribute to a shared cognitive environment, the basis for meaning inference (Sperber and Wilson, 1995: 38-46). Though sign language users with experience in foreign sign languages tend to achieve successful communication quicker than those with less experience, those with less experience still communicate much more rapidly than people who depend on spoken languages alone. Since experience with other sign languages is not required, it appears there is something embedded in sign language or in the visual modality of the language that gives extra leverage for negotiation of meaning and cross-linguistic comprehension.

The two main areas of language that seem most likely to contribute to negotiation are lexicon and grammar. A shared lexicon allows for immediate communication and lessens the need for the negotiation of meaning. If negotiation is required, lexicons that are shared or very similar would allow for much more rapid negotiation of meaning. Still, the experiences of many people are in situations where the lexicons are quite different and successful communication is readily achieved anyway.

At this point there has not been much research comparing the grammars of different sign languages. What research is available does not give evidence of as wide a diversity in the grammars of sign languages as is found among spoken languages. This may be one

feature that aids negotiation. The degree in which shared grammars or grammatical features aid negotiation is beyond the scope of this paper.

A third area, the subject of this study, is the habitual use of ad-hoc constructions created using both conventionalized and free-form signing to create less schematized (i.e., more iconic) visual representations. Sign languages typically allow for extensive use of these non-lexical, depictional forms of signing, even within one language (Liddell 2003; Taub 2000; Sandler & Lillo-Martin 2006; Schwager & Zeshan 2008; Klima & Bellugi 1979). This is not to say all sign languages use the exact same systems or same ways of expression, but, since these *kinds* of features are often used, they are expected and readily understood.

1.3 Recorded texts

In my experience, face to face communication between Deaf people is more effective than when a Deaf person views a video recording of another Deaf person, even when that video is intended to be in the same sign language. One potential reason is the nature of the medium. Sign languages are three dimensional languages. When viewed in a video using today's technology, the language is reduced to two dimensions. This may be a problem for people with no experience with video recordings of any kind, but I have observed this decrease in understanding among people with considerable experience with two dimensional visual media such as television and movies.

Another problem may be the style of language in the video. Several problems arise when the text in the video is translated from a spoken language or the presentation of material that was first acquired via a written text. As such, the problems in understanding may simply be artifacts of translation, insufficient naturalness in the signing or

vocabulary differences. If this were the sole reason for decreased understanding then non-translated texts should be readily understood. Yet this is not the case. The problem can be seen even when the text is created by a person not using an external source text.

One thing is clear with recorded texts: meaning cannot be negotiated. There is no opportunity for the observer to ask for clarification. There is no way for the presenter to get cues that would suggest a misunderstanding and give him the chance to make modification to the signing. Video recordings remove a major component from the everyday communication experience of the Deaf – language negotiation.

1.4 Hypothesis

My hypothesis is Deaf people viewing a recording of a sign language video will more readily understand texts created using ad-hoc, visual depictions and gestures than texts created with a high percentage of language-specific signs, and that this comprehension will be evident during the retelling of the text by the greater retention of visual depictions than of language-specific signing.

1.5 Study motivation

In many developing nations the Deaf have limited access to information in their local sign language. Recorded texts can be an efficient way to propagate consistent information across many local Deaf communities. A barrier to the use of such recorded texts is the often rich and diverse sign language situations in these countries. For various reasons, many countries can boast multiple sign languages. Though this can be very enriching, it can also lead to problems when addressing the communication needs of the Deaf.

In order to make use of limited resources, research into the extensibility of sign languages is important. It would be beneficial to be able to create as few recordings that can reach as many people as possible. Since sign languages can leverage many non-language specific constructs it appears the use of these would increase the extensibility of a recorded text. A text intentionally created with many depictions could, in theory, have a much broader impact than one created with an abundance of language-specific signs and few depictions.

The goal of this paper is to further enlighten how sign languages work, specifically, which parts of sign language are more readily understood across language boundaries. It is hoped this information will help people who make recorded sign language texts, by guiding them in ways that will make their products more readily understood by larger audiences of Deaf people.

CHAPTER 2

LEXICAL VS. DEPICTIVE SIGNING

Sign languages use a visual modality in which physical movements are used to create visual expressions for communication. Their lexicons contain conventionalized signs, used to represent various concepts. Sign languages also allow for the use of other, non-language specific, free-form ways to create ad-hoc constructs. Ad-hoc constructs, by their very nature, are not lexical. These ad-hoc constructs are created when lexical signs do not exist or when ad-hoc constructs are more readily understood (Jones 2013:77). The use of ad-hoc constructs is so productive certain components used in their construction have become conventionalized, and thereby lexicalized. As such, ad-hoc constructs can be created either using free-form signs, lexicalized components, or a blend of both (Cogill-Koez 2000b:212).

2.1 Sign Language and Visual Depictions

Sign languages can express the visual nature of a concept on a continuum from highly iconic, where the sign looks like what it represents, to highly schematized, where the sign may represent a specific, narrow aspect, or have little or no visual similarity to what it represents. Many conventionalized signs, though their etymologies are rooted in visual expression, are highly schematized (Cogill-Koez 2000b:211). The schematizations vary with culture and may be lost over time. For example, to make the ASL sign

AMERICA you splay the fingers of both hands then interlace fingers keeping them extended. Holding this position you then move your hands in a circular motion as if you are stirring a pot. The visual image is the melting pot, a common word picture for the United States, but not universally known. In Egypt, these same hand shapes and movements create a sign meaning COKE. To make the sign AMERICA in Egypt you mime drawing and shooting revolvers like in an old west shoot out. The current ASL sign TIME is to point to the wrist. It would be hard to believe this was the sign for 'time' before wrist watches were invented, and with fewer and fewer people using wrist watches, if this sign is retained in the future, the reason will not be based on iconicity.

Cogill-Koez (2000a:154) draws a parallel between the visual representations found in sign languages and other systems that use visual schematic representations. She points out that though the particulars of a system of visual schematics are acquired, the principles that allow for understanding them go beyond any one system, allowing people to understand various degrees and types of schematic representations. In effect, once you understand the legend to a map, the symbols make sense. Likewise, once you understand the particular schematics of a sign language you will be able to understand the different kinds of expressions.

Though Wilcox (2006:123) used the term "construal of form" instead of "visual schematic representation", his statement brings further clarity, "[Cognitive] Iconicity is not a relationship between the objective properties of a situation and the objective properties of articulators. Rather, the iconic relation is between construals of real-world scenes and construals of form." An example of this from ASL is one of the signs for COMPUTER. This sign is a depiction of a reel-to-reel tape drive. What is important here

is what happens to the sign after it goes through a normal ASL phonological change. After the change, the fingers representing the movement of the reels turn in opposite directions, mirroring each other, which would render a real tape drive useless. In this case the iconicity represented by the articulators does not map to an objective visual reality, but to a construal of the real-world. The sign maps to enough of the construal to give signers enough information to understand the meaning, while also making the sign easy to perform.

In summary, sign languages use visual expressions which are conveyed using the particulars of a schematic system which is influenced by culture, but based on principals that are universal (Cogill-Koez 2000a:166). These systems use schematic representations, with varying degrees of iconicity. These representations do not map to the real-world, but to a construal of the real-world. The construals and the schematic representations will both be influenced by culture and the cognitive environment of the signers.

2.2 Visual Depictions and meaning negotiation

When sign language users meet, the conventionalized signs that they both know will vary from very many to very few. In order to achieve clear communication, the amount of schematization may need to be reduced by using expressions that are more closely analogous to visual reality. This may include choosing to use a different lexical sign, creating an ad-hoc depiction which is less schematized, gesturing, pointing to an acceptable proxy, or, if they have access to a shared spoken language, writing on paper or fingerspelling a particular word. This process of meaning negotiation normally clarifies the depiction.

When signing, a signer may not have a sign that expresses what they are trying to say. This can happen across language boundaries, but signers often experience this within their own sign language, too. In these situations the signer will create an ad-hoc depiction to represent a concept or event relevant to the current conversation. These depictions may be created using the conventionalized components from a specific sign language or from non-language-specific free-forms that are a more clear reflection of the visual reality being represented. If this needs to be repeated a representation can be made to create a newly agreed upon schematized sign. Now both parties have added the sign to their shared resources making them available for use during this episode. This level of ad-hoc construction is very common among signers. People talented in this kind of communication are often respected for their signing skills in Deaf culture.

