

Developmental Stages in the Semantic Acquisition of Quantification by Adult L2 Learners of English: A Pilot Study

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1. Introduction

This paper reports the preliminary results of a study of adult English as a Second Language learners' interpretation of sentences that contain the universal quantifier (UQ) *every*. It has been observed cross linguistically¹ that children learning an L1 pass through a stage where their interpretation of sentences containing the UQ *every* is not consistent with that of adult speakers. For example, when shown a picture that corresponds to the following schema and asked questions (a) and (b), children between the ages of 3 and 5 respond the same way to both questions: "No.", pointing to F4 and saying "Not that one" when asked to explain their response (where F= farmer & D= donkey &↔ = feeding):

1. F1↔ D1 F2 ↔D2 F3 ↔D3 F4
 - a. "Is a farmer feeding every donkey?"
 - b. "Is every farmer feeding a donkey?"

Conflicting analyses of the L1 data have been proposed by Philip (1991; 1992; 1995) and Crain (1995, 1996, 1998). These analyses differ in that one proposes quantification to be a natural acquisition process constrained by UG and that children are proceeding through natural developmental stages. The other argues that the children have the semantic principles in place and that the failure of children to apply these principles is due to the infelicitious presentation of the test sentences. Based on these differing analyses, two different outcomes, with different implications for L2 research, initially seem possible

During the present study's initial trials, 60 subjects were divided into two groups: low & high proficiency (SPEAK scores) and given a picture identification task (PI)², a story task³ and an act-out task. Each task was followed by a question that was designed to assess the subject's interpretation of the UQ in English. Results of the initial trial produced error rates in the scope assignment of *every* more than 60% of the time regardless of L1. Another interesting result is that subjects whose L1 is similar to English in terms of quantification seem to move through the UQ misinterpretation stage more rapidly than subjects whose L1 is different from English (Chinese). In other words, low proficiency subjects had similar error rates regardless of L1, but high proficiency students' error rates were correlated to L1.

The results point to an analysis in the spirit of Philip (1991, 1992, 1995): the acquisition of semantic principles necessary to interpret quantified sentences is constrained by Universal Grammar, since adult subjects presumably have adult pragmatics in place. Like the subjects in the child studies, participants in this study are operating with a grammar not consistent with the target grammar, and this paper argues that the errors are evidence of developmental stages in semantic acquisition with interlanguage forms surfacing.

¹ Inhelder and Piaget (1964), Donaldson and Lloyd (1974), Roeper and Matthei (1974), Lee (1991), Philip and Takahashi (1991), Philip and Aurelio (1991), Philip (1991, 1995), Crain et al. (1996), Kang (2001), etc.

² Version modeled after Broselow and Finer (1986) and Finer (1991).

³ Modeled after Crain, et al. (1996).

2. L1 Acquisition of the UQ *every*

Traditional analysis of L1 quantification data (Inhelder & Piaget 1964; Lee 1991; Phillip and Verrips 1994; Philip 1995) supports the claim that children of various language backgrounds, between the ages of three and five years old do not correctly understand sentences with the universal quantifier ‘*every*’. Children may interpret sentences like example (1a) in a non-adult way. The children who respond negatively to the sentence in (1a) have been termed ‘*symmetrical response children*’. The ‘*symmetrical response*’ demands a symmetry between donkeys and farmers, or in more general terms, between agents and objects in the context. The mapping between agent and object must be one to one for these children. The next two examples further illustrate the phenomenon (where F= farmer & D= donkey &↔ = feeding):

2. “Every farmer is feeding a donkey.” / “Is every farmer feeding a donkey?”
 F1↔ D1 F2↔D2 F3 ↔D3 D4

3. “A farmer is feeding every donkey.” / “Is a farmer feeding every donkey?”
 F1↔ D1 F2 ↔D2 F3 ↔D3 F4

Children in previous studies react to these questions differently than adults and answer “No”. When asked to explain their negative response, the children point to the extra object, D4, as in (2) or to the extra agent, F4, as in (3) as their reason. Children seem to be ignoring the semantic restriction that the Principle of Compositionality imposes on the scope of the quantifiers. The children who answer with the symmetrical response allow the scope of ‘*every*’ to quantify over both NP’s in the sentence. This has been termed ‘quantifier spreading’ (Philip 1991, 1994). In the above examples, the children’s interpretation of the UQ *every* which is attached to one NP in the sentence (either subject or object) ‘spreads’ to all NPs in the sentence.

