Proposal for the establishment and funding of the Collaborative Research Centre 991

“The Structure of Representations in Language, Cognition, and Science”

for


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A05 Presuppositions of Frame Theory in the History of Philosophy

3.1 General information about the project A05

3.1.1 Title: Presuppositions of Frame Theory in the History of Philosophy

3.1.2 Research areas:
Philosophy, history of philosophy, history of epistemology

3.1.3 Principal Investigator
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3.1.4 Legal issues
This project includes

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<td>1. Research on human subjects or human material.</td>
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<td>If applicable: A copy of the required approval of the responsible ethics committee is included with the proposal.</td>
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<td>2. Clinical studies.</td>
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<td>6. Research concerning the Convention on Biological Diversity.</td>
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3.2 Summary
Project A05 aims to provide both a historical and systematic reconstruction of Barsalou’s frame conception, which the projects of the CRC are generally based on, as a model of mental representation. The main focus of the project is the question as to whether frame theory, particularly the concept of a frame, has its precursors in philosophy or in adjoined disciplines. The aim is not merely doxographic but rather should supply a deeper understanding of the structures, intentions and presuppositions of frame theory. Does frame theory represent a totally new paradigm, or does it rest upon older theories and modify their essential features? In treating these and adjacent questions, the project can refer to fragmentary historical or chronological remarks and reflections in frame investigations themselves. Barsalou’s theory of cognitive representation of concepts partially draws on the frame semantics established by Fillmore, which in turn was inspired by Minsky’s model of knowledge representation by means of semantic networks. The analysis and reconstruction of such dependencies, however, is just one of the aims of the project, which intends to take a broader line of inquiry. While Minsky is usually regarded as the inventor of the frame idea in artificial intelligence, the question arises as to what extent this invention is an independent one or whether there are doctrinal premises and roots beyond artificial intelligence. Minsky himself speaks of older theories as sources of his frame approach and points not only to the notion of a scheme in cognitive psychol-
ogy (Bartlett), which is itself indebted to Rumelhart, but also to the notion of a paradigm in epistemology (Kuhn). While investigations in the field of frame theory confront us with presuppositions in psychology, cognitive science or artificial intelligence, frame theory suggests a comparison with more remote theories that can be traced back to ancient times. Actually, older theories like categorial systems (Aristotle, Kant), conceptions of schemes (Whitehead, Rumelhart) or theories of memory (Augustine, Locke) seem to share basic intentions, structures and assumptions with frame theory. The idea of the cognitive and linguistic differentiation of perceived objects into attribute complexes seems to take place for the first time in categorial conceptions, i.e., in philosophical ontology; the idea of constructional schemes is grounded in the tradition of epistemology; and the idea of a stored and at the same time dynamic structure of representations is an item in the tradition of theories of memory. Thus, presuppositions of frame theory in the history of philosophy do not constitute a singular and linear sequence of theories. Rather, elements and items from different traditions are clearly involved. Therefore, to sum up, the aim of the project is an overarching historical and critical investigation and evaluation of frame theory in order to achieve a more clarified notion of its genesis and structures. This investigation focuses on the notion of a frame including an analysis of its neighbor concepts, its components of meaning, its explanatory virtue and, in particular, its premises in the history of philosophy.

3.3 Starting point of the project

3.3.1 State of the art and preliminary work

State of the art:
Since human beings face a host of experiences in a complex environment, they have to break down these experiences into meaningful components which can be managed by their cognitive apparatus, i.e., into basic categories. Categorization takes place at the early stages of sensory perception when incoming data are linked to more or less abstract concepts. The acquisition and use of concepts as well as categorial structures is a basic part of any learning process and of any organization of thought. Furthermore, in language a large portion of words can be considered to consist of category labels. Categorization as well as the acquisition and mental representation of concepts are crucial issues of recent cognitive science and of related scientific disciplines. Against the background of the ‘classical’ view that considers concepts as entities with well-defined borderlines and precisely describable features or conditions, alternative theoretical views on conceptualization have been proposed and discussed (Rosch/Lloyd 1978; Van Mechelen et al. 1993) – among them the prototype view, the exemplar view, the theory view, and last not least the frame view. The frame view is one of the main subjects to be treated in A05 under systematic and, most particularly, historical aspects.

Frames are usually described as a format for mental representation. The concept of mental representation as used by Fodor, Dennett and others is among the prevailing items for explaining and describing the nature, genesis and functions of ideas and concepts. According to the representational theory of mind as one of the predominant paradigms in contemporary cognitive psychology, linguistics and philosophy of mind (see Scheerer 1992, Scholz 1992), cognition and categorization occur within internal systems of representation. As a format for mental representation, frames are units of cognitive organization which have the function of structuring knowledge of the world, conserving this knowledge and restoring it as a tool for gaining further knowledge. More specific analysis usually takes place when the notion of a frame as established by Barsalou (1992, 1999) is used for systematic inquiry. Barsalou describes frames as attribute-value structures revealing a recursive structure according to which a frame’s attribute values themselves can be specified by means of further attributes and attribute values to the extent of a complex tree structure. Frames which integrate attributes, their values and constraints that relate them serve as an instrument to explain all concept types, or rather their mental representations. According to Barsalou, a broad spectrum of processes from perception to social cognition is supported by frame structures in the sense of computational mechanisms in the brain. The DFG research group RU 600 refined Barsalou’s theory with the intention of gaining a more concise and unified notion of frames (Petersen 2007), for instance in the way that every attribute, as it assigns a particular, individual value to an object, describes a functional relation. Therefore, the value is also individual or singular but can nevertheless be a complete frame.

