ISCTE IUL
Instituto Universitário de Lisboa

Department of Social and Organizational Psychology

A Situated Approach to Person Memory

A Dissertation presented in partial fulfillment of the Requirements for the Degree of

Doctor of Psychology

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My experience tells me that very often these are the most interesting or, at least, the most read paragraphs of an entire thesis. After four years studying person memory I hope now I will not forget people who do not deserve to be forgotten. I cannot promise I will succeed in this task though, given the low level of sanity left.

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Resumo

O presente trabalho estende a abordagem da cognição socialmente situada (CSS; E. R. Smith & Semin, 2004) ao estudo da memória de pessoas. A investigação em memória de pessoas têm tradicionalmente estudado as estruturas e os processos psicológicos separando-os do nosso próprio corpo e dos ambientes físicos e sociais envolventes. Com base na abordagem da CSS, argumentamos que a memória de pessoas, tal como outros processos cognitivos, é corporalizada, situada, e distribuída. Estes princípios teóricos, foram explorados em três conjuntos de estudos. Nos primeiros dois estudos testámos a ideia de que a memória de pessoas é *corporalizada*. Tal como previsto, verificámos que a recordação é facilitada por pistas espaciais e motoras apresentadas em localizações espaciais metaforicamente compatíveis. Nos quatro estudos seguintes explorámos a natureza *situada* da memória de pessoas. Os resultados mostraram que a recordação de comportamentos acerca de uma pessoa-alvo é facilitada quando o contexto físico presente durante a codificação e recuperação é relevante para a ocupação do alvo. Por último, testámos o pressuposto de que a memória é *distribuída*. Este estudo mostrou que distribuir informação a um parceiro, após a codificação ter acontecido, reduz a memória futura para essa informação. O presente programa de investigação tem implicações para o estudo da memória de pessoas e para a abordagem da CSS. Ao adoptarmos a perspectiva da CSS para investigar a memória pessoas obtemos informação adicional sobre os factores que determinam a codificação e recuperação de informação social. Paralelamente, a nossa investigação fornece apoio adicional aos principais pressupostos da CSS.

Palavras-chave: Memória de pessoas, memória humana, formação de impressões, cognição corporalizada, cognição situada, cognição distribuída.

Abstract

The present work extends the socially situated cognition approach (SSC; E. R. Smith & Semin, 2004) to the study of person memory. Research on person memory has typically focused on studying psychological structures and processes as independent from people's bodies, and physical and social environments. Based on the SCC approach, we argue that person memory, like other cognitive processes, is embodied, situated and distributed. These theoretical principles are examined in three sets of experiments. The first set of two experiments examined the idea that person memory is *embodied*. As predicted, recall was enhanced by spatial cues and motor movements in metaphor compatible locations. Another set of four experiments was designed to investigate the *situatedness* of person memory. Results showed that encoding or retrieving behavioral information about a target-person in a context with target-relevant physical contextual information facilitates the recall of social information. Finally, we tested the assumption that memory is *distributed*. This experiment showed that distributing information to a partner, after encoding has taken place, reduces subsequent memory for that information. The present research program has implications for both person memory and the SSC approach. Adopting a SSC perspective to investigate person memory provides new insights about the factors shaping the way people encode and retrieve social information from memory. Furthermore, our research lends novel support to the main principles of the SSC perspective.

Key-words: Person Memory, human memory, impression formation, embodiment, situated cognition, distributed cognition.

American Psychological Association (PsycINFO Classification Categories and Codes)

2340 Cognitive Processes
2343 Learning & Memory
3000 Social Psychology
3040 Social Perception and Cognition

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CHAPTER 1

PERSON MEMORY: FROM THE COMPUTATIONAL METAPHOR TO THE BIOLOGICAL METAPHOR

We live in complex social environments. During the course of our everyday lives we meet and interact with many different people in many different contexts. In order to maintain and develop these different relationships we need to store information about other people into our memory and be able to retrieve it whenever required. Imagine how difficult life would be if we were not able to recognize that the person who walked through the door is our best friend? If we were not capable of remembering when and where we first met our girl- or boyfriend? Or, if we were to forget the person who, in the past, repeatedly stole our money? Person memory is thus crucial for navigating in the social world, to take advantage of opportunities, to avoid risks, or to know how to behave in familiar and new social situations.

The research on person memory has indeed occupied center stage in social psychology ever since its early beginnings and has inspired various theories and increasingly sophisticated methods to identify the cognitive structures and processes driving it. However, over the last decades the way person memory has been addressed was highly influenced by the information processing approach whereby cognitive structures and processes are made equivalent to computer processes, namely as the computation of abstract internal symbols.

One of the drawbacks of this approach is that such an assumption is at best remotely related to the way people acquire and retrieve social information in their daily life. In this thesis we argue that person memory, like other cognitive processes, should be addressed as a *socially situated* phenomenon. In this view, cognition emerges, along with personal goals and motivations, from the agent's action in a physical and social environment, and must therefore be adaptively responsive to the changing features of situations in which a person finds him/herself. Moreover, both our bodies and environments may act as both constrains and scaffolds to our cognitive processes. Thus, the experimental program of this thesis sets out to systematically highlight the embodied (Chapter 2), situated (Chapter 3), and distributed nature of social memory (Chapter 4).

The present work is organized in five chapters. In the remainder of this chapter, we present a brief historical overview of the scientific study of mental representations in social cognition (section 1), describing how the field has evolved to its current shape. In section 2 we will present an overview of how person memory has addressed the way knowledge about other people is represented, stored and retrieved from memory. In this section we briefly describe the main models of mental representations, namely associative network, schema, exemplar, and connectionist models (e.g., E. R. Smith, 1998). Towards the end of this section, we identify the main differences of these models and especially their commonalities, namely their individualistic and isolated approach to cognition. Then, (section 3) we present an alternative perspective, the socially situated cognition approach (SSC; E. R. Smith & Semin, 2004) that conceptualizes cognitive processes as the result of people's interactions driven by their own bodies in physical and social environments. In this section, we describe the main assumptions of this perspective and present empirical evidence that illustrates the embodied, situated and distributed nature of cognition. Finally, in section 4, we introduce our research program where we aim to extend the SSC approach to the person memory domain.

The three chapters that follow this theoretical introduction are empirical chapters. In Chapter 2, we present two studies designed to investigate the role of *embodiment* in social perception. More specifically, we investigate the role of space and motor movements on memory for social information. Based on previous research (reviewed in Chapter 1, section 3.1), showing that abstract concepts such as valence are spatially grounded on a vertical dimension, we argued that memory for valenced social information is enhanced when that information is presented in metaphor-congruent locations (i.e., positive = up, negative = down).

In Chapter 3, we test the *situatedness* assumption by investigating the role that variations in the physical environment in the form of changing contexts play in person memory. Inspired by research suggesting that representations are not purely abstract knowledge structures, but respond adaptively to contextual information (reviewed in Chapter 1, section 3.2), we present a set of four experiments that aim to explore the idea that the way people acquire and retrieve social information is constrained by the context in which these processes take place. More specifically, we argue that the physical context (objects), when task relevant, provides cues that help encoding information in memory, thus enhancing memory performance.

In the last empirical chapter, we switch our attention to the assumption that cognitive processes are *distributed* across social agents. In this chapter, we focus less on memory for other persons' traits and behaviors, but rather on the role of other social agents as memory scaffolds, namely by investigating a novel hypothesis within the area of transactive memory. Research on transactive memory (reviewed in Chapter 1, section 3.3) has shown the benefits of distributing memory work across others (e.g., Wegner, Erber, & Raymond, 1991). However the negative consequences of this strategy have also been shown (Sparrow, Liu, & Wegner, 2011). Based on this research, we present an experiment in the last empirical chapter that examines if distributing recall responsibility, even after memory encoding has taken place, affects recall. Specifically, we investigate whether discovering that a partner of a collaborative-dyad is responsible for recalling part of the previously encoded items reduces subsequent memory for those items.

Finally, in Chapter 5 we first present a summary of the findings obtained in our experimental program and we try to integrate them in a general discussion. In this section, we present what, the contribution that the research we have conducted makes to advance our understating of the way people encode and retrieve social information. We also acknowledge and discuss some limitations of our research and advance some possible ways in which they can be addressed. Finally, we end by identifying the most likely directions future research may take given our current work.

1.1. Tracing the historical path of 'situated cognition'[1]

The roots of 'situated cognition', that is, the idea that cognition is an adaptive process that results from the interaction between the individual and the world, can be traced back to (at least) philosophers at the beginning of the twentieth century. Among these are Dewey, Heidegger, Merleau-Ponty, and Wittgenstein, whose views contradicted the established perspectives of Descartes, Kant, and numerous others who proposed a functional independence between mind, the body and the world (for reviews on the scientific and philosophical antecedents of situated cognition, see Clancey, 2008, and Gallagher, 2008).

[1] Parts of this section were adapted from Garrido, M. V., Azevedo, C., & Palma, T. A. (2011). Cognição Social: Fundamentos, formulações actuais e perspectivas futuras. [Social Cognition: Fundamentals, present formulations and future perspectives]. *Psicologia, 15*, 113-157.

In psychology, the idea that cognition is an adaptive process can already be found in the work of prominent names like Mead, Bartlett, Piaget or Vygotsky. For example, Piaget's work (1952) on cognitive development suggests that children are not passive receivers of information but instead they actively construct their knowledge based on their everyday sensory and motor experiences. This interactive approach to cognition is also present in Bartlett's (1932) schematic theory of remembering. According to this theory, "social organization gives a persistent framework into which all detailed recall must fit, and it very powerfully influences both the manner and the matter of recall" (Bartlett, 1932, p. 296).

In the late fifties and early sixties, with the establishment of the 'cognitive paradigm', there was a radical change in the way the 'object' of psychology was conceptualized. Until then, experimental psychology was dominated by the behaviorist approach and the belief that science should deal only with variables that were observable and physically measurable, such as behaviors executed in response to specific stimuli (Skinner, 1963; Thorndike, 1940; Watson, 1930). Thus, the main purpose of psychological research was to identify the laws guiding how behavior is shaped by environmental events, in particular events that would function as reinforcements and punishments. According to theories of learning, these reinforcements and punishments would, respectively, make people repeat and avoid certain behaviors (Skinner, 1963; Thorndike, 1940; Watson, 1930). During this period, research on sensation and perception relied mainly on psychophysics, while research on learning was based on paradigms without any affective or experiential meaning for participants (Gilbert, 1998). In this period, the mental content mediating between a stimulus and a response was considered irrelevant - the mind was treated as a "black box" that psychologists should not investigate (Skinner, 1963).

The rise of the cognitive revolution, heralded amongst other developments by Chomsky's (1959) influential critique of Skinner's 'Verbal Behavior', proposed that to explain human behavior it is necessary to identify the content and format of mental representations and its underlying cognitive processes. The research focus across the cognitive sciences was now on the processing and representation of information. With the development of this general framework, it was possible to divide mental operations into different stages, specifying the internal processes that presumably mediate between the initial processing of a target stimulus and the subsequently observed response (Fiske & Taylor, 1991). The computer became thus not only a methodological tool that permitted the simulation of cognitive processes (Anderson, 1976; Newell & Simon 1972, Schank & Abelson, 1977), particularly in the area of impression formation and social memory (e.g., Hastie, 1988, Linville, Fischer, & Salovey, 1989; E. R. Smith, 1988), as well as a metaphor to describe these processes. Expressions like "input" and "output", "storage", "processing" and "retrieval of information" became terms that were adapted in the explanation of human cognition (for an extensive review, see Garrido, Azevedo, & Palma, 2012).

The presumed similarity between the human mind and a computer led to the explosion of theories and research exploring the structure and the mental processes of cognition. While this shift was very important in drawing attention to 'cognitive processes', it also marked the beginning of an extended period in which the embodied and contextually embedded nature of human cognition was ignored. Indeed, the use of the computer metaphor minimized the role of the social context, motivation, and affect in the study of cognition given that an information-processing framework could hardly simulate these variables. Ignoring these variables conferred upon cognitive psychology and later to social cognitive approaches a mechanistic and reductionist view of cognition (for reviews, see Garrido et al., 2012; Semin, Garrido, & Palma, 2012, in press).

The situated cognition framework (e.g., Clark, 1997; Clancey, 2009) emerged in response to explanations of human functioning that did not take these characteristics into account. The situated cognition is not an overarching theoretical framework, but serves a generic perspective to cover a broad range of orientations that have emerged over the last two decades across different disciplines like philosophy (e.g., Clark, 1997), robotics (e.g., Brooks, 1999), anthropology (Hutchins, 1995), cognitive psychology (e.g., Yeh & Barsalou, 2006), developmental psychology (Thelen & Smith, 1994) and social psychology (e.g., E. R. Smith & Semin, 2004). It constitutes an approach offering a set of general principles and emphases cutting across many scientific disciplines and with the potential of developing a unifying perspective on human functioning (Semin & E. R. Smith, in press).

In the following, we shall first look into how the computer metaphor shaped social cognition theory and research. First, a brief overview of the social cognition approach will be presented along with its conceptualization of how to understand social psychological phenomena by investigating how people process, encode, store, and retrieve social information about others. This will include an overview of the main models of mental representations with the goal of summarizing their central characteristics, their differences, and most importantly their similarities, namely their emphasis on contextually detached internal mental processes (for extensive reviews, see Carlston & E. R. Smith, 1996; E. R. Smith, 1998). With this critique, we set the background against which we introduce the (socially) situated cognition perspective (E. R. Smith & Semin, 2004), which we will present in detail in section 3.

1.2. Social Cognition and the information-processing mind[2]

The development of social cognition resulted largely as a reaction to behaviorism and more specifically to the assumption that mental representations and internal processes could not constitute the 'object' of scientific inquiry, since they were not observable and physically measurable (Skinner, 1963; Thorndike, 1940; Watson, 1930). With the cognitive revolution, social cognition researchers took advantage of the new theoretical models and new methodological tools developed in cognitive psychology and started using them to investigate classic social psychology questions from a new perspective with new experimental techniques (Devine, Hamilton, & Ostrom, 1994).

The adoption this approach resulted in the development of new tasks and measures, such as recall or reaction times to infer psychological processes. Thus, theories that were developed to investigate how concepts like "bird" or "apple" are represented were adapted to investigate the mental representations of social concepts like "extrovert" or "librarian" (e.g., Collins & Quillian, 1969; Collins & Loftus, 1975). Also, experimental paradigms (e.g., semantic priming, Neely, 1977) that were created to show how the exposure to a word (e.g., bank) automatically activates related words in memory (e.g., money) were adopted to understand, for instance, how the presence of a member of a stereotyped group automatically activates traits that are associated with that group stereotype (e.g., Devine, 1989).

Inspired by this new cognitive wave, social cognition became an independent approach that had its first significant developments in the mid-seventies (e.g., Hastie & Kumar, 1979; Taylor & Fiske, 1978; Taylor, Fiske, Etcoff, & Ruderman, 1978).

[2] This overview on social cognition is based on the paper by Garrido and colleagues (2011). See footnote 1.

During this and the subsequent decades, the research focus shifted to information processing and representation. Thus, this approach assumes that the person is someone who is virtually entangled in some form of information processing. This applies to whether the person is forming an impression, giving a talk, thinking about his school years, watching a football match, or deciding which Apple product to buy. In all these activities, the person attends to and encodes information, interprets and elaborates the information through evaluative, inferential and attributional processes, and represents this knowledge in memory, from which it can later be retrieved and subsequently used to influence thinking, judgment, and behavior (Hamilton et al., 1994).

This new approach was then applied to almost all topics typically studied by social psychology such as the study of attributions (e.g., Gilbert, Pelham, & Krull, 1998), attitudes (e.g., Eagly & Chaiken, 1993), stereotypes (e.g., Hamilton, 1981), and impression formation and person memory (e.g., Wyer & Srull, 1986).

1.2.1. Person Memory

The study of the way people understand, explain and display social behavior rests on the assumption that one needs to address how knowledge is represented, stored and retrieved from memory (Hamilton, 1991).

A representation can be defined as information that an individual encodes, that he or she can construct and retain in memory, and later retrieve and use in different ways (E. R. Smith, 1998; Garrido & L. Garcia-Marques, 2003). The type of representations, namely its structure and underlying mental processes, is not consensual among researchers and it varies according to the different models of mental representation advanced. The literature in person memory (for a recent review, see Skowronski, in press) allows the distinction between four theoretical models of mental representations, two of them more prominent in social cognition (associative networks and the schematic representations) and two more recent and still gaining importance in social cognition (exemplars and distributed representations). Below, we will briefly review each of these models (for extensive reviews, see Carlston & E. R. Smith, 1996; E. R. Smith, 1998; Garrido & L. Garcia-Marques, 2003).

1.2.1.1. Associative Network Models

Although the main theoretical and functional assumptions of these models were initially developed within cognitive psychology they were rapidly imported into social cognition and used in the construction of several specific models, such as the Person Memory Model (Wyer & Srull, 1989) or Carlston's (1994) Associated Systems Theory. Associative network models share the assumption that representations are constituted by discrete nodes (e.g., names, verbs, adjectives) without an internal structure. These nodes are connected to other nodes through associative links and their meaning is attributed by their position in this network of nodes. The links between 'objects' are formed when these are experienced or thought about jointly and become stronger with increasing frequency of their co-activation (Carlston & E. R. Smith, 1996; Fiske & Taylor, 1991; Ostrom, Skowronski, & Nowak, 1994; E. R. Smith, 1998; Wyer & Carlston, 1994).

When a node is activated either by the presence of its referent or because it was actively thought about, the neighboring nodes sharing the same links also become active, since activation spreads along these links. The number of links between the nodes determines the number of possible alternative routes to retrieve them. Thus nodes that share many links have more chances to be retrieved than nodes that are isolated in the network. Some theories suggest that the activation of a node, unless maintained by activations coming from other nodes, only lasts for a few seconds (e.g., Anderson, 1983; Ostrom et al. 1994), while other theories suggest that the activation may last for hours or even days (e.g., Higgins, 1996).

Retrieval from memory consists in the activation of the right nodes that will be brought to consciousness if the level of activation goes above some specific threshold. In some situations, retrieval is conceived as the result of the spread of activation that flows in parallel trough the links until it reaches a necessary threshold (Anderson, 1983), and in other situations, as an explicit process of following the links sequentially from node to node (Hastie, 1988).

According to the associative network models, the nature of the processing that is given to an object determines the way the representation of that object is constructed and the way it is retrieved. For example, if behaviors that are incongruent with a specific expectancy are processed more extensively, they will establish more connections with other behaviors. A higher number of associations will increase their likelihood of being retrieved (Hastie & Kumar, 1979). The nature of processing can also cause covariations or dissociations at retrieval. If people form a single representation of an object and if different memory measures tap into that representation then one can expect positive correlations between those two measures. For example, when an individual encodes behavioral descriptions about a target-person, which are later accessed through free recall but that can also be used to draw judgments based in that same memory representation (Hastie & Park, 1986). In contrast, if the individual forms two or more representations (for example, one based in the behavioral descriptions and other in general evaluative judgments) then different tasks can access different representations (Hastie & Park, 1986), thus causing a dissociation such the one often observed between free recall (offline processing) and judgments (online processing).

1.2.1.2. Schematic Models

Schematic models are very popular in social cognition and are normally presented in contrast to associative network models (Fiske & Taylor, 1991; although see Wyer & Srull, 1989). Associative models assume the existence of discrete nodes that do not possess an internal structure, whereby meaning is constructed in a bottom up way by combining the different nodes. In contrast, schemas are broader representations with a meaningful internal structure, in which the same concept or perceptual observation can acquire different meanings if incorporated into different schemas. In this case, representations are constructed in a top-down way, namely it is the general knowledge that provides the meaning to the parts (Gestalt) and not the other way around.

One of the reasons why these models are so popular is because they provide a good explanation for the fact that people very often go beyond the information given (Bruner, 1957/1973) and use their previous knowledge to infer new characteristics and properties of objects or persons (Carlston & E. R. Smith, 1996). Thus, a schema can be defined as a structured unit that represents the general knowledge about an object or concept and influences perception, memory, and inferences (E. R. Smith, 1998).

Schemas are said to have independent structures, namely they are not interconnected as in the case of the associative network nodes. Thus, when a schema is active, then this schema does not necessarily have any implications for other schemas. A schema can be activated by being thought about (e.g., thinking about the behaviors one normally display when at a restaurant) or when in the presence of relevant information (e.g., being at a restaurant). This activation is all-or-none, that is, activating a schema makes its entire content accessible. Even when a schema is below the threshold for activation it can still possess a variable level of accessibility that depends on the recency and frequency of its use. The primary function of an activated schema is to help interpreting new information related to the schema. Thus, schemas can influence evaluation, judgments, and behavior. But activated schemas also guide people's attention to the relevant aspects of information, leading them to ignore irrelevant aspects. Sometimes this attention is directed to information consistent with the schema and sometimes to information that is inconsistent or unexpected which will likely receive more extensive processing. Another function of schemas is to guide inferences by making it possible for people to connect specific events to their general knowledge and fill in unobserved details (Carlston & Smith, 1996; Fiske & Taylor, 1991; Markus & Zajonc, 1985; Wyer & Carlston, 1994).

Although schemas are mainly used to explain how people organize information and how they make inferences about new information based on previous knowledge, schema models may also be used to explain some aspects of retrieval processes. Research shows that social schemas not only guide encoding of social stimuli but also the retrieval of information from memory (e.g., Anderson & Pichert, 1978). Thus, a schema not only affects how information is encoded but also provides cues for retrieval, normally facilitating recall of schema-consistent information, and also serves as a guide for guessing and reconstruction when retrieval attempts fail or their results are ambiguous (Carlston & E. R. Smith, 1996; Fiske & Taylor, 1991; Markus & Zajonc, 1985; Wyer & Carlston, 1994).

The effects of schemas on explicit memory (e.g., free recall) are usually attributed to processes of reinterpretation and inference based on the schema during encoding or to the use of schemas as retrieval cues and guides for guessing and reconstruction during retrieval. The effects of schemas on implicit memory, especially on judgment, are attributed to the fact that judgments are based on information that is part of the schema and not on the observable characteristics of the target object. Dissociations between measures, like recall and judgment, are normally attributed to the fact that these two processes access different schemas (Carlston & E. R. Smith, 1996; Fiske & Taylor, 1991; Markus & Zajonc, 1985; Wyer & Carlston, 1994).

Some authors (e.g., Carlston & E. R. Smith, 1996; Wyer & Carlston, 1994) suggest that schematic models, as a general conceptualization of memory, constitute a limited approach. First of all, the definition of schema is so broad and vague that is difficult to identify what kinds of knowledge structures are schematic or not. The mechanisms underlying encoding and retrieval are also poorly explained such as the nature of the relationships between schemas.

1.2.1.3. Exemplar Models

Exemplar models challenge the early abstractionist and schematic views of representations. This approach to memory representations focuses the encoding and storage of specific instances (exemplars) as opposed to abstract representations of concepts (Estes, 1986; Hintzman, 1986; Medin & Schaffer, 1978). Although these models are much more recent and less explored than associative or schema models (Medin & Schaffer, 1978), according to some authors their scope goes beyond associative or schema models (e.g., E. R. Smith, 1998).

Contrary to abstractionist models of category representation that assume that people store and use information about the typical values or central tendencies of a category, the majority of exemplar models (Medin & Schaffer, 1978; Park & Hastie, 1987; Rothbart & John, 1985) share the core assumption that people store representations of specific experiences (episodes) or specific stimuli rather than abstract generalizations.

Theorists argue that exemplars serve the same functions of schemas, namely organize previous experiences into a representation that is useful to interpret new information, to make judgments and to retrieve information from memory (e.g., E. R. Smith, 1998). The exemplar approach suggests that people represent categories by storing a number of instances that are then used to make inferences about the category. According to these models, an individual experience or episode results in the storage of a complex memory trace that includes attributes from the stimuli and the situation where the information was processed. In cognitive psychology, models like SAM (Search of Associative Memory, Raaijmakers, & Shiffrin, 1981) and MINERVA 2 (Hintzman, 1986), assume that the memory traces of different experiences are stored separately (for an application to social judgment, see E. R. Smith & Zárate, 1992).

Exemplar models, unlike associative networks and schemas, focus more on the role of retrieval processes and not so much about the structure of memory (Wyer & Carlston, 1994). Both associative networks and schemas assume the existence of individual units of knowledge representing objects or concepts (Carlston & E. R. Smith, 1996), while exemplar models assume the existence of a variety of memory traces that are individually stored, and that are activated in parallel at retrieval (Raaijmakers & Shiffrin, 1981). Thus, when a new stimulus is evaluated, judged, or categorized it is compared with many other activated traces of the exemplar. The same mechanism applies to generalizations, as they are the summary of the activated exemplars that are similar to the target stimulus.