2.3 Terminology

The terminology around this kind of phenomenon becomes awkward. The depictions of lexical signs are often highly schematized and therefore, not perceived as depictional. Because of this, it is tempting to generalize signs as either lexical or depictional. This quickly becomes problematic when one discovers lexicalized signs are often depictional and ad-hoc signing is so common, conventional components have evolved, and then lexicalized, specifically for use in ad-hoc constructs.

The goal of this paper is to differentiate two types of signing: 1) *language-specific* signing, which can be a lexical sign or an ad-hoc depiction using conventionalized lexical components, and 2) *non-language-specific* ad-hoc signing. To make this two way distinction, a three-way analyses will take place. Acknowledging the difficulties with the terminology, I will make a the following comparisons, as illustrated in Figure 1. First, I

will contrast the use of *lexical* verses *depictional* signing. Second, within the realm of depictional signing I will make a comparison between *conventionalized* and *free-form*[1] signing. Finally, to compare language-specific and non-language-specific signing, I will use a more broad notion of conventional signing to include all lexical (i.e., language-specific) items when I make the comparison between conventional and free-form.

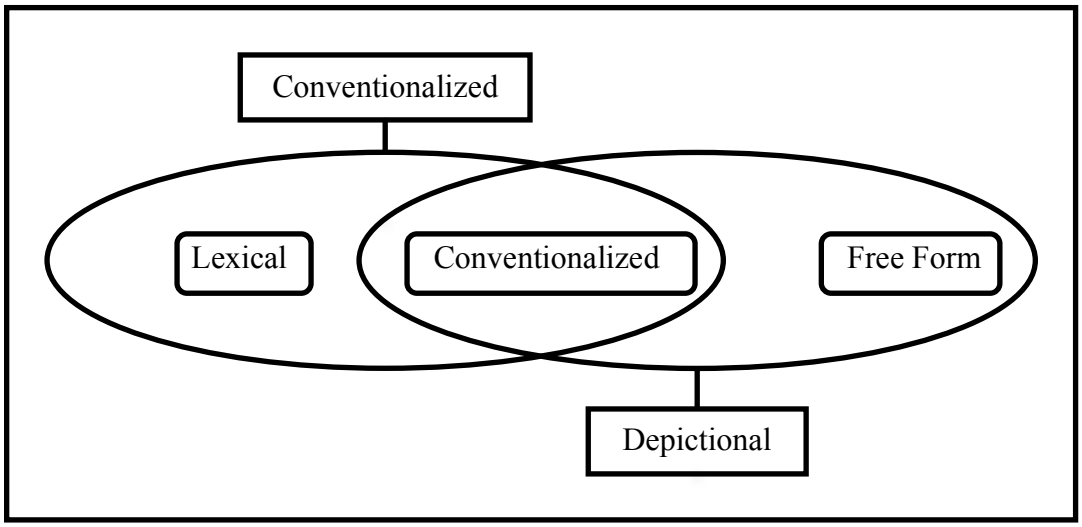

Figure 1 Various comparisons of sign language

2.3.1 Lexical

In order to understand lexical items – things you can look up in a sign language dictionary – knowledge of a specific language is required. This is an important distinction for this paper. Since lexical items tend to be highly schematized some explanation of meaning is required to understand the lexical items. Often these are memorized as arbitrary signs due to how little the sign looks like the concept it represents. When

[1] I am intentionally avoiding the term universal. Many signs, though clear depictions in one culture are foreign in all senses of the word in another culture.

referring to lexical items in the remainder of this paper, the meaning is limited to vocabulary that is often found in a sign language dictionary. Key to this definition is it's exclusion from the ad-hoc constructions discussed below. Lexical items fall within the term *conventionalized signing*.

2.3.2 Depictions

Sign languages users often take advantage of the visual nature of the language by acting-out parts of an utterance using highly iconic ad-hoc depictions. These kinds of depictions are expected by sign language users and readily understood.

2.3.2.1 Conventionalized Depictions

Conventionalized depictions are ad-hoc constructions that are more analogous to visual reality than lexical signing. The components used to create these depictions are conventionalized and quite schematic. To fully understand these depictions, experience in a specific sign language are required.

Conventionalized depictions include what are commonly known as classifier predicates or depicting verbs. They are made up of both "symbolic lexical verbs and depiction," (Lidell:261). The hand shapes in these constructions, commonly called "classifiers", have a lexical-like standardization, even if they don't fit into a formal lexicon. An ASL example of one of these component hand shapes is a fist with the index finger extended upward positioned near chest level. This is a way in which one can represent a person in an ad-hoc construction. It is never used as a stand-alone sign, but always used in an ad-hoc constructions. If you were to look up the English word PERSON in an ASL dictionary you would not find this particular formation even though it is arguably the most commonly used way of representing a person in ASL.

Other conventionalized components may be non-manual morphemes that are combined with individual manual signs, such as mouth configurations that convey meanings such as size, or non-manual markers that spread across a phrase.

By the very nature of being ad-hoc constructions they cannot be considered lexical. Although they contain conventionalized elements, the constructs themselves are not conventionalized in their entirety. All sign languages have these kinds of ad-hoc constructions, though the conventionalized components that make up an ad-hoc construction are not necessarily the same across different sign languages. For example, both ASL and Kenyan Sign Language (KSL) have a classifier hand shape that represents a vehicle but it's not the same hand shape. Further, the standard vehicle hand shape in ASL can represent a bicycle or a motorcycle, but in KSL it is limited to 4 wheel vehicles. In this paper I will refer to these as "conventionalized depictions" because they were created using conventionalized components. These constructs fall within the term *conventionalized signing*.

2.3.2.2 Free-Form Depictions

Free-form depictions are ad-hoc constructions whose meaning is inferred more from a shared visual experience and the cognitive environment than a shared language. These can range from a simple pointing motion to complex constructions that depict a series of events. These non-language-specific, free-form movements convey meaning using the body in much the same way a mime does when telling a story. This in no way discounts the linguistic value of these movements, they are clearly part of the utterance and therefore, though not part of a specific language, they are tools used by skilled sign language users to convey their meaning.

Some of the components used to create free-form depictions are sometimes called gestures. In American hearing culture, a gesture is normally limited to a single motion that contains a single meaning, maybe with various overtones, but essentially a single meaning. Sandler (2009:246) clarifies the distinction between signs and gestures, "Gestures are distinguished from the linguistic signal by being holistic and synthetic, and lacking in hierarchical and combinatoric properties." They modify language, but, in common usage of the term, are not seen as part of language. Since these kinds of constructions in sign language are often very complex and are a highly valued part of the language, the term gesture may lead to a misunderstanding. Since this form of depiction does not depend on conventionalized signing, in this paper, I will refer to these as "free-form depictions."

Some of the components of free-form depictions may have a common meaning that is shared with hearing people in that culture (Ola Orie 2009), while others are fully free-form limited to that particular sign language episode. Understanding of these signs is derived from either a shared common use, as in widely accepted depiction, clear association between the sign and the visual reality or other mutually manifest stimuli that make up the cognitive environment. Little or no training in a sign language is required to understand or use these forms, such as positioning one's hand like holding a drinking glass and moving it toward the mouth to mean DRINK. People do not have to be taught when moving the hand toward the face that the thumb should be closer to the bottom lip than the nose. Nor do they require lessons to know the speed of the wrist rotation indicates the speed the beverage is consumed.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Methodology selection

The core of my hypothesis is that depictional signing in a video text will be easier to understand than lexical signing. The justification for this claim is a person's comprehension of a language's lexical signs is proportional to how much of that language that has been acquired, where as comprehension of depictional signing is more dependent on universal principals found in other visual schematics systems. Further, it is based on the assumption that in sign languages the process for negotiating meaning is built on creating depictions that are more analogous to the visual reality of the concepts being discussed. Further, negotiation is not possible with a video recording.

3.1.1 Recorded Text Test

In order to test this precisely, I used a modified version of the Recorded Text Test Retelling (RTT) methodology described by Parks and Parks (2010). In their methodology, Deaf people watch a signed story one time through, then the story is reshown in short segments, one at a time. A person watches a segment, then retells the story to a different Deaf person who has not seen any of the story. The participant's results are scored based on how many of the original signs were retained in the retelling. Parks and Parks demonstrated that their version of the RTT was successful in measuring

different levels of inherent intelligibility between sign languages. Based on the Parks' success, I chose the RTT to test my hypothesis.

