What is “Mere” About the Mere Ownership Effect?

The Role of Semantic Processes for the Self’s Impact on Memory

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Zusammenfassung

Wird ein Objekt als eigener Besitz wahrgenommen, so erhöht dies die Erinnerungswahrscheinlichkeit für dieses Objekt in einem anschließenden Gedächtnistest im Vergleich zu einem Objekt, das zu einer anderen Person gehört *(mere ownership*-Effekt oder „Effekt des bloßen Besitzens“; Cunningham et al., 2008). Dies gilt auch, wenn die Zuweisung völlig willkürlich geschieht. Beim *mere ownership*-Effekt erfordert die Besitzzuweisungsaufgabe kein bewusstes Nachdenken über die Stimuli oder deren Bezug zum Selbst, im Gegensatz zum etablierten *Selbstreferenzeffekt* (Rogers, Kuiper & Kirker, 1977). Dieser bekannte Gedächtnisvorteil durch selbstreferenzielle Verarbeitung wird gemeinhin im Rahmen der *Verarbeitungstiefetheorie* interpretiert (Craik & Lockhart, 1972), nämlich als Folge “tieferer” und stärker elaborierter semantischer Verarbeitung zum Enkodierungszeitpunkt. Von theoretischem Interesse ist die Frage ob der *mere ownership*-Effekt auf eine ähnliche Weise erklärt werden kann. In einer Reihe von acht Experimenten wurde der *mere ownership*-Effekt genauer untersucht. Dabei wurden Rahmenbedingungen für das Auftreten des Effekts, sowie Unterschiede und Ähnlichkeiten zum Selbstreferenzeffekt geprüft. Das Hauptaugenmerk lag hierbei auf der Rolle semantischer Verarbeitung für die Entstehung des *mere ownership*-Effekts, insbesondere auf semantischer *Elaboration* und *Organisation* als Komponenten semantischer Verarbeitung (Einstein & Hunt, 1981). Nach zwei erfolgreichen Replikationen (Experiment 1+ 2, gescheiterte Replikation in Pilotstudie) untersuchten wir, ob der *mere ownership*-Effekt von semantischer Verarbeitung oder Verarbeitbarkeit im weitesten Sinne abhängt (Experiment 3): Es zeigte sich kein *mere ownership*-Effekt für bedeutungslose Pseudoobjekte. Mithilfe einer Enkodieraufgabe ohne verbale Beschriftungen, untersuchten wir, ob sich Spuren semantischer Elaboration in einer späteren Testphase nachweisen ließen. Wir fanden Hinweise für spontane semantische Verarbeitung unabhängig von der Selbst- oder Fremdzuweisung (Experiment 4). Mittels einer Verarbeitungstiefemanipulation testeten wir den Einfluss semantischer Organisation: Hier verschwand der *mere ownership*-Effekt, wenn der Selbst-/Fremdzuweisungsaufgabe zusätzlich eine semantische Klassifikationsaufgabe hinzugefügt wurde, blieb aber bestehen, wenn eine perzeptuelle Aufgabe hinzukam (Experiment 5). In einem weiteren Test für die Rolle semantischer Organisation zeigte sich erhöhtes Clustering für dem Selbst zugewiesene Stimuli im Vergleich zu einer anderen Person zugewiesen Stimuli in der freien Wiedergabe (Experiment 6). In einem letzten Experiment überprüften wir die zusätzliche Frage ob eine implizite, eher indirekte Verbindung zum Selbst ausreicht, um einen *mere ownership*-Effekt zu erzeugen. Dazu wurde das Lernmaterial im Kontext einer perzeptuellen Matching-Aufgabe präsentiert, die typischerweise zu einer Selbstpriorisierung führt (Sui, He & Humphreys, 2012; Experiment 7). Trotz eines klaren Selbstpriorisierungseffekts zeigte sich in einem unangekündigten Rekognitionstest kein Vorteil für Objekte, die konsistent mit einer mit dem Selbst assoziierten Form dargeboten worden waren. Zusammenfassend lässt sich sagen, dass der *mere ownership*-Effekt von einer expliziten Zuweisung zum Selbst sowie einer zumindest prinzipiellen semantischen "Verarbeitbarkeit", das heißt, von sinnvollem Stimulusmaterial abhängig zu sein scheint. Insbesondere fanden sich Belege dafür, dass Organisation ein treibender Mechanismus hinter dem *mere ownership*-Effekt zu sein scheint. Möglicherweise basiert der Effekt auf dem Organisationsprinzip der Einteilung in "ich" versus "nicht ich".

Schlüsselbegriffe: Selbst und Gedächtnis; Besitz; *mere ownership*; Verarbeitungstiefe; Selbstreferenz; semantische Elaboration; Organisation; Rekognition; freie Wiedergabe; Selbstpriorisierung; soziale Kognition

Abstract

If an object becomes perceived as one's own possession, even through arbitrary assignment, it is more likely to be remembered in a subsequent memory test than an object that belongs to someone else (Cunningham et al., 2008). Importantly, the ownership task does not require conscious reflection on the stimuli or their relationship to the self, as is the case for the well-established *self-reference effect* (Rogers, Kuiper & Kirker, 1977). This memory advantage produced by self-referential encoding is typically interpreted in terms of the *levels of processing* framework (Craik & Lockhart, 1972) – namely, as a result of "deeper" and more elaborate semantic processing during encoding. A question of theoretical interest is whether this mere ownership effect can be accounted for in similar terms as the *self-reference effect* (Rogers, Kuiper & Kirker, 1977). This memory advantage produced by self-referential encoding is typically interpreted in terms of the *levels of processing* framework (Craik & Lockhart, 1972) . In a series of eight experiments, we investigated the mere ownership effect more closely, testing some of its boundary conditions, as well as points of similarity and divergence between the mere ownership effect and the self-reference effect. The main focus was the role of semantic processing in producing the mere ownership effect, especially with regards to its components of semantic *elaboration* and semantic *organization* (Einstein & Hunt, 1981). Following successful replication (Experiments 1 & 2, but see the pilot study for a failed replication), we investigated whether the mere ownership effect was contingent upon semantic processing (Experiment 3). For meaningless pseudo objects, there was no mere ownership effect. Testing for a potential role of semantic elaboration using meaningful stimuli in an encoding task without verbal labels, we found evidence of spontaneous semantic processing irrespective of self- or other-assignment (Experiment 4). When semantic organization was manipulated, the mere ownership effect vanished if a semantic classification task was added to the self/other assignment but persisted for a perceptual classification task (Experiment 5). Testing for semantic organization once more, we found greater clustering of self-assigned than of other-assigned items in free recall (Experiment 6). In a final experiment, we addressed the additional question of whether a more implicit, indirect connection to the self could produce a mere ownership effect-like memory advantage. To this end, we presented to-be-learned objects in the context of the perceptual matching task known to lead to self-prioritization (Sui, He & Humphreys, 2012; Experiment 7). Despite a clear self-prioritization effect, a subsequent memory test revealed no advantage for objects consistently paired with a self-associated shape. Taken together, these results suggest that the mere ownership effect depends on an explicit assignment to the self, as well as semantic "processability" of to-be-learned items. Specifically, semantic organization appears to be a mechanism behind the mere ownership effect. It could be based on the organizational principle of a ‘‘me" versus ‘‘not-me" categorization.

Key words: memory and the self; mere ownership; self-reference; levels of processing; semantic elaboration; organization; recognition; recall; self-prioritization; social cognition

Acknowledgements

"It is the nature of the idea to be communicated, written, spoken, done. The idea is like grass it craves light, likes crowds, thrives on crossbreeding, grows stronger from being stepped on." –Ursula K. LeGuin (1974)

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Author note

Experiments 1-6 presented in this thesis have been published in a journal article (Englert & Wentura, 2016), of which I am the first author. Experiment 7 was designed and conducted in collaboration with Dr. Sarah Schäfer of Trier University. Both of us contributed equally to the planning, design, and statistical analyses of Experiment 7. Due to the collaborative nature of this research, whenever referring to the empirical work presented in this dissertation, I will employ the pronoun “we”, rather than “I”. The design and layout of this thesis follow a template created and freely provided by Professor Wolf-Fritz Riekert of Stuttgart Media University.

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eMOE	evaluative mere ownership effect
ERP	event-related potential
fERN	feedback error-related negativity
mMOE	mnemonic mere ownership effect
MOE	mere ownership effect
PFC	prefrontal cortex
RKG	remember/know/guess
RT	reaction time
SRE	self-reference effect

1 Introduction

1.1 The effect of mere ownership on memory: how a connection to the self conveys a cognitive benefit

"*When in the Land of Property think like a propertarian. Dress like one, eat like one, act like one, be one."* –Ursula K. LeGuin (1974)

What does it mean, in cognitive terms, for an object to be considered linked to one's own person? Specifically, is an object that we consider our property represented differently simply by virtue of being owned? And if this is the case, how can we tap into the cognitive mechanisms that give rise to such an altered representation?

Indeed, ownership appears to confer a special cognitive status upon an object. It has even been proposed that material possessions can be considered an extension of the self (Belk, 1991). For example, people will tend to like an object better if it is owned by themselves (Beggan, 1992). Possessions are also ascribed greater monetary value than items that we do not (yet) own. This endowment effect (Thaler, 1980) appears to be driven, at least in part, by a feeling of ownership (Morewedge, Shu, Gilbert, & Wilson, 2009).

From an evolutionary perspective, a special status of possessions makes sense: This view assumes that the cognitive system - rather than being a general-purpose "epistemic engine" (Dennett, 1991) - optimized for obtaining accurate information, is adapted to help the organism interact with and survive in the surrounding environment. Put pointedly, cognition can be thought of as "narcissistic" in that the way information processing operates is shaped by how said information relates to the organism that processes it (Akins, 1996).

Functionalist thinking lends credence to the notion that the self has a special cognitive status (for a critical review of this notion, see Gillihan & Farah, 2005). It can be predicted that an object will receive preferential processing if it holds relevance for one's own person. Material possessions, almost by definition, fulfill that criterion. They are relevant to our actions, in that they are typically at our disposal to be manipulated or utilized. They are furthermore important both to our (physical) thriving in that they constitute resources we can exploit, and to our social standing in that they can enable us to communicate aspects of our identity to other people. For all these purposes, objects that we already own constitute a much better shot at success than objects that we have not (yet) obtained. These aforementioned factors give ownership relevance in the Darwinian sense: It is important for us to be able to distinguish between those objects that do belong to us and those that do not. Therefore, it stands to reason that our cognitive system would engage with possessions in a special manner that is either quantitatively or qualitatively (or both) different from the way other objects are processed. We might well already be considered denizens of the “land of property” (LeGuin, 1974). Its ways of thinking and being seem to come to us effortlessly, whereas it is the idea of a planet where the concept of property is alien to its people, that I find difficult to imagine.

1.1.1 An effect of mere ownership? Introducing the shopping paradigm

One area in cognitive psychology where this line of functionalist reasoning can be applied is memory (Nairne, 2005; Nairne & Pandeirada, 2010; Nairne & Pandeirada, 2016). Does ownership convey a special status on a to-be-remembered object? Cunningham, Turk, Macdonald, and Macrae (2008) investigated whether the apparent privileged cognitive status of possessions extends to the domain of recognition memory. With their “shopping paradigm”, they aimed to manipulate ownership in a minimal fashion. In the original implementation of the shopping paradigm, participants were paired up to take part in the experiment together. Each participant was then assigned one of two shopping baskets, each of which had a different color. Thus, there were two different shopping baskets in front of the participant: one which was designated as one’s “own” basket and one which belonged to the other participant.

Participants were instructed to imagine having won a number of goods and to take turns drawing from a deck of cards which showed pictures of everyday objects typically available at a supermarket. Each card was marked with a colored sticker that corresponded to either one’s own or the other participant’s shopping basket. Based on this information, participants placed each card into either their own or the other participant’s basket (see Figure 1). After sorting through the deck, participants performed a surprise recognition test indicating whether an object had been part of the deck or not. Results showed that recognition performance was superior for objects that had been placed in one’s own basket. Furthermore, participants were faster to recognize “owned” objects (see Figure 2).

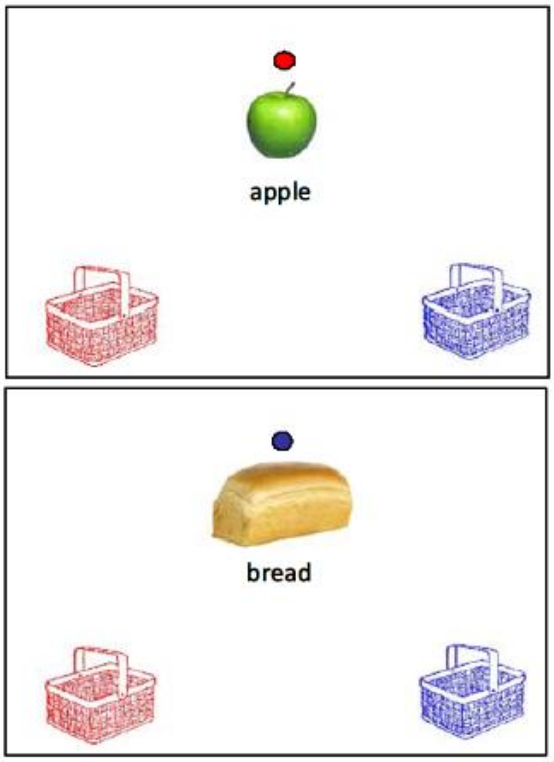

Figure 1. A graphic illustration of a trial in a computerized version of the shopping paradigm. The colored dot above the object indicates its owner. From Cunningham, Brady van-den-Bos, & Turk, 2011.

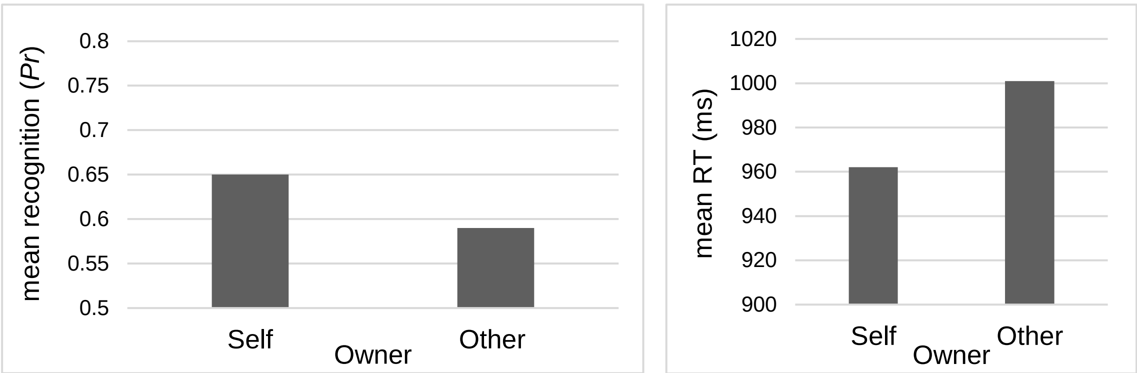

Figure 2. Recognition memory performance and response times from the seminal study by Cunningham et al. (2008). The diagram on the left shows recognition memory performance for self-owned as compared to other-owned items, the diagram on the right shows decision times for classifying self-owned vs. other-owned items as old. These graphs illustrate both superior memory performance, i.e. the mere ownership effect, and faster response times for self-owned items.

This benefit in memory performance is what I mean whenever I use the term mere ownership effect (MOE) without qualification in the remainder of this text. In contexts where it is important to distinguish this phenomenon from the tendency to rate self-owned items more positively described by (Beggan, 1992), which I will label the evaluative mere ownership effect (eMOE), I will refer to it as the mnemonic mere ownership effect (mMOE) specifically.

Since in the study by Cunningham et al. (2008), ownership was randomly assigned, it can be assumed that the self-assigned and other-assigned objects did not differ in how desirable they were to the participants. Furthermore, the MOE occurred regardless of whether it was the “owner” themselves or the other participant who had placed the object in the basket.[1] Thus, this memory advantage can be interpreted as a consequence of ownership, specifically, not of preference or performing an action.

The mMOE effect has since been replicated a number of times (van den Bos, Cunningham, Conway, & Turk, 2010; Cunningham et al., 2011; Turk, van Bussel, Waiter, & Macrae, 2011; Krigolson, Hassall, Balcom, & Turk, 2013; Sui & Humphreys, 2013). Thus, it seems a solid conclusion that imagined ownership of an item indeed enhances our memory for that item.

The conditions under which an MOE occurs are remarkably simple. The encoding task does not make strong cognitive demands of the participants. Rather, the ownership assignment is a straightforward binary classification task. The correct response is determined strictly by a color cue that is not a feature of the stimulus itself. In fact, any intrinsic properties of the material are task-irrelevant. Since the recognition test is not announced before retrieval, there is little incentive to make an effort to encode the material. Participants are not required to deliberate consciously on either the meaning or the attributes of the stimulus objects themselves, nor on the relation between the objects and their owner. Furthermore, the items are assigned randomly and item lists are balanced across participants, making it implausible that the difference has anything to do with the stimulus objects having a greater significance or special meaning for the participants prior to the experiment. Arguably, the significance of the stimulus objects is further reduced by the fictitious nature of ownership: Participants are aware that the stimulus objects will not actually pass into their possession. Not even the social situation needs to be realistic: The other person to whom the objects are assigned can be purely imaginary (van den Bos et al., 2010).

[1] It is somewhat surprising that the factor of who placed the object had no effect on memory in Cunningham et al. (2008), despite the typical finding that self-performed actions are remembered better than actions that we observe being performed by others (e.g., Zimmer, 2001).