The effects of the activated exemplars resemble what is proposed by schematic models, namely they affect the interpretation and reconstruction at a pre-conscious level. However, the activation is not all-or-none, as in the case of schemas. Instead, different parts of exemplars can be activated by different retrieval cues, different contexts, etc., (Hintzman, 1986; Raaijmakers & Shiffrin, 1981). Context effects that are difficult to explain by other approaches, like the instability and context sensitivity of stereotypes (e.g., Garcia-Marques, Santos, & Mackie, 2006) can be explained by the exemplar approach.

1.2.1.4. Connectionist Models

Connectionist models of mental representation (also known as parallel distributed processing - PDP - or, or artificial neural networks - ANN; for a detailed description see McClelland, Rumelhart, & Hinton, 1986) constitute an alternative to associative network models and schematic models that have been dominant in social cognition (E. R. Smith, 1998; 2009). These models have had more impact in neuroscience and in other areas of psychology than in social cognition, where its application is still limited (e.g., Overwalle & Labiouse, 2004; Queller & E. R. Smith, 2002; E. R. Smith & DeCoster, 1998; for reviews, see van Overwalle, 2007; E. R. Smith, 2009).

For connectionist models, a concept or object is represented by a distributed representation, namely by a pattern of activation along a series of processing units or nodes (Thorpe, 1995). Each node can represent different concepts that are retrieved when the appropriate pattern of activation occurs in all the basic nodes. These nodes are interconnected (like biological neurons in a network) and can send signals to each other through these connections (like synapses between neurons). These connections have different weights. Thus, a pattern of activation – a representation – that is initially triggered by a specific stimulus is both the result of the initial input that enters the network (representing the external stimulus) and the different weights of the connections that encode its stored knowledge. Importantly, these connection weights are not static and can be changed through learning.

A network can have a series of input nodes to which patterns are imposed. As the activation flows between the connections, a distinct pattern can appear in the output nodes of the network. Thus, this network transforms patterns from one domain into the other. For example, the transformation of input patterns representing behaviors in output patterns representing traits (Anderson, 1995). However, these patterns are not explicitly stored; the network stores the connection weights that allow the reproduction of many patterns in the presence of the right cues. This reproduction is not perfect though, but influenced by other related patterns encoded in the same network. This strongly contrasts with the assumptions of associative networks and schemas suggesting that representations are static and retrieved in an invariant manner. A distributed representation is recreated or reconstructed rather than searched for or retrieved (McClelland et al., 1986).

While other representation models distinguish between top-down and bottom-up processing, connectionist models assume that these processes are inseparable since all processing is performed by activation flows (coming from the perceptual input) through the connections (that encode the knowledge). With this assumption these models make knowledge an integral part of the system and not an explicit set of stored rules.

1.2.1.5. Similarities and differences between models

Mental representations are a central construct for social cognition. Attitudes, stereotypes and person impressions, for example, are described as mental representations. A mental representation is the body of interrelated knowledge, feelings, and beliefs one has about, let's say, our PhD supervisors, and that we use to guide our judgments, decisions and interactions with them, (Carlston & E. R. Smith, 1996; E. R. Smith, 1998). The four types of models presented so far aim to explain how these mental representations are structured in memory and how they are retrieved to guide our navigation in the social world from a social cognitive perspective. Although recent revisions (e.g., Hintzman, 1990; Raaijmakers & Shiffrin, 1992) suggest that none of these models is capable of accommodating the entire body of findings obtained in human memory research, their explanatory power seems enough to account for most of the phenomena, if not all, observed in social cognition and, in particular, in person memory (Carlston & E. R. Smith, 1996; E. R. Smith, 1998).

Associative networks, schemas, exemplar, and connectionist models are different in the assumptions they make about the formation and use of mental representations. The first three types of models were developed in a very inductive way. They first started by looking at the empirical findings and then proceeded by establishing correspondences between the findings and unobserved internal mental structures and processes that are likely to exist in order to account for these findings. In contrast, connectionist models take a deductive approach. They started by making theoretical assumptions about the organization of knowledge in the mind and its underlying processes and only after that was a research program pursued (E. R. Smith, 1998).

Another difference between these models is the focus each one puts on the encoding and retrieval of information (Garrido & Garcia-Marques, 2003; Garrido, 2006). Associative networks and schemas base their assumptions and explanations almost entirely at the level of the encoding mechanisms. For example, the incongruency effect (i.e., the superior recall of expectancy-incongruent information) is explained by the extra processing required to make sense of expectancy-incongruent information during encoding (Hastie & Kumar, 1979; although see Garcia-Marques & Hamilton, 1996). Exemplar and connectionist models place their emphasis on retrieval processes. For these models, most memory findings can be explained by the way information is retrieved, namely by cognitive resources and goals, the kind of memory test, or contextual cues (for a review, see Garrido & Garcia-Marques, 2003; E. R. Smith, 1998).

However, these models also share many important characteristics. In fact, representational structures, normally presented as opposite poles, can be accommodated within the same theoretical model (Carlston & E. R. Smith, 1996; E.

R. Smith, 1998). For example, the *continuum model of impression formation* (Fiske & Neuberg, 1990) holds that the perceiver stores and uses two types of representations - schematic and exemplar. According to this model, schematic representations are used by default and only replaced by exemplar representations in some circumstances, like when the perceiver is motivated to form an accurate impression (Fiske & Neuberg, 1990).

Inherent to all models presented (although to different degrees) is the assumption that memory processes usually involve three phases: encoding, storage and retrieval. Encoding refers to the initial phase of information acquisition; storage refers to the maintenance of information in memory over time; and retrieval refers to the access of stored information.

Although the cognitive legacy has allowed social cognition researchers to make effective use of theories and techniques from cognitive psychology to explore the role of mental structures and to develop different models of mental representation, the commitment with the information-processing approach led researchers to loose sight of the real-world phenomena that has originally motivated this research (e.g., Neisser, 1980, 1982, Forgas, 1983; Graumann & Sommer, 1994). Thus, another similarity between standard representational models of social cognition is their focus on abstract symbolic computation and isolated cognitive processing. This characteristic is especially salient in the case of the most prominent models in social cognition and person memory - schemas and associative networks (E. R. Smith, 1998).

In the next section we introduce a recent approach to the understanding of social cognitive processes, namely socially situated cognition (E. R. Smith & Semin, 2004). This framework criticizes the decontextualized view of social cognitive approach on mental structures and processes and argues that an "… adequate explanation of cognition requires understanding of the interplay between behavior, bodily structure, and environmental resources" (Semin & E. R. Smith, in press, p.2). We will start with a brief historical overview of the socially situated cognition approach and then we move to the three main pillars or principles that make this approach distinctive.

1.3. The (socially) situated cognition framework: Setting a new level of analysis[3]

Concerns with the abstract and decontextualized conceptions of cognition gave rise to a recent perspective termed 'socially situated cognition' (SSC; Smith & Semin, 2004). Inspired by recent developments in a number of other disciplines (e.g., Agre & Chapman, 1990; Brooks, 1991; Barsalou, 1999a; Clancey, 1995, 1997; Clark, 1997, 1999; Yeh & Barsalou, 2006), SSC offers a new way of thinking about social cognition where cognitive processes are viewed as the result of dynamic and adaptive sensorimotor interactions with the physical and social environments.

As Semin and colleagues (2012a, in press) have argued, one of the central features of the social cognition framework is its microscopic level of analysis. In other words, mainstream social cognitive approaches try to capture complex cognitive processes by studying these processes in independence from the social context and from action namely the main function of cognition: cognition is for action. However, if cognition emerges in the interaction with the different elements of the environment, as suggested by the SSC, then to understand how cognitive processes work one has adopt a broader perspective (Semin, et al, 2012a, in press; Semin & E. R. Smith, in press). According to SSC framework, social cognition is better understood from a macroscopic level that investigates cognitive processes in coordination with other processes that emerge in specific physical and social environments. As Gazzaniga (2010) recently suggested: it is the goals of a dialogue that organize the utterances and their compositionality and not the phonemes and morphemes that organize the utterance! Consequently, it is the higher level of organization that enables an understanding of how the parts are composed and not the reverse, as is the case when cognitive processes are studied in isolation, detached from the real world environments where they usually occur. In Barsalou and colleagues' words, "to understand a cognitive process (…) it is insufficient to understand the process in isolation. Instead, understanding its coordination with other processes that are typically co-active during real world cognition may be as important, if not more

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[3] Parts of this section were taken from two chapters: Semin, G. R., Garrido, M. V. & Palma, T. A. (2012). Socially situated cognition: Recasting social cognition as an emergent phenomenon. In S. Fiske, & N. Macrae. (eds.) *Sage handbook of social cognition* (pp. 138-164). Sage: California: Sevenoaks; and Semin, G. R., Garrido, M. V. & Palma, T. A. (in press). Interfacing body, mind, the physical, and social world: Socially situated cognition. In D. E. Carlston (Ed.), *The Oxford handbook of social cognition*. New York: Oxford University Press.

important, than understanding the internal structure of the process itself" (Barsalou et al., 2007, pp.79-80).

The SSC framework proposes an epistemological change of the way social cognitive processes are conceptualized and researched (E. R. Smith & Semin, 2004). According to this framework, the research focus should then be placed on the relation between cognitive processes, bodily structures, situations, and environmental resources (A. Clark, 2008; Semin, et al, 2012a; 2012b; Semin & E. R. Smith, 2012). Below we describe the three central principles of SSC framework and which inspired the research program we present in this thesis.

1.3.1. Cognition is embodied

Our experience of the world, and our functioning, are constrained by a set of relatively invariable conditions including our body morphology. The body is the most immediate context of cognition as "nothing gets into or gets out of our cognitive system except through the sensory-motor system and the body" (L. B. Smith & Sheya, 2010, p. 8). Thus, cognitive activities are *embodied*. In other words, they are grounded by sensory-motor and affective neural systems and not (exclusively) determined by some abstract set of symbols, as postulated by standard models of mental representation (e.g., Barsalou, 1999a; Glenberg, 1997; E. R. Smith & Semin, 2004; Zwaan, 2004).

According to a socially situated perspective, social information processing is determined by the nature of our bodily interactions with social stimuli (E. R. Smith & Semin, 2004). Indeed, a growing body of literature within social cognition suggest that bodily states, such as head and arm movements, body postures, or facial expressions, play a central role in social information processing (for reviews, see Semin, et al., 2012a, in press). Curiously, and despite the abundance of empirical evidence, there is a lack of formal theories, with well-specified predictions, to accommodate these findings, which has hampered the sustained development of the field (Schubert & Semin, 2009; Semin & E. R. Smith, in press; Zwaan, 2009).

In the following paragraphs we will try to illustrate the main research lines driving embodiment research. Thus, we will start by reviewing research that showed the first embodiment effects in social psychology and its more current follow-ups. In the second part we will provide an overview on research that has emerged over the last 10 years or so and has demonstrated how language understanding recruits the sensory-motor system. We close this section with a brief overview of how abstract concepts such as valence or time are also grounded in one's sensory-motor system. Notably, our main goal is not to provide an extensive review on embodiment but to exemplify the interface between bodily experiences and social information processing (for extensive reviews, see Barsalou, 2008; Pecher, Boot, & van Dantzig, 2011).

1.3.1.1. Early embodiment effects in social psychology

The investigation of the interface between the body and cognition has a long tradition in social psychology that precedes the recent surge in embodiment research (Semin, et al., 2012a, in press). For example, early research already demonstrated how one's bodily states influence attitudes. In Solarz's (1960) seminal study, participants were presented with cards with names of objects displayed in a box equipped with a movable response lever. For half of the participants, the task was to pull the lever toward them when they liked the objects corresponding to the words, and push it away from them when they did not like the objects. For the other half of the participants, the instruction was reversed. Participants were faster in pulling the lever towards themselves for objects they liked and faster in pushing the lever away for disliked objects. These results were later replicated by Chen and Bargh (1999). They showed that participants were faster in performing approach (avoidance) movements when they had to classify positive (negative) words. These motor congruence effects were also shown by Förster and Strack (1997, 1998). When participants were asked to generate names of famous people, approach movements facilitated the retrieval of liked names while avoidance movements facilitated the retrieval of disliked names. However recent research suggests that the link between specific arm movements and stimuli valence is not fixed, but rather depends, for example, on the self-relevance of the movement (Wentura, Rothermund, & Bak, 2000), on the initial stimulus valence (Centerbar & Clore, 2006), on the goal-relevant outcomes of actions (Maxwell & Davidson, 2007), or on the subjective representation of the self (Markman & Brendl, 2005).

Arm flexion and extension movements also have differential effects on attitude development towards neutral stimuli, as first demonstrated by Cacioppo, Priester, and Berntson (1993). In their study, arm movement was manipulated by asking participants to press the palm of their hand upwards from the bottom of a table (i.e., an approaching movement) or to press downwards from the top of the table (i.e., an avoidance movement). While doing this task participants were exposed to a set of novel Chinese ideographs that they had to rate on a like-dislike scale. Results showed the predicted pattern. Participants rated the Chinese ideographs more positively when making approach movements compared to avoidance movements.

In one of the earliest demonstrations of how body movements shape attitudinal responses, Wells and Petty (1980) showed that nodding or shaking the head influences whether participants agree or disagree with persuasive messages. Under the cover story of a study on headphone quality, university students had to make either vertical (nodding) or horizontal (shaking) head movements while listening to a persuasive communication about an increase (counter-attitudinal message) or decrease (pro-attitudinal message) in University tuition fees. In the end, participants responded to several filler questions including one where they had to give an estimate of an appropriate tuition fee. Results showed that participants who had nodded their heads agreed more with the message. They recommended a reduced fee when the message was pro-attitudinal and an increased fee when the message was counter-attitudinal (see also Tom, Pettersen, Law, Burton, & Cook, 1991). In more recent research, Brinõl and Petty (2003) took these results one step further by showing that vertical and horizontal head movements impact the agreement with persuasive messages by affecting the degree of confidence people have in their own thoughts towards those messages (for a review, see Brinõl & Petty, 2008).

Numerous other bodily movements have been shown to affect our judgments. For example, the feedback one receives from their facial muscles influences the way we respond to emotional stimuli. In an ingenious study, Strack, Martin, and Stepper (1988) showed that judgments of emotional objects differ according to an induced facial expression. In this study facial expressions were manipulated by asking participants to either hold a pen between their teeth, which activates smiling, or holding a pen with their lips, which inhibits smiling. While holding these facial positions, participants had to rate the funniness of four novel cartoons. As predicted by Strack and colleagues, the cartoons were judged to be funnier by those holding a pen between their teeth than by those holding a pen with their lips. Research also shows that perceiving happy or angry faces activates the corresponding facial muscles in observers even when these faces were presented outside awareness (e.g., Dimberg, Thunberg, & Elmehed, 2000; see also Winkielman, Berridge, & Wilbarger, 2005). According to the embodiment hypothesis, the processing of facial expressions involves the simulation of the required expression in one's facial muscles. One way to test this hypothesis is then to inhibit the simulation by blocking facial expressions and see whether the recognition of emotions is impaired or not when compared to participants that are free to mimic. That's precisely what Niedenthal, Brauer, Halberstadt and Innes-Ker (2001) have done. In their research participants watched a movie of a morphed facial expression (blend of happy and sad expressions) changing from happiness to sadness (or sadness to happiness) and their task was to detect when the expression changed. While watching the movie, some participants were holding a pen with their lips (this way disrupting mimicry), whereas others were free to mimic the facial expressions. Results were convergent with the hypothesis, namely participants prevented from mimicry performed worse in detecting the expression change compared to participants that were free to mimic (see also Oberman, Winkielman, & Ramachandran, 2007).

Recently, Foroni and Semin (2009) generalized this research on motor resonance induced by facial stimuli to linguistic stimuli and showed that reading or hearing a verb (e.g., to smile, to frown) or an adjective (e.g., happy, angry) had the same sensorimotor consequences as seeing a happy or angry face.

Recent findings suggest that simulations of emotional states are context-dependent, namely they are not always involved in the processing of emotional information but instead they are determined by specific contexts and goals (Barsalou, 2003). In a recent paper, Niedenthal, Winkielman, Mondillon, and Vermeulen (2009) provided direct evidence in favor of this assumption by showing that participants who generated positive words associated with a concept showed more embodied facial simulation (measured on the EMG) when the context was highly demanding (i.e., communicate the generated words to a supervisor) than when the audience was not that demanding (i.e., communicate the generated words to a close friend).

1.3.1.2. Embodiment of concrete concepts

The processes mediating the relationship between language and motor behavior have been addressed over the last 10 years (e.g., Glenberg, 2008; Zwaan, 2009; Zwaan & Taylor, 2006). The language – motor behavior relationship has been addressed from neurophysiological (cf. Rizzolatti & Craighero, 2004, Rizzolatti & Arbib, 1998), action theoretical (e.g., Hommel, Müsseler, Aschersleben, & Prinz, 2001) and cognitive (e.g., Barsalou, 1999a; Glenberg, 2008) perspectives. The common denominator to these approaches is the demonstration that language comprehension (sentences and words) recruits and activates the same neural substrates and motor programs that are active when the person is performing the action represented in a sentence. The embodiment argument suggests that the comprehension of concepts or action language involves the activation of the sensorimotor modalities that are recruited online and that can be re-activated offline.

One of the most influential embodiment accounts is Barsalou's Perceptual Symbol Systems theory (1999a). Barsalou proposes that multimodal stimuli give rise to online experiences inducing modal states in the somatosensory system and the visual system, as well as in affective systems. According to this theory, once established in the brain, knowledge about the categories that are represented by multimodal associative structures can be used across a number of cognitive tasks. In this view, the representations that arise in dedicated input systems during sensation and motor action can be stored and used offline by means of mental simulations that have become functionally autonomous from their experiential sources. A substantial amount of research shows that the comprehension of language takes place by means of sensorimotor simulations or what Barsalou refers to as "the reenactment of perceptual, motor, and introspective states acquired during the interaction with the word, body, and mind." (2008, p. 618).

There is considerable research that supports the sensorimotor grounding of concrete concepts. For example, research on language comprehension has provided evidence showing that motor modalities are involved in the comprehension of language describing actions (cf. Zwaan & Taylor, 2006; Taylor & Zwaan, 2008). For example, Zwaan and Yaxley (2003) showed that when word pairs were presented in iconic relation (e.g., attic presented above basement) their semantic relatedness judgments were significantly faster than when they were presented in reverse iconic relation (e.g., basement above attic). In another study, Borghi, Glenberg and Kaschak (2004) asked participants to read sentences such as "There is a car in front of you" and then respond whether a target word (e.g., roof, wheel, or road) was part of the object (e.g., car) mentioned in the sentence (e.g., roof and wheel) or not (e.g., road). The responses were made with a vertically oriented keyboard. In one of the experimental conditions, participants had to move the arm upward to respond "yes" and downward to respond "no," while in the other condition the key labels were inverted.. According to the embodiment perspective, reading the word "roof" should prepare us to act in a upward manner, because that's the kind of action we execute to interact with a roof of a car, whereas reading the word "wheels" should prepare us to act downwards. Thus, participants should respond faster to the word "roof" when "yes" required an upward movement than when it required a downward movement, while the opposite should be true for the word "wheel." And this was exactly the pattern found by Borghi and colleagues (2004).

Research has also provided evidence for the role of visual simulations in representing the meaning of language (e.g., Pecher, van Dantzig, Zwaan & Zeelenberg, 2009; Stanfield & Zwaan, 2001; Zwaan, Stanfield, & Yaxley, 2002; for a review, see Pecher et al., 2011). For example, Stanfield and Zwaan (2001) presented sentences in which the horizontal (e.g., John put the pencil in the drawer) or vertical (e.g., John put the pencil in the cup) orientation of an object was implied. Immediately after the presentation of a sentence, a picture was presented, and participants had to decide whether the depicted object had been mentioned in the sentence. On the critical trials, the picture showed the object from the sentence in an orientation that either matched or mismatched the orientation implied by the sentence. Participants were faster and more accurate to recognize the object when the orientation of the picture matched the orientation implied by the sentence than when it mismatched.

An original experimental paradigm to demonstrate that the representation of concepts is modality specific (rather than based on abstract features, as proposed by representational models) is the modality switch cost paradigm. An embodied perspective suggests that language is modality specific, that is, words that have to do with auditory input must be coded differently than words that are coded by visual input. From this, Pecher, Zeelenberg, and Barsalou (2003) have argued that modality specificity would mean that switching from one modality (e.g., auditory) to another (e.g., visual) when processing object features should have processing costs. In their research, participants were asked to determine if an object had a particular feature or not (e.g., BLENDER – loud). This was preceded by another judgment that was either modality congruent (e.g., LEAVES – rustling) or incongruent (e.g., CRANBERRIES

– tart). There was an increase in the time required to confirm the feature as belonging to the object when the modality between two judgments was incongruent.

Supporting the behavioral research described above, research findings in neuroscience have demonstrated the link between neural mapping of language and action verbs in particular (cf. Pulvermüller, 2005; for a review, see Hauk, Johnsrude, & Pulvermüller, 2004). Using sophisticated techniques measuring brain activity, Hauk and colleagues (2004) revealed that listening to verbs referring to leg actions activates regions of the motor cortex responsible for control of the leg, verbs referring to hand actions activate motor cortex regions responsible for hand control. In another experiment, action sentences were used instead of single words. In this case, participants heard action sentences such as ‘the boy kicked the ball’ or ‘the man wrote the letter’ while their brain activity was recorded. Specific motor areas responsible for the control of the different body parts named in the sentences were again found to be active (Tettamanti et al., 2005).

1.3.1.3. Embodiment of abstract concepts

The studies reviewed before provide strong support to the idea that cognition relies, at least partially, on the sensory-motor system. Thus cognition is not completely amodal and abstract. However, if an embodied approach to understanding concrete concepts in terms of simulating the sensory-motor activity of the particular actions or movements appears plausible, it becomes difficult to extend this account to concepts that we cannot touch, see, taste or smell (cf. Boroditsky & Prinz, 2008). Are abstract concepts also grounded in the sensory-motor system? A growing body of research provides consistent results suggesting sensory-motor effects in processing abstract concepts (for a review, see Pecher et al., 2011).

One of the most accepted proposals to ground abstract concepts is conceptual metaphor theory (CMT, Lakoff & Johnson, 1980, 1999; although see Andrews, Vigliocco, & Vinson, 2009; Barsalou & Wiemer-Hastings, 2005; Mahon & Caramazza, 2008). In this view, thinking about abstract concepts is structured by perceptual experiences, such as space (Tversky, Kugelmass, & Winter, 1991). According to CMT, only a few concrete concepts are learned through bodily experience such as spatial orientation and containment while the majority of concepts are more abstract and their understanding is ‘accomplished’ through repeated pairings with the concrete domains. Thus, abstract concepts are understood through analogical extensions from concrete, bodily experienced domains. In the next paragraphs, we review some examples that illustrate the grounding of the abstract concepts.

One abstract domain that has been extensively researched is affect. Empirical evidence investigating the relation between affect and verticality (cf. Crawford, 2009; Landau, Meier, & Keefer, 2010) supports the argument that metaphors alluding to the vertical spatial orientation like "I'm feeling up" or "I'm feeling down" serve to structure the way people think and represent affect-related concepts. For instance, Meier and Robinson (2004) were able to show that positive words (e.g., ethical, friendly) were classified more rapidly as positive when presented at the top rather than at the bottom of a monitor, while the opposite was true for negative words. This idea of grounding affect in vertical space was soon extended to other areas beyond categorization such as to spatial memory. For instance, Crawford, Margolies, Drake, and Murphy (2006), observed that participants' retrieval of presented images revealed an upward position bias for positive images and a downward bias for negative ones. Recently, Casasanto and Dijkstra (2010) reported that people were faster in retrieving positive autobiographical memories when performing upward movements and negative memories when performing downward movements.

Another line of research explores the link between affect and size. For example, Meier, Robinson, and Caven (2008) have shown that positive words presented in a large font were evaluated more quickly and accurately than those presented in a small font, whereas the reverse pattern was true for negative words. Other research has explored the metaphorical use of 'bright' (e.g., "Bright ideas") or 'dark' ("Dark days") to refer to positive or negative aspects, respectively. This association finds support in the observation that participants' responses were facilitated when the word meaning (e.g., gentle) and the font color (white) were congruent with the metaphor (Meier, Robinson & Clore, 2004). Related research has also shown that squares are seen as lighter after the evaluation of positive than negative words (Meier, Robinson, Crawford, & Ahlvers, 2007). Recently, Lakens, Semin, and Foroni (2012) have shown across a set of six experiments that black is consistently judged to represent negative words while white represents positivity but only when the negativity of black is co-activated.

