Constraints on Language Acquisition in Infants & Adults
Alexandra T. Kronstein, SURG Proposal – Carnegie Mellon University

Abstract

There is a large corpus of evidence to suggest that for both infants and adults to learn, there must be constraints on either the mechanism by which they learn or constraints on the input they receive. (cite) One study in particular (Fiser & Aslin, 2005) explores how adults use statistical learning to acquire internal representations of passively viewed multi-element visual scenes. Fiser & Aslin propose a constraint that governs statistical learning by guiding adults to focus solely on the relevant statistical parts of the whole scene. My research will explore the results of their experiments from the linguistic perspective by testing whether adults use the same constraints when acquiring language. There are two possible outcomes to my research: adults will either utilize these constraints when acquiring language or they will not. Either outcome will provide ample opportunities for further research.

Research Question and Significance

Language acquisition is a complex thing. There are two main perspectives from which one can view the mechanisms that govern language: the Learning Theory perspective or the Universal Grammar perspective. Essentially, advocates of Learning Theory assert that language is acquired by domain-general learning mechanisms, and many advocates of Learning Theory believe that these mechanisms are ruled by statistical constraints. Researchers attempting to support Learning Theory seek to find ways to prove that language acquisition is simply another type of learning. This view is staunchly in opposition to that of Universal Grammar. Universal Grammarians believe that language acquisition is unique to humans and that the mechanism that governs it is unique to language itself.

In order to research the underlying processes in greater depth, a researcher must have good evidence that either stance they are arguing for is valid. My research will address this primary question by demonstrating how adults acquire language. In 2005, a study done by Fiser and Aslin proved that adults use a constraint they have termed the “embeddedness constraint” when creating internal representations of complex, multi-element visual scenes. This embeddedness constraint essentially guides the learner to focus only on the relevant parts of the whole scene. Statistical elements that are not relevant to a productive and efficient internalization of the image are not even considered. Although this study focuses on visual learning, I believe it can be effectively replicated to determine if the same type of constraint is employed in language acquisition.

There are two possible outcomes to my research, and both can serve to answer the primary question of the nature of the language learning mechanism. One potential outcome is that adults will employ the same embeddedness constraint in language acquisition. This would then tell us that the same underlying mechanism governs both language acquisition and other types of learning. The other potential outcome is that adults will not employ the embeddedness constraint during language acquisition. This will tell us that there is a unique, or, at the very least, different, underlying mechanism for language acquisition as opposed to other types of learning.
I predict that the results will indicate that adults do employ the embeddedness constraint during language acquisition. After conducting my research on adult subjects, I plan to complete a similar experiment with infants from Dr. Erik Thiessen’s Infant Language and Learning Lab (ILLL). Depending on the results of the research with infants, we could determine whether or not constraints on language learning (if they exist) change as a function of development. Both of these studies will lead to important findings in the field of language acquisition research as well as the potential for more further and more specific research of the subsequent results.

**Project Design and Feasibility**

The initial experiment will only contain one participant pool (adults), though in the future I hope to test a second pool (infants) as well. The adults will be exposed to the stimuli I have begun to create with the help of Dr. Thiessen. The stimuli are twelve nonsense “words” broken into two “languages” that have been invented in the lab. Each language will contain six unique words, with three pairs of two 3-syllable words, two 2-syllable words, and two 1-syllable words. The stimuli have been synthetically created using the SoftVoice vocal synthesizer. I will use synthetically constructed stimuli because that is the most certain way to avoid giving the listener any unintentional prosodic clues to word boundaries.

The experiment will consist of three phases: a learning phase and two testing phases. During the learning phase, adults will listen to a continuous stream of speech that contains each of the three pairs of words for that particular language. They will hear each of the six unique words an equal number of times. After the learning phase is complete, the adults will be given a simple forced-choice test comparing actual words from the language with non-words or part-words from that same speech stream. I plan to analyze this data by predetermining a threshold for ‘chance’ guesses of words versus non-words. If the adults perform above the predetermined chance level in a way that is statistically significant then I can conclude that they have successfully segmented the unique words of that language.

If the adults are able to perform above chance and have successfully segmented 3-, 2-, and 1-syllable words from the speech stream, I will proceed to the next test phase, which will examine how the adults have stored the linguistic data that comprises each of the words. The adults will be given an alternative forced-choice test to determine if they have only attended to the relevant statistical information necessary to internalize a representation of the word or if they have attended to non-relevant pieces of statistical information. I plan to analyze this data by predetermining a threshold for ‘chance’ responses. If the adults perform above this threshold in a way that is statistically significant, then I can conclude that the adults have employed the embeddedness constraint in their language acquisition.

The experiment will be conducted in one of the experiment rooms in the Psychology Department at Carnegie Mellon University. The subjects will be naïve to the purpose of this experiment before they participate in it to ensure a passive listening state. They will be told a simple ‘cover story’ to explain why they should listen to the words but not to think too much about them. The subjects will receive $5 for their participation in this study.

I have already begun to create the stimuli for this experiment and they will be finished by December 2007. I plan to test adult subjects from January 2008 through March 2008. From March 2008 until May 2008 I will analyze the data and prepare a report. I know I must submit a Human Subject Clearance Request to the university before I begin testing.
Background

I am currently a Junior double-majoring in Linguistics and Russian Studies. From the time I began attending classes, I have hoped to do interdisciplinary research here at Carnegie Mellon. Currently I am enrolled in Dr. Erik Thiessen’s course, *Language Acquisition in Infancy and Childhood*, which inspired me to seek out Dr. Thiessen as my mentor. I have also begun working in his Infant Language and Learning Lab (ILLL), where I experience hands-on training in various research methods. Courses such as *Philosophy & Psychology* with Dr. David Danks from the and *Social Structure, Ethical Dilemmas, and Public Policy* with Dr. Clark Glymour have prepared me to work in an interdisciplinary field and to analyze data from multiple sources. I am currently enrolled in *Phonetics and Phonology* with Dr. Thomas Werner where I am studying the linguistic perspective of the development of underlying representations of phonemes, which I find extremely relevant to my work with Dr. Thiessen.

Feedback and Evaluation

I plan to meet with Dr. Thiessen once per week to discuss and evaluate my progress in this research. Dr. Thiessen will also be evaluating the data I have collected and he will guide me in the final presentation of my research.

Dissemination of Knowledge

I will create a poster to present the results of my research at *Meeting of the Minds 2008*. I also plan write a research paper for publication in collaboration with Dr. Thiessen.