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DISCUSSION

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Grammars, parsers, and language acquisition

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Drozd's critique of Crain & Thornton's (C&T) (1998) book *Investigations in Universal Grammar* (IUG) raises many issues concerning theory and experimental design within generative approaches to language acquisition. I focus here on one of the strongest theoretical claims of the Modularity Matching Model (MMM): continuity of processing. For reasons different to Drozd, I argue that the assumption is tenuous. Furthermore, I argue that the focus of the MMM and the methodological prescriptions contained in IUG are too narrow to capture language acquisition.

Parsing to learn: a developmental paradox[1]

C&T make the assumption that, given the appropriate experimental conditions, children will perform in a qualitatively similar way to adults in experimental tasks. Since nativist researchers assume that children must set the parameters of their input language, child language is free to vary according to the parametric variation allowed for by UG. UG places a powerful constraint on language acquisition, since the child is largely spared from actively constructing language. Assuming continuity of processing lessens the burden further, as the process of converging on an adult parser is explained away.

However, assuming continuity of processing leads to a developmental paradox. As Fodor (1998) points out, parsers implement grammars, and if the parser is innate then it is presupposed that the child has already set the parameters of the input language BEFORE receiving input. Drozd correctly infers that this presents a potential problem for the MMM, since he argues it predicts instantaneous acquisition. However, recent work by Fodor and colleagues (Fodor, 1998; Sakas & Fodor, 2001, 2003) overcomes this paradox by suggesting children parse their input using a 'supergrammar'. The supergrammar parses parametrically ambiguous input using all the potential grammars allowed for by UG. Parameters are set when an

[1] 'Parsing to learn' was first used by Fodor (1998).

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unambiguous combination of parametric values are identified (i.e. when only one grammar can parse the input). Continuity of processing is assumed. The parser is serial and structurally-driven (see Fodor, 1998). The approach does not predict instantaneous acquisition since parameter values are sometimes set incorrectly, by virtue of the fact that the parser 'guesses' parameter values where input is parametrically ambiguous (i.e. when more than one grammar can parse the input). The approach appears to differ from C&T's approach on some issues, but is similar in spirit. Learnability solutions are not evaluated in IUG; the assumption appears to be that since the standard poverty of stimulus argument holds, children could not acquire language in any way but by setting parameters with the aid of a universal parser. Fodor's model represents one way in which this could in principle be done, with the advantage of avoiding the parsing to learn paradox.

However, there are still problems with assuming a universal parser. On the strongest reading, a universal parser enables the child to assign a structural parse to the input from birth. Many researchers may not be willing to attribute this level of sophistication to the nascent language learner; without such sophistication in the infant processor, the process of converging on an adult parser must be explained. Theories of adult sentence processing provide us with a working hypothesis about the architecture of the performance system, from which learnable aspects of the parser can be identified (and C&T's approach can be evaluated).

C&T suggest Referential Theory as a likely candidate for the parser, but there are many other theories of adult language processing. According to C&T, the parser is completely modular; only the output of the linguistic system can be affected by real world knowledge. However, even the dominant generative theory of adult sentence processing, Frazier and colleagues' Garden Path Model (Frazier, 1990), identifies a role for real world knowledge during reanalysis. Additional work within adult psycholinguistics suggests C&T's conceptualisation of the parser is oversimplified.

An accumulating body of research shows non-syntactic information plays a significant role in the parsing process (see MacDonald, Pearlmutter & Seidenberg, 1994). This information ranges from fine-grained semantic information (Altmann & Kamide, 1999) to course-grained 'good enough' heuristics that ensure a correct interpretation in a majority of cases (Ferreira, Bailey & Ferraro, 2002). These phenomena are argued to INTERACT with, and in some cases act logically prior to, syntactic constraints on comprehension. They are not accessed after an initial syntactic analysis, as is argued in Referential Theory. More importantly, they are language-specific, and so must be learned, threatening C&T's continuity of processing. This body of research identifies a central role for probabilistic information. Research investigating children's processing has shown that children

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are sensitive to these probabilistic co-occurrences (Snedeker, Thorpe & Trueswell, 2001; Kidd, 2003). These effects can be explained by 'probabilistic constraints' models of processing and acquisition (e.g. MacWhinney & Bates, 1989; Seidenberg & MacDonald, 1999).

Which approach is more explanatory is an empirical question, and research investigating children's processing has been sporadic (but see MacWhinney & Bates, 1989; Frazier & de Villiers, 1990). Drozd points out that C&T have never tested the predictions of Referential Theory with children. Perhaps they will begin to do so. I suspect C&T will be unable to definitively decide between competing approaches of processing using the limited range of methodologies they consider suitable for child language research. Reaction time techniques such as preferential looking and eye tracking provide researchers with high-resolution on-line data that allow a unique look into the real-time language processing system of the child. These techniques provide a degree of sophistication that the truth-value judgment task and elicited production cannot. Developmental psycholinguistics has advanced to its current point because we have many experimental techniques at our disposal (see McDaniel, McKee & Cairns, 1996). It would be unwise to take C&T's advice and discard these tools.

Conclusion

I have argued that a central tenet of the MMM – an innate parser that directly implements a competence grammar – cannot account for empirical results in either adult or developmental psycholinguistics. Children need parsers, but contra C&T, parsers are not simple instantiations of a competence grammar. They are psychological mechanisms that must process language in a rapid and efficient manner given the real-time pressure of on-line computation. I have argued that an interactive constraint-satisfaction parser that utilises multiple sources of information is a better candidate to explain processing in development. An implication of this approach is that parsing preferences are forged during the acquisition process, thus identifying an important role for acquisition research in the advancement of processing theory (see Townsend & Bever, 2001). Future empirical research that is motivated by processing theory and that makes use of multiple experimental methodologies is needed to decide between the competing approaches discussed.

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