Barsalou and his predecessors Fillmore and Minsky are commonly regarded as a more or less unified
and classical group of main representatives of frame theory. From a historical perspective, Barsalou’s conception is usually reduced to Fillmore (1977, 1985) and to Minsky (1975) as the putative inventor (Lönneker, 2003), who therefore has to represent the starting point for a historical reconstruction and investigation. Minsky introduces the notion of a frame as follows: “Our idea is that each perceptual experience activates some structures that we’ll call frames — structures we’ve acquired in the course of previous experience. […] A frame is a sort of skeleton, somewhat like an application form with many blanks or slots to be filled.” (Minsky 1985: 244 sq.) Historical remarks by Minsky himself diminish the appearance of novelty: “The basic frame idea itself is not particularly original – it is in the tradition of the ‘schema’ of Bartlett and the ‘paradigms’ of Kuhn […]” (Minsky 1975: 213) Without further specification, he speaks of “older theories in psychology” which could not account for how the mind works when it perceives a situation and apprehends it as a complex of sense data, previous experience, tacit assumptions and expectations. Those older theories “were based on ideas about ‘chunks’ of memory that were either much too small or much too large”; frame theory, according to Minsky, offers a “useful compromise” (Minsky 1985: 244).

As a direct response to Minsky, Dreyfus (1997) attacks these ideas from philosophical and historical perspectives. Dreyfus holds that much of the Artificial Intelligence research of his contemporaries in simulating or replicating human intelligence has been limited to artificial environments that were extremely limited in scope. Instead of focusing on their ‘micro world’, AI researchers should begin with a broad, high level theory of consciousness and human intelligence that draws upon the background knowledge of philosophy. Dreyfus (1997: 161 sq.) cites the work of Husserl and explains that the phenomenologist himself attempted to propose a theory of “transcendental-phenomenology” similar to Minsky’s theory of frames. While Husserl, as Dreyfus explains, began by attempting to describe his version of knowledge representation for simple objects called the “noema” (as the correlated element of any intentional act), he ended up discovering that even the most basic ideas are inevitably linked to ever broader conceptions of the outside world. Dreyfus criticizes Minsky for his ‘naïveté’ of assuming that the theory of frames could solve problems that, although philosophers “from Plato to Husserl” had carried out serious epistemological research, had remained unsolved for two thousand years – a criticism that could also refer to the scheme approach.

Thus, from a historical perspective, frame theory is linked to categorization and memory as well as the notions of scheme and paradigm.

The discussion of categories or categorization was initiated by Aristotle who presented an ontological scheme of classification of all being into ten ultimate types (substance, quality, quantity, relation, place, time, position, state, action, affection). Every object of human apprehension can be placed into one of those categories. The categories are at the same time regarded as different kinds of predication, as the Greek term “categorein” with its literary sense of “accuse”, “say”, “judge” or, in the passive, “to be predicated” indicates. The frequently asked question as to whether the Aristotelian categories have more a logical or more an ontological meaning has to be answered in the sense of both options. Aristotle is moving from what we would regard as features of the world to features of conceptualization and ultimately to language. Therefore, the categories represent a schedule for determination, explanation and distinction of features of the world and are at the same time a guide for cognition and linguistic reference to the world. Their particular relevance for frame theory is that they can be regarded as a first and most influential attempt at an analysis of objects into attributes and values. For instance, if quantity is regarded as an attribute, three feet long is a value, and if quality is regarded as an attribute, red is a value, and so forth. Alternatively, if red is regarded as an attribute, an individual instance of red occurring at a particular place and time, for instance the color of the cover of an individual book, could be regarded as a value. In this sense, values or subframes within the frame model can be identified with abstract particulars or tropes, as they are named in recent philosophical usage. At any rate, the distinction of bearers with their attributes and values as it was established in Aristotelian ontology is at least an implicit and nevertheless indispensable assumption made in frame theory.

The most noteworthy modern contributions to the theory of categories or categorization are those of Gilbert Ryle and Stephen Körner. Ryle (1937–8) tries to throw light on a particular difficulty left entirely obscure by Aristotle: How can we identify categories and discriminate between them? Solving this problem is a prerequisite for avoiding ‘category mistakes’, i.e., the production of absurdity by combining the logically not combinable. Though Ryle regarded Aristotle’s theory as the precursor of his own, an evident
dissimilarity between both is that Rylean categories, defined as they are by multiple logical relations, are potentially unlimited in number. Ryle intended to explore what he termed ‘the logical geography of concepts’, not to engage in pigeonholing. According to Körner (1974), who also links his theory to the Aristotelian model, “[t]he manner in which a person classifies the objects of his experience into highest classes or categories, the standards of intelligibility which he applies, and the metaphysical beliefs which he holds are intimately related.” As constituents of a ‘categorial framework’, Körner distinguishes a set of categories, a set of constitution principles, a set of individuating principles and an underlying logic. The categories of a framework must effect a classification of all actual objects. Since every human being classifies and interprets objects of experience with regard to dynamic ‘categorial frameworks’, these frameworks serve as psychological tools or as key notions of intellectual assumptions and habits. Hereby Körner’s ‘categorial framework’ includes the basic features which are essential for Minsky’s frames. They are subjective patterns of perception that integrate categorization and conceptualization as well as assumptions, habits and expectations.