3.2 RTT creation

The creation of an RTT has many steps. Some of these steps can be blended or the order can be rearranged, but all these steps are essential to the test creation. Briefly, the process is as follows:

- Story creation and recording
- Selection of content points to use for testing
- Baseline creation/Home town test
- Research testing

Prior to the selection of story crafters, people who would be asked to create the stories, certain content requirements were developed. As stated above, the goal was to test the understanding of lexical verse depictional signing. It was determined the best approach was to have a single story told in two distinct ways. One version would be full of lexical signing, one would be full of depictional signing. These two version became known as the High Lex and Low Lex stories. Due to the fact the stories were being crafted in the US, the language for the stories would be ASL. The stories were also limited to approximately five minutes each.

3.2.1 Selection of story crafter

In order to maintain as natural of a story telling experience as possible a Deaf story crafter would be sought who is comfortable appearing on screen. Mark Sorenson, a Deaf

man from Minnesota, who is an experienced story teller and a professional on-screen signer, willingly volunteered to craft the stories.

3.2.2 Story creation

As determined at the onset, two versions of a single story were created. The source of the two versions was the Pear Film (Erbaugh 2001; Chafe 1980).[2] The film is about six minutes long and has several characters, props and situations, yet has no words and no explanations. It "is deliberately loose and bland, to avoid imposing a strong U.S. cultural bias" (Erbaugh 2001). The Pear Film was selected for its efforts at cultural neutrality and most important for this study, its lack of words. This gave the story crafter the advantage of creating a story from a visual experience, thus allowing for a more natural story. If the inspiration for the stories were based on a written text they may have had artifacts from the written language.

3.2.3 Story selection and recording

Once Mark was done crafting the story, since we were not in the same city, he recorded the two drafts and submitted them for review. The stories were reviewed and, in each story, the signs were classified as either lexical or depictional. A count was made of the unique – not repeated – signs. The Low Lex story was rich in depictional signs and was considered sufficient to meet the research goals. The High Lex story had more lexical signs than the Low Lex story, but, still contained far more depictional signs than lexical ones. Due to time constraints on the research project and Mark's schedule, another

[2] I have found references to this film in both forms, The Pear Film and The Pear Stories.

crafter was suggested, Stuart Thiessen. Stuart is also an experienced story crafter and it was thought he would be able to create a story with a heavy lexical content.

Stuart also found the creation of a story rich in lexical signs, yet limited in depictional signs, to be a difficult task. In order to effectively create such a story, Stuart suggested he watch the Pear Film then write a text in English based on the film. He could then use that text as the inspiration for his signed story. During the initial planning, it was thought the signed stories should be limited to visual source "texts" such as the Pear Film. Stuart's method would make the High Lex story based on a written text. On further consideration, it was determined since the goal was to measure the understanding of a particular style of signing, not a particular sign language, and since the true source of the story was still a visual "text", the ideals of the research could be loosened on this point. Stuart was then able to create a story rich in lexical signing. A lot of depictional signing remained, but less than in Sorenson's High Lex version, and enough lexical signs were present to meet the research goals, and various people I asked considered it to be good ASL.

3.2.4 Test preparation

Once both drafts were received they had to be put in a format that would enable them to be used for field testing. The software ELAN 4.5.0 was used in several stages of the research. At this point, the stories provided by Mark and Stuart were prepared for use in ELAN. In order to make the videos run on a wide variety of computer platforms, the videos were converted to mp4 files using ffmpeg 1.0, an open source video conversion tool that runs on the command line. The video had to be cropped, the file formats had to be changed and the files had to be resized for quicker online file transfers. All this was

done using ffmpeg. Later in the research project, in order to save hard drive space, the video recordings of the testing sessions were also run through ffmpeg for compression and resizing. Quicktime 10.2 was also used for quick file editing, such as splitting a file into two or joining two files into one. Appendix A has many of the ffmpeg commands used in this project listed with brief explanations.

An RTT requires the video of the story to be divided into small, manageable segments. A segment cannot be so short that a person could just copy what was seen without much understanding. If the segment is too long, then it becomes a test of the person's memory more than a test of their understanding. When creating an RTT for spoken languages, segments two to three sentences long have been used (Kluge 2006:3). The Parks (2010) used segments 10-20 seconds long for their sign language RTT.

Segmenting two videos created by two different signers posed a challenge. First, the Low Lex story was approximately five minutes long, near the length of the original story. The High Lex story took nearly ten minutes. A natural break at about five minutes into the High Lex story was identified so both stories could be the same length.

The second challenge was the length of the segments. It became apparent that segmentation at natural breaks would render vastly different segmentation lengths. The Low Lex video segments would have been longer than the High Lex video. If the segmentation followed the natural breaks of the Low Lex story, then segments would be long with large amounts of information. If the segmentation followed the High Lex story's natural breaks, the Low Lex story would appear choppy and lack continuity.

Information in this context is defined as the potential content points. In this case, the content points are the signs of each segment. This study mainly focused on manual signs.

Non-manuals, important pauses, eye gaze and other less easily distinguished signs were not included.

In order to control for differences in memory, it was decided the average length of the segments should be within a few seconds of each other. This was an attempt to create a balance between segment length and information presented. Since the stories were already drafted, I felt it would take too much of my volunteers time to try to adjust their information flow. Also, I felt imposing such a constraint would jeopardize the naturalness of the video. Since, the information flow could not be adjusted I thought it was most important to not overwhelm the test subjects with too much information in a segment.

In order to control the information flow, the High Lex was broken into natural segments which tended to produce about eight pieces of information every eight and a half seconds. Striking a balance between natural breaks and information content in the Low Lex yielded about nine pieces of information every 13 seconds. This caused the Low Lex to have a few segment breaks in somewhat awkward places.

Table 1 and Table 2 below, describe the information flow of both stories[3] by showing the length, total potential content points and final selected content points, as well as the length of each segment and the content points per segment. The stories were of similar length and had the same original content point per second rate of 0.92. Once the content points were selected, the information count and rate was still very close 0.46 in the High Lex and 0.39 in the Low Lex, even though the length of the Low Lex segments

[3] The information regarding the High Lex story was pulled from the story in the form in which it was tested, in other words, from the 5 minute version not the entire ten minute version.

averaged nearly five seconds longer. In the end, there were 34 segments in the High Lex story and 22 in the Low Lex story. Overall, it was felt the trade off between segment length and information content was acceptable.

Table 1. High Lex Information Flow

	Segment Length	**Potential Content Points**	**Selected Content Points**
Total	289.384	266	134
Average	8.5	7.8	3.9
Mean	8.6	8.0	4.0
Points/second		0.92	0.46

Table 2. Low Lex Information Flow

	Segment Length	**Potential Content Points**	**Selected Content Points**
Total	294.758	271	117
Average	13.4	12.3	5.3
Mean	13.6	11.5	5.5
Points/second		0.92	0.39

3.2.5 Selection of content points for testing

After the segmentation, content points need to be identified that form the basis of measuring the accuracy of retelling. The content points are used for the scoring of the participants results. The higher the number of content point included in a retelling of the story, the better (it is assumed) is the comprehension.

To create these content points, the test is first administered to a control group. Those content points that are mentioned by all of the members of the control group are selected

as testing content points. These content points are used to score the rest of the participants' results.

The total data collection set of US Deaf was twenty four, twelve for each video. To create the content points, four signers for each story were chosen as candidates for potential inclusion in the control group. Of those four, the three that most agreed with each other were retained in the control group for that story, the fourth was used as part of the wider study pool.

The control group was to be made up of signers, selected at random from a pool of signers who were expected to have higher than average skills. It was expected their content points would restrict scoring to items highly skilled ASL signers would retain and thereby filter out extraneous outliers from among all potential content points. This would streamline the testing by reducing the number of signs required to be checked in each participant's case.

To become eligible for the control group, the subjects were required to be Deaf. Each candidate was asked to self-rate their ASL skills on a scale of 1-5, 5 being the highest rating. Only those with a rating of 4 or 5 were considered. The candidates all learned ASL growing up attending a Deaf school, or, in one case, Gallaudet. All candidates worked in jobs where they used ASL with other Deaf people on a daily basis.

To determine which content points would be evaluated the information[4] found in each segment was put in a spreadsheet as a master list of signs. A candidate from those eligible was selected and each segment of that candidate's recording was compared with

[4] As defined in 3.2.4 Test preparation

the master list. Signs that were produced in accordance with the production in the original story were marked. The four results were compared and the participant with the least amount of agreement with the others was ejected from the content creation pool.