Another response, termed *the exhaustive response/interpretation*, was observed in child studies of universal quantification. Children who responded this way extended the ‘one to one’ mapping between agents and objects to other participants within the context. For example, when shown a picture that corresponded to the following schema and asked ‘Is every farmer feeding a donkey?’ (where F= farmer, D= donkey, O= fox &↔ = feeding):

4. F1↔ D1 F2↔D2 F3 ↔D3 O

some of the children in the studies answered “No” and pointed to the fox or other participant as the explanation for their non-target (non-adult) response.

The children who participated in the studies were applying semantic interpretations that are not available to the adult speaker. This phenomenon has been observed cross linguistically in children acquiring French (Inhelder and Piaget 1964), English and Japanese (Philip 1995), Chinese (Lee 1991), and Dutch (Philip and Verrips 1994). Traditionally, the explanation of the empirical facts has been that children are moving through a natural stage in the language acquisition process. Based on experimental studies of children’s interpretation and understanding of quantified sentences, Philip (1995) discusses that the responses that are observed in the children “...is indicative of a stage in the acquisition of universal quantification during which the child often does not apply the linguistic principles that govern an adult-like reading of a determiner universal quantifier but rather assigns a meaning to a universally quantified sentence that is similar but semantically and truth-conditionally distinct from that which an adult assigns.” In addition, he argues that the truth conditions of the exhaustive interpretation are the most stringent, followed by the symmetrical interpretation, followed by the adult interpretation.⁴ Philip (1995) provides an analysis of the symmetrical response that states

⁴ Philip (1995) states that, “... the sub-set relations among the three interpretations suggest that the symmetrical and exhaustive interpretations are wholly determined by UG and that not only do these interpretations collectively constitute a stage in the acquisition of universal quantification, but each corresponds to a distinguishable subset as well.”

that children are interpreting the universal quantifier *every* as if it were an adverb of quantification and that both NP's in the sentence are in the domain of quantification.

A different analysis is offered by Crain et al. (1996). Crain et al. (1996) state that if 'noise' is factored in, then the Philip data yield adult like responses at least as often as non-adult responses. Crain argues that the symmetrical interpretation is not preferred. Since he feels that the error rates in the Philip studies are 'disproportionately high' other factors need to be considered, namely the experimental design. Crain discusses the idea that if experimental situations force the children to "violate one kind of linguistic principle or another", and they violate a syntactic one in order to satisfy a pragmatic one, then it can not be said that they lack the violated principle. Crain (1996) explains that the high error rates in the Philip studies were due to poor experimental design: "It is appropriate to ask a yes/no question only if it is plausible to entertain both "Yes" and "No" answers. In the studies we have reviewed, only the "Yes" answer was associated with the adult interpretation; the "No" answer was not. Therefore, the test questions were pragmatically infelicitous on the adult interpretation. The test questions were appropriate, however, if they were interpreted to be about the symmetry between the subject and the object NPs. Presented with a question that is felicitous only on an ungrammatical reading, children sometimes (although not always) override their grammatical knowledge in order to assign a pragmatically felicitous interpretation." Crain explains that test questions must satisfy the *Condition of Plausible Dissent* (Crain 1991). This refers to the requirement that the situation satisfies all of the felicity conditions for the negation of the target sentence, on the interpretation that is excluded by the grammatical constraint under investigation.

The earlier studies were replicated with what Crain describes as improved methodology and the conclusion that he draws is that children as young as three do have access to the adult interpretation of these quantified sentences, but because of pragmatics and infelicity, the children failed to answer with the adult interpretation. Crain asserts that it is "crucial to the investigation of children's linguistic competence to ensure that test sentences are presented in felicitous contexts. In the contexts provided for yes/no questions such as *Is every farmer feeding a donkey?*, felicitous usage dictates that both a yes answer and a no answer should be under consideration, at the point at which the question is asked" (Crain and Lillo-Martin 1999). Crain claims that when shown pictures that correspond to the following schematic:

