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The Acquisition of Ergativity

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Abstract

This paper reports a miniature language study conducted to examine the acquisition of an ergative verb system. The study is designed to allow the learner the choice of creating either a natural or unnatural system. The study uses a new approach to teaching miniature languages in which the learner is exposed to the language while playing a computer adventure game. The learner acquires the miniature language by determining its properties while seeing words used in context. After learning a set of transitive and intransitive verbs, each with its own set of subject clitics, the learner is required to create new words with object clitics. The situation is set up in such a way that the learner has three options: 1. Respond randomly, 2. use the subject clitics of intransitive verbs, creating a system typical of ergative languages, or 3. use the subject clitics of transitive verbs, a pattern not found in natural language. It was found that most subjects (93%) did either 2 or 3, demonstrating that they were performing language learning by forming two classes of subject clitics. Most subjects (78%) used the third option, the unnatural one. This result is interpreted as evidence against a modularity driven universal grammar view of language learning. Instead it supports a cognitive account in that the unnatural pattern required less cognitive processing.

Introduction

A primary goal for language acquisition research is to identify the set of principles, which enable the child to acquire any possible language in real time. There are two general approaches to do this, learnability research and the collection and analysis of data from language learners. Within the latter, there are two choices as well, to study the acquisition of natural languages (e.g. English, French), or to study the acquisition of miniature languages. The latter observes learners acquiring miniature language systems (MLSs). This study explores the acquisition of one aspect of natural language, i.e. *ergativity,* as an MLS. Ergativity is a pattern in which the subjects of transitive verbs, i.e. verbs that take an object, are marked differently from the subjects of intransitive verbs, i.e. verbs without objects. Further, the subjects of intransitive verbs will be marked in the same way as the objects of transitive verbs. The study is structured such that learners acquire part of a MLS system and need to generate new utterances. A situation is created whereby they have two subconscious choices, either to create utterances that have the property of natural languages, or to create ones that have a property not attested in natural language. Both potential rule systems are equally complex, but the unnatural MLS language places less burden on lexical processing. If learners are driven by a universal grammar that is modular, they should prefer the natural language-based MLS. If language learning is a more general cognitive operation, than the unnatural language should be preferred.

Miniature Language Acquisition

MLS research differs from the study of natural language acquisition in four ways. First, the language acquired is one created by the investigator; hence the term "artificial language" is often used in reference to these studies. Second, the language is small, typically with a total sentence inventory under 100; hence the term "miniature". Third, the language is taught in the laboratory; hence learning conditions are strictly controlled. Lastly, the subjects are usually adults, or older children. Additional observations are that the languages are often difficult to teach, and often use nonsense words, usually CVCs.

There are basic assumptions that underlie MLS research. These assumptions are that the MLS is comparable to natural language structures, that laboratory conditions can simulate natural language acquisition, and that older children and adults will acquire the MLS with same mechanisms as used by children. The criticism of these assumptions constitutes a profound problem with the MLS research paradigm. A review of MLS studies (Ingram & Wollitzer, 1990) shows that MLSs are not comparable to natural language structures, and in some cases are unlearnable (Braine 1963). Laboratory conditions are not comparable to the context of natural language acquisition. There is no evidence to suggest that the mechanisms used to acquire an MLS are the same as those used to acquire a natural language. Lastly, the results of MLS studies to date have only confirmed previously known findings on language learning (Schlesinger 1977).

A review of just two previous studies exemplifies these problems. The first MLS study by Esper (1925) used a MLS

which consisted of the following rules: S → Color + Shape, Color → 4 nonsense words, Shape → 4 nonsense words. Adult learners were presented with 14 of the 16 possible sentences, paired with colored shapes. The results were that the subjects were able to generalize and produce the two sentences not taught. Braine (1963) used the following language: S → A + P, A → kiv, juf, foj, P → bew, mub, yag. The subjects were ten-year-old children who were trained on 4 of the nine possible structures. The children were able to generalize to untrained sentences.

We propose that MLS research needs to be restructured to overcome the problems identified above (Ingram & Pye 1993). The first change is that the MLS languages need to be miniature languages of natural language structures, i.e. *miniature real language systems* (MRLS). The study reported below does just this, creating an MRLS that contains verbs with ergative subject clitics, based on K'iche, a Guatemalan language. (Ergative subject clitics are pronominal like elements that attach to the verb to indicate the person of the verb, e.g. first person, second person, etc.). The presentation of the language forms needs to be restricted to positive evidence, i.e. learners can not be corrected during the acquisition process. Our paradigm proposes that we need to study not only rates of learning, but also error patterns. Lastly, a new procedure needs to be developed that can more accurately replicate the context of natural language learning.