Yet even under experimental conditions which serve to create only a rudimentary ownership[2] situation that lacks concreteness, choice, personal relevance, and realism, and using a task that does not call for any sort of effortful or sophisticated encoding effort, there is an MOE. The assignment of an item to the self is sufficient to produce a subsequent memory advantage: recognition memory performance for self-owned items is consistently superior to recognition memory performance for other-owned items.

These attributes seem to justify characterizing the MOE as a "mere" ownership effect, that is, a consequence of ownership, or assignment to the self, *per se*. At first glance, the phenomenon does not appear to be reducible to other more general mechanisms of memory encoding, at least not if those mechanisms involve a great deal of complexity and conscious deliberation. Rather, it appears to suggest that there is something qualitatively unique about the self. Some accounts view basic cognitive operations such as perception and affect, rather than more deliberate "higher order" cognition as most closely tied to the self (e.g., Northoff, 2015). Others have postulated that the self constitutes the central foundation for integrating different types of information and processing, enabling such higher-order cognition in the first place (Sui & Humphreys, 2015).

1.1.2 The supposed uniqueness of the self and the potential reducibility of the mere ownership effect

Krigolson et al. (2013) found that a fictitious gamble for a self-assigned item involved the fronto-medial reward system more strongly than gambling for an other-assigned item. Their results suggest that the mere act of linking a simple stimulus to the self produces processing advantages for this stimulus. In a similar vein, Sui, He, and Humphreys (2012) found a perceptual self-prioritization effect for newly learned associations between the self and arbitrary simple objects (e.g., a triangle) as compared to associations between others and simple objects. Since the pairing of self and object was completely arbitrary and did not require any elaboration on the meaning of the stimuli, it seems implausible that this effect was driven by more extensive cognitive processing of the kind which typically produces strong memory. While this view has been challenged (Sui & Humphreys,

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[2] What precisely constitutes the "minimal" character of an ownership situation is, of course, open to discussion. Different conceptual aspects and operationalizations might be taken into account when designing such a task. For example, the ownership situation is designed to be "minimal" in some senses of the word (e.g. no actual ownership, no choice, no self-knowledge needed). However, it cannot be called minimal in the sense of being implicit: Ownership is the task-relevant dimension at encoding, and this is clearly spelled out in the instructions. While participants do not need to think deeply about the self and retrieve specific information about their person, they are required to hold the self-other-distinction consciously in mind to perform the task.

2013), it remains possible that the MOE is simply a function of known mechanisms of long-term memory, making the self special in at best a quantitative sense. In fact, this is the favored explanation of a phenomenon which is strongly reminiscent of the MOE: the self-reference effect (SRE; Rogers, Kuiper, & Kirker, 1977; for a meta-analytical overview, see Symons & Johnson, 1997). The SRE is the finding that trait adjectives that were encoded with regard to whether or not they describe the participant tend to be remembered better than adjectives processed with regard to an alternative semantic task (e.g., “is synonymous with?”). The self-reference effect is commonly interpreted as an instance of “especially deep” encoding within a levels of processing framework (Craik & Lockhart, 1972). According to this theoretical framework, the strength of later memory traces depends on the type of operations performed on the stimulus material during encoding. It is assumed that certain forms of processing are “deeper” than others and therefore, result in better subsequent memory performance. For example, if a stimulus can be meaningfully connected to extant knowledge structures in long-term memory that contain abundant and readily accessible information, it will be more likely to be retrieved. This process of meaningfully linking new information to information already stored in long-term memory is known as semantic elaboration. In addition, memory performance is thought to be influenced by how well the to-be-learned material can be structured, that is, how easy it is to organize the encoding material into meaningful categories (Einstein & Hunt, 1980). According to this view, the advantage produced by a self-referential encoding task is simply due to the existence of a rich and easily available knowledge structure related to the self or to the meaningful organizational principle offered by the self (Klein & Kihlstrom, 1986; Klein & Loftus, 1988). This seems plausible, both on account of the self being a highly relevant and highly familiar concept about which we have accumulated extensive information over the course of our lives and on account of empirical evidence suggesting a role for both of these memory processes (Klein & Loftus, 1988; Symons & Johnson, 1997). It is possible that the MOE can be explained in a similar way and that mechanisms that play a part in producing the SRE also contribute to a phenomenon that likewise establishes an explicit connection between stimulus material and the self via task demands. Therefore, our main aim was to investigate whether the MOE is best accounted for in terms of such “deep” types of semantic processing (see Chapter 2.2).

1.1.3 Accessing the self: What kind of connection does the mere ownership effect need?

Apart from the question of the reducibility of the MOE to more general mechanisms of memory, there is another sense in which such an advantage might be "mere" or basic: Namely, in how implicit such a connection to the self can be and whether drawing a distinction of the self vs. the other is explicitly relevant to the encoding task and whether linking the stimulus objects to the self in a non-conceptual way can produce an MOE. For example, what if the connection to the self was purely incidental? Turk, Cunningham, and Macrae (2008) found that trait adjectives were more likely to be remembered when they had been presented in close proximity to a self- as compared to an other-relevant label, even though this dimension was not task-relevant. One interesting question is whether pairing stimulus objects with self- vs. other-related shapes in the perceptual matching paradigm (Sui et al., 2012) might produce an MOE.

1.2 Overview: Is the self special?

1.2.1 What is the self? The limits of this dissertation

While the construct of the self is a rich and controversial source of theory and debate in both psychology and philosophy of mind, a comprehensive discussion of this construct would be beyond the scope of this dissertation. For instance, the self need not necessarily be conceived as a "self-concept" or a knowledge structure which is predominantly accessed through conscious reflection. Rather, it has been suggested that the self is intimately connected to more basic cognitive functions, such as affect (Northoff, 2015). A self is always tied to – or, as some would say, constituted by – a physical body existing in a particular space and time. This body allows us to perceive and interact with the physical world while simultaneously giving us a clear sense of a boundary between what constitutes one's own self and what instead pertains to the outside world, however permeable and ill-defined this boundary may be in reality (Gallagher, 2000; Neisser, 1988). As early as 1890, James drew the distinction between "I" and "me". Here, "I" denotes a conception of the self as a subject, distinguishing it from the self as an object, or "me". The self-as-object, or "me", contains information about one's own person which can be verbally reported and is, at least in principle, accessible from a third-person perspective. As such, this self-as-concept might not be qualitatively different from any other concepts in memory. Kihlstrom, Beer, and Klein (2003) have argued precisely that, stating that the "*I* who knows the *me* is the same *I* who knows everything else" (p. 69) and that this "me" or self-concept only differs from other knowledge structures in a quantitative sense, that is, through a richer treasury of information and the fact that self-knowledge is more intimately familiar. On the other hand, "I" or the self as a subject pertains to an acting and perceiving self that is situated in, and interacting with, the physical world at a given place and time. A subject can be seen as uniquely and exclusively connected to its own actions and experiences. That is, another person can describe "me" as a terrific football player but "I" has to kick the ball and score. Further refining these conceptions of self , (Neisser, 1988) distinguished between an "ecological" and a "conceptual" self, among other facets. This conceptual distinction between different "selves" or facets of the self suggests that there are multiple empirical access routes when investigating self-memory advantages. It is plausible, that such "self-systems", even if distinct, interact closely with each other (Boyer, Robbins, & Jack, 2005). In the case of the SRE (Rogers et al., 1977), it seems obvious that task demands target the self-as-object: After all, the self-reference task means that explicit knowledge about the self has to be retrieved by participants. It is not clear, however, if this applies to the MOE to the same extent. Furthermore, even in the presence of such task demands, an involvement of other self-facets in producing self-memory effects cannot be ruled out.

However, while these different conceptions of self inform my research on the MOE, this does not mean that, on the ontological level, a clear answer can be given to the question of what "the self" truly is. There is nothing even approaching a consensus on what constitutes a self at the ontological level, or whether it is more apt to speak of multiple selves or, indeed, if there even is such a thing as a "self" and how it can be distinguished from other things (for further reading on these questions, see, for example, Whiton Calkins, 1930; Parfit, 1984; Dennett, 1991; Metzinger, 2009; Tauber, 2015; Gertler, 2015; Northoff, 2015). For practical purposes, I will eschew involvement in these philosophical discussions. Rather than committing to a specific definition of the self as authoritative, I pragmatically draw upon theoretical conceptions applicable to cognitive psychology, as well as on their empirical operationalizations, as needed. In the context of this research, I assume a shared understanding what is implied by the term "self". Furthermore, I draw a similarly pragmatic line for the psychological notion of a "self-concept". This construct has inspired decades of research in both cognitive and social psychology which cannot be adequately summarized here. Instead, this dissertation focuses on the MOE and its theoretical implications in the contexts of self-memory advantages more generally, and on the levels of processing framework as a tool for explaining these advantages.

1.2.2 The scope of this dissertation

The aim of this dissertation is to shed some light on how a link to the self can bring about self-memory advantages. Specifically, the link employed here is ownership[3], and the memory advantage in question is the MOE.

To this end, Chapter 2 provides a look at the theoretical questions and current state of empirical evidence motivating the research using the shopping paradigm presented in this dissertation. I will attempt to more closely dissect the MOE and improve understanding of both some of its boundary conditions and the mechanisms driving it. The question "is the self special?" (Gillihan & Farah, 2005) may serve as a theme connecting these inquiries. Broadly speaking, I am interested in whether or not self-referential processing can be viewed as an instance of more general cognitive processes that also underlie other memory phenomena, or whether it is more "special" than that. More precisely, the central topic of this work is the question of what it means for the MOE to be "mere" and whether the MOE constitutes evidence for a qualitatively unique cognitive status of the self or is, ultimately, reducible to more general mechanisms of memory.

Chapter 3 presents seven experiments using the shopping paradigm, and thus constitutes the main empirical section of this dissertation. There, I present research designed to address some of the questions outlined in the previous chapters. A total of seven experiments will be presented in detail. This is the main line of empirical research in this thesis and puts the MOE in the context of research of other self-memory-biases, most importantly the self-reference effect (Rogers et al., 1977; for a meta-analysis, see Symons & Johnson, 1997). To this end, I will detail and summarize research on and accounts of the SRE, most notably levels of processing (Craik & Lockhart, 1972). These theoretical considerations are the main motivations behind the pilot study and Experiments 1-6. However, side questions, such as viable and non-viable procedural details, or the role of a real social other, are also addressed. In the pilot experiment, we attempted to replicate both the MOE and test whether it extends to semantically meaningless stimuli, but failed to obtain any effect. After adjusting the parameters which we suspect were behind this initial null finding, we proceed to corroborate evidence for the MOE and to examine the boundary conditions

[3]However, Experiment 7 should be considered an exception to this.

under which the effect occurs. In Experiments 1 and 2, following the parameters of earlier shopping paradigm studies more closely, we replicated the basic finding of the MOE, using our version of the shopping paradigm introduced by Cunningham et al. (2008). We also show that the MOE seems to be independent of whether or not the social situation in the learning phase is real. In Experiment 3, we tested if the MOE would still occur when semantic processing was impeded by using meaningless stimuli. In Experiment 4, we employed a semantic matching task during retrieval to test whether semantic processing had taken place during encoding. In Experiment 5, we tested for the role of semantic processes in establishing the MOE by using a depth of processing manipulation. The MOE disappeared when the ownership assignment was combined with a semantic categorization task during encoding. In Experiment 6, we tested for the role of semantic organization in the MOE by investigating the occurrence of clustering in free recall after ownership assignment during encoding. Our results suggests that semantic processing, specifically semantic organization, is a driver of the MOE and thus, that the mechanisms underlying the SRE and the MOE are at least partially overlapping and not exclusive to self-referential encoding. The interpretation and implications of these results are more closely examined in the general discussion.

Furthermore, I will contrast the line of inquiry presented in Chapters 2 and 3 with findings and explanations of the seemingly more basic self-prioritization effect (Sui et al., 2012) which is discussed in Chapter 4. This effect is another observation demonstrating how performance in cognitive tasks appears to benefit from self-involvement. Like in the case of the SRE, it is worth asking whether the self-prioritization effect can be considered a relative of the MOE. Are these two phenomena elicited by the same experimental manipulations? Can they be assumed to be driven by shared mechanisms? The central question in this section pertains to the directness of the MOE: Here, I consider the possibility of an incidental, less conceptual connection to the self having similar cognitive impact as Cunningham et al.'s (2008) ownership manipulation. There already is some research that suggests this might be the case (Turk et al., 2008).

Chapter 5 reports a final experiment designed to address this question. In Experiment 7, we combined the presentation of visual objects with a perceptual matching task (Sui et al., 2012) which was followed by a recognition memory test. We did not obtain clear evidence that a non-conceptual or incidental connection to the self is sufficient to produce an MOE and conclude that the MOE is likely distinct from the perceptual self-prioritization effect.

Finally, in Chapter 6 and 7, I discuss the results of all eight experiments and their theoretical implications in depth, as well as consider limitations and open questions that could inform further research.

2 The mere ownership effect in context: self, memory and levels of processing

"In its widest possible sense, however, a man's self is the sum total of all that he can call his, not only his body and his psychic powers, but his clothes and his house, his wife and children, his ancestors and friends, his reputation and works, his lands and horses, and yacht and bank account. All these things give him the same emotions."

– William James (1890)

2.1 A brief overview of findings on the mere ownership effect and the shopping paradigm

As described in more detail in the introduction, Cunningham et al. (2008) found stronger recognition memory performance for objects that had been assigned to the self, as compared to objects that had been assigned to another, even in the absence of complex processing requirements or a special connection between the self and the object.

Since the seminal study by Cunningham et al. (2008) has established the mMOE, the phenomenon has been investigated more closely a number of times, using both computerized and non-computerized versions of the shopping paradigm. As mentioned in the introduction, the various replications of the MOE suggest that it is indeed a robust phenomenon (van den Bos et al., 2010; Cunningham et al., 2011; Turk, van Bussel, Waiter & Macrae, 2011; Krigolson et al., 2013; Sui & Humphreys, 2013).

Some studies on the MOE focus on specific populations. For example, Cunningham et al. (2013) demonstrated an MOE in children as young as four to six years old, in a live-version of the shopping paradigm that involved a pair of children sorting toys, rather than everyday objects. This method could be an alternative to classic self-reference tasks (Rogers et al., 1977) when investigating the development of self-referential processing, as the ownership task seems less challenging to children. Regardless of the early manifestation of this self-memory-bias, the MOE might not be a completely universal phenomenon: Sparks, Cunningham, and Kritikos (2016) investigated the MOE in both a Western and an Asian sample, using either strangers or a close other (the participant's mother or a close friend) as the "other" category. Using the standard shopping paradigm, an MOE occurred only among Western participants, whereas Asian participants did not perform differently for different owners. If the object had to be moved over the screen via arrow keys, Asians, too, exhibited an MOE, but only when the "self" was contrasted with the non-familiar other. For a close other, the pattern was reversed. The authors suggest that the more consistent MOE for Western participants might be due to an independent self-concept which allows a clear distinction between self and others, whereas the Asian participants might see themselves as more strongly interconnected with others, especially those with whom they are close (for a review on independent vs. interdependent self-concepts and the cultural differences thought to underpin these differences in self-concept, see Markus & Kitayama, 2010; for a critical perspective, see, e.g., Matsumoto, 1999).

As the original study (Cunningham et al., 2008) showed, the MOE was not modulated by whether participants actively placed the items in the basket of the respective owner, or whether they passively observed another participant do so, rendering an action-based explanation of the MOE implausible[4]. However, this does not necessarily mean that the MOE is independent of how an "owned" object relates to one's body and its location. For example, there appears to be a combined influence of action and physical proximity on the MOE. Truong, Chapman, Chisholm, Enns, and Handy (2016) investigated this by letting participants move pictures of the visual objects and by varying the position of the self- and other- target boxes between blocks, so that each type of object could either be placed near or further away from participant's body. The MOE was enhanced for objects that had to be placed close to the participant, but only if the pictorial objects were actively dragged over the surface of an interactive touchtable, as opposed to being assigned to their locations via a button press. This suggests that the MOE could be susceptible to non-conceptual influences relating to the body and its movements in space (e.g., Neisser, 1988).

The initial account by Cunningham et al. (2008) explains the MOE as the result of the formation of an associative link between the self and the stimulus object that has been assigned to it. In line with this view, source memory (i.e. "owned by me" vs. not owned by me") for self-assigned objects appears to be improved, meaning the participants are

[4]The study by Sparks et al. (2016) potentially offers a counterpoint to this, as the Asian participants only displayed an MOE when they actively moved the objects using an error key. However, there could be different explanations for this finding, such as differences in cognitive processing styles ("focal" vs. "holistic"; for a review see Kitayama and Uskul 2011), or a difference in prior familiarity for the objects between Westerners and Asians which might have been evened out by the higher demand for attention in the movement condition.

able to explicitly link the objects to themselves at retrieval (Cunningham et al., 2011; Kim & Johnson, 2015). Likewise compatible with this view is the earlier finding by van den Bos et al. (2010) that an MOE is present in “remember” but not “know” judgments (Tulving, 1985; Gardiner & Richardson-Klavehn, 2000). As participants are typically instructed to give a “remember” judgment only when they can retrieve information specific to the encoding episode, a remember/know-task can be construed as a broad version of a source memory test. Thus, it seems as though episodic memory contributes to the MOE. It seems plausible that self-owned items are remembered better due to an associative link between the object and the encoding context. Naturally, in this task, the self category is an important constituent of that context. In a similar vein, source memory for self-owned objects might be improved when the owner is used as the to-be-remembered source information (Cunningham et al., 2011). Two further findings are compatible with this notion. On the behavioral level, Turk et al. (2013) found that divided attention selectively impaired recognition memory for self-owned objects. When participants had to perform a second task (remembering a sequence of digits, or remembering the number of even digits in that sequence) in addition to the ownership assignment, no MOE was observed, in contrast to a single-task control condition. This was due to a drop in performance for the self-owned objects when attention was divided, while the secondary task did little to affect recognition memory for other-owned objects. This was true for overall recognition performance as well as for remember-judgments which have been found to reflect the MOE (van den Bos et al., 2010). These results corroborate an earlier finding by Turk et al. (2011), suggesting that self-ownership typically engages attentional resources that are not routinely allocated to the other-owned objects. This study combined electrophysiological measurements with a shopping paradigm: It was found that the P300, an ERP component typically associated with the engagement of attention (see, e.g., Polich, 2007) was amplified for self-assigned objects as compared to the other-assigned objects, after ownership was assigned. Since attention is thought to be necessary for the formation of episodic associations (Naveh-Benjamin, Guez, & Marom, 2003), but not for item memory, this fits well with the idea that such associations drive the MOE.

