Relations between Language and Memory Organization, Representation, and Processing

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Introduction

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1 Human language and memory

Memory is commonly assumed to accomplish the encoding, the storage, and the retrieval of information (Anderson, 1995). It is thus prerequisite of all types of cognitive processing. Human memory exceeds the memory capacity of any other animate being. This is not only due to the huge storage capacities and the specialization of the human brain but follows necessarily from language as the medium through which information processing is communicated and in terms of which information becomes encoded, stored, and retrieved. It follows from this that language plays a central role in all memory processes. Language permeates the speakers’ memory, in that linguistic structures provide organizing principles of human knowledge. More recently, language comprehension and production become investigated in terms of the organization and entrenchment of language in long-term memory and the corresponding retrieval in working memory (Bybee and Hopper, 2001; Gentner and Goldin-Meadow, 2003; Assink and Sandra, 2003). By taking different perspective points, speakers may express the same situation by different grammatical and lexical choices which in turn influences the organization and retrieval in human memory. Thereby whole situations may be remembered in different ways (Clark and Clark 1968; Bransford et al. 1972; Levinson 2003). Vice versa, linguistic input could not be processed without speakers retrieving their long-term store of knowledge in working memory. Language comprehension heavily depends on how the speakers’ knowledge representation drives their inferential reconstruction of information (Barsalou, 2005).

The present book addresses these interactions between language and memory from the interdisciplinary perspective of cognitive science.
2 The architecture of language and memory

2.1 The container metaphor of language and memory

Traditionally, the architecture of human memory is conceived of in terms of the container metaphor. According to this image, human memory is compared to a box where everything humans have learned may be safely stored in order to search through this container whenever any content needs to be unpacked and used. Originally, distinct modules have been assumed to be responsible for the acquisition and storage, as well as for the retrieval of different types of information (Broadbent, 1971). The assumption of clearly distinguished memory systems due to storage-specific coding differences (Baddeley, 1986; Atkinson and Shiffrin, 1968) had to be revised in favour of elaborateness of processing and interactivity between levels. In the same vein, Tulving’s distinction (1972) between semantic and episodic memory as the distinction between the more stable store of intersubjective knowledge on the one hand and the more variable store of personal, contingent experiences on the other has come under scrutiny more recently from a more dynamic perspective on the genetic relationship between the two.

The container metaphor has equally been applied to the organization of the linguistic system as conceived of by generative linguistics (Chomsky, 1986). From this mentalist stance, a distinction is made between meaning and reference, between the steady state of linguistic competence as the strictly rule-governed content of the human mind and the corresponding dynamic application of rules in linguistic performance by taking them out of the human mind. This naive view on the relation between competence and performance is caricatured by the CONDUIT METAPHOR of communication (Reddy 1993; Langacker 1987, 161f; Lakoff 1987, 449). Linguistic forms are seen as stable containers of meanings which the speaker pumps through a channel to a receiver who takes the meanings out of the container. Epistemologically, the distinction between the recursive rules of the linguistic system and the declarative facts of world knowledge reflects this dichotomy between knowledge and behaviour. The container metaphor
equally comprises the distinction and correspondence between different linguistic (sub)systems (this volume, Rummer and Engelkamp, Zelinsky-Wibbelt, Zeschel and Deppert).

The contributions to this volume point out that the integration of these dichotomies becomes inevitable in the explanation of higher-order functions of human language and memory, such as the representation, organization, and communication of concepts (Garnham and Cowles, Schwarz-Friesel, Zeschel and Deppert). The processing of linguistic constructions in language comprehension and production (Rummer and Engelkamp, Tuggy, Zelinsky-Wibbelt, Zeschel and Deppert) establishes another case in point. Linguistic creativity and iconicity come into play when linguistic input which is not part of the speakers’ conventionalized store in long-term memory (cf. Fortescue, Schwarz-Friesel, Garnham and Cowles, Bartsch, Novak and Lamb, Zelinsky-Wibbelt, Rummer and Engelkamp, Zeschel and Deppert) becomes processed through inferential and recursive reasoning. Vice versa, the organization and functioning of human memory is assumed to depend on the linguistic system (Marian and Kaushanskaya). As an integral part of the mind human memory is in turn represented through its connectionist neural basis in the brain (Bartsch, Novak and Lamb, Morales and Taylor, Fortescue, Zeschel and Deppert).