Theories of memory make up the second historical presupposition of frame theory. Memory is the mind’s capacity to store, retain, and recall past experience and previously acquired information. Investigations of memory began in the early history of philosophy (Plato, Aristotle, Augustine), including techniques of artificially enhancing its capacities. In a theory held by empiricists from Hume to Russell, occurrent memory (in contrast to dispositional memory) consists of images of past experience and memory of facts is read off from such image memory. Nevertheless, people commonly remember facts without remembering when or how they learned them. Moreover, how can we distinguish remembering something from merely imagining it? More sophisticated theories of factual memory popular in the cognitive psychology of the 19th and 20th centuries hold that, besides a past reception of it, an occurrent memory of a fact requires some sort of mental representation (perhaps a linguistic one) and continuous storage between then and now of this representation. In recent decades, memory has become one of the principal pillars of cognitive neuroscience (as an interdisciplinary link between cognitive psychology and neuroscience). The interest of cognitive science in theories of memory was primarily stimulated by Tulving (1972, 1983) and his reception of Quillian’s research on semantic networks. These networks, again, were recognized and explored as possible models of human memory by Collins (Collins/Quillian 1969). Minsky, as the suggested inventor of frame theory, postulates that when we remember things, we enter a procedure that merges our current state of mind with a previous one, and we see current reality as an instant of the remembered event. Minsky’s theory of memory is closely related to his frame theory, which, again, is founded on the notion of scheme as the third of the historical presuppositions of frame theory mentioned above.

While important inquiries on schemes as models of mental representation are Bartlett (1932) and Rulmelhart (1986), Selz (1913) developed the first prominent and influential theory of schemes in cognitive psychology. Selz assumes that the regular line of thought (“geordneter Denkverlauf”) is more than a mere associative connection of basic ideas as its elements. Rather, integrating mental complexes are at work which are activated as anticipatory schemes (“antizipatorische Schemata”) even when not all of the elements belonging to a complex are available in memory. Paradigmatic for this procedure, according to Selz, are propositional schemes (“Satz-Schemata”) accomplishing connections between a sentence to be proffered and a mental content. While Selz is a pioneer of the notion of a scheme in cognitive psychology, there are strong affinities to the older versions, namely to Kantian terms like “Schema” and “Schematismus”, as has been pointed out by Lenk (1995, 1998) and Stegmaier (1992). According to Kant, a schema is the procedural rule by means of which a category or pure, nonempirical concept is associated with its counterpart in the senses – a mental image of an external object (Critique of Pure Reason B 179 sq.). A posteriori concepts have sense when they are derived from mental images that are based on experienced sense impressions. A priori concepts, in contrast, are alleged to have sense when they are derived from a nonexperienced mental scheme or outline. The chapter on schematism in Kant’s Critique of Pure Reason is inserted to solve the problem of how we can ensure that categories have sense and significance. To sum up this item, the notion of a frame as a complex format of representation historically derives from the notion of a scheme in early cognitive psychology which again has its roots in classical theories of knowledge or in epistemology.

While Minsky (1975) names Bartlett (1932) as the main reference for his notion of a scheme, Bartlett himself owes basic assumptions of his conception to the neurologist Head who introduces his notion of a
scheme as follows: “The sensory cortex is the storehouse of past impressions. They may rise into consciousness as images, but more often, as in the case of spatial impressions, remain outside central consciousness. Here they form organized models of ourselves which may be called schemata. Such schemata modify the impressions produced by incoming sensory impulses in such a way that the final sensations of position or of locality rise into consciousness charged with a relation to something that has gone before.” (Head 1920: 605 sqq.) According to Bartlett, experiences are accumulated or stored up as schemes, which are also described as “active, developing patterns” or an “active, organized setting”. Thus, a scheme results from the “active organization of past reactions or past experiences” (Bartlett 1932: 201). Of crucial importance here is the concept of active organization denoting an essential contrast to traditional views according to which memory is described as a table of wax receiving impressions in a merely passive manner (Plato, Descartes, Locke). Bartlett’s approach as focused on the notion of a scheme has been further developed by Rumelhart who is well-known for his formal analysis of human cognition as well as his modeling of neuronal networks. Rumelhart, rendering the notion of a scheme more precisely, regards it as a complex and hierarchic cognitive structure which must be understood as part of a semantic network. In this network, standardized assumptions of most different things or matters of fact – physical objects, persons, situations, places, events etc. – are conveniently and systematically organized. In Rumelhart’s notion of a scheme, the idea of a frame as relevant for Minsky and Barsalou is prepared in a far-reaching manner. The cognitive psychology of the last decades of the 20th century makes use of “scheme” as a key notion for the description and explanation of order, regularity and organization of cognitive processes as well as for the theoretical modeling of mnestic performance as a structured or organized procedure – a line of research mainly stimulated by the growing interest in artificial intelligence (Minsky 1975).