The High Lex story was evaluated as having 266 signs. The top three test candidates included 211 (79.32%), 187 (70.30%), and 183 (68.80) of the original signs. The resulting union set had 134 signs representing 72.81% of the original set. These 134 signs became the content points for the High Lex story.

The Low Lex story was evaluated as having 271 signs. The top three test candidates included 196 (72.32%), 192 (70.85%), and 164 (60.53%) of the original signs. The resulting union set had 117 signs representing 43.17% of the original set. These 117 signs became the content points for the Low Lex story.

3.2.6 Baseline creation

Next, it was necessary to calibrate the test by determining how other signers from the same language would score, compared to the control group. This is called "baseline creation", and it involves administering the test to a small group of people who are from the same language community as the signers in the stories. The goal of this phase is to determine what an average person who uses the testing language would score. This gives a baseline to be used as a standard for comparison with other testers from other language communities.

3.3 Test Administration

3.3.1 Candidate criteria and selection

It was the goal of this research project to evaluate people from several locations across the globe, with special focus on Ghana.[5] The candidate criteria are limited to people age 18 and older, with audiological deafness who use sign language as their primary means of communication. I used a friend-of-a-friend, snowballing technique for contacting potential candidates.

Potential candidates included people from the United States, Ghana, Tanzania, Colombia, and Spain. Due to miscommunication about how the test was to be conducted, the testing done in Columbia and Spain could not be used.[6] In the United States, data was collected from 25 people in South Dakota, Minnesota, and Kansas. In Ghana, data was collected from 41 people in Accra, Kumasi, and Tamale. In Tanzania, the data was collected from 8 people in Iringa.

3.3.2 Testing standards

Initially, the goal was to follow a process much like what the Parks (2010) outlined. In their process, they had a Deaf person retell the story to another Deaf person. I also wanted to limit the involvement of hearing people in the data gather sessions as much as

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[5] Ghana received special focus because that is the country I will be working in after the research paper is complete.

[6] During the testing procedures the candidates retold the stories using their own sign languages. The intention was to have the stories retold copying the original sign language. I take full responsibility for not adequately communicating the testing procedure. I am very sorry the data could not be used. I remain grateful to those who participated in the data collection efforts in those countries.

possible. During the first testing session it became clear these goals would be difficult to maintain. First, because each testing session would require two people, the number of people required to gather data would be double the number of tests collected. If the pool of candidates was sufficiently large and the time frame sufficiently long, this may have been an achievable goal. This was not the case for this research project. Also, in the first attempt, the people didn't understand the process and it added a level of confusion and stress that was deemed prohibitive to good data collection. If I had stronger relationships with the people I was testing, or if there had been adequate time to familiarize my data collection assistants, then this might have been successful. As such, within the first day, the procedure was changed to allow for the candidate to view the video and retell the story to the camera.

The second standard was to limit the amount of involvement of hearing people. Initially, the goal was to only have Deaf people in the room during testing. This required Deaf data collection assistants. In some locations this was possible, in others, it was not. In those situations, the hearing person involved was skilled in a sign language, and skilled enough to communicate with the Deaf in their local sign language. In order to further lessen the impact, the physical locations chosen were familiar with the candidates. For example, in Ghana, one testing session was held at the offices of the Ghana National Association of the Deaf in Accra. In Kansas, some testing was done at the Kansas School for the Deaf. In Tanzania, testing was at *Neema's Craft Coffee Shop,* the work place of several Deaf people.

CHAPTER 4

RESEARCH RESULTS

4.1 Study demographics

Over the course of the study, usable data was obtained and analyzed from a total of 52 subjects from nine different locations in three different countries. Six Americans were part of the control group used to create the content points. The remaining forty-six people – nine Americans, ten Ghanaians, and four Tanzanians for each story – provided data for this study. The use of a snowball technique for recruitment does not allow for much control as to who participates in the study. The main advantage it offered was the ability to facilitate greater penetration into communities in which I had few prior contacts. The study data came from 30 men and 22 women with an average age of 35. The youngest person involved was 19 and the oldest was 59 with a median age of 30. The average age of the onset of deafness was 3, with a median age of 1.

Table 3 Gender Count and Average Age

Gender	**High Lex**	**Low Lex**	**Total**	**Average Age**[b]
Male	14 (53.85%)	16 (61.54)%	30 (57.69)%	34.90
Female	12 (46.15%)	10 (38.46)%	22 (42.31)%	36.05
Average Age[a]	34.76	35.96	35.36	

[a]Average age per test.

[b]Average age based on gender.

Table 4. Age Groupings

Age	High Lex	Low Lex	Total
18-29	13 (50)%	7 (27)%	20 (38)%
30-39	4 (15)%	9 (35)%	13 (25)%
40-49	4 (15)%	3 (12)%	7 (13)%
50-59	4 (15)%	6 (23)%	10 (19)%
N/A	1 (4)%	1 (4)%	2 (4)%

4.2 Data errors

In some cases, the results from otherwise valid candidates had to be rejected. The most common reason was missing data. When using ELAN it was easy for the person collecting the data to accidently click on the wrong segment on the ELAN screen which resulted in skipping a segment or repeating the same segment. This was an unforeseen usability issue with ELAN. Another cause of missing data was power loss in the middle of a testing session. Additionally, other data had to be rejected when the directions were not presented clearly enough to allow the tester to follow the testing protocol. Because of having to eliminate these data, valid data from the other story needed to be rejected to keep the data gathered for each story balanced in terms of demographics.

4.3 Initial Results

In the initial analysis of the data, the results were as expected. In both the High Lex and Low Lex stories, as shown in Table 5, US scores averaged the highest (77.94%, 69.73%), then Ghana (51.35%, 49.14%) and Tanzania (37.87%, 32.11%). This expectation was based on the known influence of ASL in Ghana (Kiyaga & Moores 2003) and its near absence in Tanzania. This shows that the RTT methodology produced

results comparable to what Parks and Parks found in similar situations—it did what it was supposed to do in measuring intelligibility between languages.

However, when the scores of the two stories were compared it was evident the High Lex story had higher scores than the Low Lex story, contrary to what the hypothesis predicted. The difference between the two tests was 8.21% for the US, 2.21% for Ghana, and 5.76% for Tanzania. These scores did not fall in line with the hypothesis which predicted the Low Lex story would have had the higher average scores. Using the chi-square test, the variation between the total scores for the High Lex and Low Lex was statistically significant for the USA at $p < .05$. This is understandable since the language in use was ASL. It would be expected for ASL users to understand the High Lex story well. The USA scores impacted the comparison of all countries, also giving it a $p < .05$.

Table 5 High Lex vs. Low Lex Test Results

Country	**High Lex Total[a] (134)**	**Low Lex Total (116)**
USA	77.78%	69.73%
Ghana	51.04%	49.14%
Tanzania	37.87%	32.11%

[a]The number in the table header refer to the number of content points in that category.

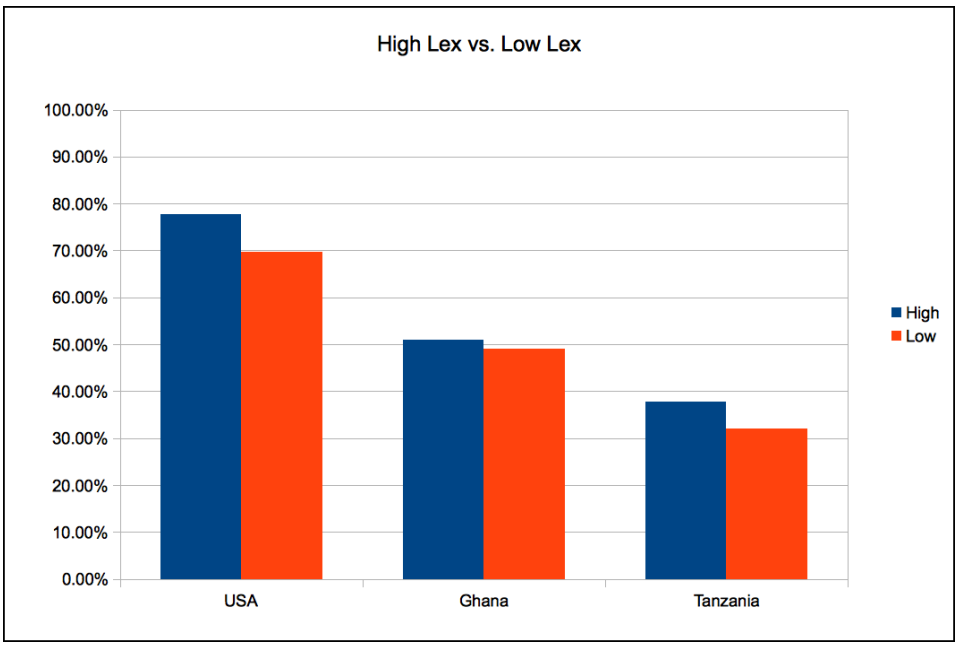

Figure 2 Comparison of High Lex and Low Lex total scores

4.4 Further Analysis

On further consideration a hole in the study logic was discovered. The comparison of the results of two different RTTs does not appear to be valid. Each RTT is gauged to itself. A comparison is normally made between people watching a single story, the single story being the standard by which people are scored. When a comparison was made between the results of the two different stories it became apparent there were variables that were not controlled. Notably, the levels of detail included, information made explicit verses information made implicit, the kinds of vocabulary used, the information flow and the impact the different on-screen signers might have had. As such, it was decided the comparison of the results of these two stories was inconclusive.

