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Frequency effects in grammatical development: a cross-linguistic, functional approach to form–function mapping

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Ambridge, Kidd, Rowland, and Theakston (this issue) present a comprehensive review of frequency effects in child language acquisition, which is a welcome addition to the growing literature of functionally based research on child language acquisition. In this commentary, I will offer some examples of my own cross-linguistic research on form–function mapping that I have pursued in the past, as one effective method for understanding the effect of input frequency.

In the acquisition of tense–aspect morphology, strong effects of verb semantics have been observed cross-linguistically. Namely, children associate past-perfective morphology with telic verbs, general imperfective morphology with atelic verbs, and progressive morphology with activity verbs, the last of which is dissociated from stative verbs (the Aspect Hypothesis; Shirai & Andersen, 1995). One important explanation for this observation was Bickerton's (1981) Language Bioprogram Hypothesis (LBH), a nativist proposal which assumed an innate predisposition that makes children sensitive to lexical aspectual notions such as the telic–atelic distinction (i.e. change of state) or the stative–dynamic distinction. Shirai (1991; also Shirai, 1994; Shirai & Andersen, 1995) proposed an alternative account, hypothesizing that input frequency can explain the observed semantic bias (e.g. children use past tense marking predominantly with telic verbs, which reflects frequency bias in the input) by comparing frequency of past tense and progressive morphology in English in parental speech and children's acquisition in the CHILDES database (MacWhinney, 2000), observing that approximately 60% association in the input is translated into 95% association in child language.

This correlation observed in English and other European languages such as French and Italian, however, is predicted by both the bioprogram account and the input-frequency account, because what LBH predicts to be acquired early is also frequent in the input. Shirai (1993, 1998, Shirai & Suzuki, 2013) then tested the competing accounts with the Japanese imperfective aspect marker *-teiru*, for which two theories make differential predictions because, in Japanese, what LBH would predict to be acquired early (i.e. *-teiru* with activity verbs) is not frequent in the input. The results indicated that input frequency is the better predictor, and thus supporting the input-based account.

With regard to the subject primacy in relative clause acquisition that Ambridge *et al.*, discuss extensively, Ozeki and Shirai (2007a) conducted a corpus study in Japanese, using the same methodology employed in Diessel and Tomasello's (2000) English study. They found clear support for input frequency. In Japanese, there was no subject primacy; children's relative clauses were evenly distributed between subject relatives, object relatives, and oblique relatives. Moreover, this exactly mirrored the frequency distribution in the input. Chen and Shirai (2014), as noted by Ambridge *et al.*, also failed to observe subject primacy in Mandarin Chinese, and argued that the lack of subject primacy is due to contributions of multiple factors.

Common to these studies I have conducted (often with colleagues) is keeping linguistic domains and analytical methods constant to the extent possible, and comparing input and children's production, both cross-typologically (e.g. English and Japanese) and intra-typologically (e.g. Japanese and Korean; Ryu & Shirai, in press). In particular, we often find surprising distributional biases in the input that we did not expect based on our intuition (called 'source conflict' by Hopper, 1997). For example, the Japanese causative morphology *-sase* is predominantly used to denote indirect causation of the permissive/assistive type (e.g. 'let/help the child eat') in the input to children, despite the fact that linguistic literature mostly use direct causation (e.g. 'make the child eat') as examples. This distributional bias is directly reflected in children's use (Shirai, Miyata, Naka & Sakazaki, 2000).

One may wonder why sometimes a distributional bias seems to influence children's form–function mapping strongly, while in other cases the input information is there, but is not taken up by the child. This is hard to know a priori because there is large variability in form–function mappings and how they are realized in input frequency both cross-linguistically and across different grammatical domains, and also because how children form form–function mapping is determined by multiple factors. For example, object relatives are more frequent in the input to children than subject relatives in English, but children seem to defy input frequency and acquire subject relatives first, as noted by Ambridge *et al.*, who attributed this subject primacy to its similarity to canonical word order in English. Another possible explanation, although not mutually exclusive, is the cross-linguistic difference in the apparently similar target structure, which argues that relative clauses in English and other European languages are syntactically based, while those of many Asian languages are governed by semantics and pragmatics (Chen & Shirai, 2014, Ozeki & Shirai, 2010), relying on Comrie's (2002) new typology of noun-modifying clauses. A similar subject primacy had been observed in the L2 acquisition of European languages, but was not observed in L2 Japanese (Ozeki & Shirai, 2007b), which they attributed to the different grammatical status of the noun-modifying clauses in many

Asian languages (Comrie, 2002, Ozeki & Shirai 2010). In any event, at least at this point, it is not easy to predict when and how much an input frequency bias will influence children's form–function mapping; we will need to conduct more cross-linguistic studies of the type outlined here to reach the stage where such predictions are possible (see discussion in Chen and Shirai, 2014, for an attempt with regard to relative clauses).

By accumulating this type of research on other linguistic domains, we can get a better understanding of the relative contribution of input frequency in grammar acquisition. Needless to say, these corpus-based cross-linguistic studies should be supplemented by experimental research as well as computer modeling, such as a connectionist simulation that takes into account and/or manipulates frequency in input structures (Li & Shirai, 2000, Ch. 7).

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