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Language and Memory

Aspects of Knowledge Representation

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Contents

Chapter 1
Memory and language: Introduction

*Hanna Pishwa**

1. Aspects of memory in linguistics

The motivation for putting up this volume originates in my study on the acquisition of English by twelve German students attending the primary and secondary school in Berlin (for details, see Pishwa 1998). The goal of the study was to examine cognitive economy in the growth of the interlanguage. The findings demonstrated the brain's ability to adapt itself to the complexity of data: accuracy of processing decreases with increased complexity and vice versa (cf. Pishwa 2002). This became evident in a predominantly holistic processing of linguistic data in the initial stage, where a learner faces a huge amount of new phenomena; holistic processing required less effort than analytic processing would have done. Only some areas, such as the lexicon and a few simpler grammatical rules, were processed analytically. Holistic processing was characterized by attention paid only to salient phenomena, which consisted of the particular marking of perceptually prominent events and goals of the protagonist; the latter are, as demonstrated in this volume, the most salient parts of cognitive schemas.

Further exposure to English enabled the students to adopt the more effortful analytic processing mode, which implied rejection of the distinctive encoding of salient perceptual and memory-based stimuli by verbalizing action schemata at lower levels of memory structures, implying that neither the abstract high-level goals nor perceptually salient events were verbalized any longer. The more accurate processing mode constituted no longer a burden for the learners since their linguistic skills had improved; it contributed to the acquisition of more subtle linguistic features. The development suggests that the hierarchical memory structure is reflected in a primitive language noticeably, while its influence remains more covert on native speakers' language, where superordinate goals extracted by the brain in communication are stored in memory but are rarely verbalized. My conclusion was that they steer our way of thinking and influence communication implicitly and that they are of particular interest from a cognitive and a linguistic point of view.

Therefore, the assumption that the properties of language (the medium) are adapted to those of the container (the brain) and the content (knowledge stored in the brain) at least to a certain degree is not unrealistic, since memory is one of the primary sources for information employed in communication. The fact that linguistic and conceptual structure are stored in memory strengthens the assumption of feature sharing. Studies on iconicity have revealed a high correspondence between these two levels in many respects (Haiman 1980; Simone 1995; Fischer and Nänny 2001). Surely, we will not find an exact copy of the cognitive representation in language because language is poorer than our knowledge. This is exactly the reason why a comparison of these two levels should be a fruitful enterprise. Although cognitive linguistics has largely neglected the influence of the knowledge structures on language, it has provided enough evidence for similarities between perceptual aspects and numerous linguistic structures, that is, our creative and manipulative ability to view states and things from various perspectives and verbalize them accordingly. In addition to perceptual aspects, metaphorical properties of language have been a popular object of comparison between language and mental structures; metaphor is an instance par excellence of one of our cognitive processing modes, namely search for similarities, without which the whole cognitive system would break down. This is particularly true of patterns, which our mind extracts subconsciously in order to organize knowledge representations for easy retrieval; the function of knowledge chunking is not space saving, which is not necessary because the brain has a huge storage capacity. An example of pattern matching at an abstract level is the recognition of the similar structure in "Romeo and Juliet" and "West-Side Story." Even categorization, which serves as a link between perception and memory with the purpose of reducing the quantity of information on the basis of similarity and contiguity, just like metaphor and metonymy, bundling it, and making it available for easy retrieval, is an established phenomenon in linguistics. Language has been found to reflect categorization at the conceptual level in hierarchical structures, observable in the characteristics of the symbolization of the single levels, for instance, with basic level items carrying the least linguistic material because of their frequent use, while subordinate categories containing richer information are supplied with more linguistic substance. Studies have also shown that most linguistic structures are organized in categories around a prototype, the core of a category, similar to mental categories. A further cognitive aspect considered in cognitive linguistics is mental spaces, which are shown to be involved with knowledge representations. However, the attention in this approach has been focused on creative

aspects rather than on memory structures. Recent studies on discourse have started searching for cognitive explanations as well (Sanders, Schilperoord, and Spooren 2001; van Dijk 2002; Virtanen 2004).

The goal of this volume is to complement cognitive linguistics by taking into consideration aspects of memory as linguistic explanation, which in turn may contribute to a development of more accurate cognitive approaches. The term 'memory' is used here to refer to the content and properties of memory as well as its processes. Since these aspects imply a large range of issues, the topics of this chapter are restricted mainly to those touched upon in the contributions; a short description of the structure of memory and the type of representations stored there is provided. While most contributions are concerned with the relation between language and (activated) stored knowledge, some, particularly those by psychologists, also address the influence of the use of certain linguistic structures on the encoding (storage) of information in memory as well as latencies in recall initiated by particular linguistic structures. Findings in this volume should lead to a deeper understanding of language and its role in communication, however, excluding issues of relativity. A desirable side-effect is that pragmatic justifications, such as implicature, which classify phenomena without further elaboration, can be replaced by more informative cognitive explanations. As already pointed out, this volume is meant to expand the field of cognitive linguistics.

A major concern of the volume is to show in what ways linguistic structures are related to representations stored in various parts of memory with regard to their content and composition. An issue closely connected to this are the principles and processes responsible for the organization of information. These aspects in turn are determined by the overall structure and properties of memory, for instance, the global economy brought about by the flexibility of the brain enabled by the utilization of varying degrees of generality and specificity, similarity and contiguity in order to cope with the huge amount of information. Although the contributions are interdisciplinary originating from linguists and psychologists with different focuses, the starting point is always linguistic structure. The contributions are allocated to three different sections. Despite the different approaches that the disciplines take to the topics, the chapters complement each other in a coherent way. The structure of the volume is adapted to linguistic aspects following the degree of their relative fixedness so that the first part of the volume concentrates on the basic structure of language concerning issues such as rules vs. structures, that is, storage and application of linguistic – in most chapters syntactic – structures. The contributions in the second part,

in opposite, view single linguistic items, most of which lack a fixed meaning, for instance, discourse markers and evaluative devices, and the relation of their functions to aspects of memory. The third part presents various aspects of discourse with regard to memory.

Since the structure of the volume is organized according to linguistic principles, aspects of memory have to be presented in this part. Therefore, this chapter provides basic ideas about memory and introduces the issues to be pursued in the chapters, which are:

- Type of memory; the information stored there, and the cognitive effort involved in recall
- Organization of information in various memories according to its generality, specificity and abstractness, concreteness in structured representations; contiguity, similarity
- Principles of chunking information: hierarchy, prototypicality
- Economy and flexibility of memory

In order to be able to discover relations between language and memory, we have to know how memory is structured, what is stored there and how, and which properties it has that could possibly be found in language and its use. Therefore, the introduction provides a minor overview of memory types, their structure and properties. Many features of memory have to be omitted here, for instance, neurological aspects, some of which are dealt with by Multhaup and Schulze (this volume). I would like to note that there are numerous approaches to the structure and functions of memory; here I will be addressing the most common models that can account for the linguistic findings.

2. Structure of memory

Memory cannot be understood without knowledge of the type of information stored there and its functions, which are considered to be the basis for the distinction of memory systems or their components. The very earliest modern approaches (Foster and Jelicic 1999) to multiple memory systems are from the beginning of the 19th century initiated by Maine de Biran, philosopher, Francois Joseph Gall, and von Feinaigle (Schachter and Tulving 1994; Tulving 1983). More recent models started by making a division between short- and long-term memory by Atkinson and Shiffrin (1968); later, working and long-term memory were separated by Schiffrin

and Schneider and Klatzky. This was followed by Paivio's distinction of verbal from nonverbal memory (1971), which introduced images into memory research. At the same time, Tulving (1972, 1983) presented his division of long-term memory into episodic and semantic memory. In the eighties, further distinctions followed: procedural and declarative memory, already recognized by Biran, and implicit and explicit memory (Ashcraft 1989; Baddeley 1999; Engelkamp and Zimmer 1994; Neath and Surprenant 2003). These distinctions will be discussed in the context of the respective memory systems: short-term memory and long-term memory. The starting point is the structure of memory followed by the types of representations that information is stored in. It should also be mentioned that psychologists are divided into two camps with regard to the architecture of memory: those who divide it structurally focusing on the systems memory contains and those who conceptualize it according to its function, i.e., processes (Foster and Jelicic 1999). For linguistic considerations in this volume, the former seems to be a more fruitful enterprise.