As mentioned in the introduction, a special prior relationship between an object and its owner was not required for an MOE – arbitrary assignment was sufficient (Cunningham et al., 2008; van den Bos et al., 2010). Nevertheless, there seems to be a distinct contribution of choice to the MOE when this factor is manipulated (Cloutier & Macrae, 2008; Cunningham et al., 2011). Cloutier and Macrae (2008) tested memory for trait adjectives that had been assigned to either participants themselves, or a partner they had been paired off with at the beginning of the learning phase. Furthermore, they varied whether or not an illusion of choice was elicited. In one condition, participants took turns drawing numbers from a bowl. Each number served as a stand-in for a trait adjective on a list which was then read out to them by the experimenter. In the condition without choice, pre-selected numbers were placed in front of each participant before the learning phase instead. In this set-up, there was an interaction between the factors of "self vs. other" and "choice": only when participants had selected the numbers themselves did a memory advantage emerge. Being made to feel like they had chosen the objects themselves, seemed to increase the memory advantage for self-assigned items. Cunningham et al. (2011) explored the effect of choice and ownership on memory, using the shopping paradigm. Choice was either manipulated in a straightforward manner, by either allowing the participants to pick one of two items while assigning the other to their fellow participant (Experiment 1)[5], or by manipulating illusion of choice in a manner similar to that of Cloutier and Macrae (2008), by selecting numbers from a grid that ostensibly stood in for the objects participants were about to "receive" (Experiment 2). They found that memory for self-owned objects was significantly improved when participants had been the ones to choose, while no such advantage emerged for the other-owned objects, both in recognition and source memory. Therefore choice, or the illusion thereof, seems to enhance the MOE. As the effect emerged even when participants did not know what the self-chosen objects were going to be, again, a particular relationship between the encoder and the encoded object does not appear necessary. Thus, it is implausible that "self-owned, self-chosen" items are *a priori* preferable or have greater overlap with extant long-term memories about the self. Rather, Cunningham et al. (2011) propose that owning a self-chosen item automatically elicits self-referential encoding processes, leading to greater elaboration of the object.

One area to which the research on the MOE can contribute concerns the alleged "specialness" of the self. The question here is, which, if any, known mechanisms the MOE can be reduced to. For example, episodic memory appears important in bringing about the MOE (Cunningham et al., 2011; van den Bos et al., 2010), as does focused attention (Turk et al., 2013). Furthermore, elaborative encoding has been proposed as a candidate mechanism behind the MOE (Cunningham et al., 2011). One potential theoretical explanation

[5]It is obvious that this method leads to a confound between choice and preference, allowing for alternative explanations that can only be ruled out when participants cannot pick the items directly.

for the MOE which will be discussed at length later on, and which is compatible with enhanced recollection and source memory, is depth of processing (Craik & Lockhart, 1972).

Challenging this account, Sui and Humphreys (2013) report a dissociation between memory effects that are driven by a connection to the self, and memory effects that are related to semantic and episodic memory more generally. In a neuropsychological case study, they describe an amnesic patient who showed impairments retrieving semantic knowledge, but who was still able to recall biographical events after suffering extensive lesions. This patient exhibited an MOE and an advantage of an encoding task that required assessing the self-descriptiveness of the material (self-reference task), but benefitted very little from semantic elaboration *per se*. This dissociation between a mere depth of processing manipulation and self-related encoding seems to suggest a functionally different role of the self. Of course, there are obvious limitations when trying to make inferences about general memory functions from a clinical single-case study. Nevertheless, this finding casts some doubt on the hypothesis that the MOE can be reduced to known memory processes such as elaboration. The dissociation reported by Sui and Humphreys (2013) is explained in terms of their own theoretical account (Sui et al., 2012), which posits that self-memory biases are qualitatively similar to the effects of reward, going so far as to speculate whether self-assignment is "inherently rewarding".

The shopping paradigm has been used in neuro-imaging studies, in order to identify key regions underlying ownership and self-referential processing. (Turk, van Bussel, Waiter & Macrae, 2011; Kim & Johnson, 2012; Kim & Johnson, 2015). Kim and Johnson (2012) posit that there is a network of brain regions underpinning associations between objects and the self, including the posterior portion of medial prefrontal cortex, the caudal portion of the anterior cingulate, parts of anterior inferior parietal cortex, the left insula, and the right superior temporal gyrus.

In line with the aforementioned idea that self-involvement is "inherently rewarding" (Sui et al., 2012), the assignment of an object to the self appears to heavily involve brain areas commonly associated with affective processing and, specifically, reward (de Greck et al., 2008; Enzi et al., 2009; Northoff & Hayes, 2011). Assignment of ownership to the self has been found to elicit activity in the medial prefrontal cortex (mPFC), areas commonly associated with these processes (Turk et al., 2011; Kim & Johnson, 2012; Krigolson et al., 2013; Kim & Johnson, 2015). In addition to greater mPFC activation for self-owned items, Kim and Johnson (2012) also found that mPFC activation was positively correlated with object preference as measured by a rating task, which suggests a role of affect in self-referential processing. Krigolson et al. (2013) investigated whether self-assignment made participants more sensitive to reward, using feedback error-related negativity, (fERN; Miltner, Braun, & Coles, 1997), an ERP component thought to be sensitive to gains and losses. Importantly, the fERN was assumed to be generated in the medial-frontal reward system. They employed a "gambling" task, where participants had to imagine winning prizes either for themselves or another person, as indicated by a color cue. They then had to pick one of four buttons, after which they were informed if they had "won" the object or not. When an object could be potentially self-owned, there was a marked difference in the fERN response, which was muted when participants gambled for the "other", suggesting that self-relevance is important for engaging in affective processing in the first place. Kim and Johnson (2015) looked at the potential neural underpinnings of the MOE both under normal conditions and under conditions of self-esteem threat. They concluded that different systems might be engaged under those different conditions. Threat to self-esteem was induced by telling participants that performance on the experimental task was indicative of their abilities, and by announcing that they would be ranked in comparison with their fellow students. In the absence of threat, the MOE was again associated with activity in regions that are generally considered important for affective processing, personal relevance, and reward, such as the medial prefrontal cortex, the anterior cingulate, and the insula. When participants self-esteem was threatened, however, the MOE was associated with activity in brain regions thought to reflect inhibitory cognitive control and regulation of negative emotions, such as the ventro- and dorsolateral PFC and the inferior and the middle frontal gyrus, suggesting that under threat, self-processing is more controlled and deliberate.

Of course, those affective processes are not incompatible with other mechanisms that have been proposed, such as increased attention and episodic binding, or more extensive elaboration, that have been surmised to contribute the MOE. At any rate, the shopping paradigm has both served as a new tool for investigating self-referential processing in general (Cunningham et al., 2013) and established the mnemonic MOE as an important observation in its own right, demonstrating that ownership can affect memory under remarkably simple conditions. The topic has proven a fruitful source of both behavioral and physiological research, as it has inspired studies investigating theoretically important aspects of memory performance in relation to the self (van den Bos et al., 2010; Turk et al., 2011; Sui & Humphreys, 2013; Turk et al., 2013), identifying factors that can modulate the MOE – such as the presence or absence of choice, cultural background or physical proximity (Cunningham et al., 2011; Sparks et al., 2016; Truong et al., 2016) - and found candidates for neural systems underpinning it (Kim & Johnson, 2015; Turk et al., 2011).

2.2 The mere ownership and other self-memory advantages: Finding a theoretical account

The MOE first demonstrated by Cunningham et al. (2008) is only one of a number of phenomena that show how an involvement of the self modulates memory. The notion of the self and its special status has motivated research in cognitive psychology for a long time. Since a great number of studies have highlighted the preeminent role of the self for human memory over the course of several decades, it is beyond the scope of the present dissertation to give a comprehensive summary of this research. Instead, I will examine the theoretical suggestion that the self as a cognitive representation in declarative memory is employed to structure and access information. For example, the concept of autobiographic memory (e.g. Conway, 2008) singles out a class of both episodic memories and general knowledge for its relevance to the self, thought to form a more or less coherent knowledge structure. In the context of theories on the structure of declarative memory and category representation, the notion of a self-schema has been employed to explain why self-relevant attributes receive processing advantages. In a by now classic study, Markus (1977) found that information related to participants' specific self-schema was more likely to be retained, implying that the self as a concept was successfully involved in encoding new information. In this regard, the most important finding for the purposes of this thesis is the so-called self-reference effect (SRE; Rogers et al., 1977), which I consider a close conceptual progenitor of the MOE. Close consideration will be given to the theoretical framework and the mechanisms that are typically proposed to account for it (Klein & Kihlstrom, 1986; Klein & Loftus, 1988; Symons & Johnson, 1997; Klein, 2012), namely levels of processing (Craik & Lockhart, 1972).

In this chapter, the MOE will be put into the context of these findings and theories. The central question of this thesis is whether the MOE can be explained in similar terms as these earlier findings on the SRE as well as which mechanisms, precisely, appear to be driving it.

2.2.1 The self-reference effect in memory

The SRE (Rogers et al., 1977; for a meta-analysis, see Symons & Johnson, 1997; for a review of conceptual issues, see Klein, 2012) is a classic finding that, on the face of it, bears a strong resemblance to the MOE. In brief, the SRE refers to the phenomenon that stimulus material which is processed in a self-referential manner during encoding is typically more likely to be remembered than material on which a different encoding task has been performed. The original study by Rogers et al. (1977) expanded on an earlier finding showing that memory performance varied greatly as a function of the type of encoding task (Craik & Lockhart, 1975). Participants were shown a list of trait adjectives and asked to process them in different ways. The encoding task could be simple and refer to perceptual characteristics of the learning material (such as whether or not it was spelled in all-capital-letters or, via a rhyming task, what the phonetic properties of the word are) or require participants to process the meaning of the word by making decisions about potential synonyms (semantic task). Generally speaking, a semantic encoding task, that is, a task where participants have to process the meaning of the stimulus in order to complete it successfully, leads to much higher memory performance in a subsequent recognition or recall task than does a task where participants only have to focus on perceptual features of the stimulus. For reasons that will become clear in the following, this previous finding is known as a depth-of-processing effect. Rogers et al. (1977) compared memory performance for the tasks previously employed by Craik and Lockhart (1975) to a self-reference task, in which participants had to decide whether or not a word was descriptive of themselves. Material that had been encoded in this self-referential manner was more likely to be remembered during a subsequent memory test than material for which participants had performed any of the other tasks (see Figure 3). When I speak of the SRE without qualification, I refer to the difference in memory performance between a self-descriptiveness task and a semantic task, specifically.

Rogers et al. (1977) attribute the effectiveness of the self-reference task to the existence of a “well-structured and powerful” self-schema. They suggest that the “self-referent decision activates the superordinate schema of self as well as the salient subschemata” (p. 686) which allow for especially effective encoding due to their aforementioned properties. In essence, they explain the SRE in terms of elaborative encoding. Since the original study, alternative accounts have been proposed. Most notably, organizational processing has been suggested to be driving the SRE (Klein & Kihlstrom, 1986). I discuss this idea extensively in Chapter 2.2.3.

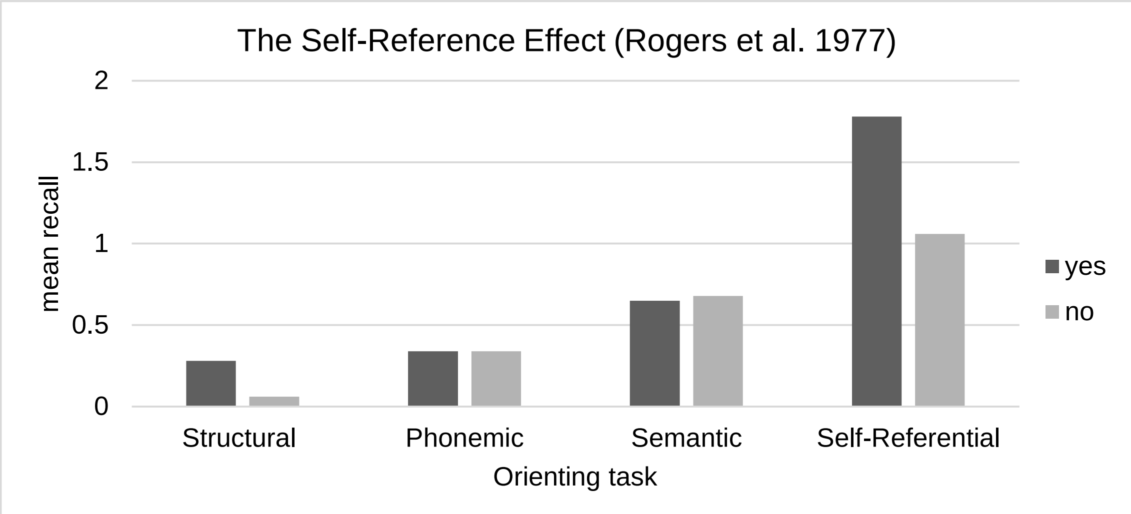

Figure 3. Graphic presentation of the original SRE reported by Rogers et al. (1977, Experiment 1). Mean recall is presented as a function of orienting task and type of judgment ("yes" or "no") made by participants. Recall performance is computed as the proportion of recalled items for each combinaton of task and judgment. Note that while the phonemic task produces an intermediate level of performance when compared to the semantic or structural task, it would be classified as "shallow" or "perceptual" in the context of this thesis. Adapted from Rogers et al. (1977).

The SRE has since been demonstrated to be a robust phenomenon and can be said to enjoy the status of a classic finding in memory psychology (e.g., Symons & Johnson, 1997; Klein, 2012). It has been meta-analytically confirmed that memory performance for self-referentially encoded items is consistently stronger than memory performance for semantic tasks. However, memory performance can also be enhanced by different manipulations that lead to similar to the performance levels. For example, the advantage for self-referential processing is smaller, when it is compared to a task where the material's descriptiveness for another person has to be judged, especially if the relationship between the participant and the to-be-referenced other is highly intimate. Furthermore, evaluative tasks or pleasantness ratings appear to produce performance levels that are comparable to those of self-referential encoding which has been attributed to an evaluative component being inherent to the self-reference task. Interestingly, tasks that ask participants to rate the self-descriptiveness of an item produce a larger SRE than do tasks that require participants to visually imagine themselves (Symons & Johnson, 1997). This could lend credence to the suggestion that the SRE is based on the self as an object or concept, and on explicitly accessing self-knowledge from long-term memory, rather than on the "I", or the self as an experiencing subject.[6] Importantly, and as discussed in detail below, comparison tasks that promote both semantic organization and elaboration lead to a smaller SRE, suggesting that the self facilitates both types of processing (Symons & Johnson, 1997).

Since a typical self-reference task requires conscious deliberation on the self, a view of the SRE as a conceptual phenomenon that is mediated by the self as a knowledge structure, seems to suggest itself. Nonetheless, it has been argued that this is too simplistic an approach to the self and its impact on memory: For instance, Klein (2012) suggests that, just like the "self" should not be viewed as a singular, coherent entity, but a multifaceted construct, the SRE should not be considered a single homogeneous phenomenon, but rather it should be assumed that there is a "family of related SREs that are influenced by a variety of variables and contexts" (p. 283). Furthermore, there is clinical evidence that suggests that an SRE can persist independently of impairments regarding conceptual processing (Sui & Humphreys, 2013). It seems likely that the SRE cannot be explained by a single well-specified cognitive operation, such as elaborative processing (Klein & Loftus, 1988; Symons & Johnson, 1997; Klein, 2012).

2.2.2 Levels of processing: A framework for research on self-memory effects?

Typically, the SRE is explained as a depth of processing phenomenon, within the levels of processing framework introduced by Craik and Lockhart (1972). This framework was proposed as an alternative to the prevailing modular theories of memory that postulate a set of distinct memory stores whose properties would then determine what happened to an encoded stimulus. Instead of these structures, or memory "stores", and on their number and properties, the focus became procedural: Encoding[7] operations are viewed as key to

[6]However, see, Symons and Johnson (1997), or Lord (1980) for an alternative interpretation of this finding.

[7]To a reader familiar with the theoretical discussions surrounding the levels of processing framework, it may appear peculiar that memory and memory strength are repeatedly discussed in the context of "encoding", and considered as functions thereof. After all, the concept of memory "encoding" itself is contentious, especially with proponents of levels of processing (e.g., Tulving, 2002). Indeed, Lockhart and Craik (1990) suggest that "there is no distinct process of memorizing that can take its place among other cognitive operations" (p.89). This follows from a core element of the levels of processing framework, the byproduct theory of memory. According to this view, there is no need to posit a process that is specifically responsible for the formation of the memory trace, except for the processes that are also required for the perception and comprehension of the study material. Instead, in the LoP framework the memory trace is conceived as simply a by-product of the processing operation required to perform the study task, thus removing the need for a specialized "encoding" process. However, I use a much more general definition of "encoding" than the one disputed by Lockhart and Craik (1990) and defended by Tulving (2002). Within the context of this dissertation, the term "encoding" simply refers to any and all cognitive processes that take place during the learning phase which subserve later stimulus retrieval,

predicting subsequent memory performance. Furthermore, the authors postulate no specialized mechanism for committing new information to memory. Rather, memory is viewed simply as a result of “online” processing of the presented information, such as perception, comprehension or categorization of study material (Lockhart & Craik, 1990). Later findings showing that some brain regions engaged in initial encoding become reactivated at retrieval, are in line with this view (Nyberg, 2002).

