true of Jackendoff's conceptual structures? They can't. Take just the last case. If I apply "beer" to the structure conceptualized by me *now present in my head and that normally is tokened in the presence of beer* (but which can be tokened whether or not there is beer actually nearby), how could my thought be false? It can't. There is no mismatch with *my reality* and *no falsity according to me.* So it is not *thoughts* that are trapped in the brain, according to Jackendoff's picture. Thoughts really can *be false* (not just *conceived false,* whatever that comes to in his semantics [p. 329]).

Finally, at the end of the day one often wants a beer. In Jackendoff's proposal, what one actually wants is a beer percept or an as-perceived-beerly-by-me conceptual structure to be tokened. Not for me – I just want a beer.

NOTE

1. Editor's note: "f-mind" stands for "functional mind" (Cf. *Foundations,* p. 21).

On the role of frame-based knowledge in lexical representation

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Abstract: In this commentary I discuss the role of types of knowledge and conceptual structures in lexical representation, revealing the explanatory potential of frame-based knowledge. Although frame-based lexical semantics is not alien to the theoretical model outlined in Jackendoff's conceptual semantics, testing its relevance to the analysis of the lexical evidence presented in his book has been left out of consideration.

Through the years, Jackendoff's approach to describing lexical representation and characterizing the nature of lexical storage and retrieval has been strictly conceptualist. However, in *Foundations of Language* (Jackendoff 2002) he has not addressed several factors of the mental representation of lexical information extensively, and consequently, various important details have remained unexplained or have been overlooked. One of these concerns the relation between the linguistic (i.e., the "dictionary") versus the encyclopedic meaning of lexical items; that is, as Jackendoff refers to them in discussing the views of others, their semantic versus pragmatic potential (Jackendoff 2002, pp. 285–86). I would argue that in discussing this conceptual facet of lexical representation we are not strictly facing meaning. Rather, in my view, we are facing here various types of knowledge and their conceptually based role in lexical representation and the mapping of meaning. As outlined by Clark (1992; 1996) and by Andor (1985; 2003), however, the relation does not only hold between "dictionary" (i.e., lexical) and encyclopedic types of knowledge, but is manifold and can occur as a result of the interaction of multiple types of knowledge, including generic and private or socio-cognitively based communal and expert knowledge during communication. All of these types of knowledge contribute to the common ground shared by speakers of a linguistic community (Andor 1985; 2003; Clark 1992; 1996, p. 92–121). In *Foundations,* Jackendoff does not address in detail the complex issue of the relation between these types of knowledge based on empirical evidence. For instance, how exactly does encyclopedic knowledge, a body of stereotypically-based knowledge, serve as a source for lexically represented knowledge? Conversely, does the latter type of knowledge serve as a source for the saturation of lexical meaning embodied by the lexical items represented in a given language?

Nor is the issue of the role of frame-based, scenic and scriptal knowledge in lexical storage and retrieval, as well as in the representation of lexical and encyclopedic knowledge types, discussed, although Chapters 9, 10, and 11 abound in traces of this domain. Jackendoff refers to difficulties in separating domains of encyclopedic and lexical semantics, for instance, in clarifying the difference between the lexical meanings of *murder* and *assassinate.* He argues that the "latter implies a political motive on the part of the agent" (Jackendoff 2002, p. 286), but fails to identify the real core of difference: These verbs belong to the lexical networks in the representation of different conceptual scenes and frames, and thus have different scripts of associated performance in their conceptual makeup.

This is an important issue to be taken into account in studying the criteria and borderlines of synonymy. Although words that are members of a given lexical field may fall into different types of synonym sets, some of them may be freely substitutable by another member of the same field and may even show the same patterns of syntactic alternations, and hence be identified as absolute synonyms; others in the same domain may be near or partial synonyms only (Cruse 2000, p. 156–60). Absolute synonymy is known to be quite rare. According to Jackendoff, items are synonymous in case they are mutually subordinate (1983, p. 104). But perhaps the most important issue concerning the set of criteria of synonymy has been overlooked by researchers of the field: Although lexical items belonging to a given lexical field may share similar denotational, categorical, subcategorization, and perhaps even selectional and relational features (i.e., argument structure), they may still reveal different grades of distance in prototypicality due to differences in their frame relatedness and the scriptal makeup of their background concepts. The higher the frame dominance, the greater the distance from the prototypical instance within the given lexical domain, and the looser the synonym relatedness to other members of the field.