Information intake through perception, which is the first stage of information processing and takes place in the so called sensory memory, is limited through restricted attention. The task of perception is to start the processing and categorization of the inputs of visual and auditory data in the respective iconic (visual) and echoic (auditory) memory (Neath and Surprenant 2003: 21–42). Attention functions as a "bottle neck" delimiting the amount of data to be processed further and therefore determines what will be encoded in memory. It may be based on a primitive instinct of self preservation with a kind of alarming function to detect changes in the environment ("conscious involuntary direction of attention"). Attention also enables us to select certain information on the basis of previous unconscious analyses ("unconscious selective attention"). Attention is already firmly established in linguistics in terms of gestalt psychology (Koffka 2001; Langacker 1987; Talmy 2000; Ungerer and Schmid 1996). Numerous linguistic phenomena, such as clause structure and choice of tense and aspect categories have been traced back to the figure-ground constellation (Wallace 1982). This approach is already an indication of the flexibility of memory and language: the salient figure cannot be fixed in any way due to its context dependence, which simply means that one and the same entity is perceived differently salient in various contexts. The figure is first analyzed in a holistic manner and then by means of a feature analysis, a sequence followed by German learners of English (see above). This sequence is taken for granted not only by gestalt psychologists but also by other cognitive scientists. It is not certain whether the gestalt principles only influence

the selection of information or also the form of knowledge representations. But even unattended information may be processed and encoded (Eysenck 1984: 56; Glass and Holyoak 1986: 36). It is assumed to influence consciously processed information (Dixon 1981). Attention is not required by automatized routines stored in procedural memory (Cowan 1995).

The subsequent step in the information processing chain is the short-term or working memory, which is considered to be entirely separated from long-term memory by some psychologists, for example, Baddeley (1999: 18), who, however, concedes "a complex set of interacting subsystems". Working memory is also viewed as an activated long-term memory without any borderline between them. This system functions as a temporary storage, which can maintain about 5–7 items simultaneously for a few seconds, corresponding to the clause length. According to Ashcraft (1989: 53), "short-term memory is the memory buffer or register that holds current and recently attended information." There are numerous, slightly varying models of this subcomponent, which can be further subdivided (Neath and Surprenant 2003: 68). While short-term memory is of primary interest for psycholinguists and psychologists, whose object of investigation is the processing itself, the main focus of the present volume is, however, the activation or storage of representations in long-term memory, that is, the source and goal of knowledge intermediated in communication. However, some of the contributions by psychologists in this volume address processing in the working memory by examining the speed; the measurement of latencies tells us about the effort, which again frequently indicates the type of memory the information is connected to (see below).

As already pointed out, long-term memory can be divided into procedural and declarative memory. Procedural memory is assumed to contain the 'how', and declarative memory, the 'what', a division which might look like a computer metaphor with a processor and data, however, without sharing many similarities with the computer. Procedural memory contains instructions of automatized abilities, such as walking, driving, and speaking; priming is a procedural skill as well (Tulving 1983: 110; Roediger, Weldon, and Bradford 1989: 15). Due to automatization, this is the fastest memory and, hence, the least costly and by the same token inflexible and rigid. Therefore, language skills rely only partly on procedural abilities. Although syntactic rules have been considered as procedural competence par excellence until recently, this view has started declining in favor of an assumption that they are stored and used as constructions with amalgamated elements (see Section 1). The contributions in this volume demonstrate that syntactic structures and rules form a continuum ranging from

rigid procedural knowledge through constructions to structures without fixed functions.

Declarative memory, which interacts with procedural memory, is composed of semantic and episodic memory. Semantic memory serves as a storage for world knowledge and the lexicon, while episodic memory contains personally experienced events (see Bublitz, Multhaup, Schulze), which are not stored in large networks as knowledge but are usually remembered as single items. Private experiences may become general world knowledge through a desemantisization process after repeated occurrences (see Multhaup), while non-repeated or not frequently enough repeated experiences remain in episodic memory, in particular, if not shared with others in the same cultural environment. In his chapter (6), Multhaup describes how information stored in semantic memory may become automatized, i.e., procedural. This can best be observed in the acquisition of language rules, which we first have knowledge of and which after enough exposure may become automatized, i.e., procedural, through an intermediary, associative stage; this stage presupposes an exhaustive analysis of the structure. Another instance of this is grammaticalization involving "semantic bleaching" of words reducing context-sensitivity. Information from episodic memory cannot be automatized. The three types of memory differ in the degree of effort involved in recall: automatized processes do not require any cognitive energy at all and can therefore be considered implicit, semantic knowledge to a certain degree, and remembering one's experiences is the most costly. The contributions in the volume show that this is of particular relevance in communication because of the limited capacity of working memory.

Although semantic and episodic memory are mentioned and described in several contributions in this volume, I would still like to present the most recent status of research on episodic memory because it has revealed new details of high relevance for the volume. Some of the differences between the two memories are shown below as characterized by Tulving in the early days (1983: 35):

Episodic memory	Semantic memory
– Sensation	Comprehension
– Events; episodes	Facts; ideas, concepts
– Personal belief	Social agreement
– More important for affect	Less important
– Inferences limited	Rich inferences enabled
– Context dependency high	Low contextual dependency

– Access deliberate	Automatic
– Recall more effortful	Retrieval effortless

Recent research shows, however, that the distinction between semantic and episodic memory is not as neat as suggested above, although many properties discovered by Tulving are still assumed to be valid. I will address a recent, more elaborate view of episodic memory as proposed by Conway (2002). In this account, episodic memory may be split into two temporally differing systems, the short-term sensory-perceptual episodic memory (hence "episodic memory") and the longer-term autobiographical memory. The primary function of these two memories is considered to be the storage of everything related to personal goals and their achievement.

Episodic memory is involved with the attainment, modification, and abandonment of goals; it cannot, however, cope with more complex goals, which are stored in the autobiographical memory, where they are 'framed' with their attitudes and beliefs. Episodic memory maintains "highly detailed perceptual knowledge of recent experience" (Conway 2002: 53) for a short duration sustaining the temporal order of events. When recalled, such memories are experienced recollectively, that is, with images and feelings. Pishwa (in print) shows that most functions of the English present perfect reflect exactly this memory system due to its relevance for results. They can be transferred to the autobiographical memory, where they supply specific information. It is worth mentioning that episodic events are stored in a different part of the brain than autobiographical memories (Conway 2002: 54).

The function of the autobiographical memory in this account is grounding the self in terms of goals, toward which everything is geared (see Pishwa); it stores information on the attainability of goals. This memory contains three kinds of knowledge: (1) lifetime periods, which cover the most extensive knowledge structures and contain knowledge of others, events, feelings, and evaluations concerning the whole period. They are assumed to be stored as abstract mental models (see below); (2) general events, which contain the optimal amount of information being comparable to basic level items. Their retrieval requires the least effort of all autobiographical knowledge, though more than that of knowledge stored in semantic memory. General events can be used as cues to access life-time periods or episodic memories; (3) episodic memories, which evoke recollective experiences with differences in the vividness of different memories (Anderson and Conway 1997: 219). Conway (2002: 67) describes them as "small 'packets' of experience derived from conscious states that remain

intimately connected to consciousness." The information contained in the autobiographical memory may, therefore, be both specific and general, for example someone's habits. When recalling this kind of information, we often find false starts, redundant information, and retrieval blockages (Anderson and Conway 1997: 219), which attests the difficulty of retrieval.

Episodic and autobiographical memory can then be considered to have a less fixed organization than semantic memory with the consequence that connections between the nodes are weaker, which supports the assumption that their recall is bound with more effort than that of semantic information. Autobiographical information is also more errorprone than semantic knowledge and shows a tendency to be subjective. A further difference between these two kinds of information is that the former can only be verbalized by the experiencer himself correctly, while a person conveying others' experiences has to keep the source of experience in mind and may have to rely on inferences (see Mushin, Pishwa). On the contrary, world knowledge can be conveyed by everyone without paying attention to the source. This means that evidentiality and epistemicity are primarily concerned with autobiographical memory. Consideration of the distinction between the three declarative memories is of high relevance for linguists, a claim that many contributions in this volume supply evidence for. For instance, the economy involved with the use of metaphor (see Schulze, Kreuz and Ashley) becomes apparent against this background: rapid activation of semantic knowledge instead of slow retrieval of autobiographical information. It is also shown that linguistic structures denoting subjectivity relate to the latter memory type.