In essence, the levels of processing view states that the strength of a memory trace, and therefore, likelihood of successful retrieval depends on which operations are performed on the learning material during encoding. It is how we process a stimulus that largely determines the strength of its later memory trace. Importantly, processing operations are organized hierarchically: It is assumed that certain stages of processing precede later

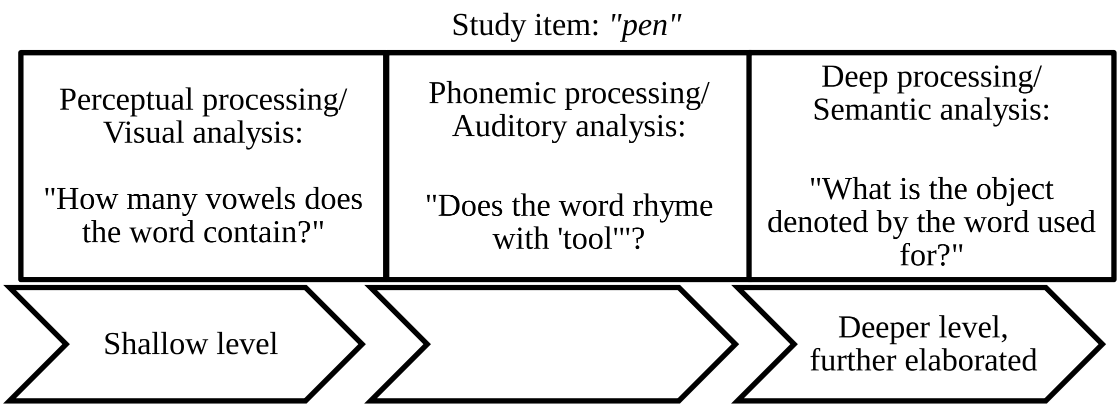

Figure 4. A graphic illustration of the levels-of-processing framework, showing different types of orienting tasks for a study item, adapted with minor changes from Ekuni et al. (2011, Figure 1, p. 334).

stages, and, crucially that some forms of processing are “deeper” than others and therefore, result in better subsequent memory performance. For example, sensory processing which can be classified as “shallow” is thought to occur early and relatively automatically, i.e. requiring few, if any, attentional resources (see Figure 4, for an illustration). In contrast, semantic analyses, a “deeper” form of processing, is more time-consuming and requires the allocation of substantial attentional resources. Furthermore, it is assumed that the products of such semantic, or “deeper”, analysis are more robust and longer-lasting than traces that result from sensory analysis or shallower processing (Craik & Lockhart,

without commitment to either theoretical view. It is not intended as either a positive or negative verdict on the byproduct theory of memory. Rather, in the context of this dissertation, “encoding” can be understood as synonymous with “learning” or “study”.

1972; Lockhart & Craik, 1990)[8]. In order to gather empirical support for their theoretical propositions, Craik and Lockhart (1975) compared memory performance for different encoding tasks in a series of experiments. These different encoding tasks could, for instance, require participants to judge either the letter case (structural task), the rhyming properties (phonetic task) or the meaning of the word, for example by being asked to find synonyms (semantic task). In line with the expectations derived from the levels of processing framework, a semantic task consistently produced the highest memory performance, with better retention rates than either the structural task, which was the weakest, or the rhyming task which produced an intermediary performance level. This so-called depth of processing effect has since been shown to be both robust and sizeable, with manipulations routinely employed in memory research (Nyberg, 2002; Ekuni, Vaz, & Bueno, 2011). A common explanation for why the semantic task is powerful in producing memory performance, is that it supports elaboration or "enrichment" of a to-be learned stimulus. This means that, after the stimulus is identified, associations may be formed based on participants' previous knowledge and experience, increasing the number of possible ways through which it can be accessed later on (Craik & Lockhart, 1972).

It is worth noting that while levels of processing has proven exceptionally fruitful for memory research, there are important limitations to consider. A number of substantial criticisms have been raised, especially regarding the tangibility and testability of this framework (e.g., Tulving, 2002; Ekuni et al., 2011) which both have been called into question. For example, it has been pointed out that an independent measure of the central concept of "processing depth" is missing which has led to charges of circularity. It is assumed that deep processing would lead to stronger memory performance, and in turn, deep processing is inferred from observing this performance. While Lockhart and Craik (1990) themselves point out that manipulating encoding tasks can work quite independently of measuring the memory performance that these tasks are supposed to affect, this still leaves open the question of what explanatory value is added by the statement that "deep processing" has or has not taken place. Indeed, Lockhart and Craik (1990) themselves have clarified that they did not intend "depth of processing" as a causal explanation for memory performance but rather as a placeholder for memory processes that needs to be disentangled and explained itself. What exactly constitutes "processing depth" is a

[8] However, it is important to note that sensory analysis, too, can lead to persistent memory under certain circumstances and the resulting traces appear to be more robust than initially assumed (Lockhart & Craik, 1990; Nyberg, 2002).

question deserving of its own research program. Depth was also never intended as a single continuous variable that can easily be measured along a single scale and that has a simple, linear relationship with memory performance. Rather, it should be seen as a result of the interplay between the cognitive processes involved in performing a certain task – processes that need to be carefully specified (Lockhart & Craik, 1990). Two such more clearly defined processes that could contribute to processing "depth" are elaboration and organization (Einstein & Hunt, 1980) which I will examine more closely in Chapter 2.2.3. It is worth mentioning that levels of processing is typically referred to as a "framework", rather than a "theory". Tulving (2002) suggests that the main distinguishing characteristics of a framework are that it is more general and less clearly defined than a theory. Indeed, it may be more apt to consider levels of processing as a lens through which memory and memory research can be viewed, rather than a set of interconnected and testable hypotheses. But as such, and if basic assumptions about the different kind of processing mechanisms are preliminarily accepted, it can be applied to a range of memory phenomena, including processing advantages due to an involvement of the self.

Returning to the SRE, within the levels of processing framework self-referential processing may be understood as an especially "deep" and elaborative form of encoding: Strong extant memory structures boost memory for and support retrieval of stimuli once they have become associated with the self. Since our knowledge on the self is abundant, strongly interconnected, well-structured and frequently accessed, the self-referential task boosts memory by integrating the material with these rich mnemonic structures. As this opens up multiple access routes upon retrieval, content which has been elaborated on in such a self-referential manner is more likely to be remembered. While semantic tasks are thought to produce high performance via this very same mechanism, it can be assumed that they achieve this in a rather less powerful manner. Self-referential information is typically connected to autobiographic and episodic memories, whereas semantic tasks typically require participants to "merely" access their world knowledge. In addition, it is reasonable to assume that we typically know a lot about ourselves, which is not necessarily the case for the knowledge we need to access in order to complete a semantic task, thus potentially leading to a greater interconnectedness of information that pertains to the self. Furthermore, the frequency with which we need to access self-related information might give this type of information higher "default" activation and thus, make it more readily available when we search our memories. Following this line of reasoning, the self-reference task can be seen as simply conferring a quantitative advantage over semantic tasks, without the need to posit any additional, qualitatively distinct, memory processes aiding the encoding and retrieval of self-referential information in particular. This is exactly what is implied by describing the SRE as a depth of processing phenomenon. The self-referential encoding task encourages a particularly large extent of elaboration, a process which the semantic depth of processing effect is likewise assumed to rely upon. In short, according to this interpretation of the SRE, the self-referential task simply constitutes an especially “deep” or “robust” form of processing.

2.2.3 Refining the concept of “deep” processing: Semantic elaboration and organization

The levels of processing framework has been expanded to incorporate a further type of operations that can be thought to constitute "deep" processing. Of particular importance to this thesis is the concept of semantic organization (Bellezza, Cheesman, & Reddy, 1977; Mandler, 2011). Seeking to integrate the organizational processing perspective with levels of processing, Einstein and Hunt (1980) proposed organization as a distinct subtype of the semantic processing operations that are of central importance to the framework. Organization can be juxtaposed with the concept of semantic elaboration which is integral to the initial conception of levels of processing. Einstein and Hunt conceptualize elaboration as a form of "item-specific" or “intra-item” processing. In this context, this means that encoding operations refer to the individual stimulus item itself, and to the links that can be formed between this item and extant information in long-term memory. For instance, one might think about, what one knows about an object, and what properties it has, what other objects there are like it, or about instances when one has encountered it before. Thus, associations are formed between the new stimulus material and content present in declarative long-term memory. "Organization", on the other hand, refers to what Einstein and Hunt (1980) term "inter-item processing". This means that associative connections are formed amongst the to-be-learned stimuli themselves. Those connections might, for instance, be based on items sharing properties (“both of these objects are typically red”) or category membership (“those are all tools”). They can either take the form of associations among the to-be-remembered items in a list, or of associations between a list item and a superordinate category to which it belongs.

If a task or a set of stimuli is conducive to organization, this means that some sort of structural template is provided[9] during encoding according to which stimuli can be grouped together, allowing participants to efficiently "organize" the learning materials in memory. It follows that, at retrieval, items of a given category, or the superordinate category itself, can function as memory cues for other items from that same category. Thus, successful retrieval of one such item increases the likelihood of successful retrieval of other items from the same category. In a free recall task this has implications for the structure of the output: It is to be expected that if an item is produced by a participant at retrieval, it is more likely to then be succeeded by an item with which it has been grouped together during encoding. In brief, this means that organization should affect recall more strongly than recognition performance, and that items of the same category can be expected to be reproduced alongside each other, that is to "cluster” together. Thus, such clustering can be seen as an indicator of organization in memory. Of course, this requires a retrieval task where participants control which item is produced at which point in time. A recognition task, for instance, would not permit testing for organization in this manner. There are several proposals for how clustering can be measured in a given recall output (see Appendix A).

Unlike in the case of organization, no predictions about the ordering of the output are made in the case of elaboration. Here, the expectation is merely that of a high overall memory performance. Different orienting tasks are thought to selectively (or, at least, predominantly) support either elaboration or organization (see Table 1, for examples). Furthermore, the composition of study lists contributes to whether or not organization is encouraged at encoding, for example by using items that belong to the same semantic categories, or to different ones.

Einstein and Hunt (1980) attempted to distinguish the contributions of elaboration and organization, as well as of semantic and non-semantic processing, to memory performance. To this end, they employed study lists that were composed of items that could be grouped into several semantic categories, such as animals or fruits (conceptual or semantic organization), or that could be grouped according to a shared a first letter (non-semantic organization). Both grouping tasks were thought to promote organization, albeit on a different “level” (i.e. non-semantic vs. semantic). In addition, Einstein and Hunt used encoding tasks thought to promote individual-item processing. These tasks were either a

[9] Or, indeed, discovered or created by participants. I would like to thank Dr. Nikolas Leichner for noting this point.

rhyming task or a pleasantness rating and thus could be assumed to differ with regards to their “processing depth”. Thus, they varied both the type (organizational, individual-item, or non) and the semantic “depth level” (semantic, non-semantic, or none) of the orienting tasks, resulting in nine potential encoding conditions during study. They obtained the highest memory performance when two semantic tasks were combined, i.e. when participants performed both elaboration and organization on a semantic level, suggesting distinct contributions of each. Furthermore, when a semantic category orienting task was used, the highest levels of clustering were observed.

Table 1. Examples of stimulus items and orienting questions thought to vary organizational processing independently of whether the task is semantic or self-referential (adapted from Klein & Kihlstrom, 1986).

Condition	Example question	Target Word
Semantic: Unorganized	Does this word fit the sentence? “The young woman had very fair___”	Skin
Self: Unorganized	Does this describe you? “I would stick my ___ out for a friend”	Neck
Semantic: Organized	Is this an external body part?	Heart
Self: Organized	Can you think of an incident in which you had an injury or illness associated with your ___?	Leg

Returning to the topic of memory and the self, Klein and Kihlstrom (1986) first tested the hypothesis that organization might be underlying the SRE. They found that a self-referential task produced greater clustering than a standard semantic task, suggesting that self-reference might foster organization more or less automatically. In a series of experiments, in which they attempted to vary the degree of organizational processing independently of whether the task was semantic or self-referential (see Table 1), they found only an advantageous effect of organization. From this, they concluded that organization, not elaboration, is chiefly responsible for the SRE. A later study, however, suggests a role for both mechanisms. Klein and Loftus (1988) varied whether study lists contained semantically related items and whether the orienting task was elaborative, organizational, or self-referential. They found that when list items were unrelated, the benefit of self-reference paralleled that of an organizational task, but when the list items were related, self-reference conveyed a similar benefit as the elaborative task, suggesting that the self might support both mechanisms. Thus, self-reference should confer a mnemonic benefit only to the extent that either (or both) of these components are not already present. Indeed, from later studies, it can be concluded that the self as a concept facilitates both organization and elaboration and that therefore, both contribute to the SRE (Klein & Loftus, 1988; Symons & Johnson, 1997): Typically, if a comparison task can be assumed to enhance either of these processes, the SRE is reduced, but not eliminated. It is thought that performance after a self-referential task is strong precisely because the self as a concept simultaneously supports both of these processes which then improve memory in combination with each other. While both processes can be facilitated by other tasks, it seems remarkable that the self appears to produce high memory performance, presumably via these processes, even if presentation and task conditions are conducive to neither (Klein, 2012).

2.2.4 Where does the mere ownership effect fit in with regards to levels of processing and the self-reference effect?

As mentioned above, the MOE and the SRE share an obvious resemblance: Both refer to improvements in memory performance that occur when a stimulus is explicitly linked to the self during encoding. At first glance, both appear to suggest that the self has a special cognitive status. This then raises the question whether those two phenomena can be accounted for in the same terms. The SRE is typically seen as a depth of processing phenomenon, with strong evidence that both semantic organization and elaboration contribute to the effect (Klein & Loftus, 1988; Symons & Johnson, 1997).

There are, of course, important differences between the SRE and the MOE: For example, the SRE is a difference between two encoding task and occurs regardless of whether or not an item has been described as self-descriptive or not. On the other hand, the MOE is a difference between two different response categories (self vs. non-self) in the same encoding task[10]. Crucially, the shopping task is much simpler than a standard self-reference task. In a self-reference task, participants are explicitly required to consciously think about the self and its relation to the stimuli, and then make their response based on their extant self-knowledge. In this sense, self-reference is studied under quasi-experimental conditions, with responses depending on participant characteristics. In the shopping paradigm, no such thought processes are required to perform the task successfully – the relationship between the stimulus and the self ("owned by me" vs. "not owned by me") is experimentally controlled in an arbitrary fashion and the correct response can be made based on a simple color cue. Therefore, it would seem that fewer conditions need to be met for an MOE to emerge than are typically present in a self-reference set-up.

Does this mean that the MOE is, unlike the SRE, not a product of elaborative processing? Does this mean that recourse to a rich and well-structured self-schema is unnecessary for the MOE? There is research that appears to highlight a role for the self which is more direct and less driven by concepts stored in declarative memory (e.g., Sui et al., 2012; Sui & Humphreys, 2013). As already mentioned, Sui and Humphreys (2013) report the case of an amnesic patient who did not exhibit a standard semantic depth of processing effect, but showed both an MOE and an SRE. So, it seems possible that self-involvement can confer a memory benefit that is distinct from any effects of "deep" semantic processing. Those results are worth mentioning here as they seem to suggest that there might be distinct mechanisms or modules that are specifically dedicated to the self, or self-related information, and that it might be extraneous to draw on complex semantic processes in order to explain self-memory-advantages.

Yet, in the case of both the MOE and the SRE, relating the stimulus material to the self during encoding translates into a benefit during the retrieval task. This raises the question if, and to what extent, those phenomena are brought about by the same overlapping processes. For example, is semantic processing a driver of the MOE, or is meaning inconsequential to the impact of ownership? If semantic processing does underlie the MOE, what

[10] In this context, it is important to note, however, that for the self-reference task, there appears to be an advantage for items that have been classified as self-descriptive as compared to items that have been classified as uncharacteristic for the participant (Rogers et al. (1977). Rogers et al. explain this as a consequence of the relative ease with which schema-consistent information can be integrated, that is, in terms of elaboration. This effect of judgment type ("yes" vs. "no") within the same task might be construed as paralleling the MOE.

exactly does it look like in terms of cognitive operations? Does ownership induce an integration of the owned object into extant memory structures about the self, helping it to become highly interconnected in long-term memory and thus, highly accessible? Does ownership support the grouping-together of owned objects as a well-defined category, subserving a distinction between the self and the world? In short, can the MOE, like the SRE be seen as a product of either, or both elaboration and organization? Or is it something else entirely, perhaps independent of such explicit conceptual processes? In order to address these questions, we conducted a series of seven experiments using the shopping paradigm.