A.N. Whitehead (1979: 8) uses the term “categorial scheme” for a provisional and tentative model of thought and comments on his own process philosophy as a “speculative scheme” working as a matrix that enables us to argue from common sense boldly and with rigid logic (see Stegmaier 1992: 1257). Furthermore, schemes are of crucial importance in the theory of cognitive development of human beings outlined by Piaget (1975). Piaget assumes that no event of behavior can be exactly identical with another. In order to repeat any activity, a child generates schemes in the sense of cognitive patterns by means of which particular modes of behavior are subsumed to a class of equivalents. Schemes are characterized by accommodation (i.e., adjustment to reality or to recent experience) on the one hand and by assimilation (i.e., modeling of reality itself by the subject that has an experience) on the other. They are necessary tools for children that allow them to repeat behavioral activities.

Schemes in the sense relevant here are more or less abstract, generalized, and essentially decontextualized patterns or models guiding expectation with a variable degree of complexity. They include slots as well as conditions for the mode of filling these slots. The conditions determine what, according to a scheme, can become perceived as well as recalled or anticipated. Accordingly, schemes have an economic function for memory, since not all detailed features of a single event of experience have to be reminded, but rather the slots of the scheme actually activated have to be filled. Schemes make it possible to relate different information or acts of experience to each other and, in this sense, to organize them. Since the schemes are usually generated habitually and unconsciously, “to organize” is used here in a special meaning which is closely related to “association” and “reintegration” as psychological concepts (see Tulving/Madigan 1970: 442–445). A scheme, once generated, is a comparatively constant tool of cognition which is largely resistant to procedures of forgetting. Its function is to synthesize the expected and unexpected, the known and the yet unknown, and to integrate it into the process of cognition. Recent contributions to the notion of a scheme under systematic as well as historical aspects are Busse (2009) and Ziem (2008).

The notion of a paradigm as the fourth main premise of frame theory was established as an epistemological concept in the late 18th century. “Paradigm” signifies a general, unquestioned theory or a set of scientific and metaphysical beliefs or, less specifically, a common view of the world. The clearest and most important reference to the close relationship between paradigms as understood in their classical version by Kuhn (1973) and his own frames is given by Minsky as follows: “According to Kuhn’s model of scientific evolution ‘normal’ science proceeds by using established descriptive schemes. Major changes result from new ‘paradigms,’ new ways of describing things that lead to new methods and techniques. Eventually there is a redefining of ‘normal.’ Now while Kuhn prefers to apply his own very effective re-description paradigm at the level of major scientific revolutions, it seems to me that the same idea
applies as well to the microcosm of everyday thinking. [...] Kuhn is seriously considering the paradigms to play a substantive rather than metaphorical role in visual perception, just as we have proposed for Frames.” (Minsky 1975: 74) Thus, Minsky immediately identifies the function of paradigms in science and the function of frames in the perception of objects or situations in everyday experience. Transformations in the mind, in analogy to “scientific revolutions”, occur when high level frame systems are replaced by newly created frame systems.

Challenging historical references and discussions are also to be found in Barsalou’s works on knowledge representation, especially on perceptual symbol systems. According to Barsalou, in the history of philosophy most theories of perception were inherently perceptual or modal. In the 20th century, the situation changed, and amodal theories became predominant. Amodal theories maintain a divergence between cognition and perception, i.e. that cognitive representations are inherently nonperceptual. Perceptual symbols in this approach are arbitrary in the sense that they bear no correspondence to the perceptual states that produce them. Barsalou analyses the pros and cons of both types of theories and discusses widespread criticism on the theories preferred by himself, namely of modal or perceptual theories of knowledge. These theories, as Barsalou states, are often believed to contain only conscious mental images, but not unconscious representations. Representations in these theories are widely assumed to arise only in the sensory modalities like introspection or reflection. Furthermore, they are typically viewed as containing only static representations instead of dynamic ones. Barsalou rejects such points of criticism on perceptual theories of knowledge as misunderstandings and explicitly demands careful readings of earlier thinkers. Traditional theories of knowledge, as he emphasizes, often go considerably beyond the simplistic stereotype criticism. Philosophers like Locke, Russell and Price in fact assume that perceptual representations are componential and generate representations productively. Philosophers like Kant and Reid and, again, Locke and Price assume that unconscious representations, then referred to as “schemata” or “dispositions”, produce conscious images. Locke, Hume, Kant and Reid assume, as Barsalou states, that images can reflect nonsensory experience, most importantly introspection and reflection. Kant and Reid are examples of thinkers who assume native mechanisms for interpreting and organizing images, dynamic as well as static. When Barsalou claims that perceptual theories of knowledge should be judged on the basis of their strongest members and repeatedly presents rich enumerations of them, he regards history of philosophy as a reservoir for fruitful inquiry.