3. Knowledge representations

Information in memory is structured and chunked in order to be easy to recall on the one hand. On the other hand, clustering brings about the flexibility required for communication. Principles of information chunking can be matched with processes such as association, specification, generalization, and search for similarities. While associative processes serve to expand representations in the horizontal direction by connecting information that we perceive to belong together through our experience of the world, specification and generalization lead to the construction of hierarchies in order to allow the choice of the right degree of specificity on every occasion: levels on top of the hierarchy are highly generalized; down the vertical axis, decline, specificity increases. Similarity – or analogy – serves to

create larger representations by matching different clusters into one, such as concepts or metaphors. The processes mentioned give rise to different knowledge representations: the form of representations in which information is stored varies largely in dependence on the stimulus and the goal of activation. Since Markman (1999) offers the most extensive treatment of the various kinds of representations, the following account will mainly relate to this source.

Among the components of mental representations we find spatial representations and features. Spatial representations do not only refer to points that fix locations in a space, but also to distances between points in a space, and dimensions for directions in a space (Markman 1999: 28). In addition to concrete locality represented by prepositions and cases in languages, distances may represent psychological similarity and perceived distance or preference. An example of this would be people's representation of concepts in categories, whereby distance between points representing members in a mental space measures relatedness of the members within a category. While spatial representations are concerned with distances, features show similarity and difference between objects. In this sense, the featural representation belongs to relatively primitive representations in that the relations between the features remain unspecified. Features are not an artificial theoretical construct by linguists or psychologists, but have a neurological basis in visual systems (Markman 1999: 63). Those operating in visual systems always have fuzzy boundaries with the advantage that if several neurons process similar, fuzzy features, the result is more accurate than in a case when only processed by one neuron. However, features are usually discrete and, hence, identifiable as separate entities as in phonology. Features may be additive, which means that any features can be added without considering the other features. Or they may be substitutive, which means that one feature is not compatible with another, for instance, red and green, which are not simultaneously applicable to one single item. Category representations, both prototypes and exemplars as well as networks (see below), can be analyzed in terms of features. However, prototypes are not based on features in the case of holistically formed exemplars.

Information tends to be chunked in memory, as already pointed out. Networks are the most common type of such chunks based on sharing of similar features and relations. Although most linguists are familiar with this phenomenon, I would still like to discuss this topic, since linguists employing this framework have omitted a number of interesting details. In early semantic networks, nodes (concepts) were linked with each other, with both nodes and links being labeled. Inheritance from upper to lower

levels was assumed to exist for space saving in the brain. Distance between the nodes was also equaled with difficulty of processing. None of these proved to be correct: The brain offers enough space for multiple storage; in some cases, a node at a longer distance may be easier, i.e., faster, to process than one at a closer distance, for example, *dog* is easier to verify as *animal* than as *mammal*, although *animal* is the highest node and further away from *dog* than *mammal*. Later experiments by Collins and Quillian made clear that differently weighted links cause differences in the degree of activation of nodes. Further work by Collins and Loftus showed connectionist effects in the networks in spreading activation, whereby the number of nodes connected to a node was found to be significant for the efficiency of processing ("fan effect"): the more nodes are connected to a certain node, the longer the processing takes. This is probably the reason why the highest abstract nodes are rarely verbalized; they maintain links to most of the nodes of a schema. This effect has been found particularly strong in recall tasks. In sentence structure, for example, a higher fan effect was found for subjects and verbs than for objects. Priming effects were already recognized in the early models.

The early models were used to make findings about automatic text comprehension, which was not particularly successful because texts are not only based on existing schemas but also provide new information. Semantic networks are well suited for the examination of concepts. They contain members of a category as well as features of the members, which may be shared. But they can also be used to model person perception when complemented with connectionistic models, which generate dispositional inferences automatically in explaining past behavior and predicting behavior in the future. In other words, they create expectations.

Later developments of networks have added procedural components to the static structures and can better explain our ability to connect various kinds of information, for instance, semantic knowledge with procedural skills. Network models show a higher complexity in that the new models contain relations between elements in a situation and allow combinations of simpler items. The assumption of different strengths of links between the nodes is meaningful to understand the growth of syntagmatic structures, such as grammatical constructions (see part 1). A spreading activation model enhanced by production rules may become highly complex and can be used to explain rule-governed and goal-directed processes (see Chipere). Structured representations may become powerful enough to include higher-order relations, such as causal relations and implications, and create coherence (see Bublitz). It is also worth mentioning that some psychologists

assume the existence of dynamic schemata, so called 'action systems', containing procedural information (Mandler 1985: 44). They are cognitively economical because they run subconsciously without costing cognitive energy, but also create negative effects such as interference in second language learning, because they are difficult to switch off. So the issue is what kind of information should be considered procedural.

Based on semantic networks are "parallel constraint satisfaction models", which are connectionistic and exhibit a higher degree of dynamicity, modeled after neuroscience. In these, several constraints operate simultaneously. For instance, in making dispositional inferences of other people, people may make use of causal beliefs, inferences, and observed facts. The model implies that dispositional inferences are made automatically.

Mental images are structures similar to other mental representations, that is, they are not stored pictures. They differ from the latter in being eligible for transformations, which are, however, restricted in so far as some parts must remain stable. These, combined with gestalt theory, are what has been the main concern of cognitive grammar: manipulation of information through the choice of perspective. Markman (1999: 190) emphasizes the similarity in function between visual structures and mental representations of other types. Despite similarities in structuring, perceptual information differs from conceptual knowledge. They complement each other: they are found at all levels of abstraction together, but deliver different types of information. Therefore, concepts do not only consist of abstract knowledge about properties and functions of concrete objects, but also of their perceptual properties.

Mental models are theoretical constructs (Johnson-Laird 1983) and moderately accurate representations of situations we experience, simply "memories of things that happened in the world" (Garnham 1997: 151). They are not only stored in autobiographical long-term memory; they also participate in the processes taking place in working memory and episodic memory as representations of the real or imaginary world as well as in high-level thinking processes. Their property of being manipulable makes them useful in the explanation of various communicative forms. Combined with world knowledge they are used in creation and comprehension of texts and are, hence, employed in language processing. Since they comprise numerous cognitive processes and representations, they are suitable for various kinds of interpretations (see Kaup).

Scripts or schemas (even called 'frames') are ripped-off mental models in that they only contain the essential parts of event chains, with the details being omitted. They are more complex than simple objects stored in cate-

gories since they imply the participation of objects and usually human beings as actors. Schemas, which are based on networks with spreading activation, are hierarchical structures with goal and outcome found at every level of generality; at the highest level of the hierarchy we find the primary goal that maintains connections to all parts of the whole structure (see Pishwa). The goal node is connected to most other, lower nodes and can be claimed to function similar to the prototype in categories in this respect, however, differing in that goals are usually abstracted by the brain without being verbalized, while the prototype is the most frequently used member of a category. Schemas grow internally through integration of information and externally through elaboration, i.e., adding of further schemas, which frequently causes reorganization. This already suggests that they are not exact copies of reality but novel organizations created by the brain. Schemas create expectations about events in the world; they are involved in all kinds of communication, they even steer our lives.

The description of all kinds of networks suggests that they are not passive storages, but "dynamic structures that store and organize past experiences and guide subsequent perception and experience by catching up environmental regularities" (Mandler 1985: 36). They are abstract representations and contribute to cognitive economy by the same token similar to metaphor and metonymy (cf. Schulze, this volume). Their creation involves integration through connection of single elements with each other into a small schema, and elaboration to enable the combination of several schemata with each other into large networks (Mandler 1985: 68). Networks are, of course, utilized in linguistics, particularly in semantics, for the description of relatedness of items and are not the central topic of any of the chapters. Thus, the description of knowledge representations serves as evidence for the organization ability of the brain, which is not restricted to these but can be observed in language and its use with similar principles operating there.