3 Empirical research using the shopping paradigm

"My 'curious little scientist' brain was working through what seemed to be a particular pressing question: 'What happens when you stick a finger into a fan?' The answer, as it turned out, was that it hurts – a lot. At the age of 3, we intuitively know that to answer questions you need to collect data, even if it causes you pain." – Andy Field (2013)

3.1 Overview of experiments

This section consists of seven separate experiments, that is, a pilot study and Experiments 1-6. All seven experiments each employ a version of Cunningham et al.'s 2008 shopping paradigm and constitute the main line of research in this dissertation. These experiments focus on teasing apart the mnemonic processes underlying the MOE and on gaining a better understanding of the role of semantic processes in producing it. In the pilot experiment, we attempted to replicate both the MOE and test whether it extends to semantically meaningless stimuli. However, the pilot study did not produce any clearly interpretable results. It is included in this dissertation both for the sake of completeness, and because I believe it can offer valuable insight into the procedural aspects that need to be considered when designing an MOE experiment. Experiments 1-6 constitute the main line of inquiry in this work: After adjusting the parameters (which we suspect are behind the initial null finding), we proceeded to gather corroborating evidence for the robustness of the MOE, and to examine the boundary conditions under which the effect occurs. In Experiments 1 and 2, we used a version of the shopping paradigm that was more closely modeled on the initial shopping procedure introduced by Cunningham et al. (2008). We also investigated whether the social situation in the ownership task needs to be realistic, or whether an MOE would still occur when the other person was both imaginary and abstract. In both these Experiments, we replicated the basic finding of the MOE. In Experiment 3, we tested if the MOE would still occur when semantic processing was impeded by using meaningless stimuli. In Experiment 4, we were interested in whether assignment-to-the self prompts semantic elaboration processes. To this end, after completing the shopping task, participants performed a semantic matching task in addition to the memory test. Our rationale was that, if semantic processing for self-assigned items had taken place during encoding, this should result in participants retrieving the meaning of these stimuli with greater ease. In Experiment 5, we tested for the role of semantic processes in establishing the MOE using a depth of processing manipulation. Specifically, we were interested in the role of semantic organization and whether it is independent of the MOE. To this end, in Experiment 5, for each stimulus object, either a perceptual or conceptual classification task was combined with the shopping task. We reasoned that, if the MOE is due to the self being an effective organizing structure for the stimulus materials, offering another meaningful organizing scheme as an alternative to the ownership assignment would weaken the MOE. The MOE disappeared when the ownership assignment was combined with a semantic categorization task during encoding. In Experiment 6 we tested for the role of semantic organization in the MOE in a different way, namely by investigating the occurrence of clustering in a free recall task administered after the shopping task.

An overview of the pilot study and Experiments 1-6 including their respective aims is provided in Table 2. Experiments 1-6 of this section have already been published in a journal article (Englert &Wentura, 2016). Appendix C provides lists of the stimulus materials used, while the original instructions for the experiments can be found in Appendix D.

Table 2. A cursory overview of the experiments presented in this dissertation, the broad method that was used, and the questions they were intended to address.

Experiment	Method	Aim
Pilot study	shopping paradigm with meaningful and meaningless stimuli	Replicate MOE, investigate the role of semantic processing
Experiment 1	shopping paradigm with improved procedure and real social situation	Replicate MOE under maximally favorable conditions
Experiment 2	shopping paradigm with imaginary, abstract other	Corroborate robustness of MOE and test whether it extends to “minimal” social conditions
Experiment 3	shopping paradigm with semantically meaningless pseudo-objects	Is semantic “processability” as a boundary condition of the MOE?

Experiment 4	shopping paradigm followed by semantic matching task during test phase	Is the MOE due to semantic elaboration? Test for aftereffects of elaboration at retrieval
Experiment 5	shopping paradigm combined with depth of processing manipulation	Is the MOE due to semantic organization? Is the MOE independent of the “depth” of an additional encoding task?
Experiment 6	shopping paradigm followed by free recall , clustering as dependent measure	Is the MOE due to semantic organization? Are self-assigned stimuli disproportionately grouped together in memory?

3.2 Pilot study

The goal of the pilot study was to conceptually replicate the MOE using an adaptation of the shopping paradigm. Since a test of the role of semantic processability was intended in this first experiment, both meaningful and meaningless objects were used, in order to allow for a direct comparison of MOEs for the respective classes of items. This required a slight modification of the original shopping paradigm: Rather than imagining that they or a fellow player owned the respective objects themselves, participants were instructed to imagine that they had been dealt a stack of playing cards on which the visual stimuli were shown. A further difference between the original study by Cunningham et al. (2008) and our pilot study was that no verbal labels were used, as they were not applicable to the semantically meaningless items.

3.2.1 Method

Participants. Forty-three students of Saarland University (28 female, 15 male, aged 18-32, median age = 22) took part in the pilot study. They were compensated with a payment of six Euros.

Design. We used a within-subjects design with self- versus other-assigned items as the sole factor. Three item lists were assigned as self, other, and unstudied list (for the recognition phase) according to a Latin square design.

Materials. Seventy-five meaningful pictorial objects and 75 meaningless pseudo-objects (Zimmer, 2012) were chosen and divided into three lists containing 50 pictures (25 meaningful, 25 meaningless) each. In a counter-balanced design, each of the stimulus set lists served as a self-assigned, other-assigned, or new stimulus set (for the recognition task). For a list of the stimuli used in the pilot study, see Appendix C1.

Procedure. Participants performed the task separately on a computer in a closed cubicle. Before the study phase, participants were instructed to imagine that they were taking part in a card game. One stack of cards (either the red or the blue stack) would be designated as their own, whereas the other stack of the same size belonged to their fellow player. They were told that their task would be to sort the cards correctly according to who they belonged to. As there is some indication that an illusion of choice increases memory for self-chosen items (Cunningham et al., 2011), participants were asked to indicate via mouse click whether they would like the red stack or the blue stack for themselves. They were always assigned their preferred color, however, this did not affect which items were assigned to them and the "fellow player", respectively.

The study phase consisted of 100 trials. Each participant sorted through 50 meaningful and 50 meaningless stimuli. Half of each type of stimulus belonged to the participant themselves whereas the other half belonged to their fellow player. At the beginning of each trial, a fixation cross was presented for 250ms at the center of the screen. After that, a picture of a "card" was presented in the same place. Each card consisted of one of the pictorial objects which was surrounded by either a red or a blue frame, indicating its owner. This frame appeared and disappeared concurrently with the pictorial object. After 2000ms, the "card" was replaced by a picture depicting a red and a blue stack of cards. Participants were asked to indicate via button press whether the card belonged on their own or the fellow player's stack, that is, whether it belonged on the red or the blue stack. An example of a shopping trial for the pilot study is shown in Figure 5.

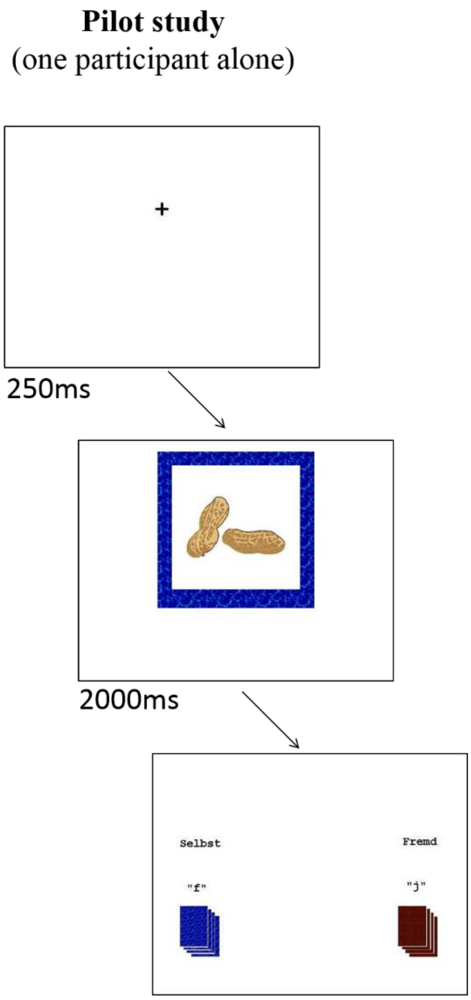

Figure 6. An illustration of the trial procedure used in our version of the shopping paradigm during the encoding phase of the pilot study.

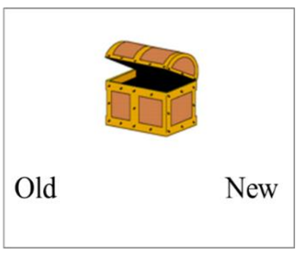

Figure 5. An illustration of the recognition memory task used in the pilots study, as well as Experiments 1, 2, 3, 5, and 7.

After the sorting phase was completed, participants were asked to perform a surprise recognition test. All items from the study phase as well as an additional 50 (25 meaningful, 25 meaningless) not previously encountered items were included in the test phase. At the beginning of each trial, a picture was presented at the center of the screen. Participants had to indicate per button press whether the picture was "old" or "new", that is, whether the picture had been presented in the study phase irrespective of whether it was self-assigned or other-assigned (see Figure 6, for an illustration). If a "new" response was made, the next trial started immediately. If an "old"-response was made, the recognition test was followed by a Remember/Know/Guess (RKG) procedure following the recommendations by (Gardiner, Richardson-Klavehn, & Ramponi, 1997; see also Gardiner, Kaminska, Dixon, & Java, 1996). Participants were asked to gauge the experience underlying their decision (Tulving, 1985; for a review, see Gardiner & Richardson-Klavehn, 2000). They were instructed to select the "remember" option if they could recall the specific encoding episode, to select "know" if they remembered that an item had been presented but could not retrieve any specific details about the episode, and to select "guess" if they had merely guessed when selecting the "old" option. This procedure was included to investigate whether the findings of van den Bos et al. (2010), who used this procedure as well, could be replicated. Since in the present study, we could not replicate the MOE to begin with, the results of the RKG procedure in the pilot study will not be discussed.

3.2.2 Results

Unless otherwise noted, all effects referred to as statistically significant throughout this dissertation are associated with *p*-values of <.05, two-tailed.

Recognition memory. Mean hit rates for self-assigned and other-assigned items as well as false alarm rates for new items are shown in Appendix B. *Pr*-scores (Snodgrass & Corwin, 1988) were computed by subtracting the false alarm rates for new items (i.e., items not presented during encoding) from the respective relative hit rates of meaningful and meaningless self-assigned and other-assigned items (see Figure 7). Overall memory performance as measured by *Pr* was significantly above chance, $t(42) = 12.34$, $p < .001$.

A two-factorial MANOVA for repeated measures with the factors owner (self vs. other) and item type (meaningful vs. meaningless) on the *Pr*-scores yielded a main effect of item type, $F(1,42) = 18.13$, $p < .01$, $\eta_p^2 = .30$, no main effect of owner $F(1,42) < 0.1$, $p = .97$ and no interaction between the two $F(1,42) =.19$, $p = .67$. Descriptively, memory performance for meaningful stimuli was better than memory performance for meaningless items. There was no main effect of owner and no interaction. Separate planned comparisons were computed testing the respective MOEs for the meaningful and the meaningless items. The difference between the recognition performance for the self-assigned items and the other-assigned items was not significant, for either the meaningful or the meaningless objects, with an MOE of near zero in each case, $t(42) = .33$, $p = .74$, and $t(42) = .31$, $p = .76$, respectively.

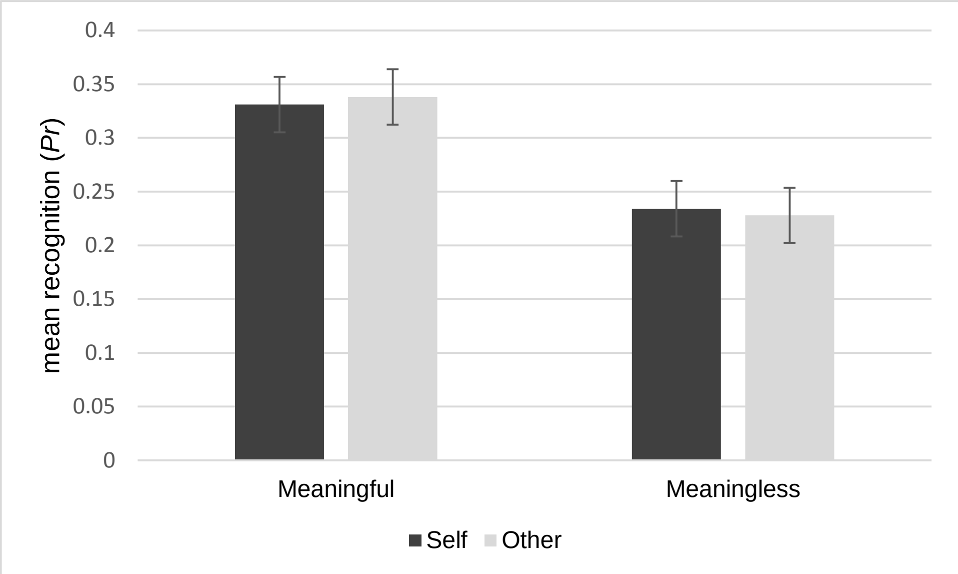

Figure 7. Mean recognition performances for self- vs. other-assigned meaningful and meaningless items in the pilot study . The *Pr*-score is computed as the difference between relative hit rate and relative false alarm rate. Error bars indicate 95%-confidence intervals for dependent measures according to Jarmasz & Hollands (2009).

Remember/Know/Guess Procedure. Since we already failed to obtain an MOE in the recognition memory performance, this renders further investigation of potential noetic states connected to the MOE obsolete. Therefore, the results of the remember/know/guess procedure are not reported here.

3.2.3 Discussion

Intending to create a conceptual replication of the shopping paradigm (Cunningham et al., 2008), we failed to obtain an MOE in this first study for both the meaningful and the meaningless items. While this result, when viewed in isolation, might suggest that the MOE is not, in fact, a robust phenomenon, there are several potential methodological causes that might explain this failure to replicate. Thus, it seems necessary to compare the parameters of our experiment to those used in other studies using the shopping paradigm. The most glaring difference appears to be the absence of a real social other. In the initial study by Cunningham et al. (2008), the role of the person being awarded the other half of the gifts was filled by another participant. In later studies (e.g. Krigolson et al., 2013), that role was filled by the experimenter whom participants had just met and who was either present in the room or nearby. In two studies I am aware of in which that was not the case (Turk et al., 2013; van den Bos et al., 2010), the imaginary other person was at least given a name (“John”). This arguably made them more tangible and therefore, the social situation more “real”. In our experiment, the other was simply introduced as a maximally abstract fellow player and neither present in the room, nor made more concrete by using a name or giving any other kind of information. While at first glance it seems plausible that a realistic social situation is a crucial facet of the mere ownership paradigm, this cannot account for our failure to obtain an MOE, since the presence or concreteness of a social other had no impact on the MOEs that we found in Experiments 1 and 2. Another possibility concerns the role of verbal labels: Given our hypothesis about the role of semantic processing it is possible that the absence of labels in the pilot study reduced any potential MOE.

3.3 Experiment 1: replicating the mere ownership effect by staying “true” to the initial shopping paradigm

After failure to obtain an MOE in the pilot study, Experiment 1 was modeled more closely on the parameters of previous mere ownership experiments. The goal of Experiment 1 was to provide a solid background for the subsequent shopping paradigm experiments. The aim was to create maximally favorable conditions for the MOE and to recreate key features of the experimental set-up employed by Cunningham et al. (2008). With Experiment 1 we replicate the mere ownership effect given standard conditions. That is, the “other” to whom one half of stimuli was assigned was a real person. Typically, participants are instructed to view a specific person as the “other”, for example, the experimenter, another participant, or a person they know. The presence of another person might make the social categories more salient and, thus, facilitate associations between the self and the stimuli. Therefore, with Experiment 1 we aimed to replicate the mere ownership effect under maximally favorable conditions.

3.3.1 Method

Participants. Thirty-eight students of Saarland University (33 female, 5 male, aged 18-39, median age = 23) took part in Experiment 1. They were compensated with a payment of six Euros.

In order to determine an appropriate sample size, an *a priori* power calculation was computed using the G.Power tool (Faul, Erdfelder, Lang, & Buchner, 2007). The MOE effect in the study by Cunningham et al. (2008) was d_Z = 0.53, which corresponds roughly to what Cohen (1988) termed a medium-sized effect (d_Z = 0.50). To detect an effect of d_Z = 0.53 with α = .05 and power 1-β = .80, N = 30 participants are needed. (Factual power with n=38 was 1-β=.89).

Design. We used a within-subjects design with self- versus other-assigned items as the sole factor. Three item lists were assigned as self, other, and unstudied list (for the recognition phase) according to a Latin square design. Player color (red vs. blue), player number (player 1 vs. 2) and player's own side (right vs. left) were varied systematically but are not of theoretical interest and will not be discussed further.

Materials. One-hundred-fifty pictorial objects (Zimmer, 2012) were chosen and divided into three lists containing 50 pictures each. The objects were chosen in such a way that each could reasonably be a possession of the participant (see Appendix C2 for a list). Thus, in Experiment 1, we used only semantically meaningful stimulus items. In a counter-balanced design, each of the stimulus lists served as a self-assigned, other-assigned, or new stimulus set (for the recognition task).

Procedure. For each session two participants were teamed up and were each handed a cardboard sign that labeled them either as "player one" or as "player two". They were then seated opposite each other, each at a different computer. The computer screens were positioned in such a way that participants were facing each other and that each participant could only see their own computer screen. On each team, one player was assigned the color red while the other player was assigned the color blue. While participants believed they both worked through the same set of materials, they were instructed not to communicate during the task which each participant worked through separately. Before the study phase, participants were instructed to imagine that they had won half the objects that were about to be presented to them in a raffle, while their fellow player had won the other half of objects.

The study phase consisted of 100 trials. To rule out primacy effects for the experimental materials, and to familiarize participants with the study task, there was for each participant an additional set of six practice trials, using items that did not appear in the subsequent memory test. To rule out recency effects for the experimental materials, the study trials were followed by six trials using items which, again, were not used in the test phase.