To better understand the data and maintain the bases of the hypothesis, each content point, in each story, was categorized as lexical or depictional. This enabled me to analyze each story internally. In the High Lex story 58 lexical[7] signs and 76 depictions were identified. The Low Lex story contained 7 lexical signs and 109 depictions. As show in Table 6 and Figure 3, except in the case of the US High Lex tests, the scores of depictional signing averaged higher than lexical signs, thus supporting the hypothesis. This was determined by first calculating the average of the lexical signs in a single story for each subject, then averaging over all the subjects for a single country. For example, in the case of the US High Lex story, this meant that, for each participant, all the scores of 58 lexical signs were added together, then divided by 58. Then the scores of all 9 US participants were added together and divided by 9, rendering an average score of 78.35%. This same process was used in all further aggregate scorings. Statistical significance of $p < .05$ was shown in the High Lex comparison for Tanzania using the chi-square test.

[7] Both the High Lex and Low Lex stories in this study were crafted by Deaf Americans using ASL signing. As such, when the term "lexical" is used in reference to this data it is referring to the ASL lexicon. Likewise, when the terms "language-specific" or "non-specific" are used they are referring to ASL.

Table 6 Lexical vs. Depictional

Country	Story	Lexical (58, 7)a	Depictional (76, 109)
USA	**High Lex**	78.35%	77.34%
	Low Lex	68.25%	69.83%
Ghana	**High Lex**	50.52%	51.45%
	Low Lex	45.71%	49.36%
Tanzania	**High Lex**	24.14%	48.36%
	Low Lex	28.57%	32.34%

aThe numbers in the table header refer the total number of signs in each category. The first number is for the High Lex story, then second is for the Low Lex story: (high lex, low lex).

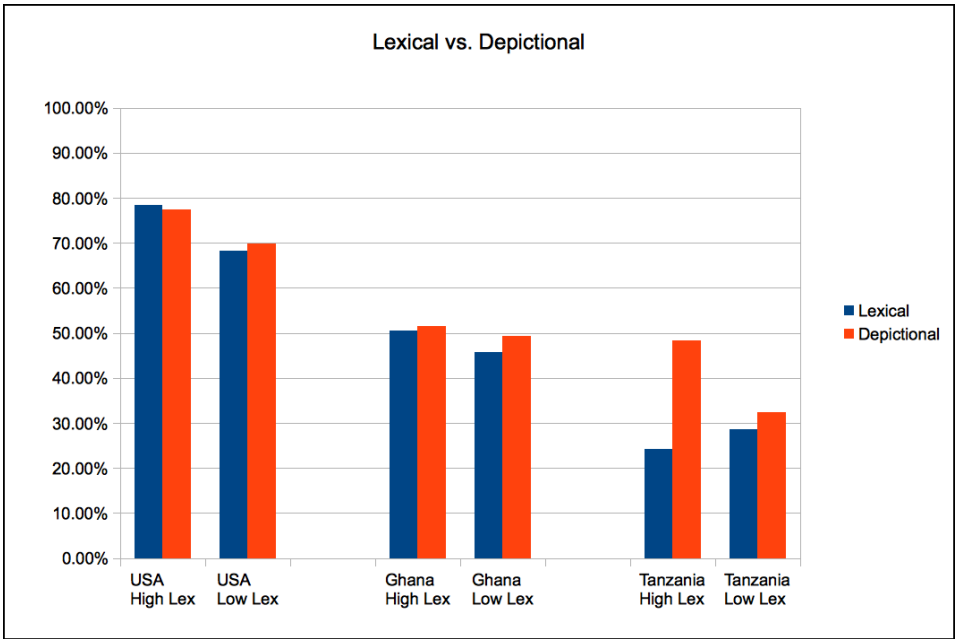

Figure 3 Comparison of Lexical and Depictional Scores

In the High Lex story, of the 58 lexical signs, there were 38 unique signs, the others were repeated signs used in various parts of the story. In the Low Lex story, of the 7, only

3 signs were unique - KNEEL[8], THREE, and TREE. TREE was used 5 times in the story. The goal of the crafter of the Low Lex story was to use as few ASL specific signs as possible. As a result, very few lexical signs were available, so that the comparison of lexical and depictional signs in the Low Lex story is based on inadequate data.

To better substantiate the hypothesis, the depictional data, which made up the majority of the Low Lex story, was further separated into two groups, conventionalized depictions and free-form depictions as defined in section 2.3.2. The High Lex story had 76 depictional representations; of those 17 were conventionalized depictions and 59 were free-form depictions. The Low Lex story had 109 depictional representations, of those 15 were conventionalized depictions and 94 were free-form depictions. As shown in Table 7 and Figure 4, the free-form depictions were consistently understood better than the conventionalized depictions, even in the USA. Statistical significance of $p < .05$ was shown in the High Lex comparison for Tanzania, and for each country in the Low Lex story using the chi-square test.

[8] It could be argued KNEEL is a language-specific depictional sign. Since there was no transition from another position, such as standing to a kneeling, it was categorized as a lexical sign.

Table 7 Depictional Signing, Conventionalized vs. Free-form

Country	Story	Conventionalized Depictions (17, 15)	Free-Form Depictions (59, 94)
USA	**High Lex**	75.82%	77.78%
	Low Lex	53.33%	72.46%
Ghana	**High Lex**	48.24%	52.37%
	Low Lex	33.33%	51.91%
Tanzania	**High Lex**	36.76%	51.69%
	Low Lex	6.67%	36.44%

[a]The numbers in the table header refer the total number of signs in each category. The first number is for the High Lex story, then second is for the Low Lex story: (high lex, low lex).

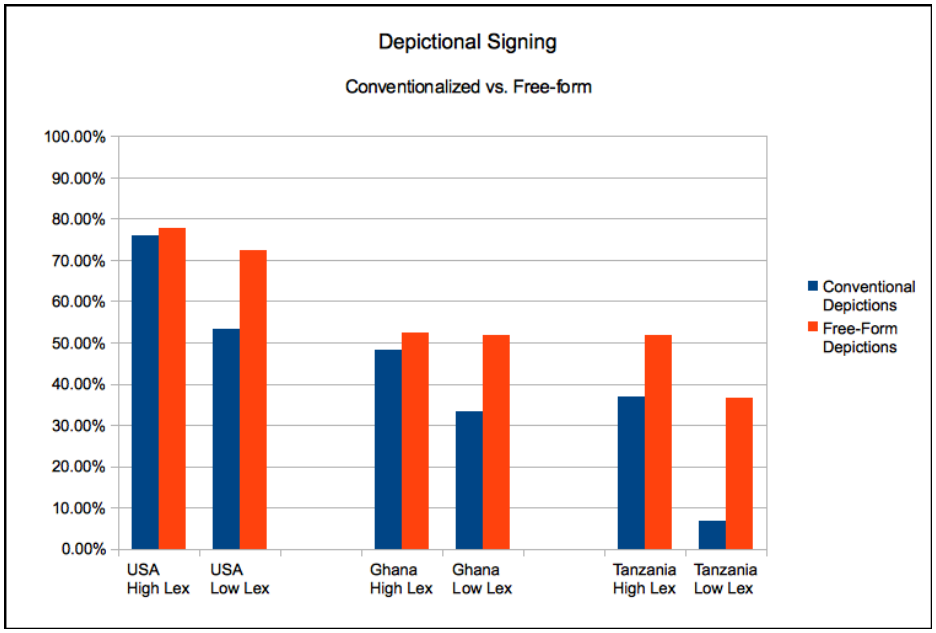

Figure 4 Comparison of types of Depictions

Finally, I analyzed the data based on the distinction of conventionalized signing vs. free-form signing. If the hypothesis were to hold true, this aggregation needed to show the free-form depictions with a higher score than the conventionalized signing. As shown in Table 8 and Figure 5, except in the case of the US High Lex scores, this

comparison further confirmed the hypothesis. Statistical significance of $p < .05$ was shown in the High Lex story for Tanzania, and for each country in the Low Lex story using the chi-square test.