Another well-documented effect is the relation between power and verticality as well as between power and size. This is illustrated by metaphoric references such as that someone with a high status or on top of the hierarchy has control over others with a lower status. Such references anchor power with space, which has been shown to influence thinking about power. Thus when we think about power differences we think about differences on the vertical dimension (Schubert, 2004). Results reported by Schubert (2004) indicate that powerful groups (e.g., master) are classified faster when they appear above the powerless groups (e.g. servant) on a monitor. The reverse is reported for powerless groups who were judged more quickly when they were shown below the powerful groups. Additionally, participants were faster and more accurate when identifying powerful and powerless groups while making judgments using an upward movement or a downward movement, respectively. Schubert, Walduz and Giessner (2009) investigated whether physical size might be a further dimension grounding the metaphorical representation of power. Using an interference paradigm similar to the one used in the studies of power and verticality, the authors showed that the size of the font in which group labels appeared on the screen influenced response times and error rates in a power judgment task. Specifically, participants were quicker to classify powerful groups presented in a bigger font and also made fewer errors. Conversely, powerless groups were classified more quickly and accurately when the stimuli appeared in a smaller font.

The abundance of metaphors that locate time spatially (e.g., a short while ago, a long break) stimulated research exploring how the cognitive representation of time is intertwined with the representation of space. At least in Western cultures, people think of the past as to the left, and the future as to the right. For instance, bimanual response tasks have revealed compatibility effects between time-related stimuli (e.g., past, future) and the spatial position (left or right) of response keys (e.g., Ishihara, Keller, Rossetti, & Prinz, 2008; Vallesi, McIntosh, & Stuss, 2011; Wegner & Pratt, 2008). These effects indicate that when participants are asked to push a key on one side or the other in response to time stimuli, they are faster when past stimuli appear on the left and future stimuli appear on the right. Compatibility effects were also shown when past and future words were presented auditorily to the left or right ear and had to be categorized in terms of temporal meaning (Ouellet, Santiago, Isreali, & Gabay, 2010; Ouellet, Santiago, Funes, & Lupiáñez, 2010; Santiago, Lupiáñez, Pérez, & Funes, 2007). More recently, Lakens, Semin and Garrido (2011) showed that when past and future referent words were presented auditorily with equal loudness to both ears, participants disambiguate future words to the right ear and the past words to the left ear.

Overall these studies show that time is spatially grounded on an axis that runs from the left-past to the right-future. A pattern that is culture-specific and probably shaped by writing-direction (e.g., Nachshon, 1985). However, such studies have been conducted in western cultures and this particular reliance on the horizontal axis is by no means universal. Research has also shown time to be represented from right to left, front to back or back to front (e.g., Boroditsky, 2000; Fuhrman & Boroditsky, 2010), or even arranged according to cardinal directions (Boroditsky & Gabi, 2010). For example, in a recent paper, Boroditsky and Gabi (2010) report that Pormpuraawans (an Australian Aboriginal Community) arranged time according to cardinal directions: east to west. This research reveals both generality and relativity of how the abstract concept of time is understood. Time is grounded spatially, which appears to be a universal: however, the spatial referents that ground time vary considerably across cultures.

An extensive review of all embodiment research is beyond the scope of this section. The research reviewed above presents only some of many studies that illustrate the interface between bodily experiences and (social) information processing (for extensive reviews, see Barsalou, 2008; Niedenthal, Barsalou, Krauth-Gruber, & Ric, 2005; Pecher et al., 2011). Overall these studies indicate the influence of perceptual and motor experiences on the mental representation of concrete and abstract concepts and thus that cognition is *embodied*.

1.3.2. Cognition is situated

The SSC framework (E. R. Smith & Semin, 2004) rejects the passive representational view of cognition and argues that the primary function of cognition is the control of adaptive action. Modeling cognition in terms of abstract, detached symbolic representations has meant treating mental representations as invariant, timeless, and largely immune to contextual influences. Thus, representations such as attitudes and stereotypes were assumed to exhibit temporal inertia as well as resistance to fleeting contextual influences (e.g., Hamilton & Trolier, 1986; Snyder, 1981). However if cognition emerges in the interaction with a constantly changing social and physical environment (e.g., Semin & E. R. Smith, 2002), then assuming that mental representations are immune to contextual factors flies in the face of the necessity for cognition to be adaptive to situational requirements. Indeed, there is considerable research that has shown situational influences on cognitive processes. These studies have revealed the adaptive nature of cognition by highlighting the context sensitivity of mental processes. Bellow we review some of these studies, with special relevance to those conducted in the person perception domain.

Until recently, stereotypes were thought as stable knowledge structures largely immune to contextual influences (Allport, 1954; Ashmore & Del Boca, 1981; Katz & Braly, 1933, 1935). This stability has commonly been assigned to their important functional role in ensuring cognitive economy (e.g., Crocker, Fiske & Taylor, 1984; Fiske, 1980; Taylor, 1981), saving the social perceiver from coping with infinite information. However, for cognition to be adaptive, situational requirements must be met and cognitive representations and processes must be tuned in flexible ways. As Santos, Garcia-Marques, Mackie, Ferreira, Payne, and Moreira (2012) pointed out, if perpetual change would render stereotypes ineffective, a complete lack of response to changing circumstances would make them both detrimental and dangerous. Because stereotypes, like other stored mental representations, are brought to mind in a particular context, their activation and application is deemed to be vulnerable to the specific elements of that context. As recent research has been suggesting, stereotypes show considerable malleability in the face of changing contexts. Rather than representing abstract and stable knowledge structures stereotypes can be malleable and sensitive to details of the situation, and their flexibility reflects the perceiver's current social motives and relationships with others in the situation (E. R. Smith & Semin, 2007). The following examples illustrate stereotypes' context-sensitive and malleable nature.

Although most common views on social perception assume that judgments about members of social groups are based on their prototypic attributes (e.g., Brewer, Dull, & Lui, 1981), this assumption has long been challenged by exemplar models of information processing (e.g., Kahneman & Miller, 1986; Medin, Alton, & Murphy, 1984). According to these models, judgments of group members may be based on specific salient instances of the group other than their more general characteristics (e.g., Judd & Park, 1988; Linville, Fischer, & Salovey, 1989). According to this view (e.g., E. R. Smith, 1990, 1992; E. R. Smith & Zárate, 1992), social judgment will depend upon the subset of relevant exemplars that are momentarily salient in a particular situation. Indeed, research has established that the accessibility of specific exemplars or group members affects category and subtype descriptions (e.g., Coats & E. R. Smith, 1999; E. R. Smith & Zárate, 1992; Bodenhausen, Schwarz, Bless, & Wänke, 1995) as well as central tendency and variability judgments about the group as a whole (Garcia-Marques & Mackie, 1999, 2001). Different members of a group can also make stereotypes differentially accessible (e.g., Livingston & Brewer, 2002; Macrae, Mitchell, & Pendry, 2002).

Stereotypes are sensitive to subtle contextual cues (e.g., Wittenbrink, Judd, & Park, 2001), to context stability (Garcia-Marques, et al., 2006) and even to context irrelevant information (Santos, et al., 2012). For example, whereas thinking about politicians who were involved in a scandal decreased participants' evaluation of the trustworthiness of politicians in general, participants who evaluated the trustworthiness of specific politicians as relatively high subsequently concluded that politicians in general are relatively trustworthy as well (Schwarz & Bless, 1992). In a similar vein, incidental exposure to atypical exemplars (e.g., Oprah Winfrey) of a social group (e.g., Black American) was shown to be sufficient to produce the expression of more sympathetic beliefs about the group (Bodenhausen, et al., 1995). Other studies report faster judgments about stereotypic attributes when category exemplars had familiar (John and Sarah) rather than unfamiliar (Isaac and Glenda) names (Macrae et al., 2002).

Moreover, even subtle changes in the context, for example whether the same woman had either a makeup brush or chopsticks in her hand were shown to significantly affect the stereotype content automatically activated (e.g., Chinese or Women; Macrae, Bodenhausen, & Milne, 1995). Similarly, Wittenbrink et al. (2001) have shown that automatic group attitudes and stereotypes, commonly thought to be fixed responses to a social category cue, are sensitive to changes in situational context. In two studies, the authors report that White participants' implicit attitudes toward Blacks varied as a result of exposure to either a positive (a family barbecue) or a negative (a gang incident) stereotypic situation. In a second study, presenting a picture of a Black American in the context of a street scene facilitated responses to negative target items (adjectives). In contrast, presenting the same facial primes framed in a church context, did not indicate prejudice, but in fact yielded a facilitation effect for positive rather than negative target items.

Stereotypes were also shown to be influenced by contextual irrelevant information activated immediately prior to the stereotype measurement (Santos et al., 2012). In a set of studies where participants were primed (supra or subliminally) with stereotypic, stereotype irrelevant and counter stereotype traits in the context of an irrelevant task, activation of stereotype-irrelevant traits (but not counter-stereotypic traits) increased their inclusion in the expressed stereotype. Furthermore, Garcia-Marques and colleagues (2006) have shown that stereotypes are malleable, even within individuals, and that this malleability depends on the context (just as in the case of representations of non-social categories, Barsalou, Sewell, & Ballato, 1986; Barsalou, Spindler, Sewell, Ballato, & Gendel, 1987; Bellezza, 1984a, 1984b, 1984c). When participants were asked to read the description of a group member and to rate its typicality before completing a stereotype trait selection task in each of two sessions held two weeks apart, stereotype stability was shown to be largely a function of context stability. When the context was stable (i.e., the description of the group member was stereotype-consistent or stereotype-inconsistent across both sessions), the degree of within-subject stereotype stability was considerable. When the context differed (i.e., the exemplars presented were stereotype-consistent in one session and stereotype-inconsistent in the other), stereotype stability greatly declined.

Another illustration reveals that subtle situational cues can easily influence allegedly automatic and invariant cognitive processes such as the ‘fundamental attribution error’ (Ross, 1977). As Norenzayan and Schwarz (1999) document, when asked to provide causal explanations for a mass murder reported in a newspaper, participants responding to a questionnaire with a letterhead 'Institute for Social Research' produced more situational explanations while those responding to a questionnaire for the 'Institute of Personality Research” produced more dispositional accounts. Other examples of such contextually driven malleability have been demonstrated for self-esteem (e.g., Crocker, 1999), the self-concept (e.g., Tice, 1992), and social stereotypes (e.g., Schaller & Convey, 1999).

Finally, recent research has also started to document the effects of the physical features of the environment on social cognitive processes. For example, Williams and Bargh (2008a) asked participants in one of their studies to hold a warm cup of coffee or a cold cup of coffee before receiving information about a hypothetical person described as intelligent, skillful, industrious, determined, practical, and cautious. Subsequently, participants registered their personality impression of this hypothetical person on several bipolar traits, half of which were semantically related to the warm-cold dimension. Their results revealed that holding a warm cup of coffee led participants to judge the target as warmer than did participants holding a cold cup of coffee. Similarly, IJzerman and Semin (2009) observed that participants in a warmer room (relative to a colder room) reported higher social proximity to a target person. On the other hand, social exclusion situations lead people to feel colder (Zhong & Leonardelli, 2008).

The effects of physical distance on social judgment have also been shown. For example, participants primed with spatially proximal coordinates reported stronger bonds to their family members and their hometown than those primed with distant coordinates (Williams & Bargh 2008b). More recently, IJzerman and Semin (2010) have shown that inducing experiences of physical and verbal proximity gives rise to perceptions of higher temperature.

Environmental scents also affect cognition and behavior across a variety of contexts. For instance, Holland, Hendriks, and Aarts (2005) demonstrated that the exposure to a hidden cleaning scent enhances the mental accessibility of the behavioral concept of cleaning. In three studies these authors showed that participants in the cleaning scent condition were faster in identifying cleaning-related words, listed more cleaning activities, and kept their working table cleaner compared to participants in the control condition without any scent. Moreover, there is some research showing that human odors affect social interaction including helping behavior (e.g., Baron, 1997) and attraction to others (cf. Demattè, Österbauer, & Spence, 2007; Li, Moallem, Paller, & Gottfried, 2007). In a recent integration, Semin and Garrido (2012) documented that environmental contexts characterized by warm temperature, close distance and pleasant smells promote generalized positive sociability evaluations. In the presence of these environmental conditions not only a social target but also uninvolved others, such as the experimenter, were rated as warmer, closer and more friendly, in contrast to the ratings observed in the cold, distant and unpleasant smell conditions. These and other findings (cf. Semin, et al., 2012, in press) highlight the interdependence between the material conditions of the environment and psychological processes and constitute compelling evidence of the adaptive and context sensitive nature of cognition.

The research reviewed above indicates that rather than representing abstract and stable knowledge structures, mental representations and processes must be responsive to situated demands and thus, context sensitive, if they are to guide adaptive responses. If mental representations were completely malleable, they would be useless. However a complete lack of responsiveness to changing circumstances would also be highly maladaptive. *Situatedness* is therefore an important feature of cognition.

1.3.3. Cognition is distributed

The third core assumption of the SSC framework states that cognition is distributed across individuals, groups, tools and objects (E. R. Smith & Semin, 2004). Rather than occurring only in individual brains, cognitive activities extend to the social and physical environment, which become integral parts of cognitive activity in their own right (Clark & Chalmers, 1998). The distributed cognition assumption "very explicitly identifies cognitive systems themselves as reaching beyond individuals into their physical and social environments" (Wilson & Clark, 2009, p. 58). Given the pervasiveness of distributed cognition in our daily social lives (for a review, see Levine & E. R. Smith, in press) it is surprising to note that relatively little social psychological research has explored its dynamics. In this section we describe research showing how individuals make use of their physical and social environments to extend their cognitive operations. This research highlights how a purely individual level of explanation fails to account for the often distributed nature of cognition, nor does it address the possible influence of the social contexts and purposes that often determine the processes and contents of our cognitive activity.

1.3.3.1. The physical environment as a scaffold for cognition

The way we process information is strongly shaped by information that is embedded in the environment. In many occasions during our daily life, we prefer to rely on environmental supports to offload information and facilitate our cognitive tasks instead of depending exclusively on inner representations. In Clark's (1989, p. 64) words, "evolved creatures will neither store nor process information in costly ways when they can use the structure of the environment and their operations upon it as a convenient stand-in for the information-processing operations concerned."

An often-cited example of how such offloading takes place is illustrated by how we solve a difficult arithmetic operation like multiplying two three-digit numbers. The mental operations in this case are distributed by using pencil and paper. As we manipulate symbols, these external resources become part of an overall cognitive system, functioning as memory storage, offering cues for what digits to process next, and so on (Clark, 1999). Another classical scaffold is to manipulate the physical environment as an aid for memory. For example, leaving an empty milk bottle by the door as a reminder to buy milk the next time we go out (Kirsch, 1995; Kirsch & Maglio, 1994). Another example of how people actively structure their immediate environment to optimize their performance can be observed in how bartenders structure bartending activities (Beach 1988). Expert bartenders who are confronted with a number of diverse drinks orders line up differently shaped glasses. The shape of these glasses corresponds to the different kinds of drinks that were requested and their spatial alignment reproduces the temporal sequence of drink orders. The exploitation of the physical environment releases memory resources. With this organization of the glasses the expert bartender does not have to think about neither the sequence nor the type of drinks that have to be prepared as they were offloaded in the environment.

These and other examples illustrate how the external actions an agent performs on the physical environment can change its own computational state or otherwise cue, prioritize and structure even the most demanding cognitive tasks.

1.3.3.2. The social environment as a scaffold for cognition

As the research reviewed before shows, cognition can be distributed across objects and tools, which effectively facilitates and structures cognition. However, one's environment is mainly constituted by other social agents and thus cognition is also distributed across other people (e.g., E. R. Smith & Collins, 2009). Indeed, a large amount of evidence shows that other people participate in the construction of mental representations and in the processing of information in a way that extends our cognitive capacities.

One of the best examples of socially distributed processing in social psychology is the study of transactive memory (e.g., Wegner, 1986; 1995; Wegner, Giuliano, & Hertel, 1985; Wegner et al., 1991). This research highlights how memory becomes progressively specialized, socially shared, indexed, and complementary among people who know each other well. The research conducted on this subject suggests that individuals in close relationships develop a distributed memory system, such that they divide responsibility for the encoding, storage, and retrieval of information from different domains, according to their implicitly shared knowledge of each other, and they jointly remember information better than do strangers (e.g., Andersson & Rönnberg, 1995; Hollingshead, 1998a; 1998b; Wegner, 1986, 1995; Wegner et al., 1991). Through self-disclosure and shared experiences, members of the system become aware not only of what information they themselves know, but also what the other members know across knowledge domains. The important aspect of transactive memory in this context is that the coordination of the interindividual memory expertise gives rise to a qualitatively different memory system. By leaning on each other the individual minds are enhanced by the socially available and accessible scaffolds. This scaffolded memory system is more elaborate than that of any single individual member's memory (Wegner, 1986).

Transactive memory is a system that is irreducible, operates at the group level and depends on a distribution of specializations within this system, as in the case of partners (Wegner, 1995). Note that each person in the system individually lacks critical pieces of information. Nevertheless, such specialization reduces the cognitive load of each individual, while providing the dyad or group access to a larger pool of information across domains and reduces the wasted cognitive effort represented by overlapping individual knowledge. Additional findings about collaborative remembering in older couples lend additional support to this idea. Although elderly individuals exhibit memory deficits relative to younger adults, when elderly couples who have been married for 40 year or more are allowed to work together, they remember just as much as young couples (Dixon & Gould, 1996). According to this account, individual memory systems can become involved in larger, organized social memory systems that have emergent group mind properties not traceable to the individuals.

Another related line of research exploring the distributed nature of cognition is the research on collaborative memory (for extensive reviews, see Hirst & Manier, 2008; Rajaram & Pereira-Pasarin, 2010; Rajaram, 2011; Weldon, 2001). Intuitively, one might think that groups recall more information than individuals alone, and indeed that's what the research suggests (e.g., Weldon, 2001). One possible explanation for why collaboration might improve memory is because the information recalled by one person provides cues that help another person to recall other information (cross-cueing; Meudell, Hitch, & Kirby, 1992; Meudell, Hitch, & Boyle, 1995). However, these cross-cuing benefits for memory disappear when the recall of collaborative groups is compared to the recall of nominal groups. Nominal groups are groups constituted by the same number of individuals as collaborative groups but where individuals perform the recall task alone, and their recall outcome is the result of pooling out the non-redundant responses. For example, if in a nominal group, participant 1 recalls items a, c, and e, participant 2 recalls a, b, and d, and participant 3 recalls items a, f, and g, then the pooled recall is seven items: a, b, c, d, e, f, g. When one compares the pooled recall of nominal groups with the recall of collaborative groups a surprising outcome emerges: the memory performance of collaborative groups is actually worse than the one of nominal groups. This phenomenon is known as collaborative inhibition (Weldon & Bellinger, 1997). The question then is: what is at the heart of collaborative inhibition? The most commonly accepted explanation states that collaborative inhibition results from the disruption of each participant's retrieval strategies during collaboration (Basden, Basden, Bryner, & Thomas, 1997). Namely, while learning information, each participant forms their own idiosyncratic organization of the information based on his or her unique experiences. Thus, each participant has a different strategy for recalling the information. During the collaborative recall phase participants are exposed to others' output that disrupts their own retrieval strategies, which leads to a lower recall than participants recalling alone.

Recently, the investigation of collaborative memory processes has also been extended to person memory (e.g., Garcia-Marques, Garrido, Hamilton, & Ferreira, 2012; Garrido, 2006; Garrido, Garcia-Marques, & Hamilton, 2012a, 2012b). These studies found that both the effects of collaborative recall (i.e., collaborative inhibition) and their theoretical accounts are parallel to those reported in the cognitive literature. In research directly examining the effects of collaboration in both stages of information processing, these authors showed that the extent to which members of a collaborative recall group share similar representations of the information they have learned determines the outcomes of their collaborative memory (e.g., Garcia-Marques et al., 2012). Further, the authors specified the role of the information processing mechanisms that are used at encoding in promoting a shared representation and consequently in determining the amount and type of information retrieved. Their findings reveal that collaborative inhibition does not take place when group members actually encode the outcomes of each other's information processing strategies (Garrido, 2006; Garrido, Garcia-Marques, & Hamilton, 2012c).

Overall, one might conclude that working alone brings more benefits for memory than does collaboration. However, collaboration also helps memory. For example, collaborative recall provides group members with a second chance to learn again the information they might already have forgotten. Namely, in a collaborative situation participants are re-exposed to information others recall and that benefits their memory when they are later tested individually (Blumen & Rajaram, 2008; Weldon & Bellinger, 1997). Ultimately, whether it is preferable to have people work alone or in a group depends on the goals and the task. If the goal is to obtain the highest possible output, without concern for individual learning, then working alone and pooling the results is better than collaboration. However, if the goal is to increase the amount of material each person ultimately learns, then collaboration is often better. Note that although collaboration can lead to more correct material being recalled, it can also more easily lead to false memories (e.g., Weldon & Bellinger, 1997; Basden et al., 1997). However, collaboration can also provide the chance to group members correct their wrong memories (although see Meade & Roediger, 2002; Roediger, Meade, & Bergman, 2001). For example, group members can reduce recall errors with the help of feedback from other group members (Ross, Blatz, & Schryer, 2008). Thus, as Rajaram and Pereira-Pasarin (2010) have pointed out, taken together the advantages of collaboration may overcome their ill effects.

The former section illustrates how cognitive activities may be *distributed* across the physical and the social environment. While using external tools, such as post-its, computers or smartphones, or organizing the physical space constitute important physical scaffolds to offload cognitive work, transactive and collaborative memory systems constitute good illustrations of how cognitive work can be offloaded to social agents, and how that distribution may shape social cognitive processing.

In section 3 we presented the SSC approach (E. R. Smith & Semin, 2004) as an alternative approach to understand social cognitive processes. The SSC approach recasts the standard social cognition approach by suggesting that cognition is embodied, drawing on our brains and sensory motor abilities; is situated, namely is the emergent outcome of dynamic processes between an agent and the environment; and is distributed across other social agents and across the environment. In the research program we will present next we adopt this perspective with the main goal of understanding whether body properties, environmental features and social scaffolds might play a role on social memory processes.

1.4. The present research program: Taking a socially situated cognition perspective on social memory

The study of social memory has always been a topic of interest in social psychology (Anderson, 1967; Asch, 1946; Rosenberg, Nelson, & Vivekanathan, 1968), however it was with the emergence of the social cognitive approach that the topic met its major developments. It is now more than thirty years after the first important papers on the topic have been published (Hamilton, Katz, & Leirer, 1980a; Hastie & Kumar, 1979; for a review, see L. Garcia-Marques & T. Garcia-Marques, 2004). We now know a great deal about how people encode, organize, and retrieve social information from memory; what are the conditions are under which specific types of information prevail over others; and its underlying mechanisms (see Skowronski, in press).

Although the field has produced robust and sophisticated theories and a cumulative body of empirical evidence, most of this work was based on models that represent knowledge as abstract structures with little or no connection with the external world. As described in section 2, the information processing metaphor (Newell & Simon, 1972; Marr, 1982; Vera & Simon, 1993) has been the dominant metaphor used to understand cognitive processes and has shaped the course of research in social cognition. The standard social cognition approach conceptualizes cognition in terms of inner representational structures, like associative networks or schemas, which through inner processes are stored in memory and retrieved to influence judgments and social behavior (e.g., Wyer & Srull, 1989).

In contrast to the information processing metaphor the recent socially situated cognition approach (SSC) proposes a biological metaphor as the best way to understand cognition. As Andy Clark (1997, p. 1) puts it: "We imagined mind as a kind of logical reasoning device coupled with a store of explicit data - a kind of combination logic machine and filing cabinet. In so doing, we ignored the fact that minds evolved to make things happen. We ignored the fact that the biological mind is, first and foremost, an organ for controlling the biological body." As we described in section 3, the SSC approach argues that cognitive processes emerge and depend on people's moment-to-moment sensory-motor interactions with the physical and social environment and not solely on the combination of symbols in one's brains (E. R. Smith & Semin, 2004; for reviews, see Semin, et al., 2012, in press; Semin & E. R. Smith, in press).

If we take the SSC approach seriously we must assume that cognition and memory are constrained by the properties of one's body and distributed across the features of the physical and social environments, as demonstrated by the different research lines reviewed in section 3. As for cognition in general, it seems straightforward to suggest that person perception processes do not occur exclusively within the individual mind, as depicted by dominant models of mental representation, but also rely on our physical bodies, and physical and social environments (E. R. Smith & Semin, 2004). Therefore and as previously stated, our main goal is to extend some of the SSC assumptions advanced by E. R. Smith and Semin (2004) to person perception and test their implications for the encoding and retrieval of social information.

