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# WHAT DOES THE IMPACT OF FREQUENCY TELL US ABOUT THE LANGUAGE ACQUISITION DEVICE?

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This peer commentary emphasizes the importance of placing frequency in an overarching theoretical framework of language acquisition. Three issues are raised that appear to be both important and timely: (a) the question of how innate, or initial, cognition can deal with stimulus frequency; (b) the likelihood that frequency has a differential impact depending on the type of knowledge concerned; and (c) preliminary evidence that frequency affects receptive language knowledge more than productive knowledge, which raises the issue of a possible dissociation between the two knowledge types.

"Frequency is a necessary component of theories of language acquisition and processing . . . Of course, frequency is not a sufficient explanation; otherwise we would never get beyond the definite article in our speech. There are many other determinants of acquisition" (Ellis, p. 178). It is hard to argue against a conclusion that presents frequency as a necessary component of theory but simultaneously acknowledges that frequency interacts with many other determinants of acquisition. Who would not agree with such a give-and-take statement? Therefore, instead of expressing disagreement, I will emphasize, in this peer commentary, the importance of placing any determining factor in an overarching theoretical framework. I will mention some issues that appear to be both important and timely, given current developments in linguistics, psychology, and neuroscience.

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## NATIVISM

The issue of nativism remains on our agenda, even if we use connectionist architectures to account for language acquisition. A superficial encounter with connectionism might leave one with the impression that connectionist architectures can account for learning from scratch. This, however, is not the case. Connectionist architectures, through the manipulations of their designers, already have a template for cognition before they process the first piece of input. The designer has determined the number of input and output units (and sometimes the number of hidden units), number of layers, connectivity pattern, input and output representations, learning mechanism, and height of initial weights (McLeod, Plunkett, & Rolls, 1998). Thus, in a sense, a connectionist network does have "innate" constraints, albeit of a non-domain-specific type. If we grant that infants possess a learning device akin to a connectionist architecture, we are still left with the question of whether they were born with this learning device or whether they acquired it soon after birth. Any theory of human learning faces the enigma of induction (Carroll, 2000; Elman et al., 1996). Apparently, infants are equipped with two gifts, neither of which is the product of learning. First, they appear to possess the ability to perceive similarities in certain acoustic and visual stimuli. Second, they appear to possess the ability to store representations of stimuli that they perceive as being similar in a manner that reflects these similarities; that is, infants appear to possess the ability to count, through which they become subject to the powerful influence of frequency. Thus, although connectionist approaches to language learning may not endow the infant with language-specific knowledge (e.g., knowledge of principles and parameters as defined in generative linguistics), they are based, implicitly or explicitly, on the assumption of some innate, or at least initial, cognition.

## IMPLICIT VERSUS EXPLICIT COGNITION

Frequency is a highly powerful determiner of learning in a connectionist architecture. Can connectionist architectures, though, account for all forms of linguistic knowledge and all forms of learning? Connectionist studies conducted so far have been mainly concerned with the processing and acquisition of forms (as opposed to the pairings of forms and meanings) at the levels of phonemes, letters, grammatical gender, and inflection (e.g., Broeder & Plunkett, 1994; Jensen & Ulbaek, 1994; Kempe & MacWhinney, 1998, 1999; Sokolik & Smith, 1992; these examples only concern L2 learning), yet language cognition also consists of knowledge of form-meaning pairs, such as lexical entries. It is this type of knowledge that can readily take the form of conscious, declarative, explicit knowledge (Ellis, 1994). Explicit knowledge may be located in other areas of the brain than implicit knowledge. It has been suggested that, whereas implicit knowledge is served by different and rather diffuse brain structures, located in various areas of the cortex, explicit knowledge resides

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in the medial temporal lobe, including the hippocampus, independent of the areas where implicit knowledge resides (Paradis, 1994; Reber, Allen, & Reber, 1999; Squire & Knowlton, 2000). It may well be that explicit knowledge, in particular lexical knowledge (i.e., knowledge of form-meaning connections), may be less susceptible to the influence of frequency than is implicit knowledge. Although vocabulary learning normally requires frequent exposure to the words to be learned, it sometimes happens that a single encounter suffices for a new word (form-meaning connection) to be remembered forever and, on the other hand, that many exposures sometimes do not result in acquisition. Thus, frequency may have a differential impact depending on the type of knowledge concerned.