5. F1 ↔ D1 F2 ↔ D2 F3 ↔ D3 D4

and asked, "Is every farmer feeding a donkey?" the children found no point to the actual question being asked because nothing in the picture corresponded to the negative answer. They therefore were "prompted to sometimes infer that some other question was intended, namely a question about the symmetry between farmers and donkeys: i.e., "Is there a one to one mapping between farmers and donkeys?" (Crain & Lillo-Martin 1999). Crain says that sometimes children were able to overlook the infelicity and answer correctly. Crain goes on to address the age factor. Older children and adults are able to answer the test questions (of the poor design variety) correctly because "older children and adults are better at taking tests than young children. Presumably older children and adults have learned to see through misleading circumstances in which test sentences are presented." In addition, the use of single picture tasks is argued by Crain to be 'ill-advised'. Crain says that a picture is 'static' and because of this, presuppositions can "only be satisfied by participants who are capable of drawing inferences about what led up to the state of affairs that is depicted. In most circumstances, it seems that young children cannot perform the necessary inferences to accommodate presuppositional failures."⁵

The above analyses provide the foundation for either a linguistic account of quantification (Roeper and Matthei 1974; Philip 1995, etc.) or a non-linguistic account (Crain et al. 1996). Research into the treatment of quantification by adult L2 learners of English can offer insight into the underlying mechanism of the acquisition of quantification, providing further evidence for one of the above theories, as well as providing insight into the nature of L2 acquisition of quantification.

⁵ It is interesting to note that according to Philip, Crain's main objections are based on the fact that he misconceived Philip's claim. Crain appears to view Philip as claiming that children do not have access to the adult interpretation. However, the claim that Philip actually makes is that there is a point when there is access to both interpretations and his goal is to explain the phenomena. I am grateful to Bill Philip (p.c) for this point.

3. Hypotheses for L2 acquisition

Based on the differing analyses of the L1 data, two different outcomes, with different implications for the theory of L2A (as well as providing insight into the first language acquisition process) initially seem possible. If Crain (see Crain 1996 for a full discussion of this) has provided the correct explanation of the L1 data then the expectation would be that the adult learners should not have difficulty with the structures that proved problematic for the children in the L1 studies. If the Philip type of analysis were to prove correct (See Philip 1995 for a full discussion of this), then the expectation would be that adult learners would experience difficulty with quantified sentences in the L2 since adult (target) interpretation of quantification is constrained by UG with developmental stages similar to those seen in other second language acquisition processes. The expectation would be that learners move through distinct stages during the acquisition process. Within the framework of a generative approach to second language acquisition, the behavior that is observed in children learning an L1 will have implications for L2A. It has been claimed by some researchers that L1 and L2 acquisition proceed in parallel. If so, then this claim generates an interesting research question: How will adult learners of English as a second language interpret sentences such as in the example in (1)? Assuming a non-linguistic analysis of quantification, the expectation would be that adults who are second language learners of English should not encounter the same types of difficulty as children with these sentence types since they already have the pragmatic ability to overlook infelicitous conditions.

Since the main claim of the non-linguistic analysis is that children have full access to the adult interpretation and that, rather than a natural stage in language development, their non-adult answers stem from the infelicitous context of the test questions, the expectation would be that adult learners have the pragmatic principles in place to overcome the 'pragmatically odd' test circumstances. The hypothesis that would logically follow from a non-linguistic analysis of quantification is that adult L2 learners should have no difficulty with the task once the lexical meaning of the word *every* was established for these learners.

Based on a linguistic account of the acquisition of quantification, the expectation would be that second language learners will experience difficulty with quantified sentences in English, regardless of their L1, assuming that the acquisition of quantification is a natural developmental stage in language acquisition, and that it is constrained by UG.

4. The Study

The present study explores whether adult learners of English as a second language will experience difficulty in the interpretation of the UQ *every*. In addition, the effect of L1 is investigated.

4.1 Subjects

The initial experiments included 60 ESL students enrolled in university ESL classes with various L1 backgrounds. The mean age of the participants was 26.2 years. Participants were divided into two groups based on proficiency level as measured by Speak Test scores⁶. Group 1 (n=30) had Speak test scores in the 40-44-point range and group 2 (n=30) had Speak Test scores in the 50-54-point range. The L1 breakdown in each group is as follows: Group 1: 10 Spanish, 10 Mandarin Chinese, 5 Korean, 3 Japanese, 2 Polish. Group 2: 8 Spanish, 3 Haitian Creole, 10 Mandarin Chinese, 6 Korean, 3 Japanese.