Before proceeding with a more detailed description of our research proposal we would like to make two important clarifications regarding our theoretical perspective First, although we criticize the individual-centered and abstract nature of person memory models that by no means implies the rejection of mental representations, but simply a different view on their nature and their role in the overall adaptive process (Clark, 1997). Thus, our position in this thesis is that the body and the environment complement and shape rather than replace internal computation (Sutton, Harris, Keil, & Barnier, 2010). The second clarification we would like to make follows from the previous one and concerns our views about theory and research on person memory. Although we criticize the individualistic and abstract approach under which person memory research has typically been studied that doesn't mean we don't recognize the importance of person memory models and research put forward over the last three decades. We believe that the theory and findings reported within this approach are important to our current understanding of the way people think about each other and thus to how people interact with others. And we also acknowledge the importance of the social cognition approach for the understanding of the processes underlying the way we encode, represent, and retrieve social information from memory. However, and as we mentioned earlier, we contend that, like other cognitive processes, person perception is not best captured as an isolated set of mental structures and processes that operate on abstract symbols. As current theory and research suggest person memory should be better addressed in the context of a situated approach.

In order to extend the SSC approach to person memory we designed three sets of experimental studies, which are presented in three separate chapters. Each set of experiments tries to address one of the general theoretical principles of SSC reviewed in section 3 in the study of person memory. In the first empirical chapter (Chapter 2), we present two experiments examining the idea that person memory is *embodied*, namely that person memory is constrained by the incorporation of sensorimotor elements during encoding of valenced behavioral information. Building on previous research showing that both the retrieval of autobiographical memories (Casasanto & Dijkstra, 2010) and the retrieval previous spatial locations of images (Crawford et al. 2006) are influenced by the ‘‘good is up’’ metaphorical association, we tested the general hypothesis that memory for positive and negative behavioral information in the context of an impression formation task depends on the location where that information was presented in the vertical space.

In the second empirical chapter (Chapter 3), we report a set of studies testing the *situatedness* of person memory. Namely, in four experiments we investigated the role of the physical context (objects) in person memory. The general question driving this set of experiments was whether impressions are immune to contextual influences, as it is implicitly assumed by standard person memory theories. If, as other cognitive processes, person memory results from the interplay between the individual and the context, then the way people acquire and retrieve social information should be constrained by the context in which these processes take place. This idea was tested in four experiments where we manipulated the meaningfulness of contextual information (objects) for target-stereotypes during encoding, retrieval, and in both these stages.

In the last empirical chapter (Chapter 4), we tested the assumption that memory is *distributed* by investigating the role of other people as memory scaffolds. Inspired by classic (Kirsh, 1995; Kirsh & Maglio, 1994; Wegner, 1995) and recent research on transactive memory (Sparrow, et al., 2011) we designed an experiment where we examined whether participants who could distribute part of the learned information to a partner would have more difficulty in subsequently recalling that information when compared to participants who had no partner to whom distribute the same information. Crucially, we expected this difference to occur even when the 'memory distribution' manipulation was introduced after learning had taken place.

The next three chapters report this research. It should be noted that each of these chapters is based on an article that was either published or submitted for publication. These chapters can be read independently and in any order. After these three chapters, we present, in a final chapter, an integrated discussion where we address the main contribution of our work and what in our view has yet to come.

CHAPTER 2

GROUNDING PERSON MEMORY IN SPACE: DOES SPATIAL ANCHORING OF BEHAVIORS IMPROVE RECALL?[4]

The impressions we form of others constitute important markers guiding the way we navigate our social world. Not surprisingly, the subject of impression formation has occupied center stage in social psychology from its early beginnings (Allport & Allport, 1921; Asch, 1946; Anderson, 1965; Hamilton, et al., 1980a; Hastie, Ostrom, Ebbesen, Wyer, Hamilton, & Carlston, 1980; Srull, 1981). A focus on the nature of the mental representations underlying how we think about persons and analyses of the processes driving such thinking shaped the course of the field, leading to the development of increasingly sophisticated bodies of theory about the nature of mental representations, their impact on judgments, and the nature of variables affecting information processing (e.g., Wyer & Srull, 1989; for reviews, see E. R. Smith, 1998; Wyer & Carlston, 1994). In this view, person cognition became the construction and manipulation of inner representations, with the implicit assumption that knowledge about persons is dissociated from any sensory base and thus amodal, (e.g., Wyer & Srull, 1989). However, cognition is constrained by the properties of our evolved brains and bodies (Semin & E. R. Smith, 2002; 2008; E. R. Smith & Semin, 2004). Adopting an embodied view of person cognition casts this field in the *active context* of navigating the social world suggesting that like other cognitive processes, impressions are structured by the incorporation of sensorimotor and affective elements.

The current research was designed to investigate the general hypothesis that valenced behavioral information acquired in the course of our daily social interaction can be anchored spatially. These experiments extend earlier work (cf. for a review, see Crawford, 2009) that has demonstrated that memory for location and shifts of spatial attention are influenced by the "good is up" metaphor, and that memory is better for valenced stimuli that appear in metaphor-compatible locations (positive in

[4] This chapter is based on the paper Palma, T. A., Garrido, M. V. & Semin, G. R. (2011). Grounding person memory in space: Does spatial anchoring of behaviors improve recall? *European Journal of Social Psychology, 41*, 275-280.

upper space and negative in lower space) than those that appear in metaphor-incompatible locations (positive in lower space and negative in upper space). We will do so by exploring for the first time the "good is up" metaphor in a standard person memory paradigm. Specifically, we examined in two experiments if memory for behavioral information about a target person depends on where such information is placed in vertical space. Thus, the novel contribution of the two experiments is to show for the first time that a vertical spatial structure underlies person memory and anchors specific behaviors and their recall.

In the following, we first present the standard person memory view and its shortcomings. We then outline an approach to person memory designed to address these shortcomings.

2.1. Person Memory: The Standard View and its Shortcomings

The delivered view of how we organize our perceptions of others, namely person memory, relies on a representational approach imported from cognitive psychology (e.g., Anderson & Bower, 1973; Collins & Quillian, 1969; Collins & Loftus, 1975). Accordingly, our knowledge of persons is represented in memory by means of abstract nodes interconnected to each other in a network of semantic knowledge. These nodes are assumed to be amodal, namely they do not retain sensory and motor qualities of the perceived stimuli. Consequently, impressions were viewed as amodal memory structures measured with variables designed to assess inferences about the “perceiver's organized cognitive representation of another person” (Hamilton, Katz, & Leirer, 1980b, pp. 123) from memory. However, criticisms made about amodal semantic network models (e.g., Harnad, 1990; Barsalou, 1999a) can also be leveled at information processing models of person memory.

An alternative view of person memory arises from recent theorizing and research from an embodied cognition perspective (e.g., Barsalou, 1999a; 2008; Glenberg, 2008; Wilson, 2002; Zwaan, 2004), namely that cognition is grounded by sensorimotor and affective neural systems. Research supportive of this general perspective is accumulating (cf. Barsalou, 2008; Semin & E. R. Smith, 2008). In particular, there is considerable research underlining the close link between specific types of linguistic stimuli and sensorimotor activation. Reading action words or sentences with action words recruits neural activity in cortical motor areas that are activated when the corresponding action is executed (e.g., Buccino et al., 2005; Pulvermüller, Shtyrov, & Ilmoniemi, 2005; Tettamanti et al., 2005). Similarly, sentences referring to actions (e.g., moving your hand toward/ away from the body) interact with the performance of these actions (e.g., Glenberg & Kaschak, 2002; Zwaan & Taylor, 2006).

However, the hotly debated question that is at the heart of embodied approaches to cognition is how we represent, think, and communicate about abstract concepts (e.g., traits) that do not afford immediate sensorimotor experiences (cf. Barsalou, 2008; Boroditsky & Prinz, 2008; Lakoff & Johnson, 1999; Semin & E. R. Smith, 2008). One of the solutions is offered by conceptual metaphor theory (e.g., Lakoff & Johnson, 1999), according to which, perceptual experiences such as space or motion serve as the metaphorical source to structure abstract target domains. Accordingly, the structural alignment between a source and a target domain grounds the abstract concept of, for example, affect or valence. Considerable evidence supports this contention in the affect area (see Crawford, 2009, for a review). For instance, in an early contribution, Meier and Robinson (2004) showed that positive words such as *ethical or friendly* are classified more rapidly as positive when they were presented at the top rather than at the bottom of a monitor, with the reverse holding for negative words.

While there is no research examining the interface between vertical spatial dimension and impression formation, there is a spate of research on spatial memory of positive and negative images. For instance, Crawford, and colleagues (2006), after presenting participants with positive and negative images on the upper or lower half of a monitor, asked them to recall the original position at which the images had been presented. Participants' retrieval revealed that there was an upward position bias for positive images and a downward bias for negative. Recently, Casasanto and Dijkstra (2010) have reported that participants were faster in retrieving positive autobiographical memories when performing upward movements and negative memories when performing downward movements.

Notably, the extant research supporting the relation between valence and verticality has relied on discrete stimulus materials that have no interconnected coherence aside from their evaluative loading; and on interference paradigms with response time as the dependent variable (see Crawford, 2009, for a review). Impression formation paradigms, by contrast, typically use rich behavioral descriptions, interconnected in a target person and involve complex integrative processes. Typically, they entail incidental learning tasks and memory measures, such as free recall, an effortful and resource demanding retrieval mode (e.g., Garrido, et al., 2012a). This contrasts strongly with experimental paradigms that have explored the spatial grounding of valenced stimuli.

Furthermore, the current extension to impression formation goes beyond replicating previous research on the spatial grounding of valence. By examining how the spatial presentation of information shapes impressions of target persons or groups, this research opens a window for exploring how other sensorimotor variables can affect and constrain impression formation and social judgment, typically regarded as amodal processes.

2.2. Overview

Based on earlier research showing that the vertical dimension serves as a source to ground the abstract target domain of affect or valence, we expected that the recall of behavioral information about a target person would be facilitated when this information is presented in a spatially compatible rather than a spatially incompatible vertical location. Thus, in both experiments the stimulus materials consisted of *behavioral information* about one of two different target persons. The target person was a skinhead in one experimental condition and a childcare professional in the other.

In both experiments, the vertical position of the relevant behavioral information was manipulated. In the first experiment, the information was presented on a large screen. In the second experiment, participants had to put the behavioral descriptions printed on cards on a higher or lower location.

In both cases, participants received a subsequent surprise recall task after having read all the behavior descriptions about the respective target person. The hypothesis under consideration was that participants' recall would be superior for positive and negative target behaviors if the target's positive behaviors were presented/placed in a vertically-higher position in space and negative behaviors in a vertically-lower position in space rather than the reverse.

2.3. Experiment 1

Experiment 1 was designed to examine if recall of positive and negative behavioral descriptions about two different targets is influenced by where the behaviors are presented on a vertical spatial location. To this end, we adapted a typical impression formation paradigm (e.g., Hamilton, et al., 1980a). Participants were asked to form an impression about the target person who was described sequentially with a number of positive (or negative) behavioral statements. This was followed by a surprise free recall task. According to the hypothesis under examination, memory performance was expected to be enhanced when positive and negative behavioral descriptions were presented respectively at the top or the bottom of a large screen, namely spatial locations compatible with the grounding of valence on a vertical axis.

2.3.1. Method

2.3.1.1. Participants and Design

Seventy-nine students (40 female; mean age 21.63) participated in this study on a voluntary basis. The study had a 2 (Target: childcare professional vs. skinhead) X 2 (Type of behavior: stereotype relevant vs. irrelevant) X 2 (Screen location: top vs. bottom) mixed design, with repeated measures on the last two variables.

2.3.1.2. Stimulus Materials

The stimulus materials consisting of 36 behavioral descriptions were used in both Experiment 1 and 2 (see Appendix A). They were selected from a larger pool that had been developed and piloted extensively (Garrido, 2003). Twelve of these behaviors were *friendly* behaviors typical of a *childcare professional* (e.g., *He helped an elderly person to use the ATM*) and 12 were *unfriendly* behaviors typical of a *skinhead* (e.g., *He intentionally ignored the phone calls of a friend*). The remaining 12 behaviors were irrelevant and not diagnostic of either stereotype (e.g., *Waited for the bus on that morning*) and were included to make the impression formation task more plausible.

2.3.1.3. Procedure

Participants, seated at a distance of 1.5 m from a large screen (200x220cm) were informed that the experiment was concerned with "the way people form impressions about others". They were also told that they would be presented with behaviors performed by a person and were encouraged to form an overall impression of this person. For half of the participants, the target was the *childcare professional* and for the other half it was the *skinhead*. They were then given some general information about the target person including his name, occupation, and the impression held by people who know him (e.g., *Pedro Rodrigues is a childcare professional. He is very friendly, helpful, and sensitive*).

A total of 24 behaviors were presented for each target consisting of 12 stereotype relevant (i.e., friendly behaviors in the case of the childcare professional and unfriendly in the case of the skinhead) and 12 irrelevant behaviors. Six of each group of behaviors was presented at the top of the screen and 6 at the bottom in a randomized order, each for eight seconds. The spatial location of the behaviors was counterbalanced across participants. Thus, if a behavior was presented at the top of the screen for one participant then it was presented at the bottom for the next participant.

After completing the impression formation task, participants were given a 5-minute filler task. They were then asked to rate the target on seven 9-point scales measuring perceived *target valence* (sensitive/insensitive; friendly/unfriendly; helpful/not helpful; positive/negative; good/bad; pleasant/unpleasant; likable/ unlikeable). Subsequently, they received an unexpected free recall task and had to recall all the behaviors that were presented during the impression formation task. Finally, participants were asked to write down what they thought the hypothesis of the study was. All participants were unaware of the actual hypothesis. They were then debriefed and thanked.

2.3.2. Results and Discussion

A coder blind to the experimental conditions categorized the recall data, using a lenient gist criterion. Recall intrusions were infrequent (< 3%) and excluded from all analyses[5]. Overall recall was 5.6 (SD = 2.8). In the following, we present separate analyses for stereotype relevant behaviors and irrelevant behaviors, since the latter are not valenced and there is no a priori reason to expect them to be systematically affected by their positioning in vertical space.

2.3.2.1. Expectancy Manipulation Check

To examine the effectiveness of the expectancy manipulation we scaled the responses to the seven items measuring perceived target valence (Cronbach alpha = .97). As expected, participants judged the childcare professional more positively (M = 7.48; SD = 1.23) than the skinhead (M = 2.76; SD = 1.11; t (73) = 17.47, $p < .001$, d = 4.01).

2.3.2.2. Recall of relevant behaviors

The chief prediction was that memory performance is enhanced for positive and negative behavioral descriptions presented respectively at the top or the bottom of a screen compared to the reverse pattern of presentations. To test this, we created a new variable *–compatibility–* by collapsing the expectancy-relevant behaviors recalled as follows: childcare professional's (positive) behaviors presented at the top and skinhead's (negative) behaviors presented at the bottom of the screen constituted the *compatible* condition; childcare professional's (positive) behaviors presented at the bottom with skinhead's (negative) ones presented at the top of the screen constituted the *incompatible* condition. According to our hypothesis recall should be higher for valence/position *compatible* behaviors over valence/position *incompatible* behaviors.

[5] The recall data of 4 participants were omitted because they did not understand the recall instructions (they inferred traits).

The number of recalled expectancy-relevant items was analyzed in a 2 (Target stereotype: childcare professional vs. skinhead) X 2 (Compatibility: compatible vs. incompatible) analysis of variance (ANOVA) with repeated measures on the last factor.

As predicted, relevant behaviors presented in compatible locations had a significant recall advantage (*M* = 2.05; *SD* = 1.22) compared to relevant behaviors presented in incompatible locations (*M* = 1.61; *SD* = 1.20; F (1, 73) = 5.44, p = .022, *MSE* = 7.24, η_p^2 = .07. There was no significant interaction between "Compatibility" and "Target" (F<1), thus meaning that both positive and negative behaviors contributed equally to the reported compatibility effect.

Additionally, there was a significant main effect for the target variable, F (1, 73) = 11.78, p < .001, *MSE* = 18.97, η_p^2 = .14, with *skinhead* behaviors (*M* = 2.18; *SD* = 1.26) being recalled better than *childcare professional* behaviors (*M* = 1.47; *SD* = 1.28). The observed recall advantage for the *skinhead* behaviors (unfriendly behaviors) is consistent with the literature suggesting an advantage for negative stimuli in memory (see Kensinger, 2009, for a review).

2.3.2.3. Recall of irrelevant behaviors

The number of correctly recalled irrelevant behaviors did not yield, as predicted, any systematic effects in a 2 (Target: childcare professional vs. skinhead) x 2 (Screen location: top vs. bottom) analysis of variance, with repeated measures on the last factor (all *p's* > .16).

Taken together, these results support our hypothesis that people ground their memory of affectively charged behaviors with reference to a vertical spatial dimension. When valence and vertical spatial dimension are made compatible recall is enhanced compared to conditions where this compatibility is absent. These results show for the first time that previous findings from spatial and autobiographical memory (Crawford et al., 2006; Casasanto & Dijkstra, 2010) extend to person memory, thus opening a new perspective to explore the implications of spatial grounding in a process that has been traditionally regarded as an amodal one.

2.4. Experiment 2

In the second experiment the vertical dimension was manipulated by means of upward or downward arm-movements – namely an explicit motor component that goes beyond standard vertical spatial manipulations (e.g., Meier & Robinson, 2004; Crawford et al., 2006; however see Casasanto & Dijkstra, 2010). Participants stood in front of an empty bookcase and had to form impressions of a target person on the basis of cards on which the behaviors were printed. They had to place these cards either on a top or a bottom shelf. If people anchor their memory of positive and negative information about others on a vertical spatial dimension, then behaviors placed in compatible shelves, (i.e., positive behaviors in the top shelf and negative behaviors in the bottom shelf) should be better recalled than behaviors placed on incompatible shelves.

2.4.1. Method

2.4.1.1 Participants and Design

Fifty-nine students (25 female; mean age 20.88) participated in this experiment on a voluntary basis. The study had a 2 (Target: childcare professional vs. skinhead) X 2 (Type of behavior: relevant vs. irrelevant) X 2 (Shelf: top vs. bottom) mixed design, with repeated measures on the last two variables.

2.4.1.2. Procedure

The stimulus materials were identical to those in the first experiment. However, now the behavioral items were presented on cards (10 x 14 cm) that were put together in a random order as a deck, which was placed on the middle shelf of an empty bookcase consisting of three shelves. The position of the middle shelf was adjusted to shoulder height of each participant. The distance between the shelves was always 42 cm. The participants were informed that this task involved a typical dual task that one encounters in everyday life, namely forming impressions while performing a concurrent task. They then received the target and expectancy information, and were instructed to pick up a card at a time from the middle shelf, read the behavior printed on the card and place it on the top or bottom shelf.

There was an arrow next to each behavior (above or under the sentence) indicating the shelf where each card should be placed. Instructions were pre-recorded and informed participants that they had 8 seconds to pick up a card, read the behavior and place it on the respective shelf. Then they received a recorded instruction indicating that they had to take the next card. This procedure was repeated until they had read and placed all the cards. Experiment 2 was otherwise identical in every possible respect to Experiment 1 except for the procedure involving the presentation and placement of the cards.

2.4.2. Results and Discussion

A coder blind to the experimental conditions categorized the recalled behaviors using a lenient gist criterion. Recall intrusions were infrequent (< 2%) and were excluded from all analyses[6]. Overall recall was 6.15 (*SD* = 2.61).

2.4.2.1. Expectancy Manipulation check

Responses to the seven items used to assess perceived target valence were scaled (Cronbach alpha = .95) with high numbers reflecting higher positivity. As expected, participants judged the childcare professional as more positive (M = 7.38; SD= .95) than the skinhead (M = 3.10; SD = 1.34; t (53) = 13.73, p < .001, d = 3.77).

2.4.2.2. Recall of relevant behaviors

Again, a *compatibility* variable was composed by collapsing the number of compatible items (positive behaviors shelved upward and negative behaviors shelved downward) and *incompatible* items (positive behaviors shelved downward with negative ones shelved upward) into two variables.

The central hypothesis predicting a recall advantage in the compatible over the incompatible condition was analyzed in a 2 (Target: childcare professional vs.

[6] Data from 5 participants was omitted because they did not understand the recall instructions.

skinhead) X 2 (Compatibility: compatible vs. incompatible) analysis of variance with repeated measures in the last factor and the number of recalled items as the dependent variable. As predicted, recall was significantly better for behaviors in the compatible condition (M = 2.43; SD = 1.16) than the incompatible condition (M = 1.92; SD = 1.27); F (1, 53) = 4.40, p = .041, MSE = 7.13, η_p^2 = .08. The interaction term was again not significant ($F < 1$)[7].

Again, a main effect of the "Target" was found, F (1, 53) = 26.47, $p < .001$, MSE = 35.33, η_p^2 = .33. Recall of negative behaviors (M = 2.74; SD = 1.17) was superior to recall of positive behaviors (M = 1.61; SD = 1.14) a finding that is consistent with the *negativity effect* (see Kensinger, 2009).

3.4.2.3. Recall of irrelevant behaviors

A 2 (Target: childcare professional vs. skinhead) X 2 (Screen location: top vs. bottom) analysis of variance (ANOVA), with repeated measures in the last factor, on the number of correctly recalled irrelevant behaviors did not yield any significant effects (all *F's* < 1).

Overall, these findings are consistent with our hypothesis that anchoring affectively charged information on a spatial vertical dimension influences recall. As predicted, behaviors presented in compatible vertical locations facilitated recall. These findings reproduce the same outcome pattern as obtained in Experiment 1, however now with an experimental paradigm involving a different manipulation namely a spatial placement procedure. These converging results underline the generalizability of our contention that in impression formation processes the recall of stereotype relevant behaviors is grounded spatially.

2.5. General Discussion and Conclusions

The two experiments were designed to contribute to the person memory literature with a hypothesis derived from an embodied cognition framework, namely, to examine the effect of how information indifferent locations on a vertical dimension influences recall. Both experiments yielded confirmatory evidence for our

[7] Although shelf height was individually adapted, we entered participants' height as a covariate in the analysis and found that it had no impact on the results (all *F's* < 1).

predictions: if the spatial location of behavioral descriptions is congruent with the valence of the behavior then a subsequent surprise recall indicates a significant recall advantage for these behaviors.

To our knowledge, this is the first set of studies examining impression formation and person memory from a grounded cognition perspective demonstrating the significance of the vertical spatial dimension in facilitating recall of a social target's behavioral information. These findings are consistent with and extend the growing body of evidence showing an association between valence and the vertical space (see Crawford, 2009), as in the case of research using interference paradigms (e.g., Meier & Robinson, 2004), or measures like autobiographic recollection (Casasanto & Dijkstra, 2010). Previous research investigating the spatial grounding of affect or valence has been done mostly with decontextualized words or images that have no interconnected coherence beyond their valence (cf. Crawford, 2009). The novelty of the research we have reported here is the use of a contextualized standard impression formation paradigm and free recall as dependent measure using a different conceptual tool – embodied cognition theories – that was never been applied to this area. It is the first time that a coherent impression is shown to be affecting recall as a function of the spatial position of behaviors that relate to a person. There is an important implication of these findings for standard representational models of person memory. If it is the case that person memory processes are driven exclusively by amodal symbolic and abstracts representations in a network of items whose accessibility depends on the strength of association between the behavioral item and the target node, then the spatial position in which behavioral information is presented should be irrelevant. Revealing the significance of spatial position for recall highlights the contribution of modal processes for person memory.

Another important question that arises from our results refers to the role of movement in driving the obtained compatibility effects. Although Experiments 1 and 2 involve differences in the magnitude and salience of vertical movements, the means and effect sizes in both experiments were similar thus suggesting that movement is orthogonal to the spatial compatibility memory effect. Therefore, an interesting argument deriving from our research is that the contributions of movement and spatial location on recall are independent. Notably, *overall* recall is higher in Experiment 2, which necessitated an over and explicit arm movement, relative to Experiment 1 which involved an implicit head movement (6.15 vs. 5.6), a finding that appears to be compatible with research on the relationship between actions and memory (Krauss & Hadar, 1999; Nilson, 2000)

The re-examination of classic issues in social cognition from an embodied perspective opens novel perspectives upon the constraints, such as spatial position, that drive and add to our understanding of the processes involved in person memory. These considerations invite the investigation of how other sensorimotor variables (e.g., bodily posture, environmental features such as temperature) that have been shown to influence judgments can affect the way we navigate our social world from the impressions we form to how we regulate our social relationships.

CHAPTER 3

SITUATING PERSON MEMORY: CONTEXT AS A MEMORY AID

Impressions of others are fundamental tools to navigate the social world. Decades of research on impression formation and person memory taught us how people encode, organize, and retrieve social information from memory; the conditions under which specific types of information prevail over others; and how people use their impressions when judging others (for reviews see Carlston & E. R. Smith, 1996; E. R. Smith, 1998). However, this research has typically focused on isolating underlying psychological processes as independent from physical and social contexts, which is precisely where such processes take place. This view is untenable from a 'situated cognition' perspective, which suggests that cognition and context are inseparable. Accordingly, theoretical models that do not incorporate mechanisms specifying how cognition and context interact cannot fully account for the operation of cognition in the "real world" (E. R. Smith & Semin, 2004; Yeh & Barsalou, 2006; Wilson & Clark, 2009). The numerous advantages of context for cognition are illustrated, for instance, with research showing how information that is offloaded to the context facilitates cognitive tasks (see Clark, 1997) or helps to organize and cue memory (see S. M. Smith, 1994).