Table 8 Language dependency, Conventional vs. Free-form signing

Country	**Story**	**Conventional Signing (75, 22)**	**Free-form Signing (59, 94)**
USA	**High Lex**	77.78%	77.78%
	Low Lex	58.08%	72.46%
Ghana	**High Lex**	50.00%	52.37%
	Low Lex	37.27%	51.91%
Tanzania	**High Lex**	27.00%	51.69%
	Low Lex	13.64%	36.44%

[a]The numbers in the table header refer the total number of signs in each category. The first number is for the High Lex story, then second is for the Low Lex story: (high lex, low lex).

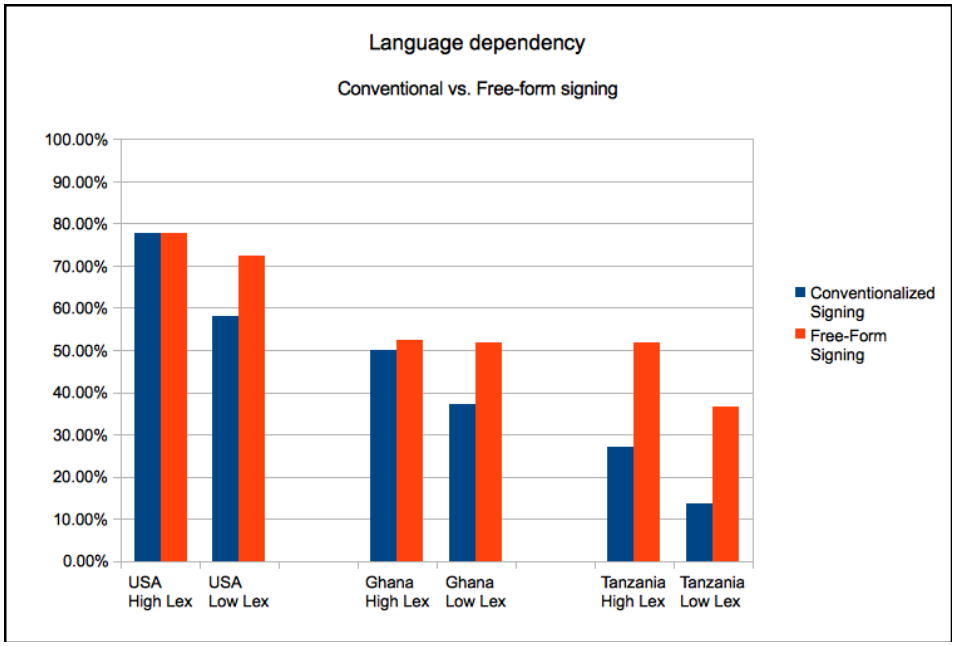

Figure 5 Comparison of Language Specific and Non-Language-Specific forms

4.5 Conclusions

Although it was determined that a comparison between the High Lex and the Low Lex stories would be an invalid comparison, the internal evidence found for each story did support the hypothesis. Most notable in this comparison was the scores of the High Lex story for Tanzania, the area with the least amount of ASL influence. In all areas of comparison beyond the High Lex vs. Low Lex scores, Tanzania showed statistically significant findings of $p < .05$. The most interesting result is that the free-form scores were 25% higher, elevating them to nearly the same score as Ghana. On the other hand, though Ghana and the USA did not show statistical significance in any area of comparison of the High Lex story, they did not contradict the hypothesis, but gave data that trended in the same direction as Tanzania.

The findings of the Low Lex story were not emphasized due to large differences in the amounts of language-specific data verse non-language-specific data available for comparison. It should be noted, the comparison of conventionalized signs verse free form sign used in depictions and overall conventionalized verse free form signing, where the data was more balanced, showed statistical significance for all countries at a rate $p < .05$. Chi-squared data can be found in Appendix B.

CHAPTER 5

DISCUSSION

5.1 Naturalness

It is important for testing of this type to try to maintain a high level of naturalness in the stories. A lack of naturalness can quickly skew the results. In order to ensure the stories were as natural as could be Deaf people who were comfortable in front of a camera were asked to compose the stories themselves. The goal of the High Lex story was to include many ASL lexical items. A concern was their creation may have been at the expense of depictional signing. Yet, more than half the signing was classified as depictional, as shown in Table 9. Since these depictions were not the goal, their presence shows they are a natural part of ASL story creation. These natural depictions became a large part of the study.

The information flow of the two stories as shown were very similar. This comparable information flow also gives evidence for the naturalness of the stories. If the rates were remarkably different one would suspect potential problems, but that was not the case for these stories.

Finally, during the testing I informally asked several American Deaf how they felt about the stories, trying to determine if they viewed them as good ASL or not. Though this data was not formally collected and fully qualitative, the answers given were always positive. Comments were made about regional variations, but even those were minimum.

5.2 Signing Style Ratios

The Low Lex story strove to create a representation that was more closely analogous to the visual reality than is found in conventionalized signing. I know of no study that offers a quantitative analysis of the normal ratio of conventionalized signing to free-form, or lexical to depictional signing, if there even is a normal ratio.[9]

The following tables present comparisons of the various categories in the two stories tested.[10] It must be remembered the stories were designed to use either a high number of lexical signs or a high number of free-form depictions, so this cannot be construed to represent a normal ratio. That said, since crafting of the High Lex story was focused on the use of lexical signs, the ratio within the depictional signs was a natural process, so it might not be too far from normal. Table 9 below, presents the ratio of lexical verse depictional signing in the content points of each story, Table 10 shows the ratio between conventionalized and free-form signing within depictions, and Table 11 shows the overall use of language specific signing by comparing the ratio of all conventionalized and free-form signs in each story.

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[9] Anecdotally, I believe what was found in the Low Lex story goes beyond the normal use of free-form signing within a language community.

[10] These are percentages of the content points selected for testing, not the stories as a whole. Nor are these the percentages of the unique signs. As stated above, the Low Lex story had seven lexical signs, but only three unique signs.

Table 9 Ratio of Lexical verses Depictional

	High	**Low**
Lexical	43%	6%
All Depictional	57%	94%

Table 10 Depictional Signing Ratio of Conventionalized Depictions vs. Free-form

	High	**Low**
Conventionalized Depictions	22%	14%
Free-form Depictions	78%	86%

Table 11 Ratio of Language Specific Forms

	High	**Low**
Conventionalized	56%	19%
Free-form	44%	81%

5.3 Processing effort

One factor that may have contributed to the lower than expected scoring found in the Low Lex story is processing effort. According to relevance theoretical terms (Sperber and Wilson 2012:6), an audience can assume a speaker is producing communication that is intended to be relevant. Therefore, they will process the communication looking for positive cognitive effects. This requires processing effort. Things that are readily understood (easily inferred) require low effort, but things that not readily understood require more processing effort. The implication of this effort is the audience expects a balance between reward and cognitive payback. Also, people's tendency is to follow a

path of least resistance, in other words, the meaning that takes the least amount of processing effort to yield relevance is the one normally taken.

According to Jones (2013:77), "Using classifier constructions instead of lexical signs increases the number of cognitive effects, using fewer signs, with less processing effort on the part of the addressee compared to the number of lexical signs required to convey the same propositions." In this paper I use the category conventionalized signs used in depictions which entails classifier constructions as used by Jones. The test results of this study support Jones conclusions.