At the beginning of each trial, a fixation cross was presented slightly above the center of the screen for 250 ms. Then, an object was presented in the same place. Below the picture, a written label was shown, denoting the object. In the right- and left-bottom corner of the screen, pictures of two boxes were presented, representing the participant's own and the fellow player's box, respectively. After 1500 ms, either a blue or a red frame appeared

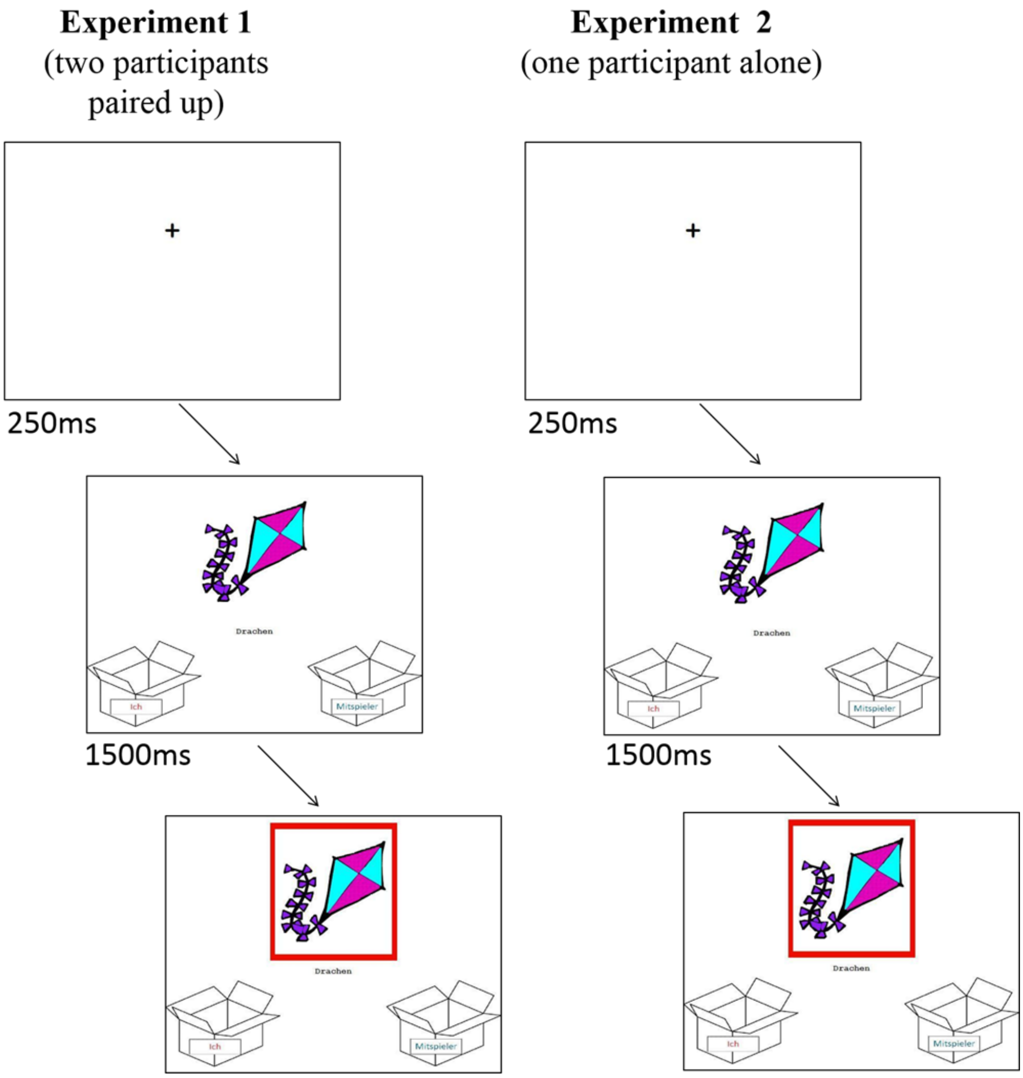

Figure 8. An illustration of a shopping trial in the encoding phases of Experiment 1 and Experiment 2. The trial procedure employed in Experiment 2 is the standard we adopted for further experiments using the shopping paradigm.

around the object, indicating ownership. Depending on the color of the frame, participants had to click either on their own or their fellow players' box. After a response was made, the next trial started. Participants worked through 50 self- and 50 other-assigned objects in randomized order. An example of a shopping trial is shown in Figure 8.

After the sorting phase was completed, participants were asked to perform a surprise recognition test. All items from the study phase as well as additional 50 not previously encountered items were included in the test phase. At the beginning of each trial, a picture was presented at the center of the screen, this time without a verbal label. Participants had to indicate per button press whether the picture was “old” or “new”, that is, whether the picture had been presented in the study phase (irrespective of whether it was self-assigned or other-assigned). If a “new” response was made, the next trial started immediately. If an “old”-response was made, the recognition test was followed by a Remember/Know/Guess (RKG) procedure following the recommendations by (Gardiner et al., 1997; see also Gardiner et al., 1996). This procedure was included as a second attempt to replicate the finding by van den Bos et al. (2010) and was identical to the RKG procedure we used in the pilot study.

3.3.2 Results

Recognition memory. Mean hit rates for self-assigned and other-assigned items as well as false alarm rates for new items are shown in Appendix B. As in the pilot study, *Pr*-scores (Snodgrass & Corwin, 1988) were computed by subtracting the false alarm rates for new items from the respective relative hit rates of the self-assigned and the other-assigned items (see Figure 9).[11] The difference between the recognition performance for the self-assigned items and the other-assigned items was significant, with better memory for the self-assigned than for the other-assigned items, $t(37) = 2.48$, $p = .018$, $d_z = .40$.

[11] Due to a slight ambiguity in the instructions of Experiment 1 (that was removed in the subsequent studies), nine participants consistently performed the sorting task with a reversed assignment, resulting in assigning own items seemingly to the fellow player and vice versa (that is, they had between 96 % and 100% "errors" during the sorting phase whereas the remainder of the sample had between 0 % and 2 % errors.) It is reasonable to assume that those participants reversed the response mapping but still consistently performed a self- versus other assignment task. Thus, for those participants the hit rates in the memory test were swapped accordingly. Note that excluding those participants from the analysis did not change the pattern of results.

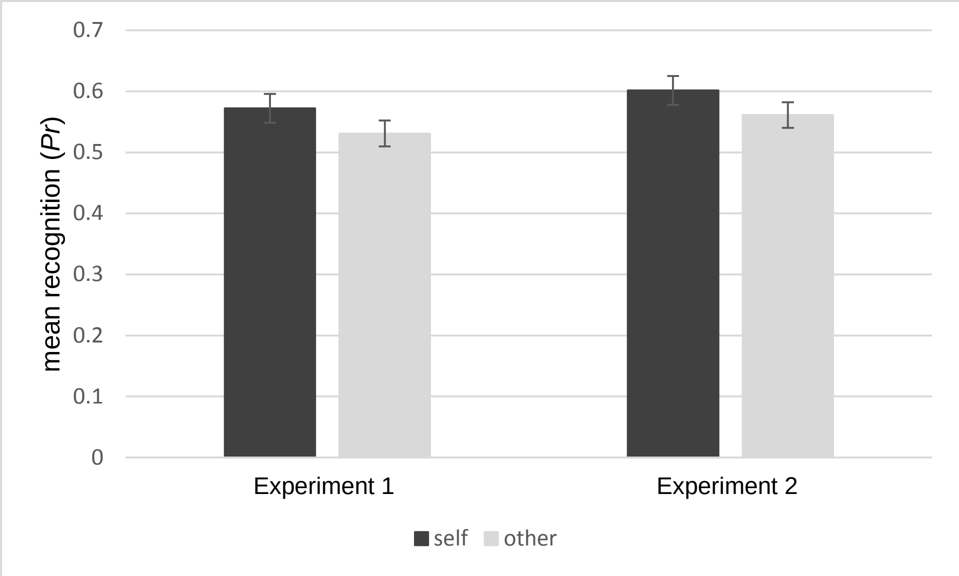

Figure 9. Mean recognition performances for self- vs other-assigned items in Experiments 1 and 2. The *Pr*-score is computed as the difference between relative hit rate and relative false alarm rate. Error bars indicate 95%-confidence intervals for dependent measures according to Jarmasz & Hollands (2009)

Remember/Know/Guess Procedure. In addition to recognition performance, we estimated the relative contributions of recollection and familiarity using the proportions of "remember", "know", and "guess" judgments for "old" answers. Mean proportions of "remember", "know" and "guess" judgments are shown in Table 3. We used the corrected hit rates for each judgment type by subtracting the false alarms from the hits for each (van den Bos et al., 2010). From those, relative estimates for the respective contributions of recollection and familiarity were computed according to the independent remember/know method (Yonelinas & Jacoby, 1995; Jacoby, Yonelinas, & Jennings, 1997). The proportion of "remember" judgments is used directly as an indicator of recollection, defining recollection as the corrected hit rate for "remember" judgments. However, familiarity cannot be estimated in the same straightforward manner: Rather, it is assumed that the proportion of "know" responses underestimates the contribution of familiarity. Since participants can be expected to select the "know" option only if they have no conscious recollection of the encoding episode, this inverse relationship between "remember" and "know" responses means that the assumption of process independence is violated if response proportions are taken as direct indicators of recollection and familiarity processes. Instead, familiarity is estimated as the ratio between the corrected hit rate for "know" judgments and the corrected hit rate for "old" responses that are not associated with a "remember" judgment.

Recollection estimates were significantly higher for self-assigned than for other-assigned items, $t(37) = 3.07$, $p = .004$, $d_z = .50$. There was no difference in familiarity estimates between self- and other-assigned items, $t(37) = .25$, $p = .80$.

Using a tangible social situation with a real and present "other" we were able to replicate the MOE found by Cunningham et al. (2008) as well as the finding that ownership affects recollection specifically (van den Bos et al., 2010). This is evidence both for the robustness of the phenomenon and its applicability to our own materials and procedure, as well as to a German-speaking sample.

Table 3. Mean proportion of "remember", "know" and "guess" judgments after "old" answers in Experiment 1. SD in parentheses.

Self-assigned			Other-assigned			False alarms		
Remember	Know	Guess	Remember	Know	Guess	Remember	Know	Guess
.64 (.21)	.29 (.18)	.07 (.10)	.58 (.24)	.34 (.20)	.08 (.09)	.14 (.24)	.43 (28)	.43 (.32)

3.3.3 **Discussion**

Using a tangible social situation with a real and present "other" we were able to replicate the MOE first described by Cunningham et al. (2008) as well as the finding that ownership affects recollection specifically (van den Bos et al., 2010). This is evidence both for the robustness of the phenomenon and its applicability to our own materials and procedure.

The contrast between this result and the lack of an MOE in the pilot study presumably also highlights the necessity of ensuring appropriate procedural parameters: Apparently, ensuring attention to the stimulus item and prevention of recoding into a non-ownership-related task are crucial for the occurrence of the MOE.

3.4 Experiment 2: Is there a mere ownership effect without a real social presence?

After replicating the mere ownership effect in Experiment 1, we wanted to extend the finding beyond real social situations. Typically, the "other" in a mere ownership set-up is a real person who is present in the experimental situation. Experiment 2 investigated whether the MOE would still be obtained if the social other with whom to contrast the self was maximally abstract and participants had minimal information about them. In the existing research, the social "other" is typically a real person that is either present in the laboratory (such as another participant or the experimenter) or somebody familiar to the participant.[12]

3.4.1 Method

Participants. Thirty-eight students of Saarland University (18 female, 20 male, aged 19-36, median age = 24) took part in the experiment. They were compensated with a payment of six Euros. Sample size was based on the same calculation as in Experiment 1.

Design, Materials and Procedure. The design, materials and procedure were the same as in Experiment 1, with the following exceptions: Rather than being teamed up in pairs at the beginning of the experiment, participants performed the task alone in a closed cubicle. Participants were not handed cardboard signs indicating their color or number. They were simply instructed to imagine that there was another person, referred to as "fellow player", who had won half of the items. The assignment of a color to each player was part of the written instructions provided on screen. An example of a shopping trial is shown in Figure 8.

3.4.2 Results

Recognition Memory. Mean hit rates for self-assigned and other-assigned items as well as false alarm rates for new items are shown in Appendix B. *Pr*-scores (Snodgrass & Corwin, 1988) were computed as in Experiment 1 (see Figure 9). The difference between the

[12]One exception to this rule is the study by van den Bos et al. (2010) where a fictitious "other" was used. However, it can be argued that this "other" was still rather concrete as he was given a name.

recognition performance for the self-assigned items and the other-assigned items was significant, with better memory for the self-assigned than for the other-assigned items, $t(37) = 2.77$, $p = .009$; $d_z = .45$.

Remember/Know/Guess Procedure. Mean proportions of "remember", "know" and "guess" judgments are shown in Table 4. Recollection and familiarity estimates were computed as in Experiment 1. Recollection estimates were significantly higher for self-assigned than for other-assigned items, $t(37) = 3.41$, $p = .002$, $d_z = .55$. There was no difference in familiarity estimates between self- and other-assigned items, $t(37) = .94$, $p = .351$.

Table 4. Mean proportion of "remember", "know" and "guess" judgments after "old" answers in Experiment 2. SD in parentheses.

Self-assigned			Other-assigned			False alarms		
Remember	Know	Guess	Remember	Know	Guess	Remember	Know	Guess
.64 (.20)	.30 (.18)	.05 (.07)	.58 (.21)	.35 (.20)	.06 (.10)	.08 (.13)	.52 (.35)	.39 (.36)

3.4.3 Discussion

Experiment 2 replicated the mere ownership effect both for old/new recognition judgments and for recollection/familiarity estimates under minimal social conditions, thereby demonstrating the effect to be independent of the presence of a real and concrete "other".

3.5 Experiment 3: Is there a mere ownership effect for semantically meaningless materials?

In a next step, we examined whether the MOE depends on using meaningful stimuli. Our rationale was that meaningless stimuli should be less likely to be processed semantically and thus, if the MOE is driven by semantic processing, it should be reduced or eliminated under these conditions. To this end, we presented participants with meaningless pseudo-objects, employing the same study and recognition task as in the previous experiments. Since we expected that the effect might disappear with meaningless stimuli, we took three measures to make a possible null result interpretable: (1) We recruited a larger sample than in Experiment 1 and 2 to have a power of 1-β = .95 to detect the smaller of the two effects that we have found in Experiments 1 and 2. Thus, a non-significant result will signal that if there is an MOE for meaningless pseudo-objects at all, it must be (with high certainty) at least smaller than those that we have found in the previous experiments. (2) To be prepared to find a more subtle, implicit variant of the MOE (i.e., a more positive evaluation for self-owned items compared to other-owned items; Beggan, 1992), we added a valence rating of objects to the procedure. (3) Since the procedure of Experiment 3 is identical to Experiment 2, we planned a cross-experiment comparison to see whether a possible null effect is significantly smaller in Experiment 3 compared to Experiment 2.

3.5.1 Method

Participants. Seventy-two students of Saarland University (51 female, 21 male, aged 18-31, median age = 23) took part in the experiment in exchange for a payment of six Euros.

The MOEs of Experiment 1 and 2 were d_Z = .40 (Exp. 1) and d_Z = .45 (Exp. 2), respectively. To detect an effect of d_Z = .40 with α = .05 (one-tailed) and power 1-β = .95, N = 70 participants are needed.

Materials. One-hundred-twenty colored pictures taken from Zimmer (2012) were used. To remove intrinsic meaning, these pictures had been created by merging and distorting pictures of real-life objects from the same database. Using a smaller number of items seemed appropriate because we expected poorer recognition performance for the meaningless stimuli (Wiseman & Neisser, 1974; Ameli, Courchesne, Lincoln, Kaufman, & Grillon, 1988) than for the previously used meaningful objects. In order to further reduce the resemblance with familiar objects, we further distorted some of the pictures using the GIMP 2.6 image editing software (The GIMP Team, 1997-2016; see Appendix C3 for a list of stimuli). As in the previous experiments, these 120 items were assigned to three equal-sized lists which, in a counter-balanced design, each functioned as self-assigned, other-assigned, and new items.

Design and Procedure. The design and the procedure for the study and the recognition phase were the same as in Experiment 2 with the following exceptions: Instead of being told that they won the depicted objects, participants were asked to imagine that they and their fellow player had won paintings from an art collection[13]. Since there was no *a priori* meaning to the pictorial stimuli presented, no labels were shown beneath the picture. After completing the recognition test for all stimuli, participants were also asked to rate the valence of the stimuli on a 9-point self-assessment manikin (SAM) scale (Lang, 1980; see Figure 10).

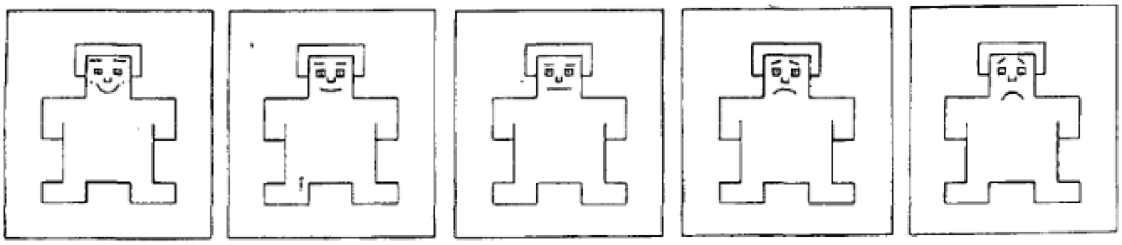

Figure 10. The self-assessment manikin (Lang, 1980) used in the valence rating tasks of Experiments 3 and 6. The scale additionally featured intermediate levels, marked by square boxes, between each pair of manikins, resulting in a 9-point scale.