Minsky’s and Barsalou’s historical remarks referring to theories in cognitive psychology and epistemology are restricted to singular aspects and are of a casual and fragmentary kind. They are not sufficient to provide us with a coherent, precise and convincing picture of theoretical presuppositions of frame theory. A state of the art that connects frame theory with wider perspectives of the history of philosophy making transparent its conceptual and doctrinal premises that reveals its connections with theories of categorization and of memory and evaluates its positive and negative qualities is still not available. Therefore, the mentioned historical references and aspects require much further development.

Preliminary work:
Project A05 builds upon (1) previous epistemological studies by the principal investigator, (2) works from his former project RU 600-B3 as well as his current DFG project on mass and force and (3) special preparatory work aligned with the project outlined here.

Ad (1): Kann (2001) includes initial investigations concerning the notion of a scheme (scheme of thought, cosmological scheme, metaphysical scheme) as an epistemological key notion which will be investigated in A05 as a precursor of the notion of a frame. Particularly, Kann (2001: 95–99, 103–108) analyzes the use of and reflections on “scheme” in Whitehead, which stimulated the question of a priori and empirical features and conditions. – A05 also continues and deepens the inquiries pursued in the applicant’s project on Whitehead’s philosophy of culture (“Die Kulturphilosophie Alfred North Whiteheads”; cf. Kann/Sölch 2011a). These inquiries were partially focused on the issue of an “organization of thought” under psychological and epistemological regards. Whiteheads early key work “The organization of thought” (published in two versions 1917 and 1925) was translated into German and commented in a new edition of “The Aims of Education” (forthcoming, Suhrkamp, Berlin 2011). – As frame theory, like other theories of representation, reflects on conceptualization, the historical inquiries into concepts in Kann (2011b) come under the preparatory epistemological work of A05. – As frame theory has its roots or precursors
in conceptions of memory, as Minsky repeatedly says, the principal investigator’s study on the theory of memory in Augustine comes under the preparatory epistemological work of A05.

Ad (2): From the perspective of frame theory, objects of experience can be resolved into complex descriptions, namely into attribute-value matrices, and these are basically obliged to the subject-predicate scheme of traditional Aristotelian ontology and at the same time to common sense. The subject-predicate scheme and its ontological counterpart, the substance-quality scheme, are among the main subjects investigated in Kann (2001). Kosubek (2008) analyzes the substance-quality scheme in Locke and Hume under the aspect of concept types while working as an assistant to the applicant in RU 600- B3. – As the relationship between paradigms and frames has been one of the predominant subjects of inquiry in the DFG project “‘Masse’ und ‘Kraft’ zwischen Mittelalter und Neuzeit: Terminologisierung und theoriengeschichtliche Bedeutung in Metaphysik und Physik” (since April 2010), this project comes under the preparatory work of A05.

Ad (3): In preparation for A05, the works of Minsky have been investigated under the aspect of historical references and relationships. Speaking of “older theories”, Minsky refers to the notion of a scheme established in cognitive science by Bartlett (1932) and to the notion of a paradigm in Kuhn’s epistemology. Both notions, again, have their roots in older theories or resemble older concepts. In the preparatory work for A05, Bartlett’s inquiry and related works like those of Schanz, Rumelhart and others have been investigated. As a precursor in a wider sense, Aristotle’s category model and subsequent models of categorization are currently being analyzed under the perspective of whether they can be regarded as initial versions of frame theory (cf. 3.3.1).

References


3.3.2 Project-related publications by the principal investigator(s)

Peer-reviewed publications and book publications:


Non peer-reviewed publications:


3.4 Project outline

The aim of the project is a comprehensive investigation and evaluation of frame theory. This investigation, though including systematic and critical aspects, focuses rather on a historical approach. On the one hand, the project will reconstruct, analyze and expand the historical presuppositions mentioned or considered by the authors of frame theory themselves. On the other hand, we will take philosophical theories into consideration, apart from the frame tradition itself, which nevertheless reveals similarities with it. As suggested by Minsky’s unspecified reference to “older theories” of memory, conceptions in the areas of epistemology, philosophy of mind, cognitive psychology as well as ontology must be investigated. In addition, analyzing apparently more remote conceptions – such as categorial schemes – in terms of their similarities with frame theory also seems a promising avenue of research. The concept of a frame as a complex format of representation has a similar compositional structure to Aristotle’s ontological distinction of a basic set of categories. Furthermore, frame theory suggests comparison with philosophic criticism of the Aristotelian categories (Ryle, Körner) or with conceptions replacing the substance-quality scheme with a theory of functions or relations as ontological primary entities (Cassirer, Whitehead). While frame theory is ultimately committed to the idea of ontological primary units and attributes adhering to these units, the history of philosophy offers a respectable range of alternative conceptions criticizing or completely avoiding the hypothesis of a node that underlies the attributes and also cannot be resolved into attributes. Therefore, frame theory and its ontological assumptions will be measured with recent analytic ontology which, vice versa, can be a useful instrument of criticism on frame theory.

