Age, Memory and Flexibility in Language Acquisition

It is well established that children tend to reach higher ultimate attainment when learning languages compared to adults (cf. Lenneberg 1967; Johnson & Newport 1989; Long 1990; Birdsong & Molis 2001; inter alia) and that the effects of fossilization are often observed in adults but not children (cf. Han 2003, 2004; Franceschina 2005; inter alia). Despite this, the exact causes are widely debated and still unknown, and short-term experimental work has typically failed to show an advantage for children over adults (Krashen, Long & Scarcella 1979). This means that evidence for the causes of age effects, and in fact all data on changes throughout linguistic development, is typically only available through longitudinal studies, which present substantial practical difficulties such as finding a homogenous participant group and leave much of the development unmeasured.

This study conceptualizes the ability to acquire a language as flexibility; a more successful learner is one who is able to adapt to input and change his or her output accordingly. Because children reach higher ultimate attainment, this suggests that they are more flexible than adults in the learning process; therefore, we should be able to actually measure this effect and, given the right methodology and analysis, find an advantage for younger learners over older learners. The similar age effects in (second) dialect acquisition (Siegel 2010) are utilized here.

This study utilizes a novel research paradigm to measure cross-subject age effects and allow direct observation of the complete perception and production experience. 67 native Spanish speakers in Ecuador were presented with a novel (artificial) dialect and asked first to listen for comprehension then repeat (“learn”) the new forms. The artificial dialect input consisted of four stories created by the consistent application of 10 grammatical manipulations to standard Spanish, as shown in the table on the next page, and the addition of novel lexical items. In addition to the artificial dialect repetition, the experiment included two verbal working memory tasks.

The results show the effect of two underlying factors, interpreted within Ullman's Declarative/Procedural (DP) model (Ullman et al. 1997; Ullman 2001, 2005) as the two memory systems. Procedural memory, most accessible for children, is used for learning automated procedures such as systematic grammatical rules. Declarative memory, strongest in adults, is used for remembering facts and events, learning novel lexical items, and for verbal working memory. The repetition of semantic content (the events of the stories) and novel lexical items was strongly correlated with the verbal working memory scores, which correlated with age. These results are explained as due to declarative memory in the DP model.

The results for the ability to repeat the novel forms in the grammatical manipulations were mixed; some showed a positive linear correlation with verbal working memory and an advantage for adults. Others, however, showed a U-shaped curve in the regression modeling, with an advantage for those with the highest or lowest working memories, but a disadvantage for those in the midrange, indicative of two underlying factors. The advantage for high working memory can be explained by strong declarative memory in adults (as a task effect, simulating acquisition by rote repetition), while the advantage for low working memory is inconsistent with the use of weak declarative memory. It is therefore suggestive of the use of procedural memory for those with low verbal working memory, the young children.

Further research will be required to fully understand the differences in the results across manipulations, but what can be seen already is that not all manipulations are learned as easily by young children. It is likely that certain manipulations would take more time, and that, given previous all around high ultimate attainment results, children would learn everything eventually.
Selected References


### Summary of manipulations by domain with examples and source language.

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<tr>
<th>#</th>
<th>Domain</th>
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<th>Source Language</th>
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| 1  | Phonetics          | Palatalization: &lt;y, l&gt; was pronounced as [j], and &lt;j, g&gt; was pronounced as [ʒ]. | *alli* [a:j] &rarr; [af:i] 'there'  
*girafa* [ksi:rafa] &rarr; [zi:rafa] 'giraffe' | Argentinian Spanish for [j]; Portuguese for [ʒ] |
| 2  | Phonetics          | Diphthongs made into monophthongs: &lt;ue&gt; &rarr; [o] and &lt;ie&gt; &rarr; [e]. | *fuerte* &rarr; [forte] 'strong'  
*miedo* &rarr; [medo] 'fear' | Originally in Latin, still found in other Romance languages |
| 3  | Phonology (prosody) | Pragmatically salient information given a rising pitch (F0). Applied digitally. | *Es solamente un esPejo.*  
'It's only a MIRror.'  
Rising pitch in *esPejo* | (For example, expressing surprise in English.) |
| 4  | Phonology          | Word-final /o/ becomes [u].                                                   | *miro* &rarr; [miru] 'I see' | Brazilian Portuguese |
| 5  | Phonology          | &lt;c, z&gt; pronounced as [θ].                                              | *cinco* &rarr; [θinco] 'five' | Peninsular Spanish |
| 6  | Morphology         | Adverbial suffix -mente truncated to -mén.                                   | *solamente* &rarr; *solamén* 'only' | From Catalan -ment and Old French -men |
| 7  | Morphology         | Irregular verbs regularized based on normal patterns.                        | *dijo* &rarr; *deció* 'said'  
*say* &rarr; *so* 'I am' | (For example, in creolization.) |
| 8  | Morphology         | Regularized masculine singular articles.                                    | *un* &rarr; *uno* 'a(n)'
*el* &rarr; *lo* 'the' | (Based on analogy to Portuguese.) |
| 9  | Syntax             | All noun modifiers except articles (demonstratives, quantifiers, possessives, numbers) go after the noun. | *Este idioma*  
'this language'
*idioma este*  
'language this' | Based on head-initial languages like Swahili. |
| 10 | Syntax             | A secondary verb goes at the end of a sentence.                             | *podemos cruzar el rio*  
'we can cross the river'
*podemos el rio cruzar*  
'we can the river cross' | Like underlyingly verb-final “V2” in German. |