4. Hierarchical structure of knowledge representations

There are many frameworks that suggest a hierarchical structure of memory and knowledge representations (Bolles 1988; Graesser and Clark 1985; Wyer and Srull 1989). These are of interest for the understanding of the storage of autobiographical memories because their content is slightly different from that of semantic memory. An attractive memory model is the dynamic memory model put forward by Schank (1982). In this structure,

the smallest units are scripts, which contain specific, idiosyncratic experiences, similar to episodic memories (see above). Scenes are more abstract than scripts and match event chains with shared goals. The level above these exhibits MOPs (memory organization packages), which are composed of scenes with a common goal and are domain specific, for instance, "flying", which contains various scenes. Schank provides a further level, TOPs (thematic organization points), with an even higher abstract analogical structure. An example would be finding of similarity between "Romeo and Juliet" and "West Side Story" mentioned above. TOPs are also involved with goals and plans applicable across various domains due to the high abstractness. The information in them is not split as in semantic networks but represented in chunks. What is of interest for this volume is that MOPs and TOPs are structures abstracted by the brain itself, which searches for similarities, of which metaphors are a further example (see Schulze). Memory structures are always organized according to a goal in this model. Goals are marked by indexing, which indicates the main feature of the memory structure abstracted by the brain. All of these structures may be personal; they are always goal-directed. Clearly, the concept behind the model is generality vs. specificity of information.

This concept was utilized in the development of CYRUS (Kolodner 1983), a computer model with a hierarchical structure. It is assumed that autobiographical knowledge is stored in such a hierarchical structure instead of schemas, scripts, or categories (Anderson and Conway 1997). Anderson and Conway set out to test the combined Schank-Kolodner memory model on episodic and autobiographical memory. Their finding was that autobiographical memories are organized according to an abstract personal history, one level of which consists of lifetime periods (see above), called A-MOPs. Below this level, we find general events, E-MOPs. While CYRUS put an emphasis on events, Anderson and Conway found that actors were the most important elements, followed by locations, and temporal information. Barsalou conducted a similar test and found that such a hierarchy contains summarized but not specific events; participant cues were the fastest, followed by location, time, and activity cues. However, temporal order of events was found to play a significant role in the organization of autobiographical memories, in particular at lower levels. A clear difference to the dynamic memory model is its focus on contexts and actions, which were not relevant in the experiments concerning autobiographical memory. Anderson and Conway conclude that this knowledge is "accessed by a complex retrieval process modulated by central control processes. The retrieval process is cyclic driven by a mental model of cur-

rent task demands" (1997: 242). The first step consists of the elaboration of the cue, which is followed by access to knowledge structures, starting at a general level. The model the authors create contains features of the dynamic model: knowledge structures, indexing, spreading activations.

These aspects, which are discussed below, can be traced in language and communication at least at three different levels, which are the basis for the structure of the volume. The first and the most debated is established linguistic structure, in particular syntax. The main issues here are: What processes are responsible for linguistic structure? In which memory is, for instance, syntax stored? How economical is language? Until recently, it was taken for granted that grammatical rules are stored in procedural memory. However, with the emergence of cognitive grammar and construction grammar, which have proved grammar to consist of entrenched cognitive structures, this view has been revised. Construction grammar started with the "uncomfortable" part of grammar, namely idiomatic expressions, which were assumed to be learned by heart as part of the lexicon due to lack of systematicity; the finding was that these are part of grammar. The grammatical theories just mentioned reject the assumption of a sharp boundary between the lexicon and syntax and take a continuum for granted with no borderline between them. This is shown to be enabled by the flexibility and the economy of memory.

The second part presents a new perspective on some of those linguistic phenomena which are usually thrown into the huge bin of pragmatics with a highly varying content. These are structures without a firmly established form-function relation, such as expressions for evaluation or discourse markers. A pragmatic explanation of the functions of such a structure does not add much to our knowledge of that very structure: they are supposed to invoke implicatures, which are required for a correct interpretation of the structure in a particular context. Contributions in the second part of this volume demonstrate that it is possible to provide proper explanations even for a strange behavior of certain structures by considering properties and functions of memory. In this part, the distinction of submemories according to the kind of content becomes critical.

The third part of the volume discusses larger contents: textual and pragmatic aspects, such as coherence and interaction. Despite the different linguistic perspective, the findings are similar to the previous parts concerning the type of memory and language, the hierarchical structure of memory, and the tendency of the brain to recognize the abstract structure in various types of text.

5. The chapters

5.1. Linguistic structure and memory

In this part, the emphasis is on the relation of established linguistic, in particular syntactic, structure and submemories and their interaction. The topic shared by all contributors is clearly the issue of the form of storage of linguistic structures: structure vs. rule, which correspond to syntagmatic vs. paradigmatic organization. This issue is, of course, connected to the type of submemory as well. Rule application requires the participation of procedural memory, while the employment of established structures is involved with the activation of memory chunks stored in semantic memory. The overall finding of the contributions is that syntax, for instance, cannot be judged to exhibit only one kind of processing; instead, its processing is involved with a whole continuum ranging from strict procedural skills to semantic knowledge. This is in line with work done by syntacticians in the last few years, which has revealed an increasing agreement on the assumption that a large part of established language, for example, syntactic structures, is stored in declarative memory and is not generated by rule application. This discovery has resulted in Construction Grammar (Croft 2001; Goldberg 1995; Kay and Fillmore 1999). A compromise adapted to the properties of the structures is the most economical solution: procedural knowledge is too rigid to cover all syntactic structures, and the employment of semantic knowledge cannot cope with the high regularity of some structures. While Chipere's chapter is concerned with the syntagmatic and paradigmatic aspects of language in general, Webelhuth et al. as well as Deane demonstrate the role of these two processes in syntactic structure and its acquisition by means of experiments. Schulze views figurative language from the perspective of syntagmatic and paradigmatic processes. Finally, Multhaup provides a comprehensive illustration of language acquisition integrating these in this account. On the whole, the contributions provide a moderate view of syntax and linguistic structure excluding extreme ideas. They suggest that linguistic skills cannot be described in terms of one single memory type but should be considered in terms network models or action systems containing both organized semantic and procedural knowledge. The case of figurative language shows a joint utilization of episodic and semantic memory.

Chipere is concerned with the role of memory for linguistic structure; the question presented is whether linguistic structure as well as its acquisition can be explained in terms of a dual system consisting of rules and associations. From the point of view of memory, rules are stored as such

and applied on each relevant occasion, an assumption found in generativist theories of language, whereas structures that cannot be split are stored as chunks and activated as associations when required. While the application of rules shows a high degree of creativity when acquired and effortless application after their automatization, the latter taxes memory constantly, with the degree depending on the entrenchment of the structure. Numerous linguistic models assume these two strategies to be enough to explain linguistic behavior claiming that systematic structures are rule-governed, while unsystematic, opaque structures are considered associations. Chipere shows, however, that such a dual model is not powerful enough because of "the assumption of mutual incompatibility between rules and associations." He provides a historical overview to illustrate this starting with views held by the classic "linguists", Plato and Aristotle, representatives of rationalism viz. empirism. He shows then the problems encountered with this division when testing subjects' syntactic knowledge. The results make clear that even rule-governed linguistic forms can be processed as associations, that is, they may be stored in declarative memory. A further challenge to the dual nature of language is shown to lie in the processing of structures by individuals: Chipere makes the finding that one single construction may be processed as a rule or as an association by different individuals. This is true, in particular, of language learners: children may process one area of language holistically, another analytically. The appropriate framework to cope with this problem is constructivism as presented by Piaget and de Saussure due to its ability to integrate both kinds of processing, however, without being restricted to these and yet providing a proper frame for individual differences. In this framework, language is considered a network consisting of paradigmatic and syntagmatic links. This is viewed as parallel to the graph theory applicable to other sciences as well.

The most important finding concerning the influence of memory on language structure made by Chipere is corroborated in the following chapter by *Webelhuth, Wendlandt, Gerbl and Walkow*, who examine the storage and processing of four different types of inversion in English. The main finding is that "the truth lies somewhere in the middle," which means that the construction is neither entirely rule-governed nor memory-based despite the fact that inversion is assumed to be a rule-based phenomenon, a transformation in some theories, a template in others such as Role and Reference Grammar. The authors investigate the universal, language-particular, and construction-particular properties of inversions within a purely syntactic framework (Principles and Parameters), using a statistical procedure in terms of optimality theory. The result is that not even syntactic structures

can be explained to function only on the basis of rules; instead, they are dependent on multiple factors, such as the presence of an identifying or existential subject and its definiteness, that is, representations in working memory, as well as the frequency of the co-occurrence of the elements, that is, syntagmatic chains stored in semantic memory. The investigation yields a continuum with varying degrees of definiteness as constraints for the four different structures examined, and basically confirms the results obtained in the psycholinguistic experiments conducted by Chipere. Since definiteness is concerned with the appraisal of the activation and existence of referents in the addressee's mind, we can claim that even the constraints for the use of an inversion are involved with various memory structures and submemories (see Bublitz).

