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Proceedings of the Twelfth Annual Meeting of the Berkeley Linguistics Society (1986), pp. 328-339

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A LA RECHERCHE DU TEMPS DE VERBE PERDU:
Semantic Bootstrapping & the Acquisition of the Future
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This paper is a part of a larger ongoing research project on the acquisition of temporal reference; a project which hopes to develop a description of temporal reference adequate to the task of describing its acquisition. However, in this paper, we are simply going to discuss one problem: the acquisition of the future tense.

In her 1980 paper "The Acquisition of Time Talk: relations between child and adult grammars", Carlota Smith has argued that it is possible, on the one hand, to claim that when young English speaking children use morphological tense, they are expressing temporal ordering notions (as opposed to aspectual notions) and, on the other, to explain just those tenses which they do control by means of a Reichenbachian approach to the tense system. Smith spends much of her paper dealing with the first claim. We will here discuss only the second claim, simply assuming Smith's tense/aspect argument for the most part and referring unbelievers to Smith (1980).

Smith (1980) argues for a continuous relation between child and adult temporal grammars. She proposes that children have a restricted Reichenbachian framework for tense, and that adults instantiate the full system described by Reichenbach (1947) (cf. also Smith 1978; Hornstein 1977, 1981; McCawley 1981; Comrie 1981, 1985; Steedman 1982; among others, on Reichenbachian systems for adults). A full system involves three times, and relations between them. The times are speech time (ST), reference time (RT) and event time (ET); the relations are simultaneity (or, in some versions, overlap) and precedence. ST is the time of the utterance. ET is the temporal location of whatever it is the sentence reports. RT is (as defined by Smith in an earlier article) the time relevant for determining the truth or falsity of the sentence (proposition determined by the sentence/context pair), or (as defined by Richard Weist, in press) the temporal context which is identified. In standard Reichenbachian systems, all three times must be specified for all tenses, and no more than one of any time type is permitted.

Within the standard Reichenbach analysis, then, the simple past, present and future tenses form a

natural class in that they are the only ones wherein the RT and ET are simultaneous. They differ, obviously enough, in the relation these two have to the ST; in the past they precede ST, in the present they are all simultaneous and in the future ST precedes the other two. These three tenses can be contrasted to the perfect tenses, where the three time types are disassociated, or RT co-occurs with ST.

Smith (1980: 265) suggests "that children's early temporal ordering system differs from the adult system in two ways: only two times are involved, and orientation is fixed at ST." (1) In the adult system, there are "shifts in orientations, such as complements that orient to matrix sentences and fictional narratives" (Smith 1980: 265). There is thus an apparently clear sense in which the child's system is a proper subset of the adult's on Smith's proposal. But note that this system formally only excludes the complex tenses for which the third time type is not redundant information.

Smith concludes, after reviewing evidence presented by Bronckart & Sinclair and others, and after her own experimental investigation of the use of tense by 4- to 6-year olds, that not only do the youngest children have a restricted version of Reichenbach's system, but also that there is an intermediate stage between that restricted version and the adult fully specified system. She claims, in other words, that the course of acquisition should be seen as divided into two parts, Stage I and Stage II. Of stage one she says "[t]he syntax of Stage I is limited to verb inflections in French and English." Of stage II, Smith says that it "allows a focal point other than ST....[t]he wider range [of temporal reference possibilities] comes from flexible use of the times and relations rather than from additions to the system" (Smith 1980: 276). The example given of Stage II speech is plans about what children will/want to do, i.e. reference to the future. Note that, then, stage II describes the child who refers to future events.

Well, according to this, there is an asymmetry among the simple tenses whereby the past and present tenses are mastered before the future.

This is then the issue that we address. Smith suggests that futures are acquired later than the present and past, but neither the adult Reichenbach system nor the subset allowed the child provides any motivation for this developmental asymmetry.