Free form signing is an interesting case. Free form signing is an effort to construct a cognitive environment where one does not exist. If two people share a cognitive environment, yet one is spending time constructing a redundant environment, their efforts may be seen as a waste of time, i.e., lacking relevance, because the meaning can be inferred with far fewer signs. For the ASL signers in the US, the free form signing had content points that were not retained, but replaced with conventionalized sign or even a lexical sign to "summarize" what was expressed in the free form text. For example, in the story a boy fell off his bicycle and rolled up his pant leg and rubbed his knee with non-manuals indicating pain. Often the participant, though asked to copy the signing they saw, would replace that entire sequence by signing PAIN near the knee. According to relevance theory a speaker presumes their own relevance when making ostensive communication. This kind of replacement showed the repetition of the full sequence was not deemed worth the processing effort the retelling would have required. As such, the content points in that section would have been missed and the score dropped accordingly.

On the other hand, free from signing can construct a cognitive environment where one does not exist. For people in Tanzania who didn't have ASL influence, the free form signing gave them more access to what was being conveyed than the conventionalized signing. It their case, the free form signing was relevant because the processing effort allowed them to infer the correct meaning. It must be said at times people drew the wrong conclusions from the free form. In a search for relevance they settled on an inference that made sense at the moment based on their cognitive environment. Without the feedback that occurs in bidirectional communication, the incorrect inference was left unchecked.

In the Low Lex story only 19% of the total signing is conventionalized, the other 81% is free form, while the High Lex story has 56% conventionalized and 44% free form. According to predictions made by relevance theory a story that requires extra processing effort must have a high cognitive pay back to achieve relevance. For ASL signers, the Low Lex story required high processing effort, but had low payback and was, therefor, not relevant. This may explain the lower than expected scores in the free form areas. If there is little or no common cognitive environment, as would be the case for non-ASL signers, the high processing effort can give them relevance allowing them to understand signs that would otherwise be incomprehensible.

5.4 Overall benefit

The evidence showed higher understanding of depictional signing than lexical signing, and higher-understanding of free-form signing than conventionalized signing. The comparison between the understanding of lexical signing and depictional signing in the High Lex, found Ghana had 1% a difference while Tanzania had a 15% difference. Within the depictions, Ghana showed a 4% better understanding of free-form signing

than conventionalized signing, while Tanzania showed a 15% difference in the same comparison, also favoring free-form signing.

The comparison between language-specific and non-language-specific signing showed Ghana had a 2% difference when comparing conventionalized signing with free-form signing, but Tanzania showed a nearly 25% difference. Still, it must be noted in both areas of comparison neither Ghana nor Tanzania achieved a score above 55%. Though depictional signing is better understood, the difference may be negligible when compared with overall understanding of a text. Further study into how much of an increase in understanding depictional signing introduces would be beneficial.

5.5 Extensibility Challenges

The motivation for this study is a desire to create sign language videos that more effectively communicate across language boundaries. As mentioned above, many Deaf signers have the ability to rapidly negotiate meaning. This processes often involves increasing the amount of similarity between a signed visual expression and its real-world referent. The premise is a video text could mimic this by an increasing the amount of similarity between its signed visual depictions and their real-world referents.

Relevance Theory predicts there may be problems in trying to communicate when the cognitive environment is unknown. Signers are always selective in what aspect of reality are included in their depictions. The selection is probably based on what they perceive is most likely to represent the whole image. Foundational to Wilson and Sperber's (2002) relevance theory is the assumption a communicator will make selections that make the most efficient use of the available processing resources of their audience. In the same work, they propose the relevance-theoretic comprehension procedure where

meaning is derived by a function in which one processes through various possible meanings until their expectation of relevance is satisfied. In order to be maximally relevant, a communicator will draw from a shared cognitive environment which, in the case of a video, is unknown.

Free-form depictions, like the ones used in these stories, are based on cultural norms that are assumed to be part of the cognitive environment, which in this case, were not always shared. In the Low Lex story, segment 12 included a girl. The feature the story crafter chose to epitomize a girl was braids at the side of the head. In Ghana the braids were only included in the retelling by 3 people. In Tanzania the two people who included the braids were both female. It was likely the braids did not denote a female for most of the participants in Africa. The depictions of hats and bushy mustaches scored quite low in Africa too, while the depiction of a goat biting was never omitted. This may have been a case where the cognitive environments of the participants lacked enough things in common with the story crafters to allow for proper inference. The biting of a goat, being much less culturally-specific, was successfully understood and reported.

Additionally, relevance theory would predict that participants would use signing that was most optimally relevant at the time of the retelling. Since the person doing the data collection and the participant used the same sign language, when conventionalized signs were available and perceived to be more likely to have optimal relevance, there would be a tendency to use those signs instead of the less than optimal depictions. The Low Lex story had far more depictional signing. This could be a factor in why the Low Lex story scored lower than the High Lex story.

Cogill-Koez (2000a:201) presents a framework where depictional signings are best explained as schematic visual representations where depictions show "both universal tendencies and culture-specific conventions." The universally underlying ability to understand visual representations should have made the Low Lex story easier to understand, but the culture-specific conventions, (i.e., language and culture specific depictions) would have been more difficult to understand. These would correlate with relevance theory's notion of cognitive environment.

5.6 Summary

The normal ratio between depictional signing and lexical signing is an unknown that requires further study. The study determined depictional signs are better understood than lexical signing. The next step would be a study to determine the amount of increase in comprehension that results from increased depictional signing. Finally, no matter which framework one subscribes to, any attempt to increase the likeness of a sign to it's visual referent will be based on what the signer sees as visually important about that referent, which may not correspond to the conceptual structure of people who know other sign languages or who are from other cultural backgrounds. The less cognitive environment the signer shares with the audience the less likely the conceptualizations will be similar and therefore may still be difficult understand.

CHAPTER 6

CONCLUSIONS

To test the hypothesis a considerable amount of time was invested in the creation, administration, and analysis of two stories. In the end, the hypothesis was not substantiated by the comparison of the two stories, but rather by internal comparisons of the signing within each story. The best evidence was from the High Lex story, which presented nearly a 5:4 ratio of conventionalized and free-form signing.

The RTT was the chosen methodology based on it's successful evaluation of intelligibility. The RTT is a gauge that is designed to evaluate intelligibility between languages using a single test story. When each test story was analyzed on it's own it performed just as an RTT was intended to areas with higher ASL influence scored better, regardless of which story was being tested. The US, where the participants all used ASL, scored the highest. Historically, ASL has had influence in Ghana. The Ghanaian scoring was lower than the US, but higher than Tanzania where there has been no ASL influence.

Several possible factors could offer explanations as to why one test scored higher than the other. Among these factors would be differences how the stories were created, information flow, the level and kinds of details included, the speed of signing and level of cultural specific references. The important thing is each test confirmed known information, proving the reliability of the RTT testing methodology, while at the same

time substantiating the hypothesis. The erroneous assumption was that the results from the two stories could be compared to each other in a meaningful way.

The motivation for this study was to find a way to enhance the extensibility of recorded sign language texts. It is my conclusion that using depictional signing is more easily understood than lexical signing. While this is true, if the depictions are not within the cognitive environment of the target audience their increase may be of little benefit. Two further studies that may help advance an understanding of the extensibility of sign languages are 1) a study to determine what an optimal ratio of depictional signing to lexical signing may be and 2) a study of the amount of increase in understanding depictional signing provides.