The method of presentation, which we have explored, consists of creating *computer based adventure games*. The games are written such that they involve the interest of the learner. An integral part of the game is learning the MLS. The language is presented in natural contexts, i.e. as people in the game speak to one another (see details below). The benefits of the approach include the fact that all of the learners' responses can be written to a file on a diskette. It has the further advantage of expanding the range of language structures that can be examined. For example, a pattern such as ergativity can be studied without the extensive travel, time, and cost needed to observe natural language learners.

Kiche Adventures

The computer games created are called Kiche Adventures. Kiche Adventures involve four main characters: Baltimore Bob, Pittsburgh Cliffie, Uncle Dave, and Wicked Heagar. The player is Baltimore Bob. The game begins with Baltimore Bob arriving at the airport in Guatemala City. He is going to Guatemala to rescue his Uncle Dave who has been captured by Wicked Heagar. Baltimore Bob does not know Miniature *Kiche* (MKiche), and will need to learn it to save his uncle. MKiche consists of intransitive verb stems with subject clitics and transitive verb stems with subject and object clitics (details are below). Bob is greeted at the airport by Pittsburgh Cliffie who will be his guide. As the two travel through the city and eventually the jungle, Baltimore Bob hears MKiche verbs used in a variety of circumstances. Bob is instructed at the onset that he can keep a diary to help him acquire MKiche words. Whenever

he hears a MKiche verb, he should write it down in his diary. This is done by the learner typing "Get <Word>", where Word is the MKiche verb. At any time, Bob can call up his diary by typing DIARY. This shows him the verbs that he has heard, and contains notes on the context in which it was used. At critical junctures Bob needs to use MKiche and create new verb forms that he has not heard.

The structure of Kiche Adventures is such that all learners are presented with a subset of transitive and intransitive verbs with subject clitics. At an early point in the game, the learner needs to show generalization of the subject clitics in order to continue (*subject clitic generalization*). That is, they need to combine subject clitics with verbs in new combinations that they haven't heard before. At a later and more critical point, the learner needs to generate object clitics from the subject clitics that they have learned (*object clitic generalization*). That is, they need to create novel verb forms that indicate the object of the action. There are three possible patterns of response. First, the learner could randomly select from the two sets of transitive and intransitive subject clitics (*random response*). If this is done, there is no evidence that the learner has formed the subject clitics into classes. It would constitute evidence that the task is not capturing learning that is consistent with natural language learning. The second possibility is that the learner can use the intransitive subject clitics as object clitics (*ergative response*). This response would indicate that the learner is creating an ergative system. It would lend itself to the interpretation that the choice was driven by universal grammar which allows the ergative pattern (Dixon 1980). The third possibility is that the learner will use the transitive subject clitics as object clitics (*unnatural response*). This system of person marking is not found in any known natural language, i.e. having one set of clitics for both subject and objects of transitive verbs, and another class of subject clitics for intransitive verbs. The reason that this is so is likely due to the high level of redundancy found in natural language. The unnatural system would only have the sequence of the clitics to tell which one marks the subject or object. The ergative system, on the other hand, has both sequence and class differences.

Miniature Kiche

Four Kiche Adventure games were created (A through D), each using a slightly different version of MKiche. Each game was developed to improve upon potential confounding variables in the previous one. The four languages were constructed from two sets of verb stems and two sets of person clitics. These two sets are given below. The verb stems are CVC, with rough translations of their meanings in parentheses. They are used in the game, however, in a different range of contexts than their English translations. Person is indicated by 1 (first person), 2 (second person), and 3 (third person). Number is singular (s) and plural (pl).

Verbs:
A Verbs: wik (call), rep (read), naz (pull), tum (pull).
B Verbs: lat (ask), mup (see), bis (push), yon (shoot).

Clitics:
A Set: on (1s), aw (2s), te (3s).
B Set: mi (1s), at (2s), ku (3s).
Neutral affix: pa (3pl)

The first game was *Game A*. The MKiche in Game A had the following properties: (V = verb, sub = subject clitic, obj = object clitic).