Are impressions immune to contextual influences as is implicitly assumed by standard impression formation theories? The current research is designed to answer this question by investigating the influence of a specific contextual variable[8], namely the presence or absence of objects related to a particular target's occupation. In the following, we first present research on person memory with the goal of illustrating how context has been neglected in the study of person memory. We then introduce the situated cognition approach and review relevant findings illustrating how context can be used as a scaffold for cognition and memory. Next, we focus on classic research revealing the context dependency of memory and furnish an entry on how contextual information can be incorporated into memory traces. Finally, we outline four studies designed to investigate how specific physical contexts can influence person memory.

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[8] For a discussion of the multiple meanings of the term 'context', see Reis (2008) and Yeh and Barsalou (2006), for example.

3.1. Person Memory: How the External World was Left Out of the Equation

Solomon Asch’s seminal work (1946) placed the study of impression formation in the spotlight and shaped what would become ‘social cognition’ (Hastie & Carlston, 1980). The *computer-metaphor,* imported from cognitive psychology (e.g., Anderson & Bower, 1973; Collins & Loftus, 1975; Collins & Quillian, 1969), focused ‘social cognition’ research on the cognitive processes and structures driving impression formation, such as the processes involved in the acquisition of first impressions; the mental representations formed from these processes; and how these mental representations subsequently influence judgments and behaviors (Wyer & Carlston, 1994; Hastie, Park, & Weber, 1984). Consequently, impression formation was viewed as information processing taking place inside the cranial vault. Impressions were considered to be abstract memory structures measured with variables designed to assess inferences about the “perceiver's organized cognitive representation of another person” (Hamilton, et al., 1980b, pp. 123) from memory. This resulted in the designation of the field as Person Memory (Hamilton, 1986; Hastie et al, 1984).

Two of the most prominent theoretical frameworks in Person Memory are the associative networks and schemas (cf. Carlston & E. R. Smith, 1996; E. R. Smith, 1998). Despite their numerous differences, both frameworks share the same conceptual focus: the view of impressions as inner representations isolated from the outside world (Fodor, 1975; Pylyshyn, 1984). For example, according to associative network theories, social information that is acquired in context is represented in memory in decontextualized abstract associative networks. These networks are constituted by nodes, connected by pathways, and organized in a hierarchical way. The inferior levels of the network are constituted by nodes, representing behaviors and traits. At the top of the network is a node corresponding to the target-person identification and categorical expectancies activated by this information. Recalling information is then viewed as a process of following these pathways between target-node and behavioral nodes (e.g., Garcia-Marques & Hamilton, 1996; Hastie & Kumar, 1979). Participants’ processing goals (Hamilton, et al., 1980a; Garcia-Marques & Hamilton, 1996) or their cognitive resources available at encoding (e.g., Bargh & Thein, 1985; Macrae, Hewstone, & Griffiths, 1993; Sherman & Hamilton, 1994; Srull, 1981; Srull, Lichtenstein, & Rothbart, 1985) and retrieval (Garcia-

Marques, Hamilton, & Maddox, 2002) are some of the factors that determine the amount and type of social information that is retrieved.

What is then the role of context in the process of forming and retrieving impressions? Classical person memory approaches implicitly assume that contextual information surrounding target-stimuli (i.e., other people or objects) is discarded or abstracted during encoding and the role of context is merely to provide the "input" to the cognitive system (E. R. Smith & Collins, 2010; Yeh & Barsalou, 2006). Despite the significance of abstraction, fundamental for cognitive economy (e.g., Crocker, et al., 1984; Fiske, 1980; Taylor, 1981) and the production of new conceptual knowledge (e.g., Barsalou, 2003a), contextual information is important, as it constitutes an external source of information[9]. Moreover, contextual information is infinitely variable, since each context presents a unique situation. Thus, each and every piece of contextual information cannot be an integral part of the abstraction and yet it is integral to adapt to changing contextual situation for the successful negotiation of social reality in a dynamic environment. As we argue in the next section, contextual information is fundamental for cognition and often facilitates information processing.

3.2. Cognition As the Interaction Between the Individual and the Context

William James, Vygotsky or Bartlett's views that mental representations emerge from dynamic and adaptive sensorimotor interactions with the social and physical context have regained currency with the emergence of the "situated cognition" approach (e.g., E. R. Smith & Semin, 2004; Semin & E. R. Smith, 2000; Semin, et al., 2012; Yeh & Barsalou, 2006). One of the core principles of this new conceptual approach is the idea that cognitive activities – such as forming impressions of others - extend beyond the isolated, information-processing brain to social and physical contexts (Clark, 1997; Clancey, 2009), which become integral parts of the cognitive system thus optimizing performance (Clark & Chalmers, 1998; Yeh & Barsalou, 2008). Although physical contexts have received a fair amount of attention in the situated cognition literature (e.g., Kirsh, 1995), to our knowledge, their impact for person memory was never been studied before (for recent *socially* situated

[9] Importantly, our argument is independent from the discussion of whether knowledge is represented modally or amodally in the brain (for a similar argument, see Yeh & Barsalou, 2006).

approaches to person perception, stereotypes, and attitudes see, for example, E. R. Smith & Collins, 2009, Garcia-Marques, et al., 2006, and Schwarz, 2007). In the next section, we briefly review two different research areas that illustrate the advantages of integrating the *physical context* in the cognitive system.

One of the most self-evident ways in which context may be used to facilitate our cognitive life consists of actively manipulating our physical environment to aid a cognitive task. For example, leaving an empty milk bottle at the door as a reminder to get milk the next time one goes out (Kirsch, 1995; Kirsch & Maglio, 1994). The second and more elaborate example of actively shaping the context, as a scaffold for memory is the way a bartender operates on a busy night. Instead of memorizing the different orders, expert bartenders line up differently shaped glasses that correspond to different drinks in a spatial order that reproduces the temporal sequence of customers' orders (Beach, 1988). In both cases, the context structures and prioritizes memory search by serving as a cue to recall the relevant information (see Semin, et al., 2012; Yeh & Barsalou, 2006).

The situated nature of memory is extensively documented by research under the label of *environmental context-dependent memory* (e.g., S. M. Smith, 1994). This work relies on the assumption that contextual information is encoded together with the to-be-remembered material (e.g., words), which in turn improves memory. Most of the studies designed to explore this assumption use an encoding-retrieval (e.g., Tulving & Thomson, 1973) paradigm with learning contexts that either match or mismatch the retrieval context. Performance is found to be better on a memory test when context during retrieval matches rather than mismatches the context during learning (for a meta-analytic review, see S. M. Smith & Vela, 2001). For example, in a classic study by Godden and Badley (1975), divers learned a list words either on dry land or under water. Later they were asked to recall these words in the same learning context (under water- under water or dry land-dry land) or in the opposite context (under water-dry land or under water- dry land). Recall was better in the same learning context than the opposite context.

The research to date in this field (e.g., Eich, 1985; Godden & Badley, 1975; S. M. Smith, 1979) clearly shows the memory advantages brought by contextual information. Moreover, the importance of the context for memory performance can be seen both during on-line and off-line processing (e.g, Barsalou, 1999b; Yeh & Barsalou, 2006; see however Wilson, 2002). At encoding context drives attention towards the relevant target-information, thus making integration of context and target information more effective. During retrieval the context may serve as a memory cue that facilitates retrieval. Importantly, the more meaningful the relationship between context and target-information is, the more effective the retrieval of target-information (Eich, 1985).

3.3. A Situated Approach to Person Memory: Overview of the Present Research

The evidence outlined from the situated cognition perspective and from context-dependent memory literature indicates that contexts exert powerful effects on cognition and memory (e.g., Kirsh, 1995). Moreover, these "context-effects" are especially strong when the relationship between context and target-stimuli is meaningful or interdependent (Eich, 1985). This led us to argue that when we form or retrieve an impression of others, physical contexts – when meaningful - help organize information in memory or retrieve information from memory, enhancing memory performance. More specifically, we hypothesized that forming and retrieving impressions about a specific target person in a physical context that is meaningfully related to the target introduces memory advantages for behavioral as well as for the contextual information.

The experiments reported in this paper were designed to systematically test the above-mentioned prediction. In the first experiment, we manipulate the contextual information available during the encoding of behavioral information to investigate whether contextual information acts as an organizing cue that facilitates the integration of behavioral and contextual information in memory. The second experiment examines the role of contextual information during encoding but under different processing goals. Next, we report an experiment that tests the role of contextual information presented during the retrieval stage by manipulating the presence of meaningful cues during recall. Finally, in the fourth and last experiment, we introduce a paradigm involving the participants' active screening of contextual information in order to investigate if attention-driving actions benefit memory for behavioral information.

3.4. Experiment 1

Experiment 1 was designed to test the hypothesis that forming impressions about a target-person in a context that matches the target's occupational category (i.e., where the relationship with the target-person is meaningful) would make the encoding of context and target related information more effective. This is expected to facilitate retrieval compared to a context - target occupation mismatch condition, where the relationship between context and target is arbitrary. The inclusion of a mismatch condition, where the context is not meaningful for the target-occupation, is based on the idea that impression formation is a heavily situated process that can take place in a multitude of contexts and therefore can be differently influenced by them (E. R. Smith & Semin, 2004). Additionally, a control condition with no contextual information was also included in order to clarify if meaningful contextual information does improve memory, as hypothesized, or if there is a memory interference introduced by non-meaningful contextual information.

To test the hypothesis, we used a modified impression formation paradigm. While forming impressions about a target-person based on behavioral descriptions presented on a computer screen, participants also saw contextual information (objects) presented on the same screen. The behavioral descriptions were either congruent with the target-occupation or neutral. The contextual information was manipulated in three between-participants conditions. The contextual information either matched or mismatched the target occupation. In the control condition no contextual information was presented. At a later stage, memory was accessed.

Because we assumed that contextual information is encoded together with behavioral information we asked participants not only to recall the behaviors but also to recall and recognize the contextual information presented before (cf. Johnson, Hashtroudi, & Lindsay, 1993). We predicted that memory for behaviors and contextual information would show an advantage in the match conditions compared to the mismatch and control conditions, thereby supporting the idea of the benefits of integrating meaningful contextual information during impression formation. Importantly, only congruent behaviors were expected to benefit from match conditions and not neutral behaviors, since the latter are not diagnostic of the target-occupation and therefore have a lower impact on the impression (Wyer & Srull, 1989).

3.4.1. Method

3.4.1.1. Participants

Two hundred forty one university students (134 females; mean age = 21.83, *SD* = 4.14) participated in this experiment in return of monetary reward or partial course credit.

3.4.1.2. Materials

The experimental material consisted of pictures of objects and behavioral descriptions about two target-persons.

Context Objects. Twenty-four objects (size: 400 x 400 pixels; color: grey scale) were selected from websites specialized in construction tools, cooking utensils and furniture. All objects had standard shapes and had no visible brands. The list of objects used is displayed in Appendix B. An independent sample of 41 students rated the objects on two dimensions – *prototypicality* (ranging from 1- not at all typical to 7 - very typical tool/utensil for a cook/construction worker) and *familiarity* (ranging from 1- not at all familiar to 7 - very familiar). Results confirmed all construction tools and all cooking utensils as significantly prototypical of the respective occupation; in contrast none of the furniture items were considered prototypical of either occupation. Furthermore, all objects were familiar to participants and no differences in familiarity were found between the three types of objects.

Behavioral descriptions. Twenty-four behaviors describing actions typical of several occupational categories were selected from a large pool of pre-tested behaviors (Garrido, Soeiro, & Palma, 2011). Eight of these behaviors were congruent or diagnostic of a construction-worker's occupation (e.g., Fixed a broken shingle in a professional way) and eight of a cook's occupation (e.g., He used different spices to get a special flavor). The remaining eight behavioral descriptions were neutral or non-diagnostic for either occupational category (e.g., He parked his car close to home). Importantly, given that we manipulated the context by presenting objects, we made sure that none of the behavioral descriptions included the names of the objects used. The list of behaviors used can be found in Appendix C.

3.4.1.3. Procedure

Participants were tested in individual cubicles. Computerized instructions informed them that the aim of the study was to examine “the way people form impressions about others in everyday life when several tasks have to be performed simultaneously”. They were then given some general information about the target person including the target’s name and occupation. For half of the participants the target person was a construction-worker while for the other half the target person was a cook. Then they were presented with sequences containing three stimuli: an object (or a blank screen), a colored circle and a behavior. First they saw an object in the middle of the screen for 2500 ms. The 16 objects were presented in a randomized order across participants. In the match conditions, eight of these objects were relevant for the target occupation (i.e., cooking utensils in the cook condition and construction tools in the construction-worker condition) and eight were filler objects (furniture items). In the mismatch conditions, participants saw the objects that were relevant for the other occupation (i.e., cooking utensils in the construction-worker condition and construction tools in the cook condition) together with the same eight filler objects. Participants in the *control* conditions saw a blank screen between behaviors instead of an object.

Immediately after seeing an object or the blank screen (inter trial interval of 100 ms), a blue or red circle appeared in the middle of the screen in a randomized order for 1500 ms. Participants’ task was simply to name the color of the circle by pressing the corresponding color-key on the keyboard. We included this task simply to recreate a “real life” situation where people perform different tasks while they form impressions, and to make sure participants were paying attention to the stimuli. After giving their response or after the 1500 ms time window, participants were presented with one of the behaviors in the middle of the screen for 6.000 ms. A total of 16 behaviors were presented in a randomized order for each target, eight congruent with the target occupation and eight neutral behaviors. The sequence object + circle + behaviors was repeated 16 times, taking approximately 3 min.

After completing the impression formation task, participants were given a 5-minute filler task followed by three unexpected memory tasks: (a) a free recall task where they had to recall all the behaviors presented; (b) a free recall task where they had to recall the names of all objects they saw; and a (c) recognition task where they were presented with eight of the previously presented target objects (construction tools or cooking utensils) and eight new distractor objects (construction tools or cooking utensils) and asked to rate each object on a 6-point confidence scale ranging from "definitely did not see it" to "definitely did see it"[10]. Participants in the control conditions did not see any objects and were only asked to free recall the behaviors. The order of performing these tasks was counterbalanced across participants, namely half of the participants performed these tasks in the order presented earlier while the other half had to first perform the free recall of objects followed by the recognition task and then the free recall of behaviors[11]. Finally, participants were asked to write down what they thought the hypothesis of the study was. All participants were unaware of the actual hypothesis. They were then debriefed and thanked.

3.4.2. Results

3.4.2.1. Recall of behavioral descriptions

A coder blind to the experimental conditions categorized the behaviors recalled by each participant using a lenient gist criterion (cf. Garcia-Marques & Hamilton, 1996). Recall intrusions (e.g., false memories or behaviors that mix two or more different behaviors) were infrequent (4.27%) and did not show a consistent pattern across experimental conditions.

The number of correctly recalled behaviors was entered in a 2 (Target Occupation: construction-worker, cook) X 3 (Context: match, mismatch, control) X 2 (Type of Behaviors: congruent, neutral) ANOVA, with target and context manipulated between participants. Since there was no significant interaction between target occupation and context we collapsed the data from the two targets ($F(2, 235) = 1.16$, $p = .315$). The means are displayed in Table 1. Two main effects were obtained: A marginal main effect of context, $F(1, 238) = 2.47$, $p = .087$, $\eta_p^2 = .02$, and a main effect of the type of behaviors, $F(1, 238) = 10.07$, $p = .002$, $\eta_p^2 = .04$. More importantly, these main effects were qualified by the predicted interaction between context and type of behaviors, $F(2, 238) = 6.08$, $p = .003$, $\eta_p^2 = .05$. Consistent with

[10] Importantly, target and distractor objects were equally prototypical of the two occupations ($t < .06$, $p > .95$, for construction tools; $t < .44$, $p > .66$, for cooking utensils) and equally familiar to participants ($t < .11$, $p > .90$, for construction tools; $t < .30$, $p > .78$, for cooking utensils).

[11] Task-order had no effect on participants' performance on the 3 tasks.

our predictions, recall of congruent behaviors was higher in the match context than in the mismatch context, $t(238) = 4.07$, $p < .001$, $d = .70$, as well as in the control context, $t(238) = 3.74$, $p < .001$, $d = .58$. No reliable difference was found between the mismatch context and the control context ($t = - .36$, $p > .72$).

This pattern of results shows that memory is facilitated, as expected, when there is a match between target and context information. The results also show that a mismatch between target and context does not interfere with memory given the similar performance in this condition and in the control condition. The recall of neutral behaviors was equivalent across all context conditions (all *t*s < .26, all *p*s > .79).

Table 1

Mean Recall of Congruent and Neutral Behaviors (collapsed across targets) as a Function of the Context Condition

	Context		
Behaviors	Match	Mismatch	Control
Congruent	3.76 (1.14)	2.90 (1.31)	2.98 (1.53)
Neutral	2.79 (1.67)	2.86 (1.69)	2.84 (1.91)
	n = 80	*n* =79	*n* =82

Note. Standard deviations are in parentheses.

3.4.2.2. Recall of objects

A coder blind to the experimental conditions counted the number of correctly recalled critical objects (construction tools and cooking utensils) and the number of false recalls, that is, objects related with the target occupation but that were not presented. Recall intrusions were infrequent (6.03%) and displayed a similar pattern across the two context conditions.

The number of correctly recalled critical objects was entered in a 2 (Target Occupation: construction-worker, cook) X 2 (Context: match, mismatch) between participants ANOVA. The recalled objects for the construction-worker and cook were merged due to the non-significant interaction between target occupation and context

($F < .08$, $p > .78$). As predicted, participants in the match contexts recalled more objects ($M = 3.40$, $SD = 1.04$) than participants in the mismatch contexts ($M = 2.28$, $SD = 1.49$), $t(157) = 5.50$, $p < .001$, $d = .87$. This finding shows, as in the case of the recall of behavioral information, that a meaningful relation between target and the context enhances recall.

3.4.2.3. Recognition of objects

Confidence-rating responses for target (previously seen objects) and distractor items (new objects) in the match and mismatch conditions were analyzed with a signal-detection model (SDT; Green & Swets, 1966; for a comprehensive introduction, see Wickens, 2002). SDT assumes the existence of a psychological dimension designated as familiarity that underlies individuals' recognition judgments. The familiarity of target and distractor items is described by means of two overlapping Gaussian distributions. The mean and standard deviation of the target familiarity distribution are the parameters of interest as they characterize memory discriminability with higher mean values generally indicating better discriminability. A SDT model was fitted to the confidence-rating responses for the match and mismatch conditions using the maximum-likelihood method. Given the small number of trials per individual, analyses were conducted on the aggregate responses, a strategy that is encouraged in these circumstances (see Cohen, Sanborn, & Shiffrin, 2008).

The SDT model provided an adequate description of the data, as $G^2(6) = 11.99$, $p = .058$. Regarding the parameter estimates, mean familiarity for targets in the match condition was higher ($M = 2.44$) than in the mismatch condition ($M= 1.96$), with standard deviations being roughly similar across conditions ($SD_{\text{match}} = 1.58$ and $SD_{\text{mismatch}} = 1.51$). The differences in the parameter estimates were evaluated by means of null-hypothesis testing, by inspecting the difference in goodness-of-fit (ΔG^2) between the SDT model described above and a restricted version in which no differences in memory discriminability are allowed ($M_{\text{match}} = M_{\text{mismatch}}$, $SD_{\text{match}} = SD_{\text{mismatch}}$). The imposed restriction was rejected as it led to a severe increase in model misfit, with $\Delta G^2(2) = 31.67$, $p < .001$.

Analyses with the SDT model clearly indicate that individuals have a better memory discriminability in the match condition, a result that is corroborated by the

Receiver Operating Characteristic (ROC) plots for both conditions (see Figure 1). The crucial differences between the two conditions are illustrated by the squares (match condition) and triangles (mismatch condition). The proportion of hits and false alarms are plotted on the vertical and horizontal axes, respectively. If memory discriminability would be similar in both conditions the ROCs would completely overlap. However, as can be seen in Figure 1, the ROC for the mismatch condition is completely below the ROC for the match condition, a result that indicates a better memory performance in the latter condition. These results clearly support our hypothesis that participants in the match condition integrate contextual information in memory to a greater extent than participants in the mismatch condition given that for the latter contextual information was not useful for the impression formation task.

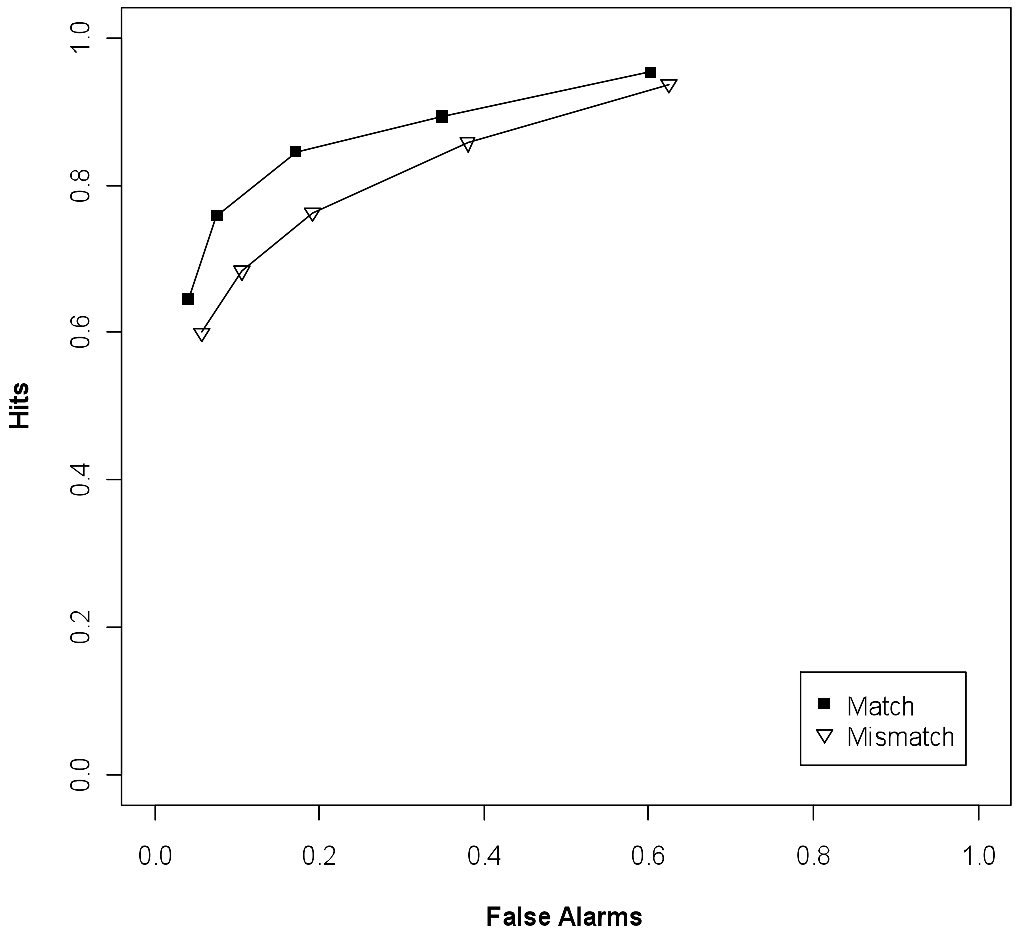

Figure 1. Receiver-operating Characteristics for Target (old) and Distractor (new) Objects in the Match and Mismatch Conditions.

3.4.2.4. Correlation between recall of congruent behaviors and recall of objects.

To further examine the relation between recall of behaviors and objects we calculated the correlations between these two measures overall and separately for each context condition. Overall, the two measures showed a significant correlation coefficient, $r(159) = .21$, $p = .007$. However, this effect was due to participants' recall in the match context, $r(80) = .28$, $p = .010$, and absent in the mismatch context, $r(79) = -.02$, $p = .82$. Thus this correlational evidence provides further support for our situated framework of impression formation.

3.4.3. Discussion

As predicted, forming impressions in a context with meaningful contextual information facilitates memory for both behavioral and contextual information. Importantly, participants in the match condition recalled more behaviors than participants in the mismatch and control conditions. These results show that the memory advantage for participants in the match condition is due to the inclusion of the meaningful contextual cues during the task of forming impressions rather than to the interference caused by the irrelevant contextual information in the mismatch condition. Interestingly, the contextual information in the mismatch condition does not seem to have interfered with impression formation, as reflected by the absence of a difference between recall in the mismatch and control conditions. This suggests that participants in the mismatch condition did not attend to the objects that were irrelevant for the impression formation task. Additional support for our hypothesis was provided by the significant correlation found between the recall of objects and behaviors in the match condition but not in the mismatch condition.