According to Minsky, older theories were based on ideas about ‘chunks’ of memory that were either much too small or much too large. This assumption is far-reaching, but, due to its lack of concreteness, nevertheless problematic and provoking for further historical investigation. Speaking of too small or too large units of memory content, Minsky offers a vague and merely quantitative distinction. A qualitative distinction of memory content, on the other hand, is given neither by Minsky nor by recent research literature which neglects the crucial question of the ontological units actually represented by frames. Early reflections on the kinds of entities which are represented by memory, can be found in Augustine, who gives a systematic qualitative distinction according to which the memoria contains images (imagines) of physical things, certain (abstract) things themselves (res ipsae) and notions (notiones) of things (Confessiones IX). Therefore, one aim of A05 is a comparison of traditional theories of memory with frame theory and its basic assumptions regarding memory contents. This branch of investigation will focus on traditional theories of memory and also include consideration of more recent theories of memory (Bartlett, Tulving).

The main idea of frame theory, according to which processes of structuring and patterning are involved into comprehension, representation and conceptualization of features of the experienced world, has a considerable history. We must consider not only Minsky’s references to Bartlett and other precursors in cognitive psychology, but also Kant, who uses the notion of a scheme (“Schema”, “Schematismus”) in the meaning of a rule by which a nonempirical concept or category is related to or associated with a mental image of a concept. Finally, “schematism” was established as the notion of a procedure which – in rough accordance with Minsky’s schemes – guarantees the ability of objects to be recognized and remembered. Although Kant assumed a definite ensemble of categories which are the same for all rational beings, categories in the meaning of recent cognitive psychology are, according to Lenk (1992: 18 sq.), modified and rendered flexible (“flexibilisiert”, “liberalisiert”). Traditional categorial systems are apparently becoming replaced by enlarged and dynamic versions. Therefore, one of the aims of A05 will be a comparison of traditional models of categorization (Aristotle, Kant) with their more flexible successors.

Some of the philosophic notions of a scheme (as occurring in Bacon, Kant, Locke, Fichte, Schleiermacher, Whitehead, Quine and others) show intersections or overlapping with the concept of a scheme in cognitive psychology and will be analyzed and compared with it.

Thus, frame theory can be provisionally traced back in three respects:

- As an epistemological format of structuring, the notion of a frame points to the notions of a paradigm and a scheme with their connotations of memory.
- As an ontological format of differentiation, the notion of a frame points back to the Aristotelian set of categories and to all subsequent conceptions which assume attribute-value structures.

- As a linguistic format of conceptualization and connection, the notion of a frame points to linguistic models of world-making, the linguistic structuring of our experience, and, in particular, to the Aristotelian categories and theories of predication based on them.

Part of the project will be a critical analysis of the notion of representation as it is used and commented on by Barsalou. Of particular importance is the distinction of modal and amodal symbols or systems of representation in Barsalou (1999) and Barsalou/Solomon/Wu (1999). Amodal symbols or systems of symbols are arbitrary in the sense that their structure bears no commonalities with their perceptual origins, which means that their structure is linked to the structure of perceptual states via mere arbitrary conventions of association. Modal systems of representation, on the other hand, are analogical in the sense that they have the same structure as perceptual states and therefore are informative about them. Perceptual symbols, as Barsalou states, are modal and analogical. Extracted from an entity or event, they are “integrated into a frame that contains perceptual symbols extracted from previous category members” (Barsalou 1999: 586). While Barsalou maintains that most cognitive linguists and psychologists of the late 20th century base their work on the assumption of amodal symbols or symbol systems, the theories of knowledge or representation from Aristotle, Epicurus, Locke, Berkeley, Hume, Kant and Reid up to Russell and Price have rather emphasized the perceptual character of modal symbols and symbol systems (Barsalou 1999: 587). Barsalou subsumes his own representational approach to this tradition of modal symbols and symbol systems. Thus, he intends to correct his contemporaries by pointing to the history of philosophy. Some questions remain, however, which should – with the sharpening of the notion of representation – be clarified in the project. In what sense are Barsalou’s “perceptual symbols” dependent on “innate knowledge”? How are frames, which occur in Barsalou/Solomon/Wu (1999: 2) in the context of larger enumerations (“feature lists, frames, schemata, semantic networks”; cf. also 5–7, 12) related to “perceptual symbols”?

The general aim of the project is a detailed analysis of the notion of a frame with its relevant aspects and features as dependent on the history of philosophy. The underlying assumption is that we should not speak of an “invention” of frame theory in Minsky, but that there is a full range of traditional premises and precursors. This thesis will be scrutinized and explicite by means of historical and critical inquiry. The inquiry itself will divide into two separate branches, due to scientific and doctrinal developments: The first branch (i) belongs to cognitive psychology as a discipline focused on breaking down mental processes into their most basic components. The second branch (ii) belongs to philosophy as the overarching discipline from which psychology as a more empirical and experimental enterprise in the sense of (i) emerged in the 19th century (Wilhelm Wundt). These two basically different but nevertheless overlapping branches of scientific development will be reflected in the two main parts of the project and correspond to two distinct lines of research as follows: A doctoral student will develop an analysis of the presuppositions of frame theory in cognitive psychology of the 19th and 20th centuries (branch (i)), while a post-doc will consider a wider range of theories of epistemology reaching back to ancient philosophy (branch (ii)). Accordingly, the doctoral student will focus his research on the pioneer works of cognitive psychology and on the explicit references within this concise tradition, while the post-doc will enlarge the perspective and take a more speculative and extensive part.