4.2 Goals

The goal of the experiment was to reproduce the earlier L1 experiments and look for evidence of quantifier spreading among adult learners, and to test for the effect of both proficiency level and

⁶ Speak test score were administered independently of this study as part of the university intake procedure. Students are placed in one of three ESL oral/aural class levels according to the Speak Test score. Scores were reported to the researcher by the participants and confirmed by participant placement.

influence of first language on the phenomena. The following questions were posed at the outset: How do ESL learners interpret the universal quantifier in English? Do they operate with a grammar that yields the adult interpretation, or do they answer in a way consistent with children acquiring a first language? Does the L1 have influence on the interpretation of the Universal quantifier? Are there examples of interference and transfer that surface? Are there stages through which learners pass on their way to full attainment of the target grammar in terms of quantification?

4.3 Test Sentences

The test sentences were constructed to test for right quantifier spreading (RQS) [*every*NP V NP] or left spreading (LQS) [NP V *every* NP]. Both transitive verbs (TV) and intransitive verb (IV) were tested:

- Right quantifier spreading (RQS), transitive verb (TV) [*every* NP]: *Is every boy holding a balloon?*
- RQS, intransitive verb (IV) [*every* NP]: *Is every boy on a tractor?*
- LQS, TV [NP *every*]: *Is a boy feeding every dog?*
- LQS, IV [NP *every*]: *Is there a flower on every hat?*

Seven contexts were tested (based on Crain 1996):

- Extra object condition
- Extra agent condition.
- Extra different agent condition.
- Different agent condition
- Non-distributive condition
- Different object condition
- Different agent incorporated

4.4 Procedures

Participants were tested on their knowledge of *every*. This consisted of picture identification tasks where students were shown pictures with one person holding three balloons, with no extra object/agents in the picture and asked, “Is a boy holding every balloon?” They were then shown pictures with a boy holding three balloons and one balloon floating to the right of the boy and asked the same question. Based on their answers to these two questions, they either qualified to proceed with the test or not. If participants were successful on this task they were able to continue with the test. In addition to assessing participant’s knowledge of *every* this served as a ‘warm-up’ task that allowed participants to become familiar with the test format. A picture identification (PI) task and a story task (ST) format were then administered to the participants. Participants were briefed on all characters and actions under discussion prior to the test questions being asked. Responses were obtained in writing. The PI task consisted of 32 test questions. 28 were actual test questions and 4 were questions meant to control for rote responses to the test questions. For the PI task, participants were either shown individual pictures and asked yes/no questions in written format, or were shown a page with two or four pictures and asked to match the test sentence to the appropriate picture. Again, the characters and actions depicted in the pictures were discussed with the participants making sure that they were aware of all the details of the pictures so that Crain’s ‘condition of plausible dissent’ is under consideration (Crain et al. 1996).

For the story task, the participants read two stories using Truth Value Judgement methodology (Crain & McKee 1985). Adopting this methodology, short stories were read by the participants and then a descriptive statement of what ‘happened’ follows. The participant must answer in writing if this was an accurate description of the story or not. These stories, which were modeled on Crain et al. (1996), included three participants who had to choose between two items. One character makes his or her choice immediately and the other two consider the other item before finally deciding to pick the same object that the first character chose. The true sentence following the story would be of the form [Every NP V NP]: i.e. “Every boy ate a cookie”. In this format, the negation of the test sentence is under consideration due to the circumstances described in the story.

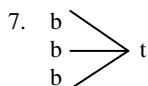
5. Results

Initially, the aim was to test for spreading errors in adult learners of English as a second language. Following the L1 work, these types of errors will be termed *Symmetry errors* (SE). Students placed in group 1 (lower proficiency) produced errors 61% of the time. Symmetry errors accounted for 70% of the non-target responses. These error rates approach those observed in a pilot study conducted by Philip & Aurelio (1990). Philip & Aurelio concluded that there was no significant difference between right and left spreading, and spreading errors occurred 87% of the time. In the present study there was also no difference between right or left spreading occurrences.

An unexpected response to the test questions surfaces, which had not been observed in the L1 studies reviewed for the present work, namely *Existential Wide Score Responses*. In this type of response participants responded “No” to the following question (where b= boy; t= tractor):

6. bt bt bt t
“Is every boy on a tractor?”