Game A: (subVobj)
Set A clitics + A Verbs (intransitives)
Set B clitics + B Verbs (transitives)
Intransitive verbs presented first

This game used a verb structure that mirrored the order of subjects and objects in English. It used different verb stems for transitive and intransitive verbs, and taught intransitives first. For example, the Mkiche verb for 'I call' is ONWIK, and the Mkiche verb for 'I ask (someone)' is MILAT. It was later decided that there were two potentially confounding variables in the game. First, since the transitive subject clitics were taught after the intransitive ones, that could result in a recency effect. That is, the learners could use the transitive subject clitics as the object clitics since they were the last acquired, e.g. MILATAT to mean 'I ask you'. Second, there were distinct verb stems for transitives and intransitives. It could be that learners could select the Set B verbs in the object clitic generalization test because they associate the subject clitics with them. For example, since the learner would have already learned ATLAT to mean 'you ask', they might associate the subject clitic AT with the verb stem LAT and thus later produce MILATAT to mean 'I ask you' in which case AT represents the object.

Game B was designed to counterbalance the effect of the verb stems. The two sets of verb stems were reversed, i.e. Set B verb stems were now intransitive verbs, and Set A verb stems were now transitive.

Game B: (subVobj)
Set A clitics + A Verbs (transitives)
Set B clitics + B Verbs (intransitives)
    Intransitives presented first

Another concern was raised about the use of the subVobj sequencing, based on English. K'iche verbs are actually of the form obj-subV. It was decided to alter the game to use that structure. This was done by taking Game A and changing the sequences. For example, the learner who would produce MILATAT in Game A to mean 'I ask you' would produce ATMILAT in Game C.

Game C (obj-subV)
Set A clitics A + A Verbs (intransitives)
Set B clitics + B Verbs (transitives)
Intransitives presented first

These three games still contained the potential problems with the order of presentation and having distinct verb classes for transitive and intransitive verbs. A last game, Game D, was created which corrected for these. It used the same verb stems for both transitive and intransitive verbs. It also used the obj-subV structure.

Structure Of Game A

The basic structure of the games can be seen by examining Game A. First, there is a Practice Game to acclimate the learner to the nature of the game. This game involves Baltimore Bob's arrival at the airport and his early interactions with Pittsburgh Cliffie. It is also preceded with some instructions on how to move about the game. It is mostly done with MKiche verbs, but there are a handful of other commands that can be used, e.g. directions (N, S, E, W), UP, DOWN, etc.. The player can also TALK TO CLIFFIE when they are stumped. Cliffie sometimes offer hints, but not always.

The Practice Game presents 7 intransitive verbs, and requires 1 generalization. The seven intransitive verbs are shown below in small letters. The learner needs to generate the verb AWTUM 'you pull' to correctly complete the game.

	'call'	'read'	'open'	'pull'
1s	onwik	onrep	onnaz	ontum
2s	awwik	awrep	awnaz	AWTUM

Once the Practice Game is completed, the player begins the actual Kiche Adventures. There are three Kiche Adventures, each constituting one advance in the overall adventure. The first adventure is "Jungle Bound". It takes Bob and Cliffie from the airport and through a series of mishaps in the city. The purpose of the game is for Bob to acquire three verb stems and three subject clitics of intransitive verbs. This creates a system of 9 verb forms. Bob hears 6 of the possible intransitive verbs, and later has to make 3 generalizations. Each of the six verbs is presented in two contexts during the game. The verbs are shown below. Capitals show words that are not presented and have to be created.

	'call'	'read'	'open'
1s	onwik	onrep	ONNAZ
2s	AWWIK	awrep	awnaz
3s	tewik	TEREP	tenaz

The second adventure is "The Search for the Wicked Witch". Here Bob and Cliffie travel through the jungle toward Wicked Heagar's cave. The purpose of this game is for Bob to acquire the three subject clitics for three transitive verb stems. In this game, the verb roots for transitives are different than the ones for intransitives. Bob hears 6 transitive verbs with noun objects, and requires 3 generalizations. Each verb is presented twice, and practiced until acquired. These are shown below, with the tested verbs in capitals.

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	'ask'	'see'	'push'
1s	milat	MIMUP	mibis
2s	ATLAT	atmup	atbis
3s	kulat	kumup	KUBIS

The third adventure is "The Search for the Magic Mirror". Here Bob will reach the cave of Wicked Heagar and attempt to save Uncle Dave. The purpose of this game is to see how Bob will create object clitics. It begins with Bob hearing 3 transitive verb stems with a third person plural clitic 'pa' which means 'them'. This shows him where the object suffixes are attached. Bob also practices three of the intransitive verbs (onwik, terep, awnaz) which he learned in the first adventure. At the critical juncture, he is instructed that he needs to create some new forms, and that he needs to use the language he has acquired thus far to do so. He needs to create 9 new verbs with object suffixes. For example, he is asked, how would you say "I ask you". Bob has to select from the two sets of subject clitics that he has learned. The game will accept either of the Set A or Set B clitics as long as they are the correct person. The answer to "I ask you" can be either MILATAW (ergative response) or MILATAT (unnatural response). The three transitive verbs with the 3pl -pa suffix are shown without parentheses. The nine test words to be produced by the subject are in CAPITALS. All other words are not presented or tested. These are placed within parentheses.