The second experiment was aimed to extend these findings by introducing a study that was designed to explore the moderating role of processing goals on the impact of meaningful contextual information in impressions (cf. Hamilton et al., 1980a).

3.5. Experiment 2

Experiment 1 furnishes evidence that the target-context match facilitates memory for both contextual information and congruent behaviors. The second experiment was designed to explore this effect further by examining its specificity to impression formation. Namely, does the goal with which people learn the target-stimuli interfere with this effect? Person-impressions entail integrative processes, when compared to memory tasks. This is the reason advanced for the enhanced memory performance observed when participants are instructed to form impressions about a target-person (impression formation goal) based on a set of behavioral information than when in comparison to conditions that instruct them to simply memorize that same set of behavioral descriptions (memory goal; Hamilton et al., 1980a). The general account for this finding is that under an impression formation goal people tend to organize and relate the different pieces of information about the target-person into a coherent impression (the Gestalt principle; Asch, 1946). According to an associative network framework, attempts to organize the information promote the development of associative links between the different kinds of information. Retrieval is therefore easier given the great number of paths and cues between the different kinds of information. In contrast, when asked to memorize people do not engage in such an organizational process. Participants under a memory goal tend to focus on the isolated meaning of the presented information (Hamilton et al., 1980a). Consequently, integrating the contextual information becomes less likely. Our argument here is that, the integrative processes triggered by impression formation goals may therefore be particularly likely to promote the incorporation of contextual information in the impressions that are being formed.

If, as we argue here, meaningful contextual information is encoded together with behavioral information during the formation of an impression, then one can predict that the contextual information will be more integrated in memory when participants (a) are asked to *form an impression*, than when they (b) are asked to *memorize* the information, irrespective of whether contextual information is meaningful or not. Consequently, participants *forming impressions* in a meaningful context should show better memory for both contextual and behavioral information than participants in the *memorizing* conditions. They should also show a better memory performance, as we have already shown, when forming an impression with match than with mismatch contextual information.

To test these hypotheses half of the participants received standard impression formation instructions, as in Experiment 1, while the other half were asked to memorize a set of sentences (i.e., the same behavioral descriptions used in the impression formation condition). The contextual information was present in the background of the screen (see Figure 2) making the context manipulation less prominent and allowing a procedure that is more similar to the standard person memory learning paradigms. Thus, participants of the two processing goals conditions were presented with a set of behavioral descriptions in a computer screen with several objects displayed in the background. Half of these objects were meaningful (match) or irrelevant (mismatch) for the target-person and behavioral descriptions. After a filler task, two free recall tests were administered to access the recall of behaviors and objects.

We predicted that forming impressions in a meaningful context would facilitate memory for both behavioral and contextual information when compared with memorizing in a meaningful context. Moreover, we expected to replicate the results obtained in the first experiment, namely better memory for behaviors and objects when the impression formation task was performed in a meaningful context than in an irrelevant context. We had no expectation regarding memory performance in these two (match and mismatch) conditions for participants in the memory goal condition. Again our hypotheses focus only in the target-congruent behaviors.

3.5.1. Method

3.5.1.1. Participants

Seventy-nine university students (50 females; mean age = 21.49, *SD* = 4.73) took part in this experiment in return of a monetary reward.

3.5.1.2. Materials

The experimental materials consisted of objects and behavioral descriptions about a target-person.

Context Objects. We used 24 objects: 10 construction tools, 10 cooking utensils and four fillers. The objects were transformed into Windows icons and presented in greyscale (see Appendix B). Two different screen backgrounds were constructed: One background contained 10 construction tools and four standard Windows icons that served as fillers (recycle bin, msn, internet explorer, and my computer), placed on the left side of a Windows 7 Basic Theme screen; The other background contained 10 cooking utensils instead of the construction tools. The only difference between the two backgrounds was the critical icons (see Figure 2). In order to control for possible interferences of the different visual characteristics of the icons (construction tools vs. cooking utensils) in memory we conducted a small pilot with two groups of students (n's of 8 and 9) not participating in the actual experiment. Each group watched one of the backgrounds for two minutes and afterwards they were presented with a surprise free recall task where they had to write down the name of the objects represented by each icon. Results showed equal recall for both types of objects.

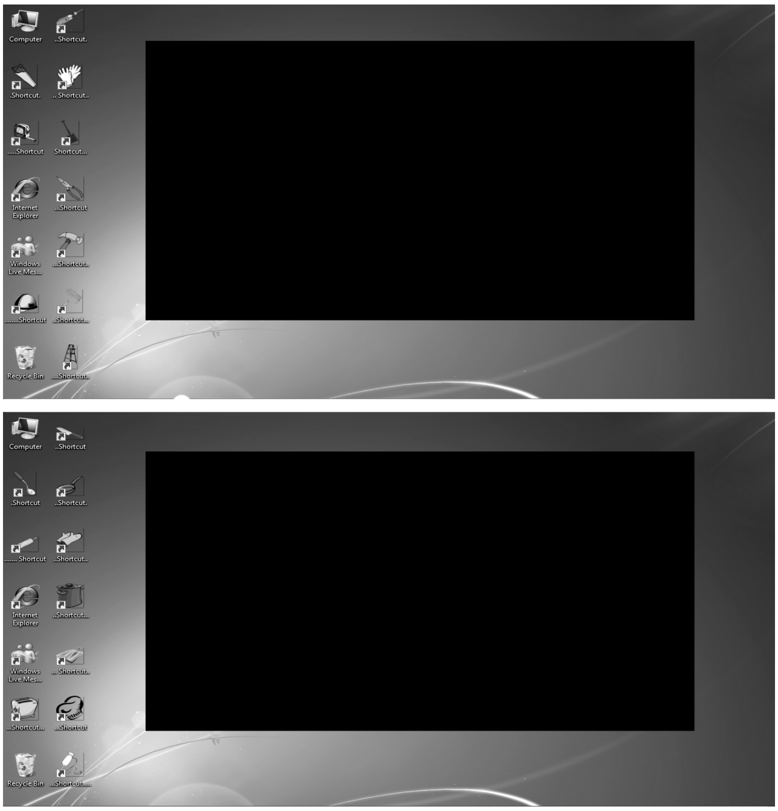

Figure 2. Background with Construction Tools (top) and Background with Cooking Utensils (bottom) used to manipulate the context in Experiments 2 and 3.

Behavioral descriptions. A total of 24 behavioral descriptions were used. From these, 12 were congruent with the occupation of construction-worker and 12 were neutral. We used eight construction-worker behaviors from Experiment 1 to which we added four new behaviors. Four new neutral behaviors were also added. The new behaviors (four congruent and four neutral) were selected from the same pool of pre-tested behaviors (Garrido, et al., 2011). See Appendix C.

3.5.1.3. Procedure

Participants were tested in individual cubicles. Computerized instructions informed them about the goal of the study. Participants in the impression formation condition were told that the study intended to "investigate the way we form impressions of a person based on his actions". They were told that they would be presented with a list of behaviors performed by a given person and were encouraged to form an overall impression of him. They were then given the target's name and occupation – construction-worker. In this experiment, we only used one target occupation given that the previous experiment had revealed that the results replicate across target occupations. Participants in the memory condition were told that the goal of the study was to "investigate the way we process and retain verbal descriptions of actions" and their task was to memorize those descriptions. Impression formation was never mentioned to these participants. After the instructions participants started the impression formation or memorization task. They were presented with 24 behaviors (12 congruent and 12 neutral) that were presented in a randomized order in the middle of the screen for 6.000 ms at a time. For half of the participants these behaviors were presented against a background with construction tools (match context) while for the other half the background had cooking utensils (mismatch context).

After this task, participants performed a filler task for 5 minutes. Subsequently, they received two unexpected recall tasks: (a) free recall of behaviors; and (b) free recall of the objects represented in the icons. The order in which participants performed the tasks was always the same because we found no task order effects in Experiment 1. Finally, participants were asked to write down what they thought the study was about. None of the participants guessed the goal of the study. Then, they were debriefed and thanked.

3.5.2. Results

3.5.2.1. Recall of behavioral descriptions

A coder blind to the experimental conditions categorized the recall data, using a lenient gist criterion. Recall intrusions (8.56%) showed a similar pattern across conditions.

The number of correctly recalled behaviors was entered in a 2 (Processing Goal: impression formation, memory) X 2 (Context: match, mismatch) X 2 (Type of Behaviors: congruent, neutral) ANOVA, with processing goal and context as between-participants factors. All cell means are shown in Table 2. Three main effects emerged: a main effect for processing goals, $F(1, 75) = 84.67$, $p < .001$, $\eta_p^2 = .53$, showing the expected superior recall in the impression formation condition compared with the memory condition; a marginal main effect of context, $F(1, 75) = 3.63$, $p = .060$, $\eta_p^2 = .05$, showing that participants in the match condition recalled more behaviors than participants in the mismatch condition; and a main effect of type of behaviors, $F(1, 75) = 5.48$, $p = .022$, $\eta_p^2 = .07$, with congruent behaviors being recalled better than neutral ones. A three-way interaction between Processing Goals X Context X Type of Behaviors also emerged, $F(1, 75) = 3.96$, $p = .050$, $\eta_p^2 = .05$. A planned comparison between processing goals showed that participants who formed impressions in a match condition recalled more congruent behaviors than participants who were asked to memorize those behaviors in the same context condition, $t(75) = 8.33$, $p < .001$, $d = 2.48$, thus confirming our hypothesis.

To further inspect our hypothesis, we performed single analyses separately for each processing goal group (see Table 2 for the means). For the impression formation group, a 2 (Context: match, mismatch) X 2 (Type of Behaviors: congruent, neutral) ANOVA, with context being a between-participants factor, yielded only two main effects, namely a main effect of context, $F(1, 38) = 4.61$, $p = .038$, $\eta_p^2 = .11$, and a main effect of type of behaviors, $F(1, 38) = 8.82$, $p = .005$, $\eta_p^2 = .19$ (cf. Table 2). Despite the absence of a significant interaction between context and type of behaviors, $F < .14$, $p > .706$, we examined whether the results of Experiment 1 for congruent behaviors were replicated. Planned comparisons within each type of behavior showed that participants in the match context recalled more congruent behaviors than participants in the mismatch context, $t(38) = 2.04$, $p = .049$, $d = .65$, thus replicating the memory advantage previously observed for congruent behaviors in the match condition. Surprisingly, participants in the match context condition also recalled more neutral behaviors than participants in the mismatch context, although this difference was weaker than the one for congruent behaviors, $t(38) = 1.87$, $p = .070$, $d = .59$.

The number of behaviors recalled by participants in the memory condition was also submitted to a 2 (Context: match, mismatch) X 2 (Type of Behaviors: congruent, neutral) ANOVA, with context being a between-participants factor. Only the interaction between context and type of behaviors was reliable, $F(1, 37) = 8.71$, $p = .017$, $\eta_p^2 = .14$. Importantly, planned comparisons on the recall of congruent behaviors showed no recall advantage of the match condition over the mismatch condition, but instead a trend in the opposite direction (mismatch > match; $t(37) = -1.33$, $p = .19$). The recall of neutral behaviors was also not significantly different between conditions, although now there was a trend in favor of the match condition ($t(37) = 1.43$, $p = .16$).

Table 2

Mean Recall of Congruent and Neutral Behaviors as a Function of Processing Goals and Context

	Processing Goals			
	Impression Formation		Memory	
Behaviors	Context: Match	Context: Mismatch	Context: Match	Context: Mismatch
Congruent	7.05 (2.44)	5.58 (2.06)	2.15 (1.35)	2.74 (1.41)
Neutral	6.09 (2.28)	4.84 (1.92)	2.75 (1.94)	2.00 (1.25)
	n = 21	*n* =19	*n* =20	*n* =19

Note. Standard deviations are in parentheses.

3.5.2.2. Recall of objects

A coder counted the number of correctly recalled critical objects and the number of false recalls. A 2 (Processing Goal: impression formation, memory) X 2

(Context: match, mismatch) ANOVA on the number of false recalls (13.30%) revealed only a main effect for processing goal, $F(1, 75) = 4.94$, $p = .029$, with more false recalls in the impression formation condition than in the memory condition, which suggests that participants in the impression formation condition went beyond the information given (see Brewer & Treyrens, 1981, and Cantor, Mischel, & Schwartz, 1982, for the role of scene schemata and situation prototypes in memory). The pattern of false recalls was similar across match and mismatch conditions.

The number of correctly recalled objects was analyzed in a 2 (Processing Goals: impression formation, memory) X 2 (Context: match, mismatch) ANOVA between-participants. Results showed a strong main effect of processing goal, $F(1, 75) = 58.71$, $p < .001$, $\eta_p^2 = .44$, as participants in impression formation condition recalled more objects ($M = 2.87$, $SD = 1.24$) than participants in the memory condition ($M = 1.23$, $SD = .71$); a main effect of context, $F(1, 75) = 8.16$, $p = .005$, $\eta_p^2 = .10$, indicating that recall of objects was better in the match condition ($M = 2.34$, $SD = 1.50$) than in the mismatch condition ($M = 1.74$, $SD = .98$); and the predicted interaction between processing goals and context, $F(1, 75) = 7.13$, $p = .009$, $\eta_p^2 = .09$. Simple comparisons confirmed our predictions. Participants with an impression formation goal in the match condition recalled more objects ($M = 3.43$, $SD = 1.21$) than participants with the same processing goal in the mismatch context ($M = 2.26$, $SD = .99$), $t(38) = 3.32$, $p = .002$, $d = 1.05$, replicating the results of Experiment 1. The same comparison was not significant for memory-goal groups, $t < 1$, $p > .895$. Importantly, participants who formed impressions in a meaningful context recalled more objects ($M = 3.43$, $SD = 1.21$) than participants who memorized the information in the same context, ($M = 1.25$, $SD = .79$). These results are consistent with the idea that participants in the memory condition attend less to the context than participants in the impression condition.

3.5.2.3. Correlation between recall of congruent behaviors and recall of objects

To further explore the relationship between the recall of behavioral and contextual information we correlated the overall congruent behaviors recalled with recall of objects and within each context condition as a function of the processing goals variable. All correlation coefficients (r) are presented in Table 3. For participants who formed impressions, results showed a significant correlation coefficient in the match context, but not in the mismatch context, thus replicating the pattern obtained in Experiment 1. No significant correlation between recall of behaviors and objects was obtained for participants who were asked to memorize the behaviors. These results support the argument that contextual information is integrated in impressions only when the context is meaningful for the task at hand, namely when it matches the target occupation, and only when participants have the goal of forming impressions.

Table 3

Correlation Between Recall of Behaviors and Recall of Objects as a Function of Context and Processing Goals

	Recall Behaviors/Recall Objects		
Processing Goals	Context: Match	Context: Mismatch	Overall
Impression Formation	.43**	-.21	.30*
Memory	.25	-.09	.05

Note. ***p* < .05; **p* < .10

3.5.2. Discussion

In Experiment 2 we investigated the moderating role of processing goals in the encoding of contextual and behavioral information. We predicted and found that meaningful contextual information is encoded together with congruent behavioral information to a greater extent when participants' goal induces a level of cognitive integration, which is not the case when they are given a memory goal (Hamilton, et al., 1980a). Participants who formed impressions in a 'meaningful' context recalled more behavioral and contextual information than participants with memory instructions in the same context. Furthermore, we replicated the results of Experiment 1. Participants with the impression instruction in the match condition showed a better memory for both behavioral and contextual information compared to participants in the mismatch condition. Correlations between recall of behaviors and recall of objects as a function of processing goals and context provided extra support for our hypothesis.

In the next experiment, we focus on retrieval processes, often neglected in person memory research (cf. Garcia-Marques & Hamilton, 1996; Garrido, et al., 2012a, 2012b), and explore the role of the context at retrieval.

3.6. Experiment 3

In the first two experiments, we studied the impact of the context during encoding of behavioral information with the assumption that contextual information is used as an extra organizational cue to form impressions thus facilitating memory retrieval. In this experiment we focused on the role of contextual information at retrieval, namely as retrieval cues to access social information. The idea driving this experiment was inspired by the argument that, retrieval cues, namely "the information present in the individual's cognitive environment when retrieval occurs" (Tulving, 1974, p.74) play a crucial role in determining the information that is retrieved from memory. A substantial body of research on cued retrieval and the encoding specificity principle shows that providing retrieval cues that match any meaningful dimension of the encoded material enhances the accessibility of encoded information thus improving memory (for a comprehensive review, see Roediger & Guynn, 1996). For example, in the seminal study by Tulving and Pearlstone (1966) participants were initially presented with word lists consisting of a category name followed by words that belonged to that category (e.g., articles of clothing: blouse, sweater). Afterwards, they were given either a free-recall test, in which they had a blank sheet of paper to note as many words they could recall as possible, or a cued-recall test, in which they were given the category names of each word list. Results indicated that participants in the cued recall test condition recalled almost twice as many words compared to the free recall group.

In this experiment, we tested the hypothesis that providing a relevant context at retrieval increases the accessibility of behavioral information encoded during the impression formation task thereby facilitating memory compared to an irrelevant context. To implement this idea we first asked participants to form impressions about a target-person in a scenario without any contextual information. After this task, they were given a surprise free recall test for the behavioral and contextual information.

Participants were randomly assigned to one of two retrieval conditions: in one condition they had to recall the behaviors in a context with meaningful (relevant) information while contextual information was irrelevant in the other condition. If the meaningful contextual information was used as retrieval cues to access behavioral information then not only memory for behaviors should be higher in this condition but memory for contextual information as well.

3.6.1. Method

3.6.1.1. Participants

Forty university students (25 females; mean age = 22.45, *SD* = 3.83) participated in this experiment in return of a monetary reward.

3.6.1.2. Materials

We used the exact same computer backgrounds and behavioral descriptions as in Experiment 2.

3.6.1.3. Procedure

The procedure of Experiment 2 was replicated with only one important exception: whereas in the previous experiments the context was manipulated during the encoding of the behaviors, here context was manipulated during recall. In the impression formation phase, all participants were presented with the behaviors about the construction-worker on the computer screen with a blank background. At retrieval, participants had to type the recalled behaviors in a text entry box in the middle of the screen that was surrounded by one of two different backgrounds. Participants were randomly allocated to the condition where the background objects matched the target occupation (n = 20 participants) or to the condition where there was a mismatch between the background objects and the target occupation (n = 20 participants). After completing this task the background with the icons disappeared. They were then asked to recall the names of the objects represented by the background of icons that were on the screen while they were writing down the behaviors that they had recalled.

3.6.2. Results

3.6.2.1. Recall of behavioral descriptions

A coder blind to the experimental conditions categorized the recall data, using a lenient gist criterion. Recall intrusions were infrequent (4.56%). They were however more frequent in the mismatch than in the match condition, $F(1,38) = 5.40$, $p = .026$.

The number of correctly recalled behaviors was submitted to a 2 (Context: match, mismatch) X 2 (Type of Behaviors: congruent, neutral) ANOVA with context as a between-participants factor. The predicted two-way interaction between context relevance and type of behaviors was marginally significant, $F(1,38) = 3.73$, $p = .061$, $\eta_p^2 = .09$. Consistent with our predictions, recall of congruent behaviors was significantly higher when the context matched the target occupation ($M = 6.30$, $SD = 1.08$) than when there was a mismatch between context and target occupation ($M = 5.15$, $SD = 1.66$), $t(38) = 2.59$, $p = .013$, $d = .82$, while the recall for neutral behaviors was equal in both contexts ($t < .31$, $p > .71$).

3.6.2.2. Recall of objects

A coder counted the number of correctly recalled critical objects and the number of false recalls. The number of false recalls (9.83%) had a similar pattern in both context conditions. The number of correctly recalled construction tools was compared with the number of correctly recalled cooking utensils. As predicted, participants in the match condition recalled more objects ($M = 4.55$, $SD = 1.60$) than those in the mismatch condition ($M = 3.10$, $SD = 1.65$), $t(38) = 2.82$, $p = .008$, $d = .89$.

3.6.2.3. Correlation between recall of congruent behaviors and recall of objects

As in the previous experiment, we calculated the correlations between the overall recall of congruent behaviors and the overall recall of objects, as well as separately for each context condition. Overall, the two measures showed a significant correlation coefficient, $r(40) = .35$, $p = .023$. This correlation coefficient was higher in the match context, $r(20) = .54$, $p = .015$, and non-significant in the mismatch context, $r(20) = .05$, $p > .828$.

3.6.3. Discussion

The goal of the third experiment was to provide a test for the hypothesis that meaningful contextual information presented at retrieval serves as a cue for memory in the case of congruent behaviors. If the context works as a retrieval cue than its impact on memory should be higher when the context is meaningful for the target-person than when the context is irrelevant. The pattern of results obtained confirmed this prediction. Namely, participants who had meaningful contextual cues at retrieval showed a better memory for both behaviors and contextual cues than participants who received irrelevant contextual cues at retrieval. Furthermore, a reliable correlation between the recall of congruent behaviors and the recall of meaningful contextual information was obtained. In short, contextual information exerts influence in impression formations processes not only at encoding but also at retrieval, acting as a cue that enhances memory.

In the final experiment, we further explored to role of the context for person memory by investigating whether increasing the link between the contextual information and the target-occupation introduces further memory advantages even when memory is accessed a day later (e.g., Eich, 1985).

3.7. Experiment 4

In the previous experiments we have argued that meaningful contextual information aids memory for behavioral information by serving as a cue to integrate and retrieve this information from memory. If this is the case, then promoting a more effective encoding of the contextual information should positively influence the recall of behavioral information. Research on human memory has extensively documented that factors like deep processing or organizational processing have beneficial consequences for memory (for a review, see Hunt, 2008). For example, Eich (1985) tested the hypothesis that memory associations between contextual information and target words should be stronger - therefore making recall of the words easier - if participants could integrate these two types of information during encoding compared to conditions where no such integration was allowed. To test this hypothesis, participants were asked to imagine the meaning of each target word in relation to one of the physical objects available in a room (e.g., a *kite* in the top of the *table*) or to imagine the meaning of each word in isolation. A recall test performed two days later, in the same or in a different context, showed that participants in the integrated imagery condition had in general, a better memory for the words than the isolated imagery participants. Building on this evidence, we created an experimental situation where participants could uncover the meaningful relationship between some contextual information and the target occupation. This in turn should enhance the recall of congruent behavioral information when encountering the same meaningful contextual information a day later compared with a condition where the same meaningful relationship existed but participants had no chance to uncover it and to a third condition where no such relationship existed at all.

To test this hypothesis we adapted the paradigm used in Experiment 1. Participants were assigned to one of three conditions. In two of the conditions, participants received the same information during impression formation. Part of this information was meaningful to the target-person and the other part was irrelevant. In a third condition the contextual information was always irrelevant. In one of the two conditions with meaningful contextual information, participants were asked to judge which contextual information was meaningful and which was not. In the other conditions with meaningful and irrelevant information they were asked to make a judgment unrelated to the contextual information. After this impression formation phase, participants were dismissed and returned a day later to the lab. In the second session they were provided with the same contextual information they had seen the day before and asked to recall the behavioral information. We expected that participants who were given the opportunity to decide on the relevance of the objects for the target person would have a better memory compared to the other two conditions. Given the twenty-four hours interval between the impression formation phase and memory assessment, we had no specific predictions for potential differences in memory performance (or their absence) between the two conditions that did not entail any judgment about the relevance of the objects for the target.

3.7.1. Method

3.7.1.1. Participants

Seventy-five university students (51 females; mean age of 23.17, *SD* = 5.09) participated in return of monetary reward.

3.7.1.1. Materials

We selected 12 construction tools and 12 cooking utensils from Experiment 1 (from the pool of 32) to use in the two match conditions. We used 12 additional cooking objects (the remaining four from Experiment 1 plus eight new ones selected from the Internet) for the mismatch condition. In Appendix B, we present the 12 construction tools and the 12 cooking utensils that were presented both during encoding phase and retrieval phase. The same 24 behavioral descriptions (12 congruent and 12 neutral) used in the previous two experiments were also used here.