## RECEPTIVE VERSUS PRODUCTIVE KNOWLEDGE

The strongest examples of the powerful role of frequency pertain to receptive processing modalities, observable in listening and reading behavior (Ellis, this issue). Transfer of knowledge acquired in receptive modalities to the use of that knowledge in productive modalities (observable in speaking and writing behavior) appears to be weak, especially in the case of L2 acquisition. Two examples may illustrate this point. First, most postpuberty L2 learners speak their L2 with a nonnative pronunciation even when the period of exposure to L2 has been longer than the period of exposure to L1 (Flege, 1987). Only seldom are L2 learners capable of attaining a nativelike accent; exceptional successful cases involve dedicated learners who paid conscious attention to their pronunciation and invested considerable time and effort in practice (Bongaerts, Summeren, Plancken, & Schils, 1995). Second, L2 production of many postpuberty learners who have been exposed to the L2 for a longer time than the L1 often exhibits permanent form errors especially when (a) the form concerned does not appear to have a semantic function (or can be perceived as semantically redundant), and (b) the L2 form does not have a corresponding form in the L1. Well-known examples from studies on ESL learners are the omission of third-person singular *-s* in present-tense verb forms, incorrect irregular past-tense forms, failure to make the verb agree with the subject in number, and use of *much* with countable nouns (Krashen, 1981, p. 13). In a laboratory study involving the receptive and productive learning of an artificial language, DeKeyser (1997) demonstrated that there was little cross-modality transfer from training to test. According to DeKeyser:

> [This study lends] strong support to the hypothesis that practice has a skill-specific effect in the sense that performance in comprehension or production is severely reduced if only the opposite skill was practiced. This is contrary to the idea of linguistic competence acquired through comprehension being equally available for production and comprehension. (p. 213)

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Thus, whereas errors in the L1 production of young L1 learners disappear with time and massive input exposure, this is often not the case in the production of L2 learners. Perhaps, once the brain has committed itself to an L1, there may be limits in its capacity to accommodate an L2, even when L2 input comes in massive amounts (Rohde & Plaut, 1999). Possible dissociations between receptive and productive knowledge representations in L1 and L2 should also be placed high on our agenda.

## CONCLUSIONS

If one has reason to believe that a certain factor, such as frequency, has been neglected in language-acquisition theories of the recent past, and one wants to place that factor back on the agenda, then it may be helpful to write a paper in which one deliberately emphasizes the role of the neglected factor at the expense of other, equally important factors. This is all quite acceptable given the aim of such a paper. Taken in this spirit, Ellis's frequency arguments are timely. However, to argue that the human language acquisition device needs high-frequency input simply underlines the need for a specification of this device in the first place. Frequency, along with other factors, needs to be placed in the framework of a comprehensive theory of the representation, processing, and acquisition of linguistic knowledge of both first and second languages (Hulstijn, in press). Connectionist architectures, both of the PDP and localist types (Grainger & Jacobs, 1998), have the advantage over symbol systems (such as most grammars developed by linguists) in that they address issues of representation, processing, and acquisition of knowledge simultaneously. In such architectures, frequency of input is indeed one of the strongest determinant factors in allowing the system to acquire knowledge. However, the jury is still out on the question of whether such architectures are capable of capturing the acquisition of many highly abstract forms of linguistic knowledge, for example, the binding principles, as defined by Chomsky (1986; see Cook & Newson, 1996, p. 252 for a summary). Finally, with the advent of new technologies and the ensuing explosion of brain studies on language processing in the recent past (Brown & Hagoort, 1999; Fabbro, 1999; Gazzaniga, 2000; Paradis, 1994), it is incumbent on cognitive scientists and SLA researchers to relate their theories of the representation, processing, and acquisition of language to the areas of the brain involved in the processing of implicit and explicit, receptive, and productive information in first and second languages.

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