3.5.2 Results

Memory performance. Mean hit rates for self-assigned and other-assigned items as well as false rates for new items are shown in Appendix B. *Pr*-scores were computed by subtracting the false alarm rates for new items from the respective relative hit rates of the self-assigned and the other-assigned items (see Figure 11). The difference between the recognition performance for the self-assigned items and the other-assigned items did not approach significance, $t(71) = .57$, $p = .285$ (one-tailed), $d_z = .01$. To provide further support for this conclusion, we calculated the Bayes factor using the Bayes-ANOVA module of JASP (Love et al., 2015). The Bayes factor in favor of the null model is $BF_{01} = 6.60$. According to the rules of thumb given by Raftery (1995), the value is considered “positive” evidence for the null hypothesis. This lack of an MOE cannot be attributed to a lack of memory in general, since both mean *Pr*-scores were significantly deviant from zero, $t(71) = 11.35$, $p < .001$, $d_z = 1.34$ for self-assigned items, $t(71) = 12.35$, $p < .001$, $d_z = 1.46$ for other-assigned items.

[13]As an anonymous reviewer for Englert and Wentura (2016) has pointed out, the framing as art does not completely remove the possibility of assigning meaning to the stimuli as “artwork” or “painting” are meaningful concepts. However, since this concept is applied to all stimuli equally, the stimulus objects cannot be individuated or discriminated on the basis of semantic content. Furthermore, the relatively poor memory performance we report in the results section suggests that participants did indeed not process the pictures semantically.

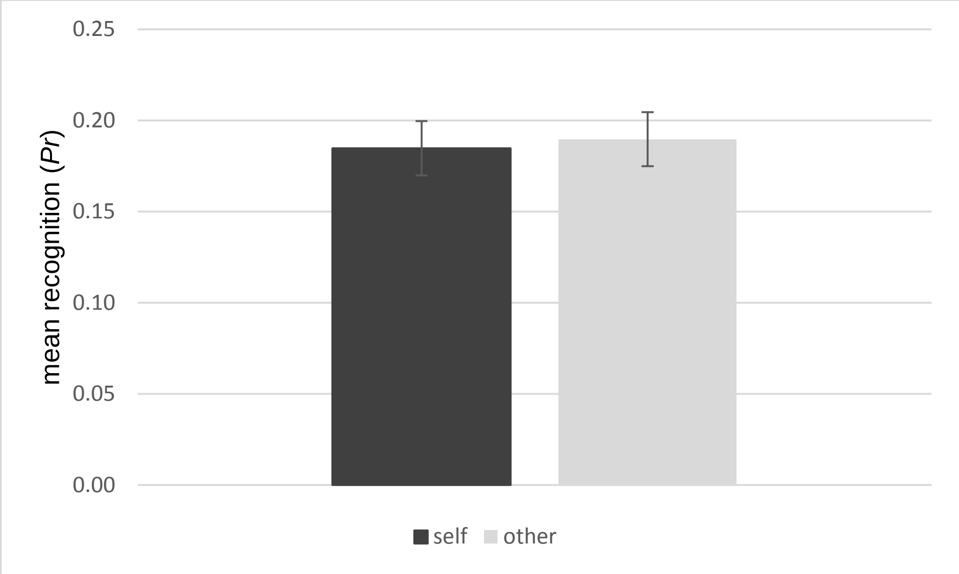

Figure 11. Mean recognition performances for self- vs other-assigned items in Experiment 3. The *Pr*-score is computed as the difference between relative hit rate and relative false alarm rate. Error bars indicated confidence intervals according to Jarmasz & Hollands (2009).

Remember/Know/Guess Procedure. Mean proportions of "remember", "know" and "guess" judgments are shown in Table 5. Recollection and familiarity estimates were computed as in Experiment 1. There were no differences between self-assigned and other-assigned items in either recollection or familiarity estimates, $t(71) = 1.41$, $p = .16$ and $t(71) = .64$, $p = .53$, respectively.

Table 5. Mean proportion of "remember", "know" and "guess" judgments after "old" answers in Experiment 3. SD in parentheses.

Self-assigned			Other-assigned			False alarms		
Remember	Know	Guess	Remember	Know	Guess	Remember	Know	Guess
.44	.46	.10	.44	.52	.04	.08	.64	.28
(.28)	(.23)	(.31)	(.29)	(.37)	(.49)	(.16)	(.32)	(.31)

Mere ownership effect across experiments. To compare the MOEs for meaningful and meaningless stimuli, the mean differences in memory performance between self- and other-assigned items, that is, the MOEs, for Experiment 2 and 3 were contrasted in an independent samples t-test. The MOE for meaningful objects (Experiment 2) was significantly larger than the MOE effect for meaningless objects (Experiment 3), $t(108) = 2.83$, $p < .01$, $d = .57$, see Figure 12.

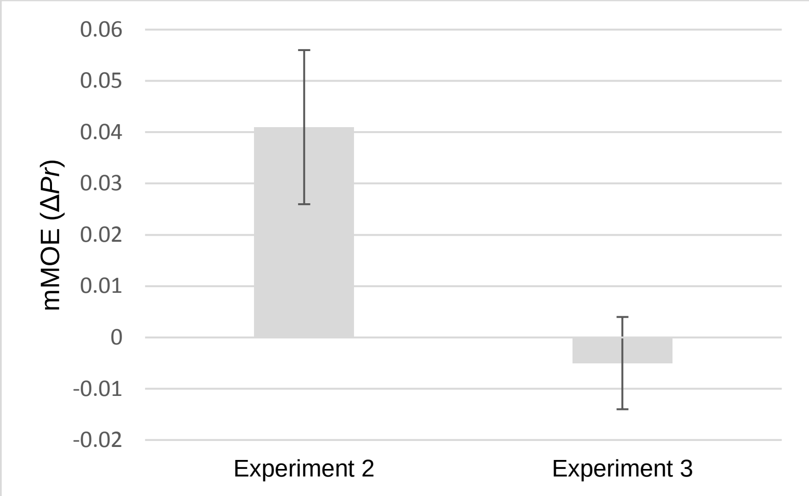

Figure 12. Mean mMOEs as computed by the difference in *Pr*-scores between the self- and other conditions for Experiments 2 and 3. Error bars indicate mean standard error.

Valence ratings. Valence ratings for self-assigned, other-assigned, and new items, respectively, were averaged to obtain a mean valence score for each condition (see Figure 13). A MANOVA for repeated measures revealed a main effect of item status (self-assigned, other-assigned, or new), $F(2,70) = 7.85$, $p = .001$, $\eta_p^2 = .10$. *A priori* Helmert contrasts revealed that valence ratings were significantly more negative for new items ($M = 4.65$, $SD = .64$) than for old items (i.e., self-assigned items, $M = 4.77$, $SD = .59$, and other-assigned items, $M = 4.80$, $SD = .59$, combined), $F(1,71) = 11.80$, $p = .001$, $\eta_p^2 = .14$. This finding replicates the well-known mere exposure effect (e.g., Zajonc, 2001) by demonstrating an influence of previous encoding on evaluation. However, there was no significant difference between self-assigned items and other-assigned items, $F < 1$. Hence, there was no MOE in either recognition performance or evaluation in Experiment 3.

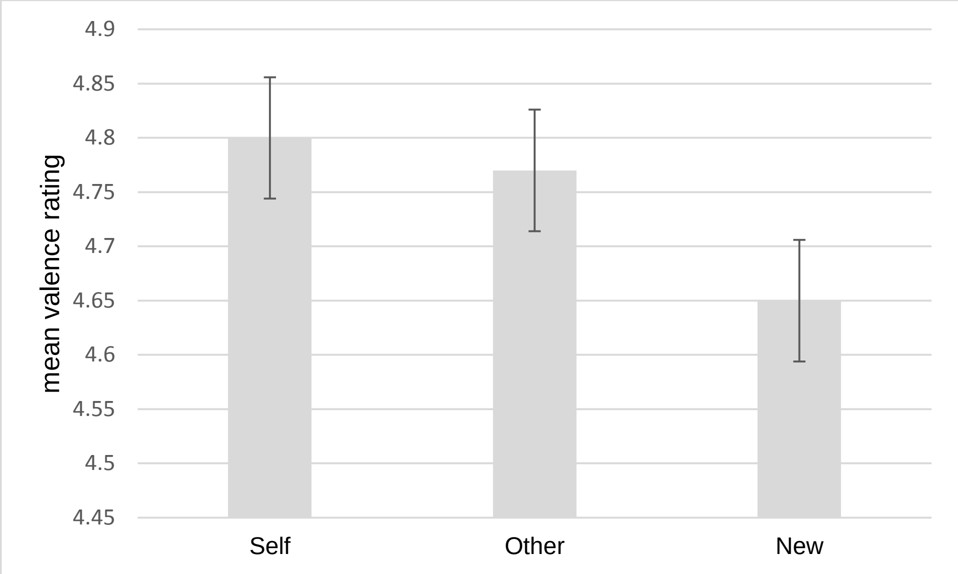

Figure 13. Mean valence ratings for self-assigned, other-assigned and new items in Experiment 3. Error bars indicate 95%-confidence intervals for dependent measures according to Jarmasz & Hollands (2009).

3.5.3 Discussion

In Experiment 3, with meaningless stimuli we clearly did not find a mere ownership effect. This was despite the fact that the power to find an effect comparable to the ones found in Experiments 1 and 2, was high ($1 - \beta = .95$). Furthermore, the effect in Experiment 2 was significantly larger than the one found in Experiment 3. Finally, although we replicated a mere exposure effect with our valence ratings, we did not find evidence for an implicit MOE in these ratings. Thus, our tentative conclusion is that the MOE is constrained to meaningful ("semantically processable") items; it does not appear to be based on a mere binding of semantically non-elaborated perceptual entities. However, there was one further difference between Experiment 2 and 3 beyond the variation of meaningful and meaningless stimuli: In Experiment 2, stimuli were accompanied by verbal labels in the encoding phase which were missing in Experiment 3.Therefore, to be on the safe side, with Experiment 4 we conceptually replicated Experiment 2, that is, we presented meaningful picture stimuli, but without a semantic label in the encoding phase now.

3.6 Experiment 4: Investigating the role of labels and the potential aftereffects of semantic elaboration

With Experiment 4, we conceptually replicate Experiment 2, that is, we presented meaningful pictorial stimuli, but this time, however, without a semantic label in the encoding phase. This arrangement allows us to add a further component to the experiment which might yield tentative evidence for the role of semantic processing during the encoding phase. If participants tend to spontaneously encode the items semantically, we might find evidence for this process later in the test phase. If semantic encoding occurred, then the meaning of the stimulus should be more readily available to participants.

Therefore, in the recognition test of Experiment 4, we employed a double task: First, stimuli were presented together with the matching label and participants had to quickly decide whether the pictured object and the label match. Then, immediately afterwards, the recognition task followed. Of course, non-matching trials were added to make the task meaningful. There are two different possible hypotheses associated with this task: First, the MOE might occur only under conditions of at least minimal semantic processing of items during encoding, that is, it might depend on semantic "processability". This hypothesis (the "weak hypothesis") means that – while replicating the MOE – we should find some evidence for semantic processing of objects presented in the encoding phase. More concretely, in this case matching responses to old items (i.e., both self-assigned *and* other-assigned items) should be faster than responses to new items. Second, the MOE itself might be mediated by semantic processing (the "strong hypothesis"). In this case, we should find a memory advantage of self-assigned items just because this assignment causes deeper semantic processing. Therefore, the meaning of self-assigned items should be more readily available than the meaning of other-assigned items. As a consequence, there should not only be a memory advantage for self-assigned items but matching responses for self-assigned items should also be faster than matching responses to other-assigned items.

3.6.1 **Method**

Participants. Forty-five students of Saarland University (31 female, 14 male, aged 18-31, median age = 23) took part in the experiment in exchange for a payment of six Euros. Data of a further participant were discarded because she performed at chance level (accuracy rate = .52) in the matching task.

The MOE of Experiment 1 and 2 were $d_Z = .40$ (Exp. 1) and $d_Z = .45$ (Exp. 2), respectively. To detect an effect of $d_Z = 0.40$ with $\alpha = .05$ (one-tailed) and power $1-\beta = .80$, N = 41 participants are needed.

Design. The self-, other-, and new-conditions followed the same design as Experiment 2. In the matching task, every item was presented twice, once in the matching and once in the non-matching condition. For each list, one half of items was presented in the matching condition in the first block and in the non-matching condition in the second block. The order of conditions in which each half of the items was presented first was varied as a between-subjects factor.

Materials. One-hundred-fifty pictures of real-life objects were selected from (Zimmer, 2012) and divided into three lists. The stimulus set was largely overlapping with the one used in Experiments 1 and 2; some objects, however, had to be replaced by objects that were more clearly nameable. One-hundred-fifty verbal labels naming objects that were not shown in the picture set were chosen for the non-matching trials in the semantic matching task. Labels were matched for word length and chosen from the same broad semantic categories as the depicted objects (e.g., “axe” and “rake”; see Appendix C4, for a list of stimulus pictures and their respective matching and mismatching labels).

Procedure. The study phase was identical to that of Experiment 3, that is, objects were presented without verbal labels. After the study phase, an old/new-recognition task was combined with a semantic matching task in which participants were asked to decide whether a written label correctly denoted the pictorial object. At the beginning of each trial, the instruction “Does the label match the picture? Keep ready.” appeared on screen. After 1200ms, it was replaced by a fixation cross which was shown for 600ms. Afterwards, a picture appeared in the same place with a verbal label beneath it, which could either correctly denote the pictured object or not. Participants were instructed to indicate via button press (“j” for “yes” and “f” for “no”) whether the pairing was correct or not. After that, a feedback slide was presented for 1000ms that contained either the word “correct” in blue font after a correct response or “incorrect” in red font after an incorrect response. If responding took longer than 1500 ms, a feedback slide was shown instead that said “unfortunately, you were too slow” in red font. The semantic matching task for any given item was always followed by a recognition test for that same item. First, the question “Did the picture already occur in the sorting phase?” appeared for 1000 ms on the center of the screen. Then, this question remained at the top of the screen while the same object as in the previous matching task was shown again at the center of the screen. Below the object were two boxes with a “no” and a “yes” respectively. Participants had to indicate per button press whether the item had already been presented in the study phase or not (“j” for “yes” and “f” for “no”). For an illustration of a trial during the test phase, see Figure 14.

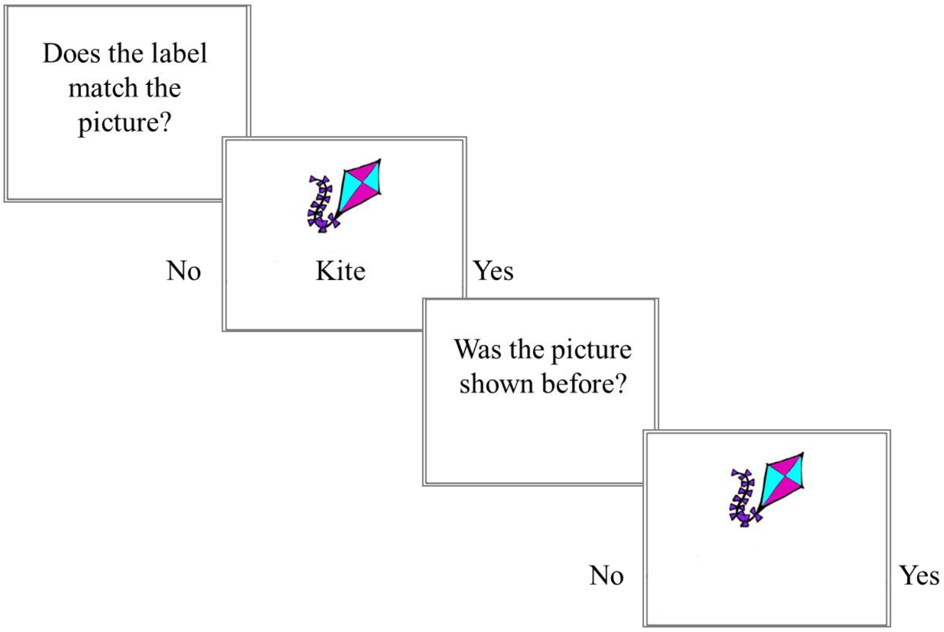

Figure 14. A graphic illustration of the semantic matching and recognition task employed in Experiment 4. In this example, a matching trial is shown.

In the first block of the test phase, participants worked through 150 trials containing each item once, with one half of the pictures combined with a correct label and the other half combined with an incorrect label. After that, participants worked through a second block of 150 trials in which the items previously paired to matching labels were now paired to non-matching labels and vice versa.

3.6.2 Results

In the following, we mainly focus on the matching trials. For the matching task itself, the response times for correct "no, non-matching" responses cannot be unequivocally interpreted since the label never referred to an old item and therefore the information provided by the pictures may be at odds with the information provided by the labels. Moreover, the recognition task that followed a non-matching trial might be negatively influenced since a wrong label might activate a competing object representation, making the question of whether the item is old or new ambiguous. Moreover, the rejection of a non-matching object-label might bias the subsequent recognition judgment. Nevertheless, we briefly report the results for the non-matching trials as well. Table 7 gives a more detailed report of the recognition data.

Matching trials. In order to test for an MOE, *Pr*-scores were computed by subtracting the false alarm rates for new items from the respective relative hit rates of the self-assigned and the other-assigned items (see Appendix B, for hit and false alarm rates, and Figure 15, for mean *Pr* values in the matching trials).

We employed a 2 (type of item: self-assigned vs. other-assigned) × 2 (block: first vs. second) ANOVA for repeated measures to account for the following fact: For half of the items (i.e., items of Block 1) the first recognition decision was used whereas for the other half of items (i.e., items of Block 2) the second recognition decision was employed (i.e., they were already tested once for recognition during the non-matching trials of Block 1). The analysis yielded a significant main effect of type of item (i.e., an MOE), $F(1,44) = 5.59$, $p = .023$, $\eta_p^2 = .11$, a significant main effect of block, $F(1,44) = 28.22$, $p < .001$, $\eta_p^2 = .62$ (*Pr*-scores were larger in the first block; see Table 7), but no interaction, $F(1,44) = 2.36$, $p = .132$, $\eta_p^2 = .05$.