2.2 Storage vs. computation

A major issue of the book is how human memory is organized in order to manage the acquisition, the storage, and the retrieval of language so seemingly easily. Roughly, we may discern three ways of explanation which have been pursued in the study of language in linguistics (Beaugrande, 1980).

From the traditional view of prescriptive grammar, all complexities are organized in storage, this allowing for a cheap retrieval. As this model restricts linguistic processing to what is encoded, creative and inferential reasoning are impossible. No account is given of associative learning by analogy, contiguity, and abstraction. Hence the
linguistic encoding of knowledge is seen as an arbitrary result of its function, and no explanation of the relation between storage and retrieval is provided.

According to the structuralist view of the lexicon as a store of irregularities, storage is cheap and retrieval is expensive. This view conforms to the “lexicon as waste-basket” metaphor which denies many low-level, not fully productive structures. Langacker refers to this model as the rule-list fallacy, the exclusion of the paradigmatic from the syntagmatic dimension of language (Langacker, 1987, 42). Only fully productive lexical relationships were originally accounted for by lexical redundancy rules (Chomsky, 1965, 168), partially productive patterns were listed. This dichotomy is still reflected in more recent generative models of the mental lexicon. Rule-based approaches generate all and only fully productive word formations, thereby not distinguishing between full and partial compositionality (Halle and Mohanan, 1985; Yang, 2000). Complex units which are not fully productive are taken to be memorized as unanalyzed wholes. Clearly, this approach does not account for how speakers acquire, store and retrieve the conjugation patterns of verbs in inflecting languages. These verb classes have to be learned paradigmatically while they are applied syntagmatically on different levels of schematicity.

Within the generative morphological tradition, dual systems distinguish a rule-based syntagmatic system which operates fully productively from an associative paradigmatic system which as a result of frequency and similarity produces semi-regular distributions of paradigmatic clusters (Chialant and Caramazza, 1995; Clahsen, 1999; Pinker, 1999; Alegre and Gordon, 1999). While full productivity remains an ideal, the relation between paradigmatic and syntagmatic processes is not accounted for by this approach. Yet, generative grammar books generally abound with exceptions to the rule.

By abandoning the container metaphor, cognitive linguistics rejects the distinction between rule-based syntagmatic structures as part of the linguistic system and paradigmatically organized facts as part of world knowledge in favour of associative networks achieving a compromise between storage and retrieval due to frequency of activation. Associative networks represent and process fully and
partially productive relationships in a single system (Bybee, 1995; Bybee and Scheibman, 1999; Sereno and Jongman, 1997; Hare et al., 1995; Schreuder and Baayen, 1995). Syntagmatically complex units are integrated into paradigms to different degrees, due to similarity between substructures and frequency of activation. The more substructures become integrated into a paradigm, the more tightly their constituents become associated with the common schema of the paradigm, and the more liable speakers are to memorize the complex unit as an instance of this regular association pattern. By contrast, the less interconnected a syntagmatically complex complex unit is, the more liable speakers are to memorize the complex pattern in terms of an unanalyzed idiosyncratic whole.

In this probabilistic network model the syntagmatic structure of an instance is represented as a function of its degree of integration into different paradigms of association schemas. Efficiency is not enabled by economy of storage. Instead redundancy of storage becomes the key to how language is processed (cf. Zeschel and Deppert, Zelinsky-Wibbelt, this volume). The grammar of a language is organized at different levels of schematicity, ranging from full specifications of lexical units, over low-level, semi-regular schemas, to high-level fully regular abstract schemas (cf. ibd. and Fortescue, this volume), where the trade-off between storage and computation becomes represented as a result of activation frequency. Fully specified lexical networks (Quillian, 1968; Collins and Loftus, 1975) grow through the speakers’ ability to categorize lexical meanings in terms of abstract schemas, their specialization by instantiation and the extension thereof to contiguous and analogous concepts (Langacker 1987; Zeschel and Deppert, this volume). Grammatical networks result from the speakers’ integration of lower-level into higher-level constructions (cf. Goldberg 1995; Croft 2001; cf. this volume Zeschel and Deppert).

From the cognitive grammar perspective taken by Tuggy (this volume) the traditional dichotomy between static storage and dynamic retrieval evaporates in favour of the activation of computational pathways between the original and the to-be-conventionalized linguistic unit. While the activation of these pathways is initially highly salient, it decreases with frequent computation when retrieval becomes more