When asked to explain their response, participants said that there were “Different tractors” involved, or “More than one tractor.” In the picture matching task participants matched the statement “Every boy is on a tractor” to the following representative schematic:



The Existential Wide Score (EWS) response accounted for 30% of the non-target⁷ responses in group 1 for the PI task.

The story task had a lower overall error rate (48%); however, the breakdown of responses termed non-target were similar (63% symmetry responses and 37% EWS responses). Overall results of both the PI and Story task are reported in table 1:

Table 1

Group 1 n=30	Total non-target responses	Symmetry responses	EWS responses
PI Task	61%	70%	30%
Story Task	48%	63%	37%

The results obtained from group 2 (higher proficiency) differ dramatically. In this group, there is a much lower rate of non-target responses overall for both the PI task and the story task: 28% and 25% respectively. The breakdown of non target responses looks very different from the responses that were provided by participants in group 1: in the PI task there were 35% symmetry responses and 64% ESW responses. In the story task, participants provided symmetrical responses only 15% of the time, and EWS responses 85% of the time. Table 2 shows the overall results for group 2.

Table 2

Group 2 n=30	Total non-target responses	Symmetry responses	EWS responses
PI Task	28%	35%	64%
Story Task	25%	15%	85%

⁷ These results contrast with the responses made by a control group which consisted of 30 native speakers of English ranging in age from 15-57 years old, with a mean age of 32.6 years old. In this group there were 0% EWS responses and one speaker was able to access a symmetrical reading 10% of the time on the PI task and 0% on the story task.

In group 1, students from all language backgrounds provided both symmetry and EWS responses. The preferred reading of the test questions was the symmetrical one for the group 1 participants. In group 2, participants from Chinese, Japanese and Korean L1 backgrounds accounted for 100% of the EWS responses. The participants accessing this interpretation are those with linear order as the main determiner of the scope of quantifiers in their L1. The following examples illustrate this finding (where g = girl & r = rabbit & \leftrightarrow = feeding):

8. $g \leftrightarrow r$ $g \leftrightarrow r$ $g \leftrightarrow r$ g
Test item: Every girl is feeding a rabbit
EWS response: “No, different rabbits”
9. $g \leftrightarrow r$ $g \leftrightarrow r$ $g \leftrightarrow r$ g
Test item: A girl is feeding every rabbit
EWS response: “No, different girls.”

Due to space limitations I will not provide a full breakdown of responses based on L1. However, in prior work on quantification in Chinese (Lee 1986), the adult norm for Chinese speakers is to interpret the existential quantifier as a specific indefinite, and the initial findings relating to the preferred EWS reading in the present study could be indicative of L1 transfer, at least by the participants whose L1 is Chinese.

6. Discussion

The present experiments provide evidence for the fact that quantifier spreading occurs with adult learners who are acquiring English as a second language. A question is raised as to whether or not information about first language acquisition can be obtained by looking at second language acquisition data. The interlanguage grammar of some of the participants in this study is the same as the child L1 grammars with relation to the interpretation of the UQ *every*. The evidence presented in this paper lends support to the fact that there is a stage in both L1 and L2 acquisition when the UQ takes scope over another NP in the sentence. Therefore, this interpretation by adults and children provides evidence for the emergence of a possible grammar, constrained by UG.

The results from this initial study provide evidence for the claim that semantic and syntactic acquisition of quantification is a grammatical issue. Crain et al. have argued that this is not the case; rather it is a non-grammatical issue and that children as young as 3 indeed had compositionality in their grammars, and the high error rates (high incidence of non-adult responses) were due to previous experimenters’ “failure to satisfy felicity conditions” (Crain et al. 1999). Crain et al. make the strong statement that “...on the basis of the findings [from their experiments] ...that young children do not lack grammatical competence with any aspect of universal quantification.” The results obtained in the present study indicate that adult learners of a second language experience difficulty with the universal quantifier in English in the same way as children learning an L1, that there seems to be L1 transfer in some cases as well, and that the acquisition and interpretation of quantification in second language learners is an area of second language acquisition that needs further research and stands to make a contribution in the field of L2A as well as L1A.

The findings from this research suggest that we could look at quantification as a universally constrained aspect of language acquisition. Working within the framework of the generative study of second language acquisition, the tentative claim can be made that Universal Grammar plays a role in the interpretation and acquisition of quantification in second language learners.

The results from this initial study provide evidence for an analysis of the acquisition of quantification in the spirit of Philip (1995) and Roeper and Matthei (1974). Learners are misinterpreting the UQ *every*, a determiner, as an adverbial quantifier and are therefore accessing a different logical form for this structure than the target interpretation. If indeed there is a subset relation between the possible interpretations, then the L2 learners’ interpretation is a stage in the acquisition process.

One finding that presents itself for further investigation is the role of transfer in second language acquisition of quantification. How can evidence of L1 transfer of interpretative constraints be tested? Quantification and scope have been well represented in the theoretical literature; however, the

implications for second language acquisition have not been fleshed out. The results from the participants in Group II seem to indicate that at some point, learners whose L1 treats quantification in a way similar to the target language pass through the stage of symmetrical quantification when they realize that the TL (target language) is not different from the L1. Students whose L1 is very different in the treatment of quantification, such as languages where scope assignment is based on linear order of the quantifiers, seem to take longer to acquire the target structure. The preliminary findings suggest that learners are accessing universal principles in the same way that children learning the L1 are. If this were not the case, the expectation would be that the Spanish participants would behave more like native English speakers in their interpretation of quantified sentences. The Spanish L1 subjects would have simply transferred their L1 parameters to the English sentences and had an interpretation more consistent with L1 English speakers.

7. Conclusions and future directions for research

The important conclusion that is to be drawn from this pilot study is that there is a misinterpretation of sentences that contain the universal quantifier *every* by adult ESL learners, and this misinterpretation mirrors that of children learning English as a first language. The adult learners in this study have access to the symmetrical interpretation of sentences with the UQ *every* in English and, therefore, respond with the symmetrical response. Further study in this area needs to be done, and the results will have implications for L1A, L2A and theories of SLA in general.

One area of further investigation would be the learnability issues that the L1 and L2 data pose. What kinds of triggers do children learning an L1 and adults learning an L2 need to hear in order to 'correct' their semantic interpretation of *every*?

Another issue that has emerged from this work is that the experimental design can prove valuable for looking at L1 acquisition issues where a maturational hypothesis has been proposed. The results from this pilot study emerge in both L1 and L2 acquisition. They can tell us about language acquisition in general since the same observations can be made in children and adults. As was stated earlier in this paper, some research into the L1 facts has pursued a hypothesis that points to maturational differences between children and adults and older children as the source of the younger children's responses. The results from this study point to an analysis that moves away from maturational explanations and towards the emergence of developmental stages in the acquisition of quantification. There are three sets of learners that this study looks at: children learning an L1 and two sets of adult ESL students, each group at a similar level of proficiency. In addition, the adult groups can be further broken down by L1 background. The adults whose L1 treats quantification differently from the target language (English), (Japanese, Chinese: Scope Rigidity: Existential Wide Scope as an adult norm) exhibit a greater degree of difficulty with the construction under investigation and take longer to acquire the target interpretation. The students whose L1 is similar to English (Spanish) experience initial difficulty with the structures, but seem to acquire the target interpretation rapidly. Currently, this study is being expanded to look at longitudinal data rather than cross sectional data to confirm the hypothesis stated above: namely, that learners whose L1 is similar to the TL in terms of quantification move through the misinterpretation stage more rapidly than those learners with a greater degree of difference in the assignment of quantifier scope in their L1.

Trials are underway that look at different quantifiers, namely *all* and *each*, and in addition to cross sectional data, longitudinal data are being obtained with the goal of observing the proposed developmental stages in individual learners. Along with these issues, the issue of persistence of this form is being investigated: Does the symmetrical response ever get fully expunged from the grammar as it apparently does in L1 acquisition?

In this paper I have looked at the interpretation of universally quantified sentences in English by adult second language learners from various L1 backgrounds. The results from this preliminary work provide evidence for the fact that adult learners experience the same type of interpretative errors observed in children learning an L1. Conflicting analyses of the L1 data exist, and the results of the present study point in the direction of the acquisition L2 quantification governed by a linguistic principle (i.e., UG) with developmental stages that parallel L1 acquisition.

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Proceedings of the 6th Generative Approaches to Second Language Acquisition Conference (GASLA 2002): L2 Links

edited by Juana M. Liceras,
Helmut Zobl, and Helen Goodluck

Cascadilla Proceedings Project Somerville, MA 2003

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