In the same vein, the chapter by *Deane* investigates grammatical constructions in terms of lexical co-occurrences applying statistical methods on corpus data with the aim of discovering how learners process constructions and store them. An assumption of innate linguistic knowledge, that is, involvement of procedural memory, is rejected on the basis that "a significant portion of the correlation between co-occurrence and semantics is mediated by the existence of constructions". Hence, Deane opts for inductive associative learning of syntactic structures. This raises the question of what mediates the relationship between semantics and syntax and raw occurrence data. According to Deane, the answer lies in a construct consisting of the paradigmatic class and the syntagmatic structure, which emphasizes the "mental reality of linguistic structures." Constructions, which are the result of the interplay of paradigmatic and syntagmatic processes (see Chipere) can be treated like words because of their basic status in Construction Grammar (see also Kay and Fillmore 1999); all constructions are assigned a specific meaning. An analysis of constructions requires, then, according to the study, specifications of the grammatical patterns and the word classes of the elements, correlation between cooccurrence and semantic similarity. It is hypothesized that all that is required for a successful acquisition of the ditransitive construction, for example, is the statistical ability (Zipf's first law) to induce the generalization that such structures with various sequences belong to a common category. This outcome shows in reality how semantic knowledge becomes procedural (see Multhaup).

The chapter by *Schulze* examines the processing of metaphor and metonymy, with an emphasis on the economy and the flexibility of cognition. By doing this, he provides a detailed description of various kinds of information chunking in mental representations, which implies both an interaction of various submemories and an involvement of different processes.

Figurative language is shown to reduce cognitive complexity in that only the most salient parts of a structure are stored and activated, a view opposite to common belief that they add complexity in being stylistic devices (see also Kreuz and Ashley). The difference between metaphorical and schematic structure, both containing abstract information, is elucidated: While the latter originates in the similarity of attributes and can be activated partially, metaphors are based on analogical similarity, that is, on similarity of relations and could, hence, be taken to be instances of MOPs considered within Schank's memory model. The principle behind the processes of metaphorization and metonymization is shown to be cognitive economy as conceived in relevance theory: maximal benefit at minimal cost by employing analogical instead of analytical processing. While analogies are automatic and effortless, analytic processing is slow and effortful. Figurative language represents optimization of resources due to the abstract and dense information package and is, hence, easy to process.

The description of the cognitive apparatus underlying metaphor and metonymy in language is underpinned by a neurological model to provide background for the way contiguity leads to semantic networks containing various kinds of relationships, to metonymy, and finally to analogy and metaphor. In these processes, semantic and episodic memory can be considered to be jointly involved in that metaphoric and metonymic thinking arise "from recurring patterns of embodied experience." Therefore, the function of figurative language can be considered to facilitate the understanding of certain concepts. The starting point of metaphor and metonymy is shown to lie in paradigmatic and syntagmatic processes similar to grammar. The origin and the function of figurative language show a tight relation between cognition and language: language is a tool for the management of attention and is therefore also flexible and inaccurate, though accurate enough to allow efficient communication, for instance, through the development of tools like metaphor and metonymy.

Multhaup, who views information processing in language acquisition by comparing three types of theories (behavioristic, innatist, and constructivist), arrives at the same conclusion as the previous contributors –already indicated by the title of his chapter – "ends meet." Right at the beginning, it is made clear that "declarative and procedural knowledge are not stored in separate compartments but in a way that makes (physical) forms have (cognitive) functions." Initial chunk learning is shown to take place in declarative memory in order to be utilized for communicative purposes in procedural memory. It is emphasized, however, that declarative knowledge does not turn into procedural knowledge only by frequent activation but has to

undergo a cognitive analysis first. In the same vein, the author argues that episodic and semantic memory cannot be kept apart: Certain episodic information is transferred into semantic memory through decontextualization processes (see Bublitz). It is argued that no extreme theory could be correct because our cognitive processing is guided by pattern-finding abilities (see Schulze), which is accompanied by "intention-reading skills" in communication and presupposes an ability to create and modify existing knowledge structures. A broad discussion including various cognitive aspects of relevance for topics of language learning terms "declarative" and "procedural knowledge", "explicit" and "implicit knowledge," is underpinned by findings from neuroscience. The chapter shows that the investigation of language acquisition is an enterprise particularly fruitful for discovering properties of language processing and structure in general as well as those of single standard languages, as memory takes a multitasking role in language acquisition.

5.2. Select linguistic notions and memory

A significant finding provided by contributions in this part is that the use of less well entrenched structures causes a more thorough mental processing and along with it, a higher degree of subjectivity and evaluative force than structures with fixed functions; such structures also tend to acquire interpersonal functions. They also tend to be involved with a higher processing load than those referring to clearly related memory structures and, hence, their use leads to a better memorability, in particular if involved with evaluation, than the use of structures with established functions. The structures examined in this part are mainly related to autobiographical memory. Mental processes involved in the decoding of their functions are those typical of creative cognition, characterized by inaccuracy and fuzziness (Finke, Ward, and Smith 1992), i.e., they share features with processes taking place in problem solving. The findings are ascertained in entirely different studies, such as investigation of evaluative language in newspapers (Bednarek), use of causal connectives in Greek (Kitis), various forms of 'try' (Pishwa), and negation (Kaup). This part also demonstrates that different types of memory sources yield different functions, thus strengthening findings in memory research. It is structures related to episodic/autobiographical memory that tend to exhibit subjective functions. The analyses also suggest that structures that involve memory only to a certain degree (Bednarek, Kitis, Pishwa) are used primarily subjectively,

evaluatively, and intersubjectively, while those with an accurate reference to long-term memory, such as a causal connector in Greek (Kitis) reflecting stored causality, are only used ideationally. The investigation of negation (Kaup) shows in addition that negated information does not even leave traces on memory as such; it simply does not exist in memory. Its processing in working memory shows a preference for mental models, that is, holistic patterns, rather than for propositions.

Bednarek investigates the role of memory in the use of evaluative language, a highly complex phenomenon due to its heterogeneous symbolization and multiple origins. Arguments concerning memory are based on frame (schema) theory; the seat of frames is not stated because of the multifariousness of evaluation. Cognition is assumed to be involved in an evaluative act in two different ways: an evaluation may be the result of a cognitive operation in communication (see Kaup), or an evaluation may already be attached to a memory structure. While the latter seems to be rather constant, online evaluation varies to a high degree: it may be a spontaneous act of evaluation, it may symbolize expectedness, particularly failed expectations, or it may be used for rhetorical-pragmatic purposes. The role of memory for (the verbalization of) evaluation can thus be considered to lie either in a direct activation of stored memory structures or in activated expectations brought about by an experience stored in frames.

The expression of an evaluation may be "inscribed", i.e., explicitly verbalized, or "evoked", i.e., inferred by the addressee without an explicit expression. In the latter case, evaluation is brought about by a relation of appropriate frames to the content conveyed by a message in a certain context, which implies activation of knowledge representations along with additional processing; this would usually be called "implicature" or "invited inference" in pragmatics. Certain verbs such as 'admit' are considered as an intermediate solution, being neither a verbalized evaluation nor entirely unexpressed. 'Provoked' refers to an evaluation of an intermediate degree, which is found, for instance, when an evaluative parameter other than positive/negative provokes exactly this parameter in an utterance.

Evaluative expressions found in an English newspaper corpus are classified in terms of a parameter framework consisting of ten parameters, which are shown to interact strongly with each other. The investigation shows that tabloids contain more evaluative expressions as well as clusters of parameters than do broadsheet papers, in which usually only one parameter is found in a single expression. The findings could be interpreted with regard to the participation of memory as follows: the less accurate an expression is the more knowledge representations are activated for the recognition of the

evaluation and the higher the degree of subjectivity and the evaluative force; this finding is confirmed in the other chapters in this part. Effort involved with this kind of evaluation is high, while activation of an evaluation stored in memory structures requires much less cognitive energy.