Working program:

Years 1–2:

- Minsky’s writings, especially those texts in which the frame concept is introduced and explained, will be carefully investigated. In the process, we intend to clarify Minsky’s commonly suggested status as the inventor of frame theory. This first step of the project will also be the starting point for our further investigations (branch (i)).

- The notion of a frame in comparison with its antecedents, the notions of schemes (Bartlett, Rumelhart) and paradigms (Kuhn), will be analyzed in detail. Relevant literature will be reviewed and discussed in order to reach a convincing description of those key notions. On the basis of the intended comparative analysis, we will investigate exactly how frame theory is related to its precur-
sors in cognitive psychology and epistemology (branch (i)).

- The notion of a frame will be compared with adjacent notions as “category”, “categorial scheme”, “categorial framework”, and, more generally, with the idea of categorization. Theories of categorization will be reviewed and critically discussed. Criticism of the Aristotelian model (Ryle, Körner) will be included. Categorial schemes and theories of categorization will be analyzed with regard to their similarities to and divergences from the frame approach. The relevant literature will be reviewed and discussed in order to develop a convincing description of the concepts and vocabulary of conceptualization. This part of the project will extend the precedent perspective in historical as well as systematic terms (branch (ii)).

Year 3:

- We intend to conduct critical analysis of Barsalou’s notion of a frame as well as adjacent notions (“feature lists”, “schemata”, “semantic nets”) within the context of his distinction of modal and amodal symbols or systems of symbols (branch (i)). This critical examination applies to Barsalou’s references to the history of philosophy, according to which the modal approach makes up the main line of thought (Aristotle, Locke, Berkeley, Kant, Reid, Russell, Price and others). These references themselves require detailed analysis (branch (ii)).

- Examination of older theories of memory will be included. Minsky links the origin of frame theory to older theories of memory, and Tulvington (among others) regards Aristotle’s theory of memory as the main root and reference of all later contributions to this subject. Therefore, theories of memory from the philosophical tradition will be taken into consideration with regard to the question as to whether they actually are committed to frame-like presuppositions. This investigation will involve a discussion of different accounts of memory content or representations as they are discussed in the contemporary philosophy of mind (branch (i)).

- The work on Whitehead’s notion of a scheme (“scheme of thought”, “cosmological scheme”, “metaphysical scheme”, etc.) will be continued and completed. The following steps will be a comparison with Whitehead’s “organization of thought” and his theory of symbolic representation. It will be investigated whether Whitehead’s idea of organization of thought can be scrutinized by means of frame theory and, vice versa, the extent to which frame theory resembles basic assumptions in Whitehead’s epistemology (branch (ii)).

Year 4:

- The final part of the project will be committed to an integration of the results of the previous steps, i.e., a synthesis of the historical investigations and of the main features or implications of the frame concept. The aspired result is a coherent and precise survey of the development of the frame paradigm. A historical as well as critical examination seems indispensable for a unified and suitable concept of frames and its modeling. In this final part of the project in particular we expect collaboration with other projects of the CRC which will open up perspectives to modify the formal theory of frames (branches (i) and (ii)).

3.5 Role within the Collaborative Research Centre

The role of project A05 in the context of the CRC is a historical and critical contribution of its basic notions, in particular of the notions of frame and of representation. Both notions will be investigated in respect of their underlying ideas, their historical development and their theoretical assumptions. Thus, the project will yield deeper insight into general aspects and requirements of frame theory. The importance of the idea of representation and of frame theory for the CRC as well as the fact that the uses of “frame”, “scheme”, etc. are far from being clear and standardized, mean an indispensable requirement concerning the key notions and assumptions of the CRC. Thus, the following questions will be examined: Which philosophical theories can be regarded as the precursors of frame theory? Which ontological and epistemological assumptions coincide with crucial assumptions of frame theory or with frame theory in general? In which regards does frame theory call for clarification, criticism, and improvement? Which historical presuppositions and developments stimulated frame theory? Does frame theory represent a subordinate or a main branch or even a paradigm shift in epistemology? What does the frame paradigm amount
to and which versions can be distinguished? Does frame theory open up ways of explaining linguistic data that could not be explained by earlier theories? What idea of the history of frame theory is suggested by authors like Minsky and Barsalou themselves, and which modifications are required? By treating these programmatic questions, the project will help to clarify the main intentions of the idea of representations and particularly of frame theory as a predominant model of representation. The historical and critical analysis of such matters will be of crucial importance for adjacent projects which are focused on the notion of frame and making use of it as well as supposing it without critical reflection or analysis. Projects intending improvement or revision of the frame concept will also benefit from the historical and critical results of the project. Since historical investigations of representation and frames will shed some light on general aspects of the organization and representation of knowledge, it will contribute to all objects concerned with these items. Conversely, projects which are concerned with the activation of frames as a neuronal process, can supply information about the question as to which conceptions of schemes or frames or older approaches are the best proved. Last not least, a historical investigation of frame theory represents a complementary focus to the naturalistic and empirical perspectives taken by the majority of the CRC projects.

From philosophical and linguistic perspectives, frame theory is just one among several different approaches to explain conceptual shifts. Cooperation with the other A-projects will help to examine these approaches in respect of their comparative advantages and disadvantages. The inquiry of concept types as well as the mechanisms of abstraction explored by the C-projects have their precursors or even origins in the philosophic theories of ancient times and of the Middle Ages, and this requires comparative investigation. The structures and developments of concept frames as systematically analyzed in the A-projects reveal close affinities to the historical and critical approach of A05. Project A05 can also offer a historical foundation for the B projects.

Specifically, collaboration is planned with the following projects (listed in order of application, not in order of importance):

**Cooperation with A01 (Mathematical modeling of frames)**

A05 will cooperate with A01 in investigating the nature of frame components. A common aim of both projects is the ontological status of instances, classes and qualities. While types of qualities have been included into the type system lined out in A01, the question of making distinctions between special quality types has not yet been treated sufficiently. The philosophic approach of A05 is concerned with the Aristotelian scheme of categories as an early precursor of frame theory. Aristotelian categories – and our common-sense ontology as well – establish the distinction of (among others) categories of quality like ‘red’ and of substances like ‘animal’. The question arises, as to whether the Aristotelian approach can be an adequate tool for distinguishing quality types in the meaning presupposed by A01, or whether later conceptions within the tradition of philosophy and analytic ontology, e.g., process or trope ontologies, provide us with alternative and possibly more convincing models of ontological distinction. Thus, A01 and A05 are both focused on the question of the most adequate ontological assumptions or distinctions by means of which frame components (attributes and values, frames and subframes, constitutive and facultative parts of frames and so forth) can be identified and analyzed. Whereas A01 intends the concrete modeling of the contents and formal structures of mental concepts, the aim of A05 is to reflect and clarify theoretically the basic ontological assumptions concerning that enterprise.

**Cooperation with A03 (Grounded cognition: Causal indexicals and affordances in frames)**

A03 investigates the question in which way concepts are “grounded” in basic sensory-motor representations. One of the project’s aims is to explain the transition from obviously “grounded” cognition to more abstract concepts. Relations between sensory-motor processes and abstract mechanisms will be analyzed, especially in terms of frame transformation. Can abstraction mechanisms be assumed to be at work already at the level of perception? What are the kinds of abstraction mechanisms relevant here? Since A05 is investigating historical precursors of the frame idea underlying the CRC, one issue closely related to A03 is the extent to which basic abstraction mechanisms have been analyzed in the history of philosophy, especially in Aristotle, whose categorial scheme can be regarded as a paradigm of highest-level abstractions. Thus, A03 and A05 will closely cooperate in exploring the following questions: Does the history of philosophy provide us with models or theories we can make use of when we investigate abstraction as emerging from grounded cognition? How can different affordances like “sit-on-able” and “step-on-able”
or “climb-on-able” be related to the traditional model according to which a chair has essential and nonessential qualities? Which explanations of the transformation of basal concepts into abstract concepts and which models of abstraction have proven the most successful? How can they be adopted to frames? For these and related questions, the close cooperation between projects focused on systematic perspectives (A03) and on historical perspectives (A05) is indispensable.

**Cooperation with A04 (Accessing conceptual information in language production and comprehension)**

A04 investigates the dynamics of the activation of frames and of the conceptual components within frames in comprehension and language production. Since frame activation is dependent on memory, which again is one of the key items of early frame theory (Minsky) and of scheme theory (Bartlett), A04 and A05 can cooperate in the inquiry of the function of memory for the activation of frames. And since A04 employs the distinction between different category levels, while A05 investigates traditional category schemes as precursors of frames, cooperation will help to clarify the categorial assumptions and distinctions that are actually the most relevant in comprehension and language production. The theoretical assumptions concerning categorization and conceptualization worked out in A05 could be tested by means of the experimental work of A04.

**Cooperation with B04 (A frame-theoretic investigation of unification and reduction in scientific theories)**

B04 investigates the concepts of unification and reduction with regard to scientific theories and sees frames as an excellent tool for comparing competing scientific theories – even when they belong to different paradigms. Unification and reduction indeed suggest the mingling of paradigms or, alternatively, the dominance of one paradigm over the other. Given that two paradigms represent opposing ontological views, it can be impossible to reconcile the differences underlying the two paradigms to form one unified paradigm. In this respect frame theory promises to be a useful tool of analysis. Since Minsky refers to the concept of scheme (Bartlett) on the one hand and the concept of paradigm (Kuhn) on the other hand as historical presuppositions of frame theory, and since A05 will investigate these historical presuppositions, we expect close cooperation between B04 and A05 with regard to the frame-based analysis of scientific theories. Accordingly, both projects can cooperate in extensions or modifications of the formal theory of frames itself.

**Demarcation from other funded projects of the principal investigator(s)**

Since April 2010, Christoph Kann has been principal investigator of the DFG-funded project “.Masse’ und .Kraft’ zwischen Mittelalter und Neuzeit: Terminologisierung und theoriengeschichtliche Bedeutung in Metaphysik und Physik”. The project presupposes the concepts of paradigms, schemes and frames in order to analyze conceptual and terminological shifts between the Middle Ages and the Modern Age. Apart from that it does not overlap with the presently applied project.