3.7.1.2. Procedure

Participants were tested in individual cubicles. They received computerized instructions informing that the experiment' goal was to explore the way people form impressions while performing other tasks. The procedure of Experiment 1 was replicated except for the following modifications. 1) Participants were randomly assigned to one of three conditions: in the salient-match context condition and in the non-salient-match condition half of the objects matched the target occupation (12 construction tools) while the other half were fillers (12 cooking utensils); in the non-salient-mismatch condition there was a mismatch between all the objects and the target occupation (24 cooking utensils). 2) Immediately after seeing the object, participants in the salient-match condition were asked to think about the object they saw before and to respond "yes" if they considered the object relevant for the target occupation or "no" if they didn't think that the object was relevant. By asking participants to make these judgments we expected to draw their attention to the meaningful relation between the construction tools and the target occupation[5]. In the non-salient conditions (both match and mismatch), participants were presented with a geometrical shape and asked to respond "yes" when the shape was of a triangle and "no" when the shape was not a of triangle. This task was designed simply to enhance comparability between the conditions and to make sure that the only difference between salient and non-salient conditions was the participants' focus of attention to the relationship between context and target. After giving their response, participants were presented with a behavior about the target. The sequence object + judgment + behavior was repeated 24 times. At the end, participants were thanked, dismissed and asked to return in the next day at the same time.

Participants returned to the lab on the next day around the same time (*SD* = 67.08 minutes) and were presented with a surprise recall task. Importantly, we reinstated at recall the same context they had during impression formation, namely participants in the salient-match condition and non-salient-match condition had the construction tools in the background of the screen during recall and participants in the mismatch condition had the cooking utensils (see Appendix B). In the end participants wrote down what they thought the study was about. None reported any relevant inferences. They were then debriefed and thanked.

3.7.2. Results

3.7.2.1. Recall of behavioral descriptions

As in the previous experiments, a coder blind to the experimental conditions categorized the recall data. Recall data from three participants was excluded from the analysis because they did not recalled any behavior but instead they inferred traits about the target. Given that the recall task was performed a day after the impression formation phase memory intrusions were expected to be more frequent and it was relevant to analyze how they were distributed across conditions. A one-way ANOVA, with context as a between factor, on the number of memory intrusions (18.76%) did not reached significance, $F(2, 69) = 2.27$, $p = .112$.

The number of correctly recalled behaviors was examined in a 3 (Context: salient-match, non-salient-match, mismatch) X 2 (Type of Behaviors: congruent, neutral) ANOVA with target and context as between participants factors. Two main effects were obtained, one for context, $F(2, 69) = 4.44$, $p = .015$, $\eta_p^2 = .11$, and a large main effect for the type of behaviors, $F(1, 69) = 32.47$, $p < .001$, $\eta_p^2 = .32$, as well as a marginally significant interaction between context and type of behaviors, $F(2, 69) = 2.57$, $p = .084$, $\eta_p^2 = .07$. Cell means can be seen in Table 4. Planned comparisons confirmed the predicted pattern for the recall of congruent behaviors, namely participants in the salient-match condition recalled significantly more behaviors than participants in non-salient-match, $t(69) = 2.05$, $p = .044$, $d = .59$, and mismatch conditions, $t(69) = 4.11$, $p < .001$, $d = 1.25$. Furthermore, congruent behaviors learned in the non-salient match condition had a significant recall advantage over congruent behaviors learned in the non-salient mismatch condition, $t(69) = 2.00$, $p = .049$, $d = .56$. No context effects were obtained for the recall of neutral behaviors (*t*s < .704, *p*s > .484).

Table 4

Mean Recall of Congruent and Neutral Behaviors as a Function of Context

	Context		
Behaviors	Salient-match	Non-salient-match	Non-salient-mismatch
Congruent	4.48(1.16)	3.74(1.35)	3.04(1.15)
Neutral	2.65(1.30)	2.35(1.64)	2.42(1.53)
	n =23	*n* =23	*n* =26

Note. Standard deviations are in parentheses.

3.7.3. Discussion

The results from Experiment 4 support our prediction that participants who were made more aware of the context by judging which objects were meaningful for the target occupation showed a better memory for the behavioral information than those who also had meaningful objects but did not perform any judgment regarding the context objects. Similarly, their performance was superior to participants who had only irrelevant contextual objects and did not have to make any judgments regarding the context objects. These results support the argument that the context provides extra cues to organize and retrieve behavioral information and that the more that context is perceived as relevant the higher the memory advantage for behavioral information.

Furthermore, the recall advantage of participants in the non-salient match condition over participants in the non-salient mismatch condition is striking since it shows support for the idea that the integration of meaningful contextual information in impression formation constitutes a memory advantage that lasts over a longer period than immediate recall.

3.8. General Discussion

The four experiments reported here establish a connection between standard research and theorizing on impression formation and person memory and the emerging view on situated cognition (for a recent review, see Semin et al., 2012a), by drawing the implications of one of the chief propositions of situated cognition, namely situatedness as context and context as a scaffold. The four experiments introduced a progressive increase in the role that context has by manipulating the meaningfulness of the available contextual information across the different stages of an impression formation paradigm.

3.8.1. Context and Person Memory – Reconciliation

The term 'context' is a very broad one that "subsumes other types of knowledge structures that support specific focused information processing, and that have a setting and referential functions… such as schemata, frames, tasks, plans, or situations" (S. M. Smith, 2007, p. 111). For standard research on person memory the context consists exclusively of expectancies and stereotypes that shape social information processing in a top down fashion (Carlston & E. R. Smith, 1996; E. R. Smith, 1998). Thus the context acts as an internal structure that operates independently from external influences. Postulating the existence of abstracted knowledge structures was endorsed to meet the requirements of cognitive economy. According to the principle of cognitive economy, processing potentially infinitely variable detail would induce a state of informational complexity that the cognitive apparatus would not be able to cope with (e.g., Crocker, et al., 1984; Taylor, 1981). Consequently, representations such as stereotypes, attitudes and impressions of personality were assumed to exhibit temporal inertia as well as resistance to fleeting contextual influences (e.g., Hamilton & Trolier, 1986; Snyder, 1981). Moreover, as contextual information is infinitely variable, since each context presents a unique situation, each and every piece of contextual information cannot be an integral part of the abstraction. However context is integral to adapt to changing contextual situation for the successful negotiation of social reality in a dynamic environment.

The assumption that person impressions, like other mental representations, are immune to contextual factors is at odds with the argument that cognition must be adaptive to situational requirements and tuned flexibly. Moreover, the pattern of results obtained across the four experiments reported in the paper casts some doubt on this established assumption immunity of impressions to contextual influences. Our results suggest at least some degree of integration between *external* context and impressions such that memory performance is partly affected by the characteristics of the contextual information present during impression formation or retrieval. This evidence is congruent with a growing body of research showing that other mental representations such as stereotypes (e.g., Garcia-Marques et al., 2006) or attitudes (e.g., Schwarz & Sudman, 1992) are not invariant knowledge structures (e.g., Allport, 1954) but show a considerable degree of sensitivity as a function of contextual changes and requirements (for a review, see Semin et al., 2012). Interestingly, and in line with our argument, our results show that impressions are influenced by contextual information that is meaningful, while relatively unaffected by irrelevant contextual information. Obviously, impressions, like other mental representations would be useless if they were completely malleable, as would be a complete lack of responsiveness to changing circumstances. Thus, without disregarding the importance of the existing body of knowledge in person memory (Carlston & E. R. Smith, 1996; E. R. Smith, 1998), with our research we intended to present a more balanced approach to person memory where the physical contextual information should be considered as an important factor constraining social information processing (see also Garcia-Marques, et al., 2012; Palma, et al., 2011).

3.8.2. Context as Cognition and Beyond

Research has been showing how cognitive activities can be extended beyond the individual and distributed across people and groups, who constrain information processing and shape mental representations (e.g., E. R. Smith & Collins, 2009). For example, research on *transactive memory* shows that individuals in close relationships, like friends or couples, develop a distributed memory system that allows them to perform better in memory tasks than strangers (e.g., Wegner, 1986, 1995). The benefits of extending cognition to the surrounding context are even more obvious in tasks that require cognitive effort (Sparrow, et al., 2011) and tasks that supersede the expertise of a single individual such as navigating a large Navy vessel (Hutchins, 1995).

In the case of the studies reported here, we have shown that having meaningful contextual information (versus irrelevant contextual information) during the encoding of behavioral information about a target-person improves memory for both the behavioral information and the contextual information (Experiment 1-2). This effect was shown to be due to the presence of meaningful contextual information and was not the result of any interference caused by irrelevant contextual information (Experiment 1). Second, we were able to show a context driven memory advantage only when participants had an encoding goal that required a higher degree of integrative processing, namely an impression formation goal but not a memory goal (Experiment 2). Third, we found that meaningful contextual information also acts as a memory-enhancing cue when presented at retrieval (Experiment 3). Finally, we found not only that this effect is also manifested when memory is accessed a day after the impression formation task but most importantly, that this effect was even stronger for participants who a day earlier had judged the relationship between contextual information and the target occupation to be meaningful (Experiment 4).

These studies were designed to reveal how context impacts person memory by removing the immediacy of context step by step from experiment 1 to experiment 4.

Our studies indicate that relevant contexts work as a memory aid. For example, construction tools are helpful as contextual features when one forms an impression about a construction worker. This however does not mean that a set of fixed contextual features is always coupled with a fixed set of behavioral information. In line with Barsalou’s (2003b) ideas of situated representations of categories as situated conceptualizations, we argue that particular contexts are ‘disposable’. A given context that is relevant in one situation to form an impression about a person can become irrelevant to form an impression about the very same person in a different situation. According to this view, an impression of a construction worker, for example, is not a single generic and static representation but a situated one. These impressions are dynamically shaped depending on the particular goal that is relevant at that particular moment. The next step would be therefore to show, in an impression formation setting that different behaviors exhibited by, say a cook, will determine the utensils she or he needs at the moment. Preparing a soufflé requires different tools than preparing a roast. The situated goals will change the contextual cues (say the utensils) that are relevant to perceive, understand and anticipate the target's behavior. Such tools will always vary with the goals that are pursued at a specific point in time and are therefore momentary. Thus, a situated approach is a functional one in that situated cues while relevant are transient and do not become additional baggage that is abstracted and immutably retained. They can be forgotten and replaced when the situation changes.

Another interesting research avenue that would illustrate the functional role of contexts in situating impressions would be to show that enabling participants to actively download information upon contextual meaningful objects would make them externalized memory aids thus reducing memory load completely. Thus, a possible extension of the studies we reported here would be to enable participants to perform what has been termed *epistemic actions* (Clark, 2008), namely actions that deliberately shape the environment actively and utilize it as a scaffold for memory (e.g., Beach, 1988; Kirsh, 1995). Epistemic actions are designed to shape the environment deliberately and direct one's focus of attention towards information that is relevant for the task at hand. These strategies constitute very efficient ways to cope with our increasingly complex social world. During the course of our everyday life we have to interact with a number of different people, occasionally at the same time, with friends and strangers. We have to remember who said what, assign faces to names, etc. Being able to use the contextual information in order to cue and prioritize information processing is likely to make navigating a complex social reality easier.

3.9. Conclusions

The studies that we report here show the importance of looking outside of the cranial vault to understand the diverse sources we use in processing and representing information about others. We use all types of devices to navigate the social world, bridge distances with cell phones and Skype, external devices to extend our memory, diaries to remember who we have to see, when, and so on. Thus, we lean on the environment and external devices when we navigate our social world and we do so in interaction with others and the environment. Unlocking the traditional view according to which all is locked in the brain can be afforded by adopting a functional approach, namely a framework that regards cognition as situated action. The research we present here constitutes a step in this direction.

CHAPTER 4

SOCIALLY OFFLOADING INFORMATION AFTER ENCODING: CONSEQUENCES FOR MEMORY RETRIEVAL

In the course of our daily lives, we structure and rely on our social and physical environment to enhance our cognitive performance. We use paper and pencil when multiplying two 3-digit numbers to avoid holding some numbers in working memory (Wilson & Clark, 2009) thus decreasing memory load and facilitating processing. In the current research, we investigated the effects of others as memory extensions (e.g., Wegner, 1995). Specifically, we examined how memory retrieval is affected as a consequence of offloading part of the learned stimuli on others after encoding has taken place.

A growing body of research has demonstrated the tendency of people to "lean on the world" (Clark, 1997) by utilizing external resources to offload cognitive work (for reviews, see Semin, et al., 2012; in press). For example, one efficient strategy to remind us we need to buy milk the next time we go out is to place the empty bottle next to the door (Kirsh, 1995; Kirsh & Maglio, 1994). Another example of a distributed memory system (Hutchins, 1995) shows that pilots of an airplane do not store the information related to the current flight solely in their brains but they distribute this information across cards, indicators, etc, across the cockpit. Such external memory devices reduce an exclusive reliance on internal memory and become an integral part of a larger cognitive system (Clark & Chalmers, 1998, E. R. Smith & Semin, 2004; Yeh & Barsalou, 2006).

Recently, Sparrow and colleagues (2011) showed people's reliance on the Internet as a memory extension. For instance, participants who were led to believe that a computer would save the trivia statements that they typed for later access performed worse in recalling the statements than participants who were informed from the beginning that the computer would erase what they typed (Experiment 2).

Of course, earlier work already demonstrated that people, like linked computers, share memory systems with others in dyads or groups (Peltokorpi, 2008; Wegner, 1986; 1995). Thus, memory can be socially distributed (for reviews, see Barnier, Sutton, Harris, & Wilson, 2008; Hirst & Echterhoff, 2012) and collaborative (e.g., Garcia-Marques, et al., 2012; Garrido, et al., 2012a; 2012b). A good example of how people use others as external memory aids is the work on *transactive memory* (e.g., Wegner, 1995). This research suggests that individuals in interdependent relationships develop a distributed memory system, such that they divide responsibility for the encoding, storage, and retrieval of information from different domains, according to their implicitly shared knowledge of each other. This division of labor reduces the memory load of each individual and makes the system more efficient. For instance, dating couples recall more words jointly than do pairs of strangers (Wegner, et al., 1991).

4.1. Overview of the Present Research

As reviewed above, humans distribute cognitive resources across physical, virtual, and social environments. The external environment constitutes a crucial part of a cognitive system superseding the capabilities of an individual brain alone. However, the research to date has focused mainly on how information is stored in the external environment while learning. But, what happens when people distribute part their memory work to their external environment (i.e., a partner) after encoding has taken place? In this research, we examine this question.

It is easy to imagine situations in which keeping a set of information in mind may impose processing constrains upon other information such as impairing their recall. Therefore, offloading the extra information to a physical (e.g., post-it), a virtual (e.g., computer), or a social scaffold may have memory benefits (e.g., Wegner, et al., 1991). The first implication of offloading encoded information to a social scaffold is an obvious one. Recall performance drops for the part of information stored by an external agent (scaffold) that is 'co-responsible' for recalling (cf. Sparrow, et al., 2011). Moreover, the availability of an external scaffold should also release memory space for extra information, even when there is no instruction to store this information. Thus, participants who have the opportunity to offload part of the learned set of items to a partner may have spare memory capacity or free cognitive resources. The subsequent recall of this information can be taken as an indicator of processing capacity (not expended in processing items that were offloaded; e.g., Wickens, 1984).

These hypotheses were tested in a design in which participants were first presented with thirty items from three distinct categories and only subsequently informed that they had a recall test. The particular subset of information to be recalled and the composition of the recall conditions configured the design of the experiment.

The first and critical condition consisted of a collaborative dyad where each participant was responsible for recalling words from one of two specified categories. Thus, one participant would be responsible for a set of words (self-words) while the partner would be responsible for another set of words (partner-words).

In order to make meaningful comparisons we had two further conditions: non-collaborative dyads and an individual condition. After having encoded the list, these participants were informed that they were responsible for recalling one (self-words) of the three word categories. No further instruction was given. These two conditions allowed us to examine performance differences between the collaborative dyad and the non-collaborative dyad as well as the individual condition on the third category.

The specific hypothesis was that in a subsequent memory test when participants were asked to recall all the presented items, recall of the category that the partner (partner-words) was responsible for would be significantly reduced compared with the recall of the category that no one was responsible for (control-words). This difference should only occur in the collaborative dyad condition given that participants in the other two conditions had no partner to offload this information.

The second and novel prediction was that if memory capacity is enhanced in the collaborative dyad condition, then the recall for the unmentioned third category (control-words) for which neither person in the dyad was responsible would be higher in the collaborative dyad compared to the other two conditions. Overall, however, self-words were predicted to be recalled better than partner-words and control words, thus replicating the well documented benefits of retrieval practice on memory (e.g., R. A. Bjork, 1975).

4.2. Method

4.2.1 Participants

One hundred and nine university students (65 females; mean age = 21.90, *SD* = 2.44) participated in this experiment in return for payment or course credit.

4.2.2. Materials

The stimuli consisted of three categorized word lists with 10 exemplars per category (selected from Murdock, 1976). The categories were Countries, Animals and Professions[12].

4.2.3. Procedure

The experiment consisted of three phases: learning, practice, and a recall phase. During the learning phase, participants worked either in dyads or individually. The practice and the recall phases were performed individually.

Learning phase. Upon arrival at the lab, participants were welcomed and randomly assigned to one of three experimental conditions. One-third of the participants were seated individually (Individual condition) and two-thirds were seated in dyads (Collaborative Dyad and Non-Collaborative Dyad conditions) and shared the same computer screen. Participants were informed that their first task was simply to learn a set of words from three different categories (Countries, Animals, and Professions), in order to complete a later unspecified task. All participants were instructed to read the words silently and, importantly, participants learning in dyads were instructed to refrain from talking (cf. Barber, Rajaram, & Aron, 2010). Subsequently, they were presented with the 30 words, one at a time, in random order. Each word was presented for 3000 ms, followed by a 1000 ms interval. Each word was accompanied by the respective category name. After completion, participants had to call the experimenter.

Practice phase. Participants in dyads were then separated. Participants in the individual condition stayed in the same cubicle. Participants were reminded that they were presented with words from three different categories and informed that at a later stage of the experiment, they would be asked to recall some of those words. The further instructions differed according to the experimental condition.

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[12] We used the following exemplars per category. Countries: Mexico, Germany, Spain, Russia, Japan, Cuba, Canada, Egypt, Poland, Australia; Animals: Bear, Pig, Rat, Wolf, Rabbit, Cow, Lion, Elephant, Tiger, Donkey; Professions: Teacher, Writer, Nurse, Dentist, Secretary, Policeman, Scientist, Businessman, Salesman, Engineer. The range of word frequencies within each category varied from 9.22 to 29.77 for Countries; from 11.41 to 25.45 for Animals; and from 5.92 to 29.66 for Professions (cf. Keuleers, Brysbaert, & New, 2010).

Participants in Non-Collaborative Dyad (N-CD) and Individual (I) conditions, were informed that they would be asked to recall words from one of the three categories. They were then asked to keep in mind the words from this category. The words from the remaining two categories were never mentioned to these participants. The N-CD condition, where participants were co-present during the stimulus item presentation, was introduced to control for the possible interference of factors such as distraction on participants' memory performance.

In the critical Collaborative-Dyad condition (CD), participants received the same general instructions but were further informed that the words they would be asked to recall were those from one category while their partner would be asked to recall the words from the other category. Thus participants' task was to focus on the words only from one category (self-words) while their partner would allegedly be responsible for the words from one (partner-words) of the other two categories. In fact, to simplify the experimental design both participants received the same self-words. The words from the third category were never mentioned (control-words). The categorized lists were counterbalanced across self, partner, and control-words.

After these instructions, all participants were again reminded of the word category ascribed to them and given one minute to rehearse those words while the next task loaded. Then they all performed the same unrelated tasks for about 30 minutes.

Recall phase. After the filler tasks, participants were given a free recall task. They had to recall as many words as possible from all three categories and not only from the category ascribed to them. Participants typed the recalled words in a text entry box in the middle of the screen. There was no time limit for this task.

After the recall task, all participants were asked to respond to several questions about their motivation and their mood during the experiment, their impression of the partner (CD and N-CD) and two control questions about the word category ascribed to them (all conditions) and their partner (CD). Responses were given on 9-point rating scales except the two last questions, where they had to indicate the correct category.

4.3. Results

The dependent variable was the proportion of correctly recalled words. Three participants did not recall any words and two responded incorrectly to the control question about the category assigned to them and were excluded from all analyses[13]. The categorized lists were merged into self-words, partner-words, and control-words, since there was no interaction between the list counterbalance and word task (F = 1.11, p = .36) or a significant 3-way interaction between these and the group condition (F = .86, p = .63). The proportion of correctly recalled words was then submitted to a 3 (group condition: CD, N-CD, I) X 3 (word task: self-words, partner-words, control-words) mixed model ANOVA, with the word task variable manipulated within participants. This analysis yielded a large main effect of word task, $F(2, 202) = 41.80$, $p < .001$, $\eta_p^2 = .29$. Post hoc tests (i.e., Sheffé) confirmed that self-words were better recalled than partner-words (M = .48 vs. M = .33, $p < .0001$) and than control-words (M = .48 vs. M = .34, $p < .0001$). This pattern is congruent with research showing that retrieval practice facilitates recall of practiced words (e.g., Anderson, Bjork, & Bjork, 1994). More importantly, there was a marginally significant interaction between group condition and word task, $F(4, 202) = 2.18$, $p = .07$, $\eta_p^2 = .04$ (see Figure 3).

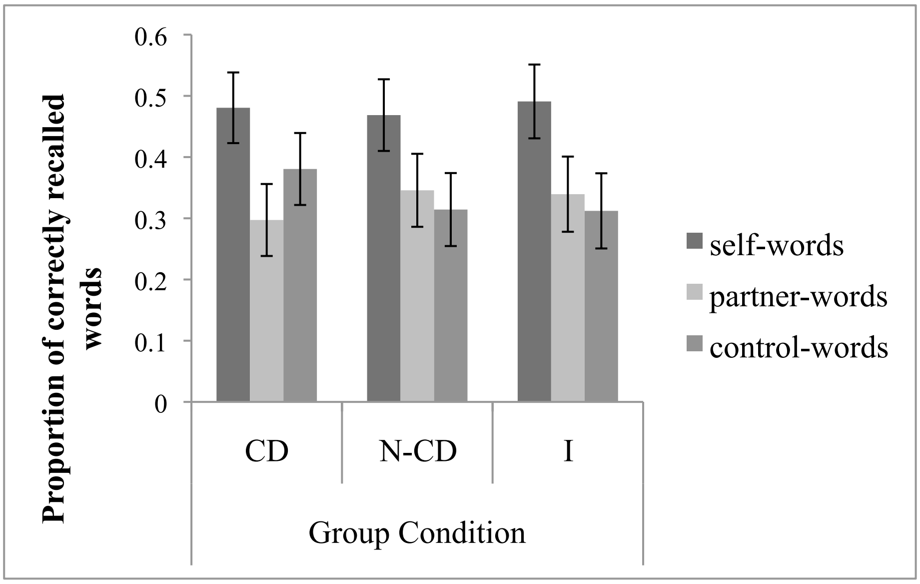

Figure 3. Proportion of correctly recalled words as a function of the Group Condition and Word Task. The error bars indicate 95% confidence intervals.

[13] When we include the data from these five participants in the analysis the general pattern remains unaltered; two-way interaction: $F(4, 212) = 2.05$, $p = .09$, $\eta_p^2 = .04$; CD: contrast between control-words (M = .36, SD = .18) and partner-words (M = .28, SD = .17; $t(106) = 2.76$, $p = .01$).

Consistent with our predictions, partner-words were recalled less well than control-words in the CD condition ($M_{partner\text{-}words}$ = .30 vs. $M_{control\text{-}words}$ = .38, $t(101)$ = 2.79, p = .01, d = .59) but not in the N-CD condition ($M_{partner\text{-}words}$ = .35 vs. $M_{control\text{-}words}$ = .31, $t(101)$ = -1.04, p = .30) or in the Individual condition ($M_{partner\text{-}words}$ = .34 vs. $M_{control\text{-}words}$ = .31, $t(101)$ = -.88, p = .38). Thus, participants in a collaborative-dyad had a reduced recall for partner-words; a pattern not expected or found for N-CD or individuals.

Interestingly, a contrast comparing the recall of control-words in the CD condition with the recall of control-words in the other two conditions (contrast: 2, -1, -1) yielded a marginally significant effect, $t(101)$ = 1.84, p = .07. The same kind of comparison with the partner-words (contrast: -2, 1, 1) was not significant, $t(101)$ = 1.24, p = .22[14]. These results suggest that the recall of a third subset of words (control-words) was enhanced in the CD conditions compared to the N-CD and the individual conditions.

Finally, the word task main effect reported before was corroborated by a contrast analysis showing that self-words were recalled better than partner-words and control words across all conditions (contrast: 2, -1, -1; all ts > 4.84 all ps < .001) and no differences for self-words across these three conditions were obtained (all ts < .53, all ps > .60). The absence of differences in the recall of self-words across all conditions also rules out the possible role of distraction or social facilitation effects in the observed pattern of recall.

