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See also **Indo-European 1: Overview; Semiotics; Structuralism**

Bever, Thomas

Within linguistics, Thomas Bever can be considered a renaissance scholar. His work impacts the fields of theoretical linguistics, psycholinguistics, cognitive neuroscience, reading, esthetics, and language development. He is probably best known for his work that distinguishes independent systems of language processing (production and perception) from the system that represents grammatical knowledge. He argues that the universal properties of language can come from a variety of sources, including what can be said, understood, remembered, and learned, and are not necessarily the result of grammatical knowledge.

Originally interested in music and theater, Bever reports that he decided to take a major in linguistics primarily because it was the course of study with the fewest requirements that involved language courses. While an undergraduate, he worked in the psycholinguistics lab of Margaret Bulowa (assisting in an early study of language acquisition using a camera system he designed). His undergraduate thesis was on the stages of the acquisition of phoneme perception in infants. He was one of the first students in the linguistics doctoral program at MIT, where he studied both linguistics (mostly phonological theory under Morris Halle) and psychology.

In 1964, Bever was elected to the Harvard Society of Fellows, where he worked in the laboratory of George A. Miller. He continued working with Miller when they both moved to Rockefeller University in 1967. It was in Miller's lab that he first explored the question of the relationship between formal grammatical models and psychological reality. Here, he collaborated extensively with Jerry Fodor, Merrill Garrett, and Jacques Mehler. Bever's earliest work was partly a response to behaviorist claims that speakers and language learners do not have access to 'abstract' or 'deep' levels of language. Using perceptual experiments, Bever and his colleagues showed that speakers

do indeed have access to abstract grammatical information. The experiments involved placing a click in a neutral place in the stream of sounds. People tend to perceive these clicks not in the place where they actually occur, but at some phrasal boundary. Bever extended these tests to even more abstract structures. The following two sentences, although apparently similar on the surface, differ in the deep semantic relations underlying them. In (2a), the noun phrase *the troops* is the patient of the main clause. In (2b), the troops is the agent of the embedded clause:

- (2) (a) The general defied the t/roops_i [to fight]
#
- (b) The general desired [the t/roops to fight]
#

(from Bever 1998:128)

Syntactic constituency is marked with square brackets; the placement of the click is marked with a slash. People perceive the click in different places (marked with a #) in the two sentences, corresponding to the structure of the sentence. The click experiment showed that speakers were aware of the deep semantic difference in the structure of these clauses: the click was perceived at a clausal constituent boundary reflecting the deep positioning of the noun phrase.

These click experiments led Bever to another major area of research, that of cerebral dominance (the idea that one half of the brain is more powerful) in language and other cognitive skills, both in humans and in animals.

Perhaps Bever's most important contribution to linguistics showed that there is no single system that contributes to our production and processing of language. In Generative Grammar, there are a set of rules

for generating the structure of sentences. These rules constitute our knowledge or 'competence' in language. Linguists tap this knowledge using acceptability judgments. In early work, George Miller hypothesized that the set of generative rules were essentially identical to the set of processes we use to produce and decode sentences. One consequence of this idea is that the more rules involved in generating a sentence, the harder it should be to produce or understand; this hypothesis is often known as the 'Derivational Theory of Complexity'. While initial experimental results testing this were promising, several studies by Bever and his colleagues showed that it was based on some faulty assumptions about how the rules were organized. Bever (in work that continues up to the present time) suggests that perhaps more than one system is at work when processing or producing a sentence. For example, when hearing a sentence, one uses a set of perceptual strategies to provide an initial structure to the sentence. One example of such a strategy is the idea that noun-verb-noun (NVN) sequences map onto agent-action-patient semantics; another is that the first noun-verb sequence heard constitutes the subject and predicate of the main clause. These perceptual strategies are not the same as the generative rules that give us acceptability judgments. Instead, these strategies form a separate cognitive system. Evidence for this proposal comes from the fact that at the stage when children seem to rigidly use perceptual strategies in other domains (such as in estimating numerosity)—at approximately 3 years of age—they rigidly apply linguistic perceptual strategies to sentences they hear, often doing much worse than younger children. For example, in tests where they are asked to identify which picture is best associated with a particular sentence (3), 2- and 4-year-olds both correctly identify *Big Bird* as the agent and *Cookie Monster* as the theme. However, 3-year-olds reverse the roles, consistent with the NVN strategy, which treats the first noun as an agent.

(3) Cookie Monster was hit by Big Bird

Since there is a stage at which children seem to exclusively use these perceptual strategies, it seems reasonable to conclude that they exist.