A sceptic might all too quickly conclude that the Reichenbachian approach has nothing useful to add to

language acquisition studies. Let's agree for the next 10 pages to reject that conclusion. Our goal here is not to question the framework but to see what can be answered with it.

A defender of Smith might point to the fact that English does not have any verbal inflection that signals the future, and so it is no wonder that there is an acquisitional asymmetry. According to Smith (in her 1978 article) the future in English is manifested by means of a tense and time adverbial pair. As also noted, however, Smith points out that the developmental asymmetry holds with respect to French, and French does have future inflection on the verb. So, whatever is the cause of the staggered acquisition of tenses, it cross-cuts any simple reliance on morphological markings. (2)

One might wish to point to the modal nature of the future tense as a reason for the developmental asymmetry. As Gerhardt (1983) says "semantically it is an unrealis notion, imbued with modal overtones...futurity is never a purely temporal concept". This issue has just started to be addressed in the child language literature (most completely by Gee-Gerhardt 1983), and in fact the modal underpinnings and overtones of the future tense surely could give pause to the language learner. They are not, however, reason to assume an a priori ordering of acquisition. (3)

So, there is still a place for an explanation of why, despite the formal symmetry and lack of consistent encoding strategy across languages, the future should be acquired after the present and the past in a Reichenbachian framework.

At this point we will appeal to an independently motivated acquisition theory, one that might account for the acquisition of semantic notions other than just time. We will work with a version of the Semantic Bootstrapping approach to acquisition that has been most recently elaborated by Steven Pinker (1982, 1984; although see also Grimshaw 1981; McNamara 1982; Wasow 1983 and others). There are important parallels and differences between Semantic Bootstrapping (henceforth also SB) and Organizing Principles such as those advocated by Dan Slobin, however space constraints force us to leave out discussion of the issues involved.

SB is, strictly, an approach to grammar acquisition, and this is significant: formal, syntactic stuff such as verbs, nouns, etc are the units of acquisition (rather than cognitive structures, for

example). The basic idea driving SB is this: there are a number of imperfect correlations between formal properties / categories that the grammar requires, and semantic properties / categories which a language learner might plausibly have cognitively and perceptually available antecedent to language; the child initially uses these imperfect correlations as if they were perfect, thus acquiring a subset of some grammatical category; later, purely grammatical properties are used to extend the set to those members of the category which did not enter into the initial correlation, completing acquisition. So, in particular, a child might initially acquire the categories noun and verb on the basis of semantic / cognitive categories such as physical object and physical action, respectively.

It is important to note that it is the categories of the adult grammar, noun and verb, which are acquired, not the semantic correlates, since, if it were the latter, the acquisition problem would remain, given that the adult categories do not correspond to any straightforward semantic notions. In the case of noun or verb, morphosyntactic information--distribution, co-occurrence privileges, inflectional/-derivational morphology--can be used to extend membership in the category beyond the initial "semantically transparent" members.

Our strategy now is to argue that our Reichenbachian child can become a Reichenbachian adult by means of SB. Our first claim in this regard is that it is no accident that RT is the odd time out. RT is qualitatively different from the other two times; it is, as well, the rather most distinctive part of Reichenbach's system (cf. Hornstein 1981). The difference between RT and the other two times is an ontological difference. RT is a theoretical term--it is definable only by means of the theory of tense. ST and ET, on the other hand, are observational terms definable (initially) by means of cognitive and perceptual information independent of purely linguistic knowledge. Another way to put this might be as an observation-inference distinction: knowledge of RT is much more heavily dependent on inference than is that of ET & ST. The intuition is that there exist, independent of knowledge of language, events of various sorts, including speech events, with specifiable, recognizable temporal locations, while, contrariwise, the existence of reference times, with their temporal locations, depends on an antecedent means of referring to events in time (cf. Fodor 1984 on observation vs.

inference).