The three motivation questions (α = .66) and the two questions regarding the impression about the partner (r = .68) were averaged to form two separate indexes. These indexes were then submitted to separate single factor ANOVA's that showed no differences in motivation across the three conditions (F = .92, p = .37) and also no differences regarding partner's impressions between the CD condition and N-CD condition (F = .06, p = .80). An ANOVA did reveal a significant difference between conditions in the self-reported mood (one question), $F(2, 101) = 4.57$, p = .01, η_p^2 = .08. Sheffé post hoc tests showed that participants in the N-CD condition reported more positive mood than participants in the Individual condition (M = 7.46 vs. M =

[14] A further 3 (group condition: CD, N-CD, I) X 2 (word task: self-words, partner-words) analysis using the control-words as a covariate revealed that participants in the CD condition recalled less partner-words than participants in the N-CD and I conditions (contrast: -2, 1, 1, $t(100)$ = 2.41, p = .02).

6.45, p = .01). However, entering participants' mood as a covariate in the analyses had no impact on the results.

Overall, the obtained results indicate that collaborative dyads constitute social scaffolds that successfully reduce memory load (as indicated by poorer memory observed for partner-words), and release cognitive resources to process further information (as suggested by the enhanced recall of control-words observed).

4.4. Discussion

The experiment reported here was designed to investigate the consequences for memory retrieval of distributing memory work onto others after the encoding of information had taken place. Our first finding revealed that distributing a subset of encoded words onto a partner (collaborative dyad condition) makes those words less accessible in memory, as reflected by its poor recall when compared to a third subset of non-distributed control words. In the other two conditions (non-collaborative dyad and individual conditions), where participants could not distribute their memory, this difference was not obtained. This result extends prior work on transactive memory systems showing for example memory impairment for information that a computer will save than for information that will be erased (e.g., Sparrow, et al., 2011). However, the current findings are distinct from this research. Whereas previous work had focused mainly on how people rely on external agents, like other people (Wegner, et al. 1991) or computers (Sparrow et al., 2011), to store part of the to be encoded information, the present work examined whether offloading information that was already encoded also results in less accessibility for that information in a later recall test.

One possible explanation for the lower accessibility for partner words in CD conditions compared to the other two conditions can be found in research on goal-directed forgetting (E. L. Bjork, R. A. Bjork, & Anderson, 1998). The main idea underlying this research is that, in many circumstances, forgetting is an adaptive process and not the result of mere memory failures. For example, this research has shown that participants who are notified after learning to forget a list of words actually present weaker recall for those words compared to words cued to be memorized. Inhibition has been suggested as the main mechanism underlying these and other related findings (Anderson, 2003). In line with these arguments, it is possible that participants in the CD condition took their partner's responsibility for memorizing a set of words as a cue to forget them, given that this information was not relevant for their own task, and engaged in an inhibitory process in order to focus on their own task. Although inhibition seems a plausible candidate mechanism underlying our findings, it may well be the case that participants simply did not rehearse the partner's words without necessarily trying to inhibit them.

Although marginal, we also found a main effect of control words that are better recalled in the CD condition compared to the two other conditions. This finding is particularly interesting because it indicates the potential of social scaffolds has memory saving devices. Indeed, while offloading memory information to a social partner saves us from keeping that information in memory it seems to release memory capacity to engage in another task, namely keeping other information in mind. This finding is quite akin to those found across different literatures indicating that when information processing on a given task is made easier, the performance on a cognitive demanding concurrent task increases (e.g., Ogden, Levine, & Eisner, 1979; Rolfe, 1973).

To conclude, the present research provides initial evidence that social scaffolds successfully reduce memory load for distributed information even after that information has been encoded. Further, the results seem to suggest that this process is particularly adaptive since it releases cognitive resources to process additional information.

CHAPTER 5

A SITUATED APPROACH TO PERSON MEMORY: MAIN FINDINGS AND FUTURE DIRECTIONS

The main goal of the present research program was to extend the socially situated cognition approach (SSC; E. R. Smith & Semin, 2004) to person memory research.

The study of how we represent and access information about other people, has received considerable empirical scrutiny over the last decades (see Skowronski, 2012). However, a central feature of most of the research conducted in this domain is the notion that person memory is the outcome of internal processes that take place exclusively within the individual mind (for exceptions, see, for example, Garcia-Marques et al., 2012; Garrido et al 2012a; Palma et al, 2011). Thus, one can argue that the person memory literature suggests implicitly that the mental operations involved in the encoding, storage, and retrieval of social information are immune to or detached from one's physical and social environments.

However, people do not operate in a social vacuum and person memory often takes place in specific physical and social environments that can influence the way we encode and retrieve information about other people, as suggested by the research reviewed in our introductory chapter (e.g., Kirsh, 1995; Kirsh & Maglio, 1994; Wegner, 1995). Thus, in this dissertation we aimed to provide empirical evidence for the idea that person memory is socially situated activity that relies partially on the properties of our bodies and physical and social environments.

According to the SSC approach, reviewed in detail in section X, one can better understand how social cognitive processes emerge and evolve by studying them in relation to bodily structures, situations, and environmental resources (E. R. Smith & Semin, 2004). The SSC approach is based on three central principles:

(a) Cognition is embodied, namely it's grounded in sensory-motor and affective neural systems;

(b) Cognition is situated, which means that it is shaped by the specific requirements of the context; and

(c) Cognition is distributed, that is, it makes use of the different agents in the environment, which extend individual capacities.

As we illustrated in the first chapter, there is now considerable empirical evidence supporting each of these principles in different social psychological domains (for extensive reviews, see Semin, et al., 2012a; in press).

Based on these three principles and on specific research supporting them, we tested and present, in three empirical chapters, the embodied, situated and distributed nature of person memory. For designing the experiments presented in these chapters, we adapted existing paradigms in order to accommodate manipulations that would allow us to test our hypothesis. We believe that overall, the results we obtained support our hypotheses and are likely to contribute to our understanding of person memory and human memory as a socially situated activity. In the next section, we present a summary of the main findings presented on each chapter and their potential implications.

5.1. Summary and implications of the findings

5.1.1. The embodied nature of person memory

In the first empirical chapter (chapter 2), we presented two experiments designed to examine whether person memory is embodied. More specifically, the question was: is person memory constrained by the introduction of sensorimotor elements during the encoding of valenced behavioral information? Recent research has shown that both the retrieval of autobiographical memories (Casasanto & Dijsktra, 2010) and the retrieval of previous spatial locations of images (Crawford et al. 2006) are influenced by the metaphorical association between valence and vertical space (cf. Lakoff & Johnson, 1980, 1999). For example, Casasanto and Dijsktra (2010) showed that people retrieved more positive autobiographical memories, and were faster in retrieving them, when performing upward movements and negative ones when performing downward movements.

Based on this research we tested, in two experiments, the general hypothesis that memory for positive and negative behavioral information in the context of an impression formation task depends on the location where that information is presented in the vertical space. In both experiments, we asked participants to form an impression of a positive or negative target-person based on behavioral sentences. These sentences were either congruent or neutral with the target-person. In the first experiment, we manipulated the vertical dimension by presenting the sentences at the top and at the bottom of a screen. As predicted, the results showed that the recall of behavioral sentences was superior when the target's positive and negative behaviors were presented in compatible vertical spatial locations (up or down respectively).

In the second experiment, we went beyond standard vertical spatial manipulations by introducing a distinctive motor component, namely upward or downward arm-movements. Specifically, in this experiment the behavioral sentences were presented on cards that participants had to place in a top or bottom shelf. As predicted, recall was enhanced for behavioral items that were placed in a vertical position that was congruent with their valence thus lending additional support to the idea that our bodies and spatial referents shape the way we form impressions about other people.

The pattern of results obtained is also consistent with previous research showing an association between valence and the vertical space (see Crawford, 2009), as in the case of research using interference paradigms (e.g., Meier & Robinson, 2004), or measures like autobiographic recollection (Casasanto & Dijkstra, 2010). Our results also converge with recent findings showing that mental representations of trustworthy and untrustworthy individuals contain motor actions of approach and avoidance (Slepian, Young, Rule, Weisbuch., & Ambady, 2012). Most importantly, these findings expand previous research on person memory, as they are, at least to our knowledge, the first showing that the recall of social information about a target-person is also affected by the spatial position where that information was previously encoded.

Overall, both our results and other related findings have an important implication for standard mental representation models. According to traditional models of person memory, person representations result from the computation of internal abstract symbols. However we have shown that embodied cues, such as spatial cues and motor movements, also impact the amount of social information we encode and retrieve from memory. These results suggest that, like other cognitive processes, person memory is *embodied*.

5.1.2. The situated nature of person memory

In the first empirical chapter we successfully demonstrated that person memory is influenced by embodied cues, like space and motor movements. These results encouraged us to continue pursuing our research agenda by empirically testing the second principle of the SSC approach (E. R. Smith & Semin, 2004) to person memory, which we present in the second chapter. Specifically, we explored the idea that person memory is a situated activity by examining whether the way people acquire and retrieve social information from memory is constrained by the physical context in which these processes take place. Our argument was inspired by different lines of research showing that group representations are malleable knowledge structures that respond adaptively to contextual information (Garcia-Marques et al., 2006); that memory representations contain not only target information but also contextual information acquired during encoding (S. M. Smith, 1994); and that offloading information to the context facilitates cognitive tasks and cues memory (Kirsch & Maglio, 1994). In four experiments we tested the hypothesis the physical context (objects), when task relevant, provides cues that help encoding information in memory, thus enhancing memory performance.

In the first experiment, contextual information was presented during the encoding of behavioral information to investigate whether meaningful contextual information for the target-stereotype acts as an organizing cue that facilitates the integration of behavioral and contextual information in memory. Results in two free recall tasks and a recognition task showed that having meaningful contextual information (versus irrelevant contextual information) improves memory for both the behavioral information and the contextual information. This effect was shown to be due to the presence of meaningful contextual information and not as the result of any interference caused by irrelevant contextual information.

In the second experiment, we examined the role of contextual information during encoding but under different processing goals: an impression formation goal vs. a memory goal (Hamilton, et al., 1980a). Results showed that the context driven memory advantage obtained in the previous experiment occurs only when participants had an encoding goal requiring a higher degree of integrative processing, namely an impression formation goal but not a memory goal.

Inspired by research on cued retrieval (Tulving & Pearlstone, 1966), in the third experiment, we tested the role of contextual information presented during the retrieval stage by manipulating the presence of meaningful cues during recall. Results confirmed that meaningful contextual information also acts as a memory-enhancing cue when presented at retrieval. Additionally, across the three experiments a reliable correlation between the recall of congruent behaviors and the recall of meaningful contextual information was obtained supporting the argument that context and cognition are interdependent.

Finally, in the fourth and last experiment presented in the third chapter, we introduced a paradigm involving active screening of contextual information by participants in order to investigate if attention-driving actions on the context benefit memory for behavioral information. We found not only that this was the case when memory was accessed a day after the impression formation task but most importantly, that this effect was even stronger for participants who a day earlier had judged the relationship between contextual information and the target occupation to be meaningful.

The experiments presented in the third chapter aimed to establish a connection between standard research on person memory and one of the core principles of situated cognition, namely the situated nature of cognition. Across four experiments we explored the role of the context for person memory by manipulating the meaningfulness of the available contextual information across the different stages of an impression formation paradigm. Our results converge with a growing body of research showing the malleability of mental representations (e.g., Garcia-Marques et al., 2006; Schwarz, 2007), as we showed that the context where people encode or retrieve social information influences their memory performance. Thus, our results seem to suggest that people do not only encode behavioral information but also contextual information and that this contextual information (when relevant) helps encoding and retrieving information about others. Overall, the four experiments converge upon the conclusion that person memory is *situated*.

5.1.3. The distributed nature of person memory

After having successfully showed, in the second empirical chapter, that memory for social information is affected by the physical context where encoding and retrieval take place, in the last empirical chapter of this thesis (chapter 4) we investigated the role of the social context as a scaffold to memory. Thus, in this chapter we focused on the third principle of the SSC approach (E. R. Smith & Semin, 2004), namely the distributed nature of cognition. Research on transactive memory has already shown the costs and benefits of distributing memory work (Wegner, et al., 1991; Sparrow et al., 2011).

However one common characteristic of this research is that the distribution of memory responsibility always occurs during the encoding stage. Notably and because in many situations memory can be distributed after one has already encoded the information, we designed one experiment to examine this question, namely whether distributing recall responsibility after memory encoding has taken place affects recall. Our results showed that discovering that a partner of a collaborative-dyad is responsible for recalling part of the previously encoded items reduces subsequent memory for those items when compared to baseline items. Critically, this pattern was not found in the other two conditions where recall responsibilities were not distributed.

We believe that the results obtained make a potentially important contribution to the existing research on transactive memory. Recent research by Sparrow and colleagues (2011, Experiments 2 and 3) showed that participants who were told they could rely in the computer to save the information they would need to recall later had worst memory for that information than participants who were warned that the information would not be saved by the computer. Our results extend this research in that they show that information that is distributed to a partner is hard to recall when compared to other information that was not distributed, even when this information was previously encoded. Our results seem to suggest that having a partner with whom to share part of the learned information works as an implicit cue to safely forget that information (cf. E. L. Bjork, et al., 1998; we will return to this point in the next section of this general discussion). Overall the results from our last experiment constitute additional support for the idea that memory is *distributed* across social agents.

Taken together, the results derived from our experimental program lend support to the idea that one can gain additional explanatory power to understand person memory processes by adopting a socially situated perspective. However, as any scientific work, also our research has limitations that should be addressed in the future. In the next section we address a few issues that require further investigation. Importantly, some of these limitations and proposed solutions are the result from our own reflection upon our work but also from comments of colleagues and expert reviewers.

5.2. Limitations and future directions

5.2.1. How is person memory embodied?

The two experiments presented in Chapter 2 showed that the retrieval of social information about a positive or negative target-person can be influenced by the spatial vertical location where that same social information was encoded. Social information congruent with a positive target was better recalled when encoded in a higher location, whereas social information congruent with a negative target was better recalled when encoded in a lower location. These results converge with a growing body of evidence that links bodily action with memory, emotion recognition or language comprehension (for reviews, see Barsalou, 2008; Semin, et al., 2012, in press) and more specifically with conceptual metaphor theory (CMT; Lakoff & Johnson, 1980, 1999).

However, in what sense is person memory ‘embodied’? According to one of the most influential embodiment accounts (Barsalou, 1999a), knowledge is represented by partial simulations of bodily experiences, in modality-specific areas of the brain. It is tempting to interpret any data showing links between body and mind as evidence in favor of this hypothesis. Although the results of our first two experiments could be easily interpreted in light of this framework, the finding that space interacts with memory for social information does not necessarily constitute evidence that the effect is driven by mental simulations (Barsalou, 1999a). Further research is needed to determine whether people simulate at retrieval the spatial and motor components present at encoding (for neural evidence on the role of simulation on recall, see Polyn, Natu, Cohen, & Norman, 2005). One way to test this idea would be to block people’s motor simulation during recall. For example, in a control condition, participants could squeeze a soft ball with their dominant hand (the same hand used to move the card in Experiment 2) while verbally recalling the behaviors. If people partially simulate the vertical motor movements associated with the target-behaviors during recall, then blocking the simulation should reduce our effect. Specifically, the recall of behavioral information congruent with a positive and a negative target should be independent of the vertical location where it was presented.

According to the CMT (Lakoff & Johnson, 1980, 1999), thinking about the abstract concept of valence automatically activates the spatial up–down image schema (positive = up; negative = down). Research by Meier and Robinson (2004; Experiment 2) supports the automatic activation of image schemas by showing that evaluating positive and negative words presented at the center of the screen directs spatial attention to the image schema-congruent locations. Specifically, participants were faster in identifying target stimuli presented at the top of a screen after having evaluated a positive word and faster in identifying target stimuli presented at the bottom of a screen after having evaluated a negative word. Thus, one candidate mechanism to explain our results (especially in Experiment 1) is the enhanced spatial attention to metaphor congruent locations. It might be that forming impressions about a positive (negative) target directs attention to higher (lower) locations thus promoting a deeper encoding of the target-congruent behavioral information presented at those locations. This prediction could be tested in future experiments using, for example, spatial attention as an alternative dependent variable.

5.2.2. How is person memory situated?

In the third chapter of this thesis we presented four experiments showing that the encoding and retrieval of social information is affected by the presence of target-relevant physical contextual information. These results seem to converge with a situated view of cognition (e.g., E. R. Smith & Semin, 2004; Yeh & Barsalou, 2006) according to which cognitive activities are facilitated when framed by contextual information. However the question that remains is how exactly does the context facilitate memory for social information? One possibility is that the contextual information changed the nature of the processing given to the behavioral information in the compatible conditions. More specifically, the contextual information in the compatible conditions might have primed the target-stereotype making it more accessible in participants' minds, compared to participants in the other conditions, and thus increasing its influence on processing the information. As previous research shows, stereotypes can drive attention towards congruent information at encoding and also serve as retrieval cues for that information (for a review, see Skowronski, in press). Thus, the recall advantage in the compatible conditions might simply be due to differences in stereotype activation between conditions. From a situated cognition point of view, this alternative is not so interesting because it doesn't require contextual information to be part of mental representations.

Another possibility that is more in line with the situated cognition approach is that mental representations of other persons are context-specific, as we interact with people in specific contexts. Then it makes sense to assume that contextual information is an integral part of mental representations and that those contextual cues help retrieve information from memory (cf. Yeh & Barsalou, 2006). Our results also seem consistent with this idea however they don't allow us to differentiate between the two possible explanations. More research is then necessary to clarify the role of context for social memory.

5.2.3. How is memory distributed?

The main goal of the third empirical chapter was to investigate the distributed nature of cognition by extending existing research on transactive memory (cf. Sparrow, et al, 2011). In particular we tested whether information that is distributed to a partner is more easily forgotten than information that was not distributed, even when the distribution of memory responsibilities between partners was manipulated after the information was learned. Our results provided evidence in favor of this hypothesis. Indeed participants working in collaborative dyads recalled less partner words than baseline words, a pattern that did not occur in the other two experimental conditions where memory responsibilities were not distributed.

After having confirmed our hypothesis, the next obvious step is to identify the mechanisms driving our pattern of results. What is it exactly that people do when they are told that their partner is responsible for recalling part of the learned stimuli? It might be the case that telling participants that the partners with whom they learned the categorized words would recall one of the word categories works as a cue to forget that word category. Research on forgetting has shown that participants can successfully forget part of the learned material either when explicitly instructed to do so (e.g. direct-forgetting paradigm; Macleod, 1998) or when implicitly cued, like in the case of retrieval-induced forgetting (E. L. Bjork, et al., 1998). If it is the case that participants really perceive their partner assignment as a cue to forget, then manipulating the perceived competence of the partner should moderate our effect. Namely, telling participants that their partner normally scores high in memory tests should give rise to a pattern of results similar (or even stronger) to the one obtained in our experiment. On the contrary, telling participants that their partner normally scores low in memory tests may either reduce our even revert our pattern of results.

5.3. Concluding Remarks

The present thesis represents a new line of research that combines standard person memory research with the recent socially situated cognition approach. Our goal was to integrate these two approaches while resisting the temptation of creating a theoretical dichotomy between the two, as we believe that is the wrong way to advance science (cf. Garcia-Marques & Ferreira, 2011).

The present research program has implications for both person memory and the SSC approach that result from our attempt to combining them. On the one hand, adopting a SSC perspective to investigate person memory gave us news insights on other factors that shape the way people encode and retrieve social information from memory. On the other hand, our research is also important to SSC perspective as it provides additional support to its main principles.

However, the effort to combine these two areas is by no means concluded. Our results should be viewed as a small step towards a more integrated approach of person memory that takes into consideration the role of body and physical and social environmental features on how people encode and retrieve information about others. Further empirical evidence is necessary to develop this line of research and to improve our understanding of the precise cognitive processes that may explain our results.

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Appendix A

Behavioral Descriptions Used in Both Experiments of Chapter 2

Behavioral Descriptions Congruent with the Childcare Professional
He helped a stranger pushing a car that was broken
Gave way his parking place to a car driver who was carrying two children
Helped a friend to study for an exam
Helped a neighbour carrying the groceries upstairs
He often visits a friend in the hospital
He helped a lost child to find the parents
He deviated from its usual route to give a lift to a work colleague
He called all his friends to wish the good parties
He helped a lady with a stroller to go down the stairs
Helped a stranger to find a street
He stopped his car and helped a stranger to change a tire
He helped an elderly person to use the ATM
Behavioral Descriptions Congruent with the Skinhead
He said he did not speak English to avoid having to help a foreigner who was lost
Always tries to overcomes others in a line because he is not to loose time
He was the only person that did not congratulate a work colleague on his anniversary
Always parks his car occupying two parking spaces
He responded bad to the colleagues when these gave him the good days
Laugh when an elderly person slipped and fell to the floor
He didn’t called to his mother on her anniversary
Avoids talking with his son’s friends
He intentionally ignored the phone calls of a friend
Never greets his maid

Insulted the front driver because this was driving slowly
He did not make way for a disabled person to pass
Behavioral Descriptions Neutral for both Target-Occupations
He looked to his clock to see the time
He got up early to go running
He consulted his agenda to see a phone number
He hung up his coat in the hanger
Lost his agenda with all his phone numbers
Someone rang the door and went to see who was it
Went to the store to renew his identity card
Ate a piece of fruit after dinner
Collected the children from school in the evening
Went to the post office to get a package
He waited for the bus on that morning
Informed the taxi driver about where he wanted to go

Appendix B

Construction Tools and Cooking Utensils (Objects) used in the Four Experiments of Chapter 3 to Manipulate the Context at Encoding and at Retrieval

Construction Tools
Gloves* [1,2,3,4]
Helmet* [1,2,3,4]
Hammer* [1,2,3,4]
Ladder* [1,2,3,4]
Saw* [1,2,3,4]
Shovel* [1,2,3,4]
Paint Roller* [1,2,3,4]
Electric Drill* [1,2,3]
Tape Measure [1,2,3,4]
Pliers [1,2,3,4]
Level [1,4]
Wheelbarrow [1,4]
Drill [1,4]
Spatula [1,4]
Brushes [1]
Rope [1]
Cooking Utensils
Rolling Pin* [1,2,3,4]
Kitchen Knife* [1,2,3,4]
Pan* [1,2,3,4]
Pot* [1,2,3,4]
Chef's Hat* [1,2,3,4]

Pot Holder * [1,4]

Roasting Tray* [1,4]

Fork* [1]

Oven Mittens [1,2,3,4]

Electric Hand-Mixer [1,2,3,4]

Spoon [1,2,3]

Toaster [1,2,3]

Chopping Board [1,2,3]

Electric Hand Blender [1,4]

Griller [1,4]

Strainer [1,4]

Note. Objects marked with * were used as target objects (presented during impression formation) in Experiment 1. The numbers 1, 2, 3, and 4 represent the experiments where these objects were used to manipulate the context.

Appendix C

Behavioral Descriptions used in the Four Experiments of Chapter 3

Behavioral Descriptions Congruent with the Construction Worker Occupation
Unloaded several sand bags from a truck[1-4]
Got up very early to be the first to arrive at the construction site[1-4]
Arrived from work with the clothes completely dirty and stained[1-4]
Flirted with women passing by the construction site[1-4]
Correctly attached the tiles to the bathroom walls[1-4]
Fixed a broken shingle in a professional way[1-4]
Filled two containers with rubble[1-4]
Suffers from back pain due to the hard work he performs[1-4]
Perspired a lot on that day[2-4]
Spoke loudly over the noise of the machines[2-4]
Operated the crane with concentration and caution[2-4]
Has low schooling because he started to work when he was very young[2-4]
Behavioral Descriptions Congruent with the Cook Occupation
Is able to prepare different kinds of food[1-4]
Bought fresh ingredients in the market[1-4]
Always serves the meals with an excellent presentation[1-4]
Used different spices to get a special flavor[1-4]
Everyone praised the meal he prepared[1-4]
Beats the egg whites firmly for the meringue[1-4]
Opened a bottle of wine very easily[1-4]
Washed the salad[1-4]
Cut the carrot thinly[2-4]
Peeled and cut potatoes in slices[2-4]

Weighed the sugar to make a cake[2-4]
Prepared a list of ingredients needed to prepare a meal[2-4]
Behavioral Descriptions Neutral for both Target-Occupations
Went out to buy clothing[1-4]
On the way to work bought a magazine[1-4]
Opened the mail box and collected the mail[1-4]
Had a haircut at the barber in the neighborhood where he lives[1-4]
Spent Wednesday night watching TV[1-4]
Woke up in the morning and turned on the radio[1-4]
Took the key from his pocket to open the door[1-4]
Went to the store to renew his identity card[1-4]
Collected the children from school in the evening[2-4]
Went to the post office to get a package[2-4]
Parked his car close to home[2-4]
Found a two-euro coin at the doorstep[2-4]

Note. Behavioral descriptions marked with 1-4 were used in all Experiments and behavioral descriptions marked with 2-4 were used in Experiments 2 to 4.