APPENDICES

APPENDIX A

FFMPEG COMMANDS

```
// -i = input video, -i input metadata, -b:a audio bitrate 128k, -ar
audio sample rate 22k,

// -c:v copy video codec -preset:v use video preset "slower", -
profile:v use baseline provfile for baseline older machines,

// -vf scale=iw/3:-1  scale by 66%, -vf transpose=1 rotate
(transpose)by 90°, -metadata:s:v rotate=0 remove rotate metadata tag,

// -ss 0 -t 10 starting at time 0 contine for 10 seconds, meaning just
do a sample to see if it works

// test-out.mp4 output file


   ffmpeg -i orig.MOV \
   -i m-in.txt \
   -b:a 128k \
   -ar 22k \
   -c:v libx264 \
   -preset:v slower\
   -profile:v baseline \
   -vf scale=iw/3:-1 \
   -vf transpose=1 \
   -metadata:s:v rotate=0 \
   -ss 0 -t 10 \
   test-out.mp4

//to create videos for low end devices use -profile:v baseline, also if
the size is too big it causes problems 640x480 is your friend from the
old world. Here I divide by 3. The bit rate can even drop more if
needed.

   ffmpeg -i input.mov -b:v 1000k -vf scale=iw/3:-1 \
   -profile:v baseline output.mov

// crop video

   ffmpeg -i input.mov -filter:v "crop=out_w,out_h,x,y" out.mov

// make video for most all machines

   ffmpeg -i input.mov -profile:v baseline out.mp4

//compress using x264 and just copy the audio as is

   ffmpeg -i INPUT.mov -c:v libx264 -preset slow -crf 24 \
   -c:a copy OUTPUT.mov

//test just a piece -ss start place -t for how long, start at 30sec go
for 60sec

   ffmpeg -i INPUT.mov -c:v libx264 -preset fast -crf 24 -c:a copy \
   -ss 30 -t 60 OUTPUT.mov


//change size, rotate (transpose) the file, remove rotate metadata tag
```

```
   ffmpeg -i INPUT.MOV -c:v libx264 -preset slower -crf 24 -c:a copy -
   metadata:s:v rotate=0 -vf transpose=1 OUTPUT.mov

//add a watermark, overlay is the location of the watermark
width:height.

   ffmpeg -i INPUT.MOV -c copy -vf "movie=WATERMARK-FILE.png
   [watermark]; [in][watermark] overlay=main_w/2-150:main_h-overlay_h-
   10 [out]" OUTPUT.mov


//resize, iw is input width /2 divide by 2, :-1 means keep aspect
ration

   ffmpeg -i input -vf scale=iw/2:-1 output


//add metadata without re-encoding -c copy means just copy, no encoding

   ffmpeg -i input -c copy -metadata location="here" -metadata
   date="2013" out

//increase brightness

   ffmpeg -i test.mp4 -vf "lutyuv=y=val*2.8" -ss 0 -t 10 b2.8-out.mp4

//bash loop through many files

   for i in *.mp4; \
   do ffmpeg -i "$i" -vf "lutyuv=y=val*2.8" "b2.8_$i"; done

//change the gamma

   ffmpeg -i b2.8-out.mp4 -vf "lutyuv=y=gammaval(.7)" /
   -ss 0 -t 10 b2.8_g.7-out.mp4

//get info from a file

   ffprobe input.mov

<trim video>

// -ss before -i(nput) seeks to this time, then starts - can be use
after input and before output. Will decode, but ignore until time,
slower but more accurate.

// -t is used for duration. Write until that time is reached.

   ffmpeg -sameq -ss hh:mm:ss[.xxxx] -t hh:mm:ss[.xxxx] /
   -i input.file output.file

//This will phyically rotate the file and replace the rotate metadata
tag with 0.

// transpose values:

// 0 = 90CounterCLockwise and Vertical Flip (default)

// 1 = 90Clockwise

// 2 = 90CounterClockwise

// 3 = 90Clockwise and Vertical Flip

   ffmpeg -i INPUT-FILE.MOV -metadata:s:v rotate=0 -vf transpose=1 /
   OUTPUT-FILE.MOV
```

APPENDIX B

STATISTICAL SIGNIFICANCE

In the course of the paper four main comparisons where made, High Lex vs. Low Lex, Lexical vs. Depictional, within the depictional data Conventionalized vs. Free Form, and language dependency was compared with overall Conventionalized vs. Free Form. The later three comparisons were made in the High Lex and Low Lex stories. To show the relevance of the data, the chi-square test for statistical significance was chosen. Table 1, below, shows the p scores for each comparison. For this paper, $p < .05$ was considered significant.

Table 1 Probability Scores

TEST	**USA**	**Ghana**	**Tanzania**
High vs. Low	*0.000014145*[a]	0.341628271	0.057128314
HIGH Lexical vs. Depictional	0.674936757	0.735762436	*0.000000010*
HIGH – Depictional, Conventional vs. Free Form	0.609732977	0.341579534	*0.029952024*
HIGH – Language Dependency, Conventional vs. Free Form	1.000000000	0.388362197	*0.000000005*
LOW Lexical vs. Depictional	0.792248491	0.554465157	0.678911937
LOW – Depictional, Conventional vs. Free Form	*0.000006932*	*0.000023670*	*0.000004697*
LOW – Language Dependency, Conventional vs. Free Form	*0.000073653*	*0.000092058*	*0.000037299*

[a]The italicized numbers indicate $p < .05$.

Table 2, below, is an example of how the chi-square was applied to derive the p score. It is the comparison of the Low Lex vs. High Lex scores. To calculate the chi-square I used the following procedure. Fill in the Observed Included which is a

summation of all USA content points that were included in the retelling. Fill in the Observed Excluded which is a summation of all USA content points that were excluded (not included) in the retelling. Add the Observed Included for the High Lex and Low Lex to get the Total for that *row*. Do the same for the Observed Excluded *row*. Next, add the Low Lex Observed Included and Observed Excluded to get the Total for the Low Lex *column*. Do the same for the High Lex *column*. Now put a value in the cell where the Total row and Total column intersect, the Total-Total cell. At this point you only have observed values, so this is a summation of the totals of the observed cells, either by row or by column, the sum should be the same.

The Expected rows can be calculated in different ways. This formula can be used in each Expected cell to give the correct value: (column Total * observed row Total)/ Total-Total. In our example, the Low Lex Expected Included is found by (1044*1666)/2250 = 773. The Low Lex Expected Excluded is found by (1044*584)/2250 = 271.

Once the Expected values are filled in, then the rows below the Expected values are filled in. In the example I labeled the row with the formal used to find the cell values: $(\text{Observed-Expected})^2/\text{Expected}$.

Next, the chi-square cell is the sum of all the "$(\text{Observed-Expected})^2/\text{Expected}$" cells.

The DF cell is the degrees of freedom. It is calculated using this formula: (number of rows-1) * (number of columns-1).

The p-value is found using a built in function in Libra Office, CHIDIST(). It takes the chi-square cell and the DF cell as arguments and returns the p-value.

Table 2 Chi-Square example

USA	**Low**	**High**	**Total**
Observed Included	728	938	1666
Expected Included	773	893	1666
(Observed-Expected)^2/Expected	2.62	2.27	
Observed Excluded	316	268	584
Expected Excluded	271	313	584
(Observed-Expected)^2/Expected	7.48	6.48	
Total	1044	1206	2250
	Chi-Square		18.84950957
	DF		1
	P-value		0.000014145
	Null Hypothesis		**FALSE**

APPENDIX C

PARTICIPANTS

The following people graciously gave of their time to help me by providing data for my research.

Country	Name	Country	Name
Colombia	Carlos	Ghana	Gloria Coappng
Colombia	John Jaider	Ghana	John Fothorinay Zinok
Colombia	Julian Salinas	Ghana	Joseph Kwabena Duah
Colombia	Nestor Bustos	Ghana	Kadiri Mohammed
Ghana	Aadishetu	Ghana	Matthew Kubachua
Ghana	Abdul Shakul	Ghana	Mavis Baiboo
Ghana	Abdulai Latlf	Ghana	Maxwell Nkansah
Ghana	Abena Fosuaah	Ghana	Naima John
Ghana	Adel	Ghana	Patrick Amoako
Ghana	Akulaa Anabila	Ghana	Peter Giasi
Ghana	Aminu	Ghana	Rebecca Amofa
Ghana	Amolo-Fredrick Junior	Ghana	Richard Asumadu
Ghana	Anani Damesi	Ghana	Richmond Larbi
Ghana	Charlotte Esi Arhur Paniin	Ghana	Robert Sampana
Ghana	Daniel Agbeci	Ghana	Sadia Mahama
Ghana	Diana	Ghana	Sagamatu
Ghana	Dominic Osei	Ghana	Sandra Nyarkco
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Ghana	Dufaie Abunea	Ghana	Zakaria Alahssn
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Country	Name	Country	Name
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Tanzania	Maneno John Mtandi	USA	Patricia
Tanzania	Maria Kasuva	USA	Paul Bristol
Tanzania	Maritna Jarome	USA	Petra Horn-Marsh
Tanzania	Modestus Mbilinyi	USA	Robert Westerhaus
Tanzania	Nuru Pengo	USA	Sean Kelly
USA	Beth Beadle	USA	Sharon Waltrip
USA	Connie Hanson	USA	Shawn Friesen
USA	Dale Armstrong	USA	Sherry Gabel
USA	Daniel Allen	USA	Sue Qualls
USA	Darla Beck	USA	Tim Fitzgerald
USA	David Hoffman	USA	Timothy Jackson
USA	Ivelis Bauman	USA	Tom Sweetman
USA	John Prestidge	USA	Tyler

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