Obviously, these perceptual strategies must relate in some way to grammatical rules. Bever claims that we use both systems in a kind of 'analysis by synthesis': we use perceptual strategies to provide an initial hypothesis about the structure of the sentence and the semantic relations that underlie it, then we go back with our generative rules and check the structure. One piece of experimental evidence that he presents is that tone and click perception at the end of clauses is poor, suggesting that this is the stage at which synthesis is occurring.

Bever's wide-ranging interests reflect the complexity of the phenomena he studies. His work has raised ques-

tions about the intersections among language acquisition, sentence processing, formal grammar, and neuroscience (among other areas) and has shown that one cannot thoroughly theorize about any one of these without considering the interactions with other domains.

Biography

Thomas Bever was born in Boston, Massachusetts, on December 9, 1939. He completed his B.A. (1961) magna cum laude with highest honors in psychology and linguistics from Harvard, tutored by Roman Jakobson, and his undergraduate thesis was on the stages of the acquisition of phoneme perception in infants. His Ph.D. (1967), Massachusetts Institute of Technology, dissertation on Menomoni phonology was supervised by Morris Halle. He was Lecturer, MIT Psychology department, 1964–1966; Assistant Professor, 1967–1969, and Associate Professor, 1969–1970, Rockefeller University; Professor of Psychology, Columbia University, 1970–1986; Chairman, Columbia University Interdisciplinary Ph.D. Program in Psychology and Linguistics, 1973–1986; Pulse Professor of Psychology and Professor of Linguistics, University of Rochester, 1985–1995; Head, Language and Cognition Program 1986–1989 and 1992–1994, Director, Cognitive Science Program 1991–1992, Director, Center for the Sciences of Language 1988–1995 at the University of Rochester; Research Professor of Cognitive Science, Linguistics and Psychology, University of Arizona, 1995–present; Head, Department of Linguistics, University of Arizona 1998–2003; Phi Beta Kappa 1961, National Institutes of Health Predoctoral Fellowship 1962–1964, Harvard Society of Fellows 1964–1967; National Science Foundation Faculty Fellowship, summers 1974–1977, Guggenheim Fellowship 1976–1977, Fellow, Center for Advanced Study in the Behavioral Sciences 1984–1985; Vice-President, the Rockefeller University Chapter of the American Association of University Professors, 1969–1970; and Co-founder and Associate Editor, *Cognition*, 1973–present.

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ANDREW CARNIE

Bilingual Acquisition

Children growing up exposed to two or more languages acquire each of them in much the same way as monolinguals (speakers of just one language). Bilingual acquisition during childhood can thus be regarded as an instance of simultaneous acquisition of two 'first' languages. In fact, if children are exposed to more than two languages simultaneously, they are able to acquire full competence of each that does not substantially differ from the speaking ability of monolinguals; bilingualism is therefore a special case of multilingualism.

Comparison with monolinguals is one of the main issues in research on bilingual acquisition. It can be extended to all types of acquisition where more than one language is learned, independently of age of onset and proficiency attained in each language. The present discussion, however, is limited to child bilingualism. Whether types of bilingual acquisition should, in fact, be distinguished according to the age of onset of learning ('bilingualism' vs. 'foreign language learning') depends ultimately on the results obtained in these comparisons. Given our current state of knowledge, it is plausible to assume that age of onset is a crucial factor causing fundamental differences between child and adult language acquisition. Consequently, it is necessary to distinguish between simultaneous and successive acquisition of bilingualism. 'Simultaneous' acquisition does not necessarily imply that the child has been exposed to both languages from birth, although this interpretation has

occasionally been suggested. The controversial issue here is the age range during which changes occur, which result in qualitative differences between first and second language acquisition. Although sufficient evidence is not yet available, the period around three years of age appears to be of particular significance. The most widely accepted view is that one may qualify as 'simultaneous' those instances of bilingual acquisition where the child is exposed to two languages before the age of three. In this case, each language of the bilingual is predicted to share crucial similarities with that of the respective monolingual speakers but to exhibit differences in comparison with languages learned at a later age.

The insight that bilingual acquisition proceeds in the same way and leads to the same type of linguistic knowledge as monolingual acquisition is largely due to a number of case studies carried out in the late 1970s and 1980s, although the first monograph documenting the linguistic development of a bilingual child (Ronjat 1913) arrived at a similar conclusion. Until the 1970s, it was frequently assumed that bilinguals face serious difficulties in separating language systems and that they run the risk of ending up with mixed languages. Such views were often the result of inadequate research methodologies. Large-scale studies, frequently focusing on disfavored minority groups, failed to perform in-depth analyses of bilingual language use. Early case studies, carried out by amateurs without the appropriate training, analyzed the language use of