The paper by *Kitis* provides evidence for the involvement of two different kinds of memory in the functions of Greek causal connectives, which correlate with the source of the information combined by the connective. One of them, *epeiδi,* is only used when the information in the subordinate clause is "a purely semantic or content conjunction"; it connects clauses that are stored together in everybody's mind and cannot be challenged. This suggests that the information chunk is retrieved from semantic memory. The function of the other two, *γiati* and *δioti,* is rather a subjective statement involving episodic – or, in terms of Conway's memory model autobiographical – memory and online processing. These two connectives display the speaker's/writer's view on the relation between the clauses adding causality or a reason between pieces of information, which are not stored in this relation in memory (see Bednarek). *γiati* may also reflect shared information and, thus, behave like *epeiδi.* However, its primary function is found at a discourse level, where it indicates relevance relations between adjacent and remote clauses. It can be moved around freely in the sentence due to its being desemanticized (see Pishwa); when positioned at the end of a clause, *γiati* functions as a presuppositional marker. Kitis concludes that *epeiδi* is the connective at the ideational level, while the other two can also be used and on the textual and interactional level of language, where they imply a high degree of subjectivity. The cause for the different functions is found to lie in their etymology still discernible in the meaning: *epeiδi* reflects a temporal anteriority, which is a presupposition for causality established in memory. The root of *δioti* (*γiati* being its low variety) is similar to that of *because* being derived from Ancient Greek 'by+cause'; the English *because* can be used subjectively as well in that the speaker provides her own opinion of the cause. It is quite obvious that languages need some desemanticized structures to cover functions not captured by others.

Pishwa's analysis of 'try' relates to the hierarchy of knowledge representations on the one hand in that 'try' is related to goals, the highest, abstract nodes of schemas, representing a generalized structure. On the other hand, it deals with personal goals (schematic goals also frequently serve as personal goals) and, hence, with social cognition in that goals are social phenomena (Barone, Maddux, and Snyder 1997: 255). The analyses show that 'try' symbolizes a non-default goal; default goals are stored in seman-

tic or autobiographical memory. This function lends it a high degree of abstractness and desemanticization allowing 'try' to acquire multiple functions (see Kitis), which can be explained by considering knowledge about the world and people. From a cognitive point of view, the default function of 'try' implies that the intender is uncertain about the outcome of the goal and, hence, that it is not stored in the speaker's memory. The analysis demonstrates a tight relation between the intender's certainty about the attainment of the goal, the speaker's knowledge of the intender's goal, and the authenticity of goals. Subjectivity and evaluative force increase along with decrease of the intender's certainty concerning the attainability of the goal, with a speculation about others' goals by a speaker, and with past goals, an unnatural constellation. This means that the function of 'try' is also dependent on the person category of the clause subject and the tense of 'try'. The less certain the intender is about attaining her goal, the more abstract its meaning and the higher the probability for added subjectivity. The results suggest, similar to *γiati* in Greek, that it is the desemanticized nature of structures that allows multifunctionality. With regard to memory, it means that linguistic structures without a firm reference in memory structures tend to be used subjectively; 'try' as a marker for a non-default goal is an instance of this category.

The analysis of 'try' illustrates a further remarkable feature of memory, namely that people are able to retrieve accurate information of the attainability of goals instantly despite the fact that they have never encountered them before. The question arises of whether the whole memory is scanned in search for information about attainability or whether there is other kind of information. In fact, autobiographical memory is assumed to store knowledge of constraints for goals that are worth pursuing; 'worth pursuing' always refers to goals that are judged to be attainable. As mentioned above, social cognition assumes that we store rules or regularities in particular schemas about goals. This shows that an analysis of 'try' would be impossible without considering the structure of knowledge representations and social cognition, which provide proper explanations instead of classifications offered by pragmatics.

The chapter by *Kaup* examines negation focusing on the form of the representation of the negated state in the addressee's working memory (proposition, referent, or image). This is an interesting issue because negated states do not refer to anything in the real world, and hence, are lacking both in the speaker's and the addressee's long-term memory. On the contrary, the non-negated state is assumed to be stored in the addressee's mind, which the speaker attempts to change by negating it. In

order to find out about the representations and the processing taking place in working memory, Kaup tests the processing of negation within three approaches to language comprehension. The first (propositional) model views the linguistic input in working memory as propositional, which requires an additional level of propositional encapsulation for negation. Accordingly, negation implies a higher complexity with regard to mental processing and a lower availability of the negated item than of a non-negated one. In the second approach, the situation-model theory, meaning representations are not propositions, but mental tokens representing the referents. This model has similarities with discourse-representation theory (DRT), in which negation applies to a subordinate discourse representation structure making the referents that are introduced in the scope of the negation operator less available than those introduced in affirmative phrases. In opposite, referents not introduced in a negated clause are not influenced by the negation. In the third model (experiential view), the representation of elements is holistic in being the same as that utilized in non-linguistic cognitive processes (perception, action, imagery). The availability of the negated element does not depend on the linguistic form but on the content of the described state of affairs. According to this, a negated clause is more complex than an affirmative one because it is processed in two stages by the comprehender: (1) a simulation of the negated state of affairs followed by (2) a simulation of the actual state of affairs. To summarize: the three accounts differ with respect to assumptions concerning representational issues in language comprehension and the processing and representation of negation.

Before the description of the experiments, Kaup presents findings made in previous studies, which argue for a more difficult processing for negated clauses than for affirmative clauses due to a longer processing time and a higher error rate. The first experiment conducted by Kaup verifies these findings concerning the degree of difficulty. Further experiments also confirm the prediction that the processing time of negated sentences is longer than that of affirmative sentences; the three models agree on this finding. An additional finding restricts this generalization, however, showing that the processing time is dependent on the felicity condition of the negated sentence. When negation is tested with respect to the truth value of the clause, differences between the models arise concerning processing, whereas they agree with regard to the results: false affirmatives take a longer time than true affirmatives and false negatives take a shorter time to process than correct negatives, and on the whole, negatives take a longer time than affirmatives due to the creation of the additional representation

for the negated state. These findings support the analyses in the above chapters concerning the claim that if a structure relates to stored information in memory its processing requires less mental effort than that of a structure with an opaque reference.

Differences between the models arise in further tests. The experiential-simulations view is supported by the results of a test in which the delay between the affirmative and the negative is varied: a longer delay between a sentence and a recognition task decreases the response time. This favors the two-level processing assumed in the experiential view and disconfirms the assumption that comprehenders construct an explicit encoding for the negation in working memory. Next, the accessibility of negated information is tested by using verbs describing creating and destroying activities. While the type of activity does not matter to propositional theory and DRT, it does make a difference in the experiential-simulations view, which assumes a simulation of the actual state. This test also considers the finiteness of the object created/destroyed. After the presentation of a short narrative story, which also contains a negation, two probe words are presented. In destruction activities no difference is found in the processing of negated and non-negated activities. In contrast, a difference is noticeable in creative activities, both with an indefinite and definite object; the latter is processed faster than the former. This finding, complemented by a further experiment employing the presence/absence of colors of an object in the test, is interpretable only within the experiential view. In the following experiments, so called "equivalence effects" are tested in various ways. The results again lend support to the experiential view showing that comprehenders create only the negated state first by creating an image of it if the delay between the sentence and the picture is short. After a longer delay between the clauses to be compared, the actual negative situation is processed faster than its affirmative counterpart.

The final part of the chapter discusses the encoding of negated sentences in long-term memory, that is, their recall. Numerous studies referred to demonstrate a poor memory performance for negated sentences due to various types of errors that appear in dependence on the linguistic material. The errors can be explained correctly in terms of the three processing models.

The overall results favor the view that we process whole patterns or images instead of creating syntagmatic chains (propositions) or focusing on some of their parts (DRT). Supporting evidence for the superiority of the experiential view as a language comprehension model is provided by studies investigating the availability of negated elements: the type of activity is

found to influence this, as predicted by the experiential view, while the other two approaches do not pay attention to semantic differences of the verbs. Further evidence for this is provided by the study on anaphor resolution connected with double negations. Kaup states that further studies are necessary to corroborate the findings, because it remains unclear in how far the results can be transferred onto other phenomena or whether they are restricted to negation. However, the chapters in the first section show a tendency toward patterning of linguistic elements in other linguistic areas as well.