This can be tested experimentally. For instance, within the domain of verbs of cutting, *mow, trim,* and *prune* are quite distant from *cut,* the prototypical member of the group, whereas *slice* is nearer. Concerning verbs of jumping, *bounce* is lower down in the gradience of prototypicality than are *spring* and *hop,* whereas *prance* and *dance* are even further away from the prototypical member *jump* in this lexical domain. Features of categories and their lexical representation in a certain domain occur as clusters, as pointed out by Jackendoff and others. However, an important property is overlooked: The more types and kinds of features are shared by members, the higher the rate of prototypicality manifested, but at the same time, a high coincidence of feature clusters results in a lower rate of frame dominance. In Jackendoff's view "the prototype is simply an instance that happens to maximally satisfy the cluster conditions" (2002, p. 356). I believe that the role of the prototype lexical concept in a lexical field is more marked: It is the item that provides the criteria of coherence within the lexical domain and sets boundary conditions on membership in its lexis.

Finally, let me briefly address Jackendoff's approach to the interesting issue of frame-based reference, the case of frame-based lexical items. In his conceptualist view, "reference is taken to be at its foundation dependent on a language user, . . . being in the *real* world is *not* a necessary condition" (2002, p. 304). Such is the case of *unicorns, dwarfs, trolls, goblins, chimera,* and so forth. All such entities require some rate of conceptualization, as Jackendoff suggests, in at least some minimal way to gain reference (2002, p. 304). However, he fails to provide adequate terminology for such cases of items. As frames are types of conceptual structures which are based on global and stereotypical information, are dominantly dependent on encyclopedic knowledge, and are acquired in lack of direct exposure to empirical experience contrary to scenic knowledge (Andor 1985), the above lexical items are typically acquired and retained in memory on such grounds. A great many lexical concepts such as *marmots,* but even *tigers* or *cows* may first be acquired on such grounds, and then, based on exposure to direct experience, scenic knowledge, their content is modified and standardized upon speakers' gaining full lexical competence. Thus, their feature makeup may show analogies to those acquired on the basis of scenic knowledge.

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brain, Meaning, Grammar, evolution

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Abstract: I reject Jackendoff's view of Universal Grammar as something that evolved biologically but applaud his integration of blackboard architectures. I thus recall the HEARSAY speech understanding system - the AI system that introduced the concept of "blackboard" - to provide another perspective on Jackendoff's architecture.

The subtitle "Brain, Meaning, Grammar, Evolution" for *Foundations of Language* (Jackendoff 2002) suggested that Jackendoff would devote major portions of his book to brain and evolution. Alas, there is no serious discussion of the brain (beyond a few passing references to aphasia) and the discussion of evolution (Ch. 8) focuses on an incremental account of Universal Grammar (UG) that ignores brain evolution. Space does not permit proper discussion of the brain here. Instead, I lament Jackendoff's view of Universal Grammar as something that evolved biologically; and then recall the HEARSAY speech understanding system to provide another perspective on Jackendoff's architecture.

Concerns about Universal Grammar. Jackendoff (2002, p. 263) views UG as "the unlearned basis from which language is learned" and argues that "it had better be available to help children learn case systems, agreement systems, fixed word order, and grammatical functions in case the language in the environment happens to have them."

I find this view incoherent if it implies that evolution yielded adaptations specific to each of these systems. What selective pressure would cause humans whose language does not use cases to evolve a brain with a device *specialized* for learning case systems?! Instead, I think we should seek to understand what made the brain "language ready," providing capacities that make possible the discovery of Jackendoff's language "components" over the course of many millennia, and their acquisition by the child over the course of a few years. One listing of such capacities (based on Arbib 2002b) follows:

Complex imitation: the ability to recognize another's performance as a combination of familiar movements and then repeat it.

Symbolization: The ability to associate an arbitrary symbol with a class of episodes, objects or actions. (These symbols may have been unitary utterances, rather than words in the modern sense, and may have been based on manual and facial gestures rather than being vocalized.)

Parity (mirror property): What counts for the "speaker" must count for the "listener."

Intentional communication: Communication is intended by the utterer to have a particular effect on the recipient, rather than being involuntary or a side effect of praxis.

From hierarchical structuring to temporal ordering: Perceiving that objects and actions have sub-parts; finding the appropriate timing of actions to achieve goals in relation to those hierarchically structured objects.

Beyond the here-and-now: The ability to recall past events or imagine future ones.

Paedomorphy and sociality: A prolonged period of infant dependency combines with social structures for caregiving to provide the conditions for complex social learning.

In hindsight we may see these as preadaptations for language but they were adaptive in their own right, and underlie many modern human capacities other than language. In this view, Universal Grammar is only tenable as a descriptive umbrella for the immense variety of human languages, not as a "genetic reality" or "neural reality" that implausibly contains all possible grammatical structures in embryo (one is reminded of the "little man" that seventeenth century spermists "saw" inside the head of the spermatozoon [Pinto-Correia 1996; 1997]). I applaud Jackendoff's attempt to provide an evolutionary sequence for language but argue (e.g., Arbib 2002b) that case systems, agreement systems, and so on, are to be seen as human inventions that required no change in brain structure for their discovery and cultural transmission. Moreover, I see these as coarse grain compared to the actual inventions that were made across the millennia and which eventually coalesced into the more-or-less coherent structures that Jackendoff and other linguists tend to treat as natural and indivisible. What is universal is the need for expression, not the choice of linguistic structure for meeting those needs. The evolution of language from protolanguage is part of the history, not the biology, of *Homo sapiens.*

Déjà-entendu. Jackendoff makes much of the AI notion of blackboard in presenting his architecture for language, but does not cite HEARSAY-II (Erman et al. 1980; Lesser et al. 1975), perhaps the first AI system to develop a blackboard architecture. While obviously not the state of the art, it is of interest because it foreshadows features of Jackendoff's architecture. Digitized speech data provide input at the *parameter level;* the output at the *phrasal level* interprets the speech signal as a sequence of words with associated syntactic and semantic structure. Because of ambiguities in the spoken input, a variety of hypotheses must be considered. To keep track of all these hypotheses, HEARSAY uses a dynamic global data structure, called the *blackboard,* partitioned into various levels; processes called *knowledge sources* act upon hypotheses at one level to generate hypotheses at another.

First, a knowledge source takes data from the *parameter level* to hypothesize a phoneme at the *surface-phonemic level.* Many different phonemes may be posted as possible interpretations of the same speech segment. A lexical knowledge source takes phoneme hypotheses and finds words in its dictionary that are consistent with the phoneme data - thus posting hypotheses at the *lexical level* and allowing certain phoneme hypotheses to be discarded. To obtain hypotheses at the *phrasal level,* knowledge sources embodying syntax and semantics are brought to bear. Each hypothesis is annotated with a number expressing the current confidence level assigned to it. Each hypothesis is explicitly linked to those it supports at another level. Knowledge sources cooperate and compete to limit ambiguities. In addition to data-driven processing which works upward, HEARSAY also uses hypothesis-driven processing so that when a hypothesis is formed on the basis of partial data, a search may be initiated to find supporting data at lower levels. A hypothesis activated with sufficient confidence will provide the context for determination of other hypotheses. However, such an *island of reliability* need not survive into the final interpretation of the sentence. All we can ask is that it forwards the process which eventually yields this interpretation.

Hanson and Riseman (1987) based the architecture of their computer vision system VISIONS on the HEARSAY architecture as well as neurally inspired schema theory (Arbib 1981; Arbib et al. 1998). Such a conceptual rapprochement between visual perception and speech understanding offers a computational framework for further exploration of the Saussurean sign (Arbib 2003; Hurford 2003). Arbib and Caplan (1979) discussed how the knowledge sources of HEARSAY, which were scheduled serially, might be replaced by schemas distributed across the brain to capture the spirit of "distributed localization" of Luria (e.g., Luria 1973). Today, advances in the understanding of distributed computation and the flood of brain imaging data make the time ripe for a new push at a neurolinguistics informed by the understanding of distributed computation. Despite its disappointing inattention to the brain, Jackendoff's book could make a valuable contri-