	'ask'	'see'	'push'
Sub1s			
Obj			
1s			
2s	MILATAW/AT	(mimupaw/at)	MIBISAW/AT
3s	(milatte/ku)	MIMUPTE/KU	(mibiste/ku)
3pl	(milatpa)	(mimuppa)	mibispa
Sub2s			
O			
1s	(atlaton/mi)	ATMUPON/MI	(atbison/mi)
3s	ATLATTE/KU	(atmupte/ku)	ATBISTE/KU
3pl	(atlatpa)	atmuppa	(atbispa)
Sub3s			
O			
1s	KULATON/MI	(kumupon/mi)	KUBISON/MI
2s	(kulataw/at)	KUMUPAW/AT	(kubisaw/at)
3pl	kulatpa	(kumuppa)	(kubispa)

The last adventure is "The Final Quest". It tests some further miscellaneous generalizations.

Results And Discussion

Table 1 presents the results from 87 subjects who have played the game. These consist of a range of adults from teenagers to middle age. The majority, however, are university undergraduates.

Table 1: Response patterns of Subjects.

Response	A	B	C	D	Total
Random			4	2	6
Ergative	4	7	2	5	18
Unnatural	16	11	22	14	63
Total	20	18	28	21	87

A first observation is that only 6 subjects used the random response. We take that as one piece of evidence that that the learners were applying principles of language learning. The large majority of subjects (93%) acquired the subject clitics as classes and used them as a class in the object clitic generalization test. In fact, the common response of the subjects in interviews was that they felt that had given the 'correct' response when they produced the object clitics. They were generally quite surprised when told that the program would have accepted either set of clitics.

The second major finding was that the unnatural response was more highly favored in all four games (78% vs. 22%) for those subjects which did not respond randomly. This was despite the fact that many of the subjects were linguistics students, and in a few cases, even linguistics professors. A background in linguistics did not mean that the learner would select the ergative system. This trend in the data argues against the hypothesis that language learning is modular.

Why then, would the subjects prefer the unnatural response? Our account of this concerns the processing that is involved. In the object clitic generalization test, the learner has two choices, use the subject of intransitive class or the subject of transitive class. Observe that the use of the latter involves retrieval of both the subject and object clitics from the same class. The ergative pattern, however, requires retrieval from both classes of clitics. While both potential systems have the same linguistic complexity, the unnatural one involves less processing in the production of transitive verbs.

Why then, is the preferred unnatural not found in natural language? We suggest that language prefers the ergative system because it involves more redundancy. The listener has two sets of cues for identifying the subject and object clitics, their sequence and their class. The unnatural class has no redundancy, only the sequence of the subject and object clitics to rely on. We suggest that this property makes it highly unpreferred. By this account then, language is more shaped by the need for redundant structure than innate modular learning mechanisms.

The last issue to address is whether or not the subjects were using the same mechanisms to acquire MKiche as language learners. We offer three arguments that they were. First, there was the result mentioned above that the large majority of subjects (93%) acquired the subject clitics by class. There was no semantic basis to do so; it was the result of noting that one class occurred with verbs that took objects and one did not. Second, it took learners quite a long time to acquire the MKiche verbs. The average time to complete the game was between three and four hours. An examination of

the responses in the computer files showed a great deal of effort to figure out the meanings of the verb forms. As a linguistic exercise, however, it would be a trivial task. This can be seen by thinking of the versions of MKiche above as a linguistics problem. It takes students a matter of seconds to solve it when presented this way. The fact that they were involved with contextual learning of these forms, we suggest, triggered language learning rather than problem solving. Third, it was noteworthy that trained linguists did not uniformly consider the ergative solution. There were three PhDs in linguistics who played the game. Two of the three used the unnatural response, and were surprised when we explained the potential ergativity of the system. They were clearly not using their linguistic knowledge and problem solving skills. One was a phonologist and one a syntactician. The third linguist did mentioned that they assumed it was an ergative system. This was a recent Ph.D. who had just completed a syntactic dissertation on ergativity.

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