As of yet the putative parallel with the syntactic category example might seem unconvincing. In those standard examples, no new category is posited; an existing category has its membership extended by altering the criteria so that environmental salience of referents is replaced by formal, system-internal properties. In our case, an entirely new time, RT, is created, apparently de novo. The asymmetry is merely apparent, however. We are assuming that the child is acquiring a logical syntax, the Reichenbach tense analysis (see Hornstein 1977, 1981 for more on this very problem). We are not assuming that the child must learn the relations of precedence and simultaneity (overlap), nor that there are time types. What the child must learn is what the time types are, which of the possible tenses they realize, and how.

On this view, the analog to a syntactic category, such as verb, is the general category time type, and the specific types are analogous to subclasses of verbs (e.g., transitives, intransitives). That is, just as the child is acquiring, but not creating, the formal category verb with its specific subtypes, so the child is acquiring, but not creating, the formal category time type with its specific subtypes. The problem is to match bits of the linguistic environment with bits of the formal vocabulary provided; the SB solution is that some of the linguistic environment correlates with the non-linguistic environment in ways that are perceivable as non-random by the child, and this offers the way into the formal system.

In the specific case at hand, ST & ET are claimed to be environmentally transparent, as we might say, in a way that RT is not. We are suggesting that the child comes ready to find time types and that a developmental asymmetry is expectable vis-à-vis which types are acquired when. So, the child is equipped with some notion of time type and is ready to impose ordering relations on these things, whatever they might be. Further, we assume that the child begins to have events cognitively and environmentally available, about which to speak, and including speech events as one subtype. Given that the simple present and past are analysed as involving just ST and ET, we can see how it is that the child comes to first understand and use the linguistic encodings of just these tenses.

Well, almost anyway. Because we still have not explained why the third simple tense, the future, is not part of the system. Here things get a little more

complicated as we expand the notion of semantic bootstrapping to something we would very tentatively like to call 'cognitive bootstrapping'.

We propose that it is just the property that makes RT the oddball of the time type system that makes future the oddity of the simple tenses. That is, it is the lack of environmental transparency that explains the future's later acquisition relative to the other simple tenses. No child (nor anyone else) will have had an environmentally salient experience of the future. Fleischman (1982: 22-3), writing in a tradition that goes back at least to Aristotle (cf. Dahl 1985), notes the "...cognitively more abstract, irrealis nature of future as an ontological category vis-à-vis the more tangible and empirical past or present." So, the relating of linguistic forms to the logical syntax will initially be mediated both by the sorts of things whose temporal locations are used in the logical syntax ((speech) events) and by properties of the temporal location the tense picks out (experientiable or not). The child is faced with a multi-level problem.

Assuming, then, that the child comes to recognize that experienced times are referred to by means of a system that makes use of time-type-events, we are faced with the question of unexperienced times and nonevents. That is, how does the child come to tenses other than the past and present, and times other than ST and ET, and is there any order inherent to this process.

A strict ordering might seem required whereby the future would be acquired before any tense that requires RT, since, as has been duly noted above, future is formally on a par with past and present, and so its postulation might simply be a matter of pattern completion, as we might say. This has an odd feel to it, however, in that it presumes no cognitive change is needed to understand the concept of futurity--or, at any rate, that such a change could be driven purely by considerations of the logical syntax of the temporal reference system--and we have presumed that at least initially general cognitive abilities are crucially involved in language acquisition.

The alternative is that considerations of formal symmetry would not weigh heavily enough to push acquisition in the direction of the future? In this case, RT could be acquired next. We feel obliged to point out here that acquisition of RT does not necessarily imply simultaneous acquisition of the complex tenses--i.e. present perfect, etc. Remember that in the adult system, all three time types are

required for the specification of all tenses, simple and complex. The child just acquiring RT would not necessarily immediately experiment with them in complex configurations. We might, rather, expect experimentation with them in conjunction with one of the other time types. An examination of the typical learner errors at this stage of development would be relevant.

Notice that so far the decision is only in terms of which alternative to choose first since ultimately, of course, both must be done. In fact, whichever is done first, the problem recurs immediately, since the increased expressive power of the system is limited to one additional tense, given the one new parameter.

It is this very constrainedness which is the power of the Reichenbachian tense system, and which makes it so appropriate to describe acquisition. What we would like to do is capitalize on the formal restrictiveness in such a way as to be able to tie together the apparently independent parameters of temporal location and time type, so that the child is led to future and RT in a single step and the possibilities of other locations or types never have to arise, given the adequacy of the now doubly augmented system. In other words we are going to suggest that the semantic bootstrapping of RT and cognitive bootstrapping of the future in some way depend on each other. What we are looking for is a data driven solution to this learning problem. That is, we want to locate something plausibly in the linguistic environment of the child that would enable (or, better, require) the simultaneous extension of both the domains of time types and temporal locations. This is exactly in keeping with the SB approach we advocate, since it is new data, unanalyzable in terms of, but apparently in a paradigmatic relation with, the semantically transparent categories that have already been established, which motivate the child's altering the intension (and extension) of the class in question (e.g. time type, as discussed above).

One place to look for this data-driven solution is in the linguistic environment of the child, and linguistic output produced by the child. We mentioned earlier that, in English, in the child's linguistic environment--ie speech by adults--there is no morphologically specified future but rather, according to Smith, a present tense and time adverbial pair. In the adult system it is also, according to Smith (and Hornstein) "the combination of tense [by which Smith means morphological inflection JC/RC] and adverbial

that establishes RT." As to children's speech, Fletcher (1979) reports that when will is first used to refer to the future, the support of a temporal adverbial seems to be "felt as necessary" by the child. In French, adverbs are seen in conjunction with first the present, then the periphrastic future, and finally the simple future, in children's speech to refer to posited or desired states of affairs in the future. In other words, when the future tense is first used, in both languages, it is accompanied by temporal adverbials. And it is temporal adverbials in the adult language which mainly serve to mark the RT.

So, the secret is out, and the secret word is adverbs. Not too surprising given that in many semantic domains adverbs are acquired before inflectional markings of the category. Weist (in press: 367, 373) seems to come to the same conclusion when he writes of the intermediate stage:

The restricted reference time system is characterized by the onset of temporal adverbs and the use of temporal adverbial clauses....In general, temporal adverbs are used to establish reference time and the onset of the restricted RT system is relatively stable across diverse languages.

This restricted RT system is exactly what we were referring to earlier: that stage where RT is introduced but the full Reichenbachian system (i.e. complex tenses) is not yet instantiated. What we want to suggest, then, is that it is future oriented adverbs that push the child into extending the Smith (1980) system into full Reichenbachian glory.

The story goes something like the following: The child controls a temporal system with ET and ST. Temporal adverbials occur in the linguistic environment and must be integrated into the temporal system. As Hornstein suggests, some temporal adverbials can associate with ET--this allows the integration. But not all temporal adverbials associate with ET; some associate with RT. We thus have just the sort of situation that Semantic Bootstrapping requires: a paradigmatic class (temporal adverbials) in which a subset is acquirable by means of an environmentally transparent relation (by association with ET) but acquisition of the entire class requires extending a category (time types) into an environmentally opaque domain (i.e. RT). There are, then, distributional/morphosyntactic data (the fact that some temporal

adverbials do not associate with ET) which lead the child to a third time type.

This doesn't directly address the question of the future, however. In fact, as we hinted at above, we want to suggest that Semantic Bootstrapping cannot directly address the future (don't worry if the title of the talk now sounds misleading). This is because temporal locations (past, present, future) are not formal categories, but rather conceptual categories. This is not to say that they don't have formal reflexes as Reichenbachian time type sequences; it's just that the problem here isn't extending a category, it's figuring out its interpretation. The problem for the child is: what is an 'ST precedes ET'. There is a parallel with the Semantic Bootstrapping treatment of RT: there are one opaque and two transparent objects in each domain. RT versus ET and ST, and future versus present and past. But, as noted, the temporal locations are not formal categories.

What we would like to claim, however, is that the Semantic Bootstrapping account of RT provides for the acquisition of the future as a side benefit. Among the temporal adverbials associating with ET are future oriented ones, which will be the conceptual bootstrap the child uses to answer "what is ST precedes ET". If we allow the formal asymmetry to exert pressure (bias the learner) (a somewhat weaker and perhaps more plausible claim than the strict ordering mentioned earlier) then we can suggest that the child will be inclined to try and explicate the obscure future-oriented adverbials. Further, the adverbials are useful just because they are full words or phrases with structure and denotata: they are linguistic things about which information can be easily requested and given (see the commonly reported "Mommy, is it tomorrow yet? Is it after juice yet? What is a Saturday?"), unlike, say, verbal inflections.

So, future is not semantic bootstrapped: it is conceptually bootstrapped. This Conceptual Bootstrapping piggybacks on the Semantic Bootstrapping of RT by means of temporal adverbials. To put it another way, the child has found an operating principle that works and, following another operating principle, has thus applied it several times.

To sum up, we have pointed out an asymmetry in the course of acquisition of tense which is not predicted by the formal symmetry in the Reichenbachian analysis of tense. We have proposed an account that motivates this mismatch, and then resolves it.

Our next task is clearly to test our operating

principle -- acquisition of the future piggybacks on the Semantic Bootstrapping of RT -- in new linguistic environments --more languages, and more language acquisition data --to see whether it generalizes.

In other words, it seems to us that whether or not children are little linguists, there is one very real sense in which linguists should be big children.

FOOTNOTES

* We would like to thank Ruth Berman, Julie Gee, John Goldsmith and Dan Slobin for pre- and post-presentation discussion. The fault is all ours for not taking more account of what they said.

1. In fact, the term 'orientation' in Smith's article seems not to refer to the third time type (RT) at all but to an entirely different and obscure notion, which is not explained in this paper. What the reference point actually is, and what it might have to do with the notion of orientation is treated more extensively in Cassell (in preparation).

2. Pursuing this a bit further, it is worth pointing out that even if French, too, marked futures by means of a tense and temporal adverbial combination, as Smith has argued English does, there would still be an explanatory lacuna. First, one would require some independent explanation for the observation, in this hypothetical world, that children initially acquire those tenses that are inflectionally signalled, and only later learn those that require adverbials as well. In the absence of an independent account of the general primacy of inflections, the observation of such an effect in this case would be the statement of a problem, not a solution to one. Second, one would want to know why the tenses should have arrayed themselves as they did. That is, given the formal (logical) symmetry of the three simple tenses, it is mysterious, in this hypothetical state of affairs, why they should find themselves consistently encoded asymmetrically. Notice that this problem is independent of the first, since even if there were some account of inflectional primacy forthcoming (which, from the literature, seems unlikely), there would still need to be some other independent reason for the tenses to be matched to their particular encodings.

3. This might not be obvious, so we'll elaborate a little. As noted, Gerhardt (1983) argues for the modality of the future in child language. Without a

similar argument that the adult future is modal, the acquisition problem has only been deepened by this analysis of child language. Note that an analysis of the adult future as modal would need to explain all generalizations expressed in tense-based systems -- eg. the adverb rules of Hornstein 1977, 1981. We know of no such analysis. Should there be an analysis of adult temporal systems analogous to Gerhardt's account of the child's, it is still not clear that the tense-based approach would be irrelevant. Note that Gerhardt says that "futurity is never a purely temporal concept..." which at least strongly implicates that it is always at least partially temporal. This suggests to us an interaction effect: the tense system (say, a Reichenbachian system) and the modal system come together in the expression of futurity, but each requires separate analysis. Such modular thinking is hardly novel.

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