5.3. Discoursal units and memory

This part views larger linguistic units, that is, discourse, from various angles: coherence in general, epistemic aspects, politeness, and persuasive language. The contributions support the assumption (Schank 1982) that memory is not a static storage but a processor and that the function of language is only that of a trigger to activate parts of the vast bulk of information stored in memory. This becomes evident in the context-dependent flexibility of linguistic structures and the interaction of the two declarative memory types (Bublitz). It is also revealed by the ways the brain extracts and stores an abstract structure in all types of communication, which may be the speaker's awareness of the source of knowledge in story telling (Mushin), an unpronounced speech act and politeness (Holtgraves), or its perlocutionary force (Kreuz and Ashley). The contributions also bear out the assumption that utterances conveying new, unexpected information are paid more attention to than those carrying familiar information: for instance, the processing of irony demands more time than that of metaphors, obviously because metaphors are rarely new, while irony is frequently novel and has to be processed anew in every context (Kreuz and Ashley). Irony also implies evaluation, which is assumed to contribute to more thorough processing; messages that are processed more thoroughly are also more persuasive.

The contribution by *Bublitz* relates coherence to various types of declarative memory. The intersubjective aspect of coherence creation is emphasised in that comprehension, an essential element of coherence, is defined as a collaborative undertaking despite the single minds working on the meanings. This is enabled by the activation of linguistic and world knowledge shared by the participants. The function of linguistic items is to serve as "interpretation triggers" for the activation of knowledge stored in

memory in order to make sense of the whole. Accordingly, coherence, defined as a "collaborative and hermeneutic" phenomenon, does not exist in texts but is negotiated by the participants sharing these two kinds of knowledge; it is also found to be variable, approximate and scalar. Coherence is involved with common ground, which is explained as "those actually activated fragments of knowledge that are relevant to the ongoing process of understanding" instead of the usual "shared world and cultural knowledge". This demonstrates the contextual flexibility of knowledge: In order to understand the construction of coherence, we have to know what is meant by context, since utterances change their meaning from one context to another. Indeed, Bublitz defines context as volatile in that speakers "create current contexts for current utterances." This definition is followed by the presentation of the involvement of various types of memory (cf. Multhaup and Introduction), which are then discussed with regard to their contribution to coherence. Episodic memory containing private experiences, simply labeled as memory, can be made public, however, without being turned into common knowledge; episodic knowledge acquired by recipients is comparable to mental models according to the author, which is in line with the assumptions of the content of memory structures presented in the first part of this chapter. An example illuminates the big difference between semantic knowledge and events stored in episodic memory: the latter is loaded with subjectivity and interpersonal information and therefore promotes coherence, while semantic knowledge is impersonal, but can be manipulated in multifarious ways by relating categories and concepts to each other, by arranging them causally or temporally, and be used creatively in other ways to provide background knowledge. Bublitz shows, however, by means of an example that frames stored in semantic memory may also be involved with emotions, evaluations, and attitudes shared by the whole community. The final perspective of the chapter focuses on the joint contribution of these two memories to coherence concluding that both are equally effective with regard to coherence because episodic memory when verbalized goes public and becomes comparable to frames.

Mushin emphasizes the dynamicity of memory by considering evaluative expressions found in retold narratives. Evaluation has a broader scope than generally assumed in that it involves the ways a story is encoded and reconstructed. This is because retelling is a constructive process by the memory, which extracts the relevant information from a story and recreates it when retelling, keeping track of the source of information and the degree of epistemicity. The chapter starts with the investigation of the perspective

– epistemological stance – taken by the reteller with regard to the source of information. There are three stances that the narrator may take when retelling. It is possible to use a personal experience epistemological stance, which means that the events are told as if the reteller had experienced them himself. The narrator may also use the reportive or imaginative stance. While the reportive stance attributes the story to someone else, the imaginative stance treats it as fictional without referring to the source of knowledge, although the narrator keeps it in her mind. The material investigated is a "Mouse soup" story, which is doubly retold. The choice made by the narrators was not the reportive epistemological stance but the imaginative stance, whereby the original story itself was not altered. In some passages, however, the narrators switched to the reportive mode; this was particularly the case when evaluations were verbalized. Mushin considers the preferred use of the imaginative stance "evidence for the constructive process of story telling" and explains it as the narrators' intention to present a tellable story. However, as the other chapters show, the constructive process is not restricted to narratives.

The second part of the chapter views expressions for inferencing, such as *must*, which only appears in reportive stance. This took place in the experiment, for instance, if the narrator in the "first generation retelling" was not sure about her information and marked it explicitly; when this was retold by a "second generation" reteller, the epistemic stance was verbalized again. Mushin notes that inferences are by no means always explicitly marked. This can be explained by the fact that memory complements incoming information by adding schematic knowledge so that the narrator is not even conscious of whether the information was verbalized or inferred by her memory.

The chapter by *Holtgraves* is also concerned with pragmatic issues. It investigates the comprehension and storage of speech acts and politeness and shows their dependence on social parameters. The first part investigates speech acts using a recognition memory procedure and a cued recall procedure. The experiment concerned with recognition shows us that speech acts are stored in memory even if unpronounced. Recall was better when an utterance "performed the speech act named by the recall cue, relative to the control condition." The recall task also showed individual differences in dependence on the participants' communicative style with a tendency to indirectness promoting recall for speech act cues. The conducted experiments show the importance of the illocutionary force in both comprehension and representation; an illocutionary force is recognized by communicators even if it is not verbalized directly. The second part of the

paper investigates wording for politeness, which is interesting because it is well known that exact wording is only rarely remembered; the information is extracted and transformed into an abstract meaning. However, it is possible to remember wording of information with high interactional value, that is, of politeness. The memorability of a message depends on the status and closeness of the communicators, which Holtgraves investigates by means of experiments. The main finding is that memory is best for polite forms when they contradict expectations: when a person in a high position is polite or a person with a low status is impolite. Remembered information is of relevance for future conversations because the content influences the cognizer's evaluations of others. Therefore, the author concludes that conversation memory is "an important and interesting endeavor."

Kreuz and Ashley view the persuasive force of non-literal language by testing their reading time and memorability relating these to the long-term representation of the persuasive message. Previous findings, which are partly contradictory, indicate that non-literal language does influence the persuasiveness in various ways, for instance, metaphors are claimed to exert a positive influence on persuasiveness. The same applies to rhetorical and tag questions, which increase the effect of argument strength, however, in dependence on the strength of the argument the question is attached to. Two different processing mechanisms are introduced to be tested: operant conditioning and cognitive response hypothesis. The first simply means in the context of, for instance, rhetorical questions that a language user is conditioned through the process of acculturation to answer questions. The findings support the view that rhetorical and tag questions do enforce persuasiveness. "Cognitive response" to these kinds of questions leads to differentiated outcomes concerning cognitive elaboration in dependence on the strength of the argument. The chapter describes experiments examining these two processing modes with added, more refined features to find out about their influence on persuasiveness. Kreuz and Ashley set out to investigate the influence of non-literal language on long-term memory, which is dependent on the route leading to persuasiveness: while the central route refers to the quality of a message's arguments and may lead to permanent attitude change, peripheral processing relates to other factors, for instance, the attractiveness of credibility of the communicator, and can result in temporary attitude change. The investigation addresses the valence of the test items because of the different processing of positive and negative information. The main experiment with forty participants was preceded by "norming studies" in order to elicit only ideal material consisting of idioms, which were replaced by metaphors, similes, hyperboles, understatements,

ironic statements, and rhetorical questions; also the understanding of metaphors was tested before the experiment. The findings were that positive statements in non-literal language required a longer reading time than negative statements, while the reverse was true of literal language (cf. Kaup). Furthermore, ironic statements were read more slowly than all other types and were remembered better than similes and understatements, and also a simile was read more slowly than a hyperbole or an understatement. The reason for the long processing time of ironic statements is assumed to lie in the "asymmetry of affect" effect, according to which speakers are more familiar with a positive formulation about a negative state than the other way round (canonical vs. non-canonical irony). The authors assume that the additional processing time due to the non-canonical cases, which shows that non-default constellations require more processing, which leads to better memorabilty, which again leads to a higher persuasiveness. The surprising result of the study was that metaphors and rhetorical questions were neither processed nor memorized differently from literal language, a finding that contradicts all previous research results except that provided by Schulze (this volume).

6. Conclusion

I hope that the chapters will convince the reader of the existence of firm and multiple relations between language and memory. The contributions in this volume demonstrate not only that the structure of language reflects properties of memory and it processes but also that the function of single linguistic structures can be predicted to a certain degree on the basis of their relation to a certain part of memory. At least as important is the degree of the correspondence of linguistic structures and memory. These aspects guarantee the processability of language and ensure its suitability as an ideal communication device because both information and the language itself are stored in memory. If language did not share properties with its storage communication would be more cumbersome due to two different systems. Luckily, this is not so, as the chapters in this volume show.

The first part shows a light shift in the view of the storage of fixed language structures in favor of associative patterns indicating that grammar is not necessarily composed of rules, which are the very last stage of automatization, but that it shows a highly flexible structure beginning in the lexicon. The second section demonstrates convincingly that linguistic structures with a loose relation to a particular part of memory tend to be

used subjectively and intersubjectively. The last section illustrates the tendency of memory to impose structure onto all kinds of discourse and communication. These findings should be only the beginning in language-memory research, which is fruitful and should therefore be followed by further work.

Note

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Part 1. Linguistic structure and memory

Chapter 2
A constructivist epistemology for the language sciences

Ngoni Chipere

1. Introduction

Language is Janus-faced, bearing rule-like regularity on one face and usage-based idiosyncrasy on the other. For two millennia, however, students of language have sought to establish one or the other as the true face of language (including, of all people, Julius Caesar, who favoured regularity over idiosyncrasy). The analogists of classical Greece viewed language as an orderly phenomenon possessing an internal logic. Their arch-rivals, the anomalists, saw language as an irregular phenomenon shaped largely by social usage. This ancient schism cuts across contemporary sciences of language: contemporary linguistics disagree sharply on whether language is rule-based or usage-based while psychologists differ on whether linguistic representations are based on rules or associations.

Repeated failure to determine if knowledge of language takes the form of rules or associations has now lead to a growing perception that it encompasses both forms. Numerous experiments have shown that linguistic representations incorporate rules and associations (see papers in the volume edited by Nooteboom, Weerman and Wijnen 2002; see also Marcus 2001; Wray 2002; Townsend and Bever 2001; and Pinker 1999). Such studies have led to a growing recognition of the need to integrate rules with associations and there is now a proliferation of 'hybrid' models of language processing.

These new models seek to combine rules and associations by employing a 'dual route' approach involving two co-operating language processors – one based on rules and the other based on associations (see Chipere 2003 for a discussion of two such models). The rule-based processor is employed to deal with regular linguistic forms while the association-based processor is employed to handle irregular forms. There are problems with this formulation, however.

The problems arise primarily from the fact that, whereas rule-based and memory-based models were grounded in either rationalism or empiricism, the new dual route models lack a clear epistemological basis. The resulting epistemological vacuum has left the new hybrid models vulnerable to often covert influences from rationalism and empiricism. This article addresses two particularly problematic assumptions that emanate from the traditional epistemologies.

Firstly, it is often assumed that these forms of representation are distinct and mutually incompatible. This assumption arises from the historical opposition between rationalists and empiricists, which has led to the polarisation of rules and associations. Thus we find that, although dual route models are predicated on the co-existence of rules and associations, they retain the assumption of mutual incompatibility between these forms of representation. For instance, dual route models assign different processing roles to rules and associations: rules are assigned to regular phenomena and associations to irregular phenomena. This separation of rules and associations is reified by locating each form of representation in its own special processor. This assumption of separateness, however, is violated by the fact that rules and associations *interact* in a cognitively productive manner.

A mathematical analogy can be used to illustrate the point. Nooteboom, Weerman, and Wijnen (2002) note that it is possible to say that there is only one number, 1, and that all other numbers are derived from it by operations of addition, subtraction, multiplication and division. While this may be true, we routinely reckon with numbers higher than 1 as if they were primitives in their own right. In other words, we reckon with *stored* products of computational processes. The human ability to store and re-use computational products appears to be a natural and possibly indispensable aspect of mental functioning. One needs only imagine how onerous, if not downright impossible, mental arithmetic would be if one had to write 1+1+1+1 instead of simply writing 4.

The observation in the last paragraph can be taken further. Consider that once a formula has been derived for solving a mathematical problem, mathematicians will typically not bother to derive the formula each time they need to use it. For instance, the formula for calculating the area of a circle is routinely applied with no thought given to the process of its derivation – it is simply recalled from memory and applied. The process can be repeated endlessly: the expression for calculating the area of a circle may, in turn, be used to derive other expressions, such as the one for calculating the volume of a cylinder and so on. It appears that the human brain natu-

rally compresses processes into products and thus enables itself to engage in more complex processes. There is a productive interchange between computation and storage that cannot be accounted for if rules and associations are separated.

The second assumption that dual route models inherit from rationalism and empiricism is that speakers of a language share the same mental representations of the language. Rationalists assume that speakers of a language share the same grammatical rules while empiricists assume that speakers of a language share the same set of associations. In dual route models, these assumptions manifest in the dual language processors: a rule-based processor that can handle all the regular phenomena in a language and an association-based processor that can handle all the irregular phenomena. Yet again, this inherited assumption runs foul of the facts, for it appears that speakers vary considerably in linguistic representation.

To illustrate the nature of this variation, let us return to the mathematical analogy one last time. If one wishes to learn the formula for calculating the area of a circle, one can learn the formula or one can recreate the deductive process by which the formula was discovered. To use a catchy phrase, one can either be a rule-follower or a rote-learner. Rote learning is the easier option while rule-following is more demanding. However, rote-learning results in item-specific knowledge while rule-following guarantees the ability to generate valid solutions for a wide range of mathematical problems.

Evidence will be presented to show that speakers differ precisely along these lines: some tend to rote-learning and others to rule-following. On account of this variation, native speakers differ in the range of sentences that they can understand in their native language. The rule-followers can decode a wider range of syntactic structures than the rote-learners. This pattern of variation cannot be accounted for by dual-route models that assume that each speaker is fully equipped to deal with all linguistic regularities via a rule-based processor and all linguistic idiosyncrasies via an association-based processor.

In summary, dual-route models are unable to account for a) the productive interaction of rules and association and b) native speaker variation in syntactic competence. The failure arises from the fact that these models lack epistemological grounding and therefore unwittingly inherit invalid assumption from rationalism and empiricism. The foregoing observations indicate the need to fill the epistemological vacuum of the post-rationalist/empiricist era.

This article will seek to show that rationalism and empiricism are inadequate bases for the study of language. It will then propose that constructivism provides the required epistemological under-girding. It will seek to show that constructivism provides principled accounts of a) the interaction between creativity and memory and b) individual variations in linguistic representation. This thesis is developed in five steps.

Section 1 shows how rationalism and empiricism give rise to the assumption that a) mental representations of language are *either* rule-based *or* memory-based and b) the assumption that all native speakers of a language share a single mental system of linguistic representation. These assumptions are falsified in Sections 2 and 3, which show a) that rules and associations are aspects of a single system of mental representation and b) that mental representations of language vary across individual native speakers. Section 4 presents constructivism as an epistemological basis for handling both the interaction of rules and association and variations across individuals in general mental representation. Finally, Section 5 brings constructivism to bear on these issues as they relate specifically to knowledge of language.

2. Rationalism and Empiricism

This section traces the origin of rationalism and empiricism to Plato and Aristotle. It seeks to seeks to show how these epistemologies have influenced the study of language over the past two thousand years. The historical accounts provided in the section are drawn mainly from Ellegård (2003) and Hergenhan and Olson (2000).

2.1. Rationalism

Rationalism originated in the ancient Pythagorean cult of number. The Pythagoreans observed that the physical universe displays a high degree of mathematical regularity. For example, musical sound displays exact mathematical relationships, as do physical shapes, such as triangles and circles. The Pythagoreans sought to generalise such observations even to aesthetic concepts such as harmony and justice. Their mathematicization of everything led them to formulate the motto: *Number Rules the Universe.* They proposed that number is eternal and exists independently of the hu-