For the analysis of the matching task, only reaction times for which a correct response was made were used in the analyses. Trials with reaction times below 318 ms and trials with reaction times above 1139 ms were excluded from the analyses using the Tukey criterion for outliers (Tukey, 1977). Mean correct reaction times and accuracy rates are shown in Table 6.

Table 6. Mean response times (in ms; accuracy in parentheses, in %) for self-assigned, other-assigned, and new items in Experiment 4.

	Old Items		
	Self-assigned	Other-assigned	New Items
Matching trials	700 (.88)	700 (.89)	709 (.89)
Non-matching trials	750 (.89)	751 (.90)	753 (.90)

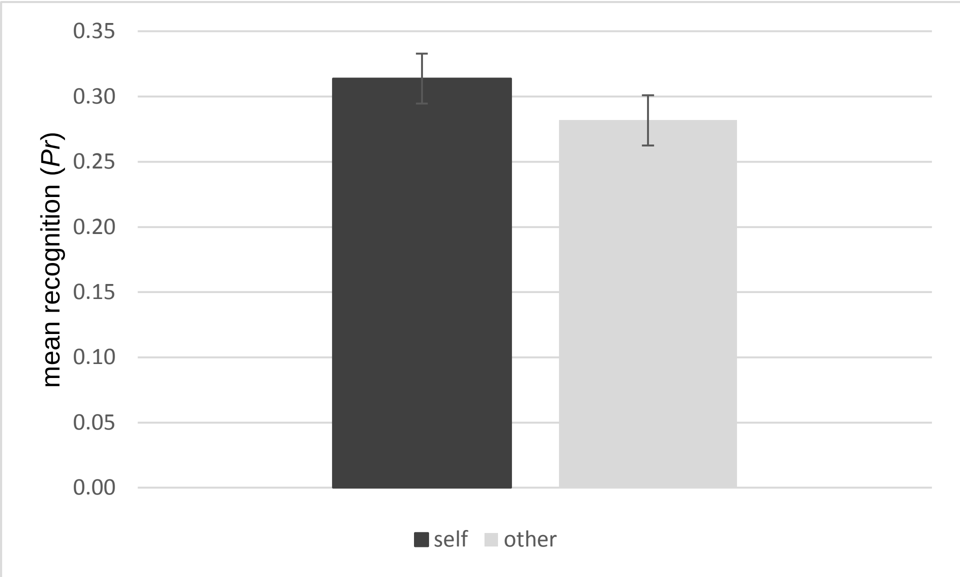

Figure 15. Mean recognition performances for self- vs other-assigned items in Experiment 4 (matching trials only). The *Pr*-score is computed as the difference between relative hit rate and relative false alarm rate. Error bars indicate 95%-confidence intervals for dependent measures according to Jarmasz & Hollands (2009).

A one-factorial (type of item: new vs. self-assigned vs. other-assigned) MANOVA for repeated measures on RTs yielded a main effect of item type that missed the conventional level of significance, $F(2,43) = 2.64$, $p = .08$, $\eta_p^2 = .11$. However, *a priori* Helmert contrasts (that correspond to the "weak" and "strong" hypotheses, see above) yielded clear-cut results: First, there was not the slightest response advantage for self-assigned over other-assigned items, $F < 1$ (Bayes factor in favor of the null model is BF01 = 6.19; i.e., "positive" evidence for the null according to Raftery, 1995). Thus, there was no evidence for the strong hypothesis. Second, responses to old items (i.e., items presented in the sorting phase as either self-assigned or other-assigned) were significantly faster than responses to new items, $F(1,44) = 5.34$, $p = .026$, $\eta_p^2 = .108$. For accuracy, there was no effect, $F < 1$.

Non-matching trials. In the non-matching trials, self-assigned items were associated with a nominally better recognition performance than other-assigned items ($M_S = .31$ vs. $M_O = .29$). However, the difference was not significant, $t(44) = .89$, $p = .381$, $d_z = .13$. For the matching task, there was neither a main effect for response times nor for accuracy, both $F < 1$.

Table 7. Mean *Pr*-scores for self- and other-assigned items by block for Experiment 4. SD in parentheses.

	Matching trials		Non-matching trials	
	Self-assigned	Other-assigned	Self-assigned	Other-assigned
Block 1	.36 (.21)	.35 (.17)	.37 (.18)	.34 (.17)
Block 2	.27 (.18)	22 (.17)	.25 (.19)	.24 (.17)

3.6.3 Discussion

In Experiment 4, we again found a recognition memory advantage for self-assigned objects over other-assigned objects, that is, an MOE, comparable to the effects in Experiment 1 and 2, albeit without presenting verbal labels in the encoding phase (as in Experiment 3). This result, combined with the findings of Experiments 1-3, corroborates our tentative conclusion that the MOE in recognition memory depends on the meaningfulness (i.e., semantic "processability") of the self- and other-assigned items. A second result indeed indicates the role of spontaneous semantic processing in the genesis of an MOE. If participants had spontaneously processed objects semantically during the sorting phase, they should be faster to verify matching object-label pairs in the matching task. Indeed, mean correct matching responses for objects that had appeared in the encoding phase were faster than responses for new objects. This result corroborates the view that objects were semantically processed during the study phase. Note that the result was specific for the matching trials when the label denoted the correct concept (i.e., it was not found for the non-matching trials). This detail makes it implausible that the response time advantage for old objects is due to a mere facilitation of perceptual processing (see, e.g., Tulving, 2000), which would have facilitated non-matching responses a well. With some caution, the result suggests that the mere ownership advantage seems to not be located at a purely perceptual level. This interpretation is corroborated by the fact that the MOE in Experiment 4 was clearly present only in matching trials, that is, in a retrieval context that provides item picture and label as a cue. The MOE dropped to a non-significant level if the item picture served as a cue in a conflicting semantic context. Although there are certainly arguments why recognition performance might be diminished if the recognition task is preceded by a non-matching object-label pair (e.g., the compound cue of object and wrong label might only create a weak familiarity signal, e.g., Ratcliff & McKoon, 1988), one might argue that an MOE located at a purely perceptual level should not have been influenced by the type of preceding matching trial. Interestingly, mean correct matching responses for self-assigned objects that had appeared in the study phase were clearly not faster than matching responses for other-assigned objects. This result is at odds with a view that semantic processing is the *mediator* between self- versus other-assignment and the memory effect: We have found no evidence to suggest that assignment to the self simply triggers (deeper) semantic elaboration, which is then the proximal cause of the memory advantage.

3.7 Experiment 5: Investigating the role of semantic organization using a depth of processing manipulation

The results of Experiment 3 and 4 suggest that the mere ownership effect in recognition memory depends on the meaningfulness (i.e., semantic "processability") of the self- and other-assigned items. Thus, it seems reasonable to surmise that the mere ownership effect is indeed driven by some form of semantic processing. If this is indeed the case, then forcing semantic encoding via task requirements should make the ownership assignment redundant with regards to how deeply a stimulus is processed and thus, reduce or eliminate the MOE.

On a theoretical level, semantic processing is by no means a homogeneous construct: Different types of encoding are postulated depending on task specifics and stimulus properties. Einstein and Hunt (1980) distinguish semantic elaboration from semantic organization (see also Chapter 2.2.3). The classical explanation posits that semantic elaboration typically drives depth of processing phenomena. Semantic elaboration can be thought of as a kind of "intra"-item processing and to rely predominantly on extant declarative memory: Elaboration takes place when an item is connected to other concepts in long-time memory. Since the self is itself an important and rich concept, that is frequently activated, information that gets connected to the self benefits from many and easily accessible associative connections that enhance subsequent memory for the item (Rogers et al., 1977).

An alternative hypothesis following from the older literature on the self-reference effect focuses on *organization* between study items instead of *item-specific elaboration* as the memory-enhancing mechanism (Klein & Kihlstrom, 1986; Klein & Loftus, 1988; Symons & Johnson, 1997). The basic idea behind this distinction is that encoding instructions might either lead to item-specific elaboration processes, independent from the remaining study items, or to an organization of the list items into meaningful categories (Einstein & Hunt, 1980). It is known that providing participants with a semantically meaningful organization principle (e.g., “Is the pictured item a type of food?”) typically leads to better memory performance compared to a control situation with categorization according to an arbitrary, non-semantic feature (e.g., “Is the pictured item framed?”; see Foos & Golkasian, 2008). For the explanation of the self-reference effect the former principle means that a given item is related to the rich and complex structure of the self-concept (i.e., abstract self-knowledge, autobiographical episodes etc.). The latter principle means that the study items are organized into two meaningful categories, the *me*-category and the *not-me*-category. Though the two principles are not completely disjunct (Einstein & Hunt, 1980), they are sufficiently discriminable.

Going back to the MOE, we might focus on the *organization* process since the hypothesis of an *elaboration* process is burdened (although not falsified) by the result of Experiment 4 (i.e., by the result that matching responses were not significantly faster for self-assigned compared to other-assigned items). Thus, we hypothesize that the assignment of objects to the self or to an abstract other leads to a memory organization of items belonging to me versus belonging not to me. Of course, to explain the MOE, we have to assume that the categorization as self-assigned versus other-assigned is *asymmetrically* meaningful, that is, the self vs. other categorization functions as a task which encourages organization especially for the self-owned items.

This is not a far-fetched hypothesis since the representations of two categories being contrasted need not be symmetrical. For example, it seems plausible that greater salience is associated with the self category due to its relevance. Note, that in experiments using a category dichotomy for the test of organization processes, such asymmetries are typically either not examined or – if examined – not emphasized, since the comparison of the two poles of the category dichotomy is usually only of quasi-experimental character and has to be taken with caution.

To test the hypothesis that semantic organization is the driving principle behind the MOE, we combined the mere ownership task with a manipulation that required participants to classify pictures either according to a meaningful semantic feature (i.e., “Is the object natural or artificial?”; semantic organization task) versus an arbitrary superficial feature (i.e., “Is the object colored green or purple?”; non-semantic organization task).

We expected the *semantic* categorization task to provide an efficient organizing scheme for the stimulus material that would lead to improved recognition performance, whereas *perceptual* categorization should at best provide a weak organizing principle, since it was completely arbitrary and did not draw on any meaningful characteristics of the items. Thus, it was expected to provide a weaker organizing scheme.

Additionally, participants had to categorize the objects as self-assigned versus other-assigned as in the experiments before. We hypothesize that in the context of the *perceptual* categorization task, the self/other-assignment task is the stronger principle of organization and a mere ownership will be obtained. However, the *semantic* categorization task already provides a strong and, most notable, non-arbitrary principle of organization (i.e., objects *are* natural or artificial in contrast to the arbitrary assignment to self or other), and might therefore dampen the tendency to use self/other assignment for the purpose of organizing the study items. Thus, if the MOE is mainly due to organization, there should be a reduction of the effect if objects were already categorized according to their meaning.

3.7.1 Method

Participants. Seventy-three students of Saarland University (61 female, 12 male, aged 18-36, median age = 22) took part in the experiment in exchange for a payment of ten Euros.

The rationale for the choice of sample size was as in Experiment 3: Since the MOE might disappear in the context of the semantic organization task, we choose a power of $1-\beta = .95$. To detect an effect of $d_Z = .40$ (see Experiment 1 and power planning for Experiment 2) with $\alpha = .05$ (one-tailed) and power $1-\beta = .95$, N = 70 participants are needed.

Design. The design for the self, other, and new assignment was the same as in Experiment 1. For the additional categorization task, each participant classified one half of the stimuli according to their color and the other half to their meaning (natural/artificial). Which half of the items were assigned to which task was varied as a between-subjects factor. The factors ownership (self vs. other) and depth of processing (perceptual vs. semantic) were varied orthogonally.

Materials. Two hundred and forty pictures of objects were chosen from Zimmer (2012) to serve as stimuli in the experiment. Half of these objects could be clearly categorized as artificial objects, while the other half could be clearly categorized as natural objects. Each of these pictures was edited into a monochrome scale using the Gimp 2.8 image editing software (The GIMP Team, 1997-2016). Half of the artificial objects and natural objects, respectively, were converted into green monochromes (120 on the color wheel), the respective other half were converted into purple monochromes (300 on the color wheel). For the self-other assignment, black frames on a white background, shaped either as squares or circles, were used to indicated ownership (instead of red and blue frames as in Experiments 1 to 4, since color was a task-relevant feature in one of our study tasks in Experiment 5). For a list of stimuli used, see Appendix C5.

Procedure. Before the study phase, participants were asked to imagine that they had won half the objects that were about to be presented to them in a raffle, while their fellow player had won the other half of objects.

The study phase consisted of 160 trials. To rule out primacy effects for the experimental materials, and to familiarize participants with the study task, there was for each participant an additional set of 16 practice trials using items that did not appear in the subsequent memory test. To rule out recency effects for the experimental materials, the study trials were followed by 16 trials using items which, again, were not used in the test phase.

Figure 16 shows an exemplary illustration of the encoding tasks. At the beginning of each trial, a question indicated to participants whether they should perform the perceptual or the semantic categorization task. For the perceptual task, participants were asked whether the presented object was green or purple whereas for the semantic encoding task, participants were asked whether the presented object was natural or artificial. The question remained on screen for 1500ms after which one of the pictorial objects was presented for another 1500ms, along with the category labels corresponding to the task. After the item had disappeared from the screen, participants indicated whether the object was green or purple by pressing “w” or “s” (perceptual categorization task) with their left index finger or whether the object was natural or artificial by pressing “o” or “l” with their right index finger (semantic categorization task). The time period during which the item was available for encoding was the same for the semantic and the perceptual task.

Throughout the course of the first task, the labels “green” and “purple” for the perceptual task or the labels “natural” and “artificial” for the semantic task were presented directly above and below the area in which the picture was presented, respectively. After a response had been made, the screen went blank for 600ms. Then, the second task started with a second question appearing on the screen, namely to whom the item belonged. The same item was presented again for 1500ms. In the right- and left-bottom corner of the screen, pictures of two boxes were presented, representing either the participant's own or the fellow player's box, indicated by a square or a circle symbol, respectively. After 1500ms, either a circular or a squared frame appeared around the object, indicating ownership. Depending on the shape of the frame, the participants had to click either on their or the fellow player's box. After a response was made, the next trial started. Participants worked through 80 self- and 80 other-assigned objects. On half of the items in each group, the perceptual task was performed, whereas the semantic task was performed on the other half.

After the study phase was completed, participants were asked to perform a surprise recognition test. All items from the study phase as well as an additional 80 not previously encountered items were included in the test phase. For each trial, a picture was presented at the center of the screen. Participants had to indicate per button press whether the picture was "old" or "new", that is, whether the picture had been presented in the study phase or not. Thus, participants did not need to recall details about the orienting task or the ownership assignment in order to complete the memory test. If a "new" response was made, the next trial started immediately. If an "old"-response was made participants were asked to perform the same Remember/Know/Guess procedure as in Experiment 1 and 2.

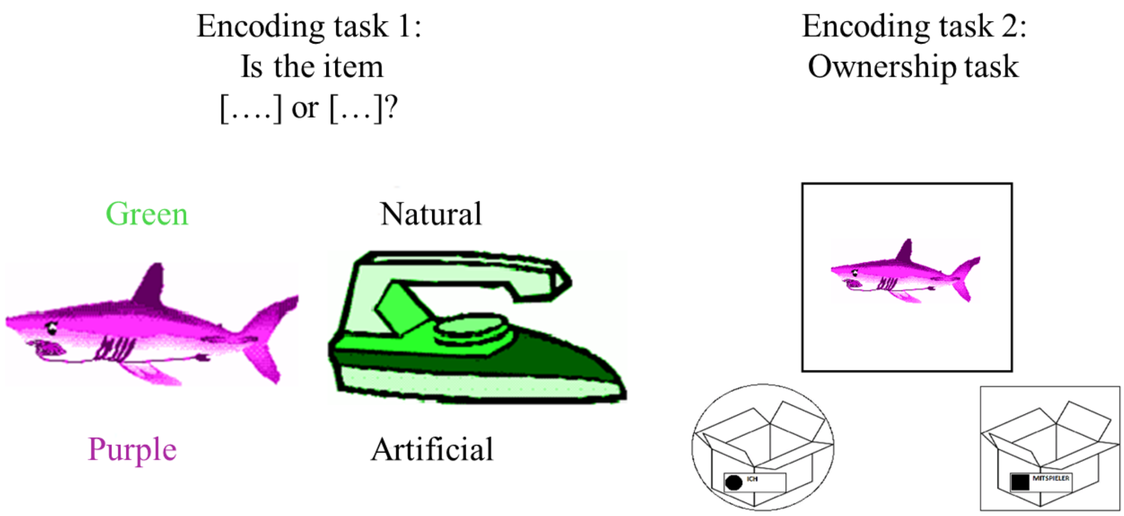

Figure 16. A graphic illustration of the encoding tasks (either perceptual or semantic classification and ownership assignment) used in Experiment 5. Since the first encoding task could involve color, ownership is now indicated via geometric shape.

3.7.2 Results

Mean hit rates for self-assigned and other-assigned items as well as false alarm rates for new items are shown in Appendix B. For the memory performance, *Pr*-scores were computed by subtracting the false alarm rates for new items from the respective relative hit rates of the self-assigned and the other-assigned items. *Pr*-scores were computed separately for items in the perceptual and the semantic categorization condition (see Figure 17).

Recognition Performance. We conducted a 2 × 2 repