The role of containment and rules in the acquisition of underlying forms

Ruben van de Vijver & Dinah Baer-Henney
Universität Potsdam
vijver.rubenvande@googlemail.com, dinah.baerhenney@googlemail.com

Simple lexical representations are motivated by economy. Such representations require less storage space, and are easier to retrieve. For children, who have a smaller lexicon, is might be more important, however, to store lexical items with more details making it easier to connect items with one another. We will show that the latter is more important than the former in acquisition. We propose that a lexical entry contains all allomorphs and that these allomorphs are connected by rules (Albright & Hayes, 2003) whose application is constrained by containment (Prince & Smolensky, 1993).

In a wug test (Berko-Gleason, 1958) we asked 10 5 year old children to produce a plural for a given singular, and 30 5 year olds to produce a singular for a given plural. We used both existing words and phonotactically legal nonsense words. Children produce plurals from singular existing words, from singular nonsense words and singulars from existing plurals. They do not, however, produce singulars from nonsense plurals. Instead they repeat the given plural as singular. This effect has been observed for Dutch children (Kerkhoff, 2007) as well as for American adults (Pierrehumbert, 2006).

To explain this asymmetry, we propose a theory of the acquisition of underlying forms that is based on the principle of *containment* (McCarthy & Prince, 1993). This principle says that the input must be contained in the output. We specifically propose that underlying forms contain all members of a paradigm, in our study the singular and the plural of nouns, and children gradually use their underlying forms to isolate affixes from roots. The members of a paradigm are linked by means of rules, whose application is constrained by containment.

Containment says that no element may literally be removed from the input, and, as a consequence, the input is contained in every candidate form (McCarthy & Prince, 1993). In the case of nonsense words, children will assume that the output form is the input form. If they are asked to form a plural from a given singular, they avoid removing elements from the input, but they may add material. If their lexicon contains singular plural pairs, they perform a phonological analysis to establish the rules which connect the pairs (Albright & Hayes, 2003).

The underlying forms are richer than is assumed in standard generative phonology (Chomsky & Halle, 1968; Prince & Smolensky, 1993). The underlying form of a noun contains all members of its paradigm, for example, the underlying form of the German noun [tɪʃ] "table" is < /tɪʃ/, /tɪʃə/>. At first, the plural suffix is not isolated; there is evidence that children first use either form as singular or plural (Brown, 1973). If a child is asked to form a plural for the nonsense singular [kɪʃ], she will use her lexicon and try and find a rule that derives it. Since [kɪʃ] and [kɪʃ] only differ in the place of articulation of the onset, the rule she uses to link the singular [tɪʃ] with the plural [tɪʃə] is used to derive the plural of [kɪʃ]: [kɪʃə]. All material of the singular is present in the plural and containment is not violated. She cannot form the singular [kɪʃ] from the plural [kɪʃə], since this would violate containment.

In the standard phonological theory, a single underlying form derives all allomorphs. The motivation for this theory of unique underlying representations comes from economy. It is easier to store and retrieve a single form from a small lexicon and it relates the allomorphs of a paradigm to one another. If applied to our data it leads to a dilemma: Children are able to produce a plural from a given singular word and a plural for a given nonsense word. They are able to use the given form as input and add a suffix. They also recognize a given plural word as consisting of a base, used as underlying form, and a suffix. They cannot do this with a given plural nonsense form. To solve this dilemma we assume richer underlying representations, the members of which are linked by rules whose application is constrained by containment.

References

Albright, A. & Hayes, B. (2003). Rules vs. analogy in English past tenses: a computational/experimental study. *Cognition*, *90*(2), 119–161.

Berko-Gleason, J. (1958). The child's learning of English morphology. *Word*, *14*, 150–177.

Brown, R. (1973). *A first language: The early stages*. Cambridge, MA: Harvard University Press.

Chomsky, N. & Halle, M. (1968). *The Sound Pattern of English*. New York: Harper and Row.

Kerkhoff, A. (2007). *Acquisition of Morpho-Phonology: The Dutch voicing Alternation*. PhD thesis, University of Utrecht, Landelijke Onderzoeksschool Taalkunde.

McCarthy, J. & Prince, A. (1993). Prosodic morphology I: constraint interaction and satisfaction. Ms. University of Massachusetts, Amherst and Rutgers University, New Brunswick [Technical Report No. 3, Rutgers University Center for Cognitive Science. To appear, Cambridge, Mass.: MIT Press].

Pierrehumbert, J. B. (2006). The statistical basis of an unnatural alternation. In L. Goldstein, D. H. Whalen, & C. Best (Eds.), *Papers in Laboratory Phonology VIII* (pp. 81–107). Berlin: Mouton de Gruyter.

Prince, A. & Smolensky, P. (2004/1993). *Optimality theory: Constraint interaction in generative grammar*. Malden, MA, Oxford, UK, Victoria, Australia: Blackwell. (Ms. Rutgers University, New Brunswick and University of Colorado at Boulder [Technical Report No. 2, Rutgers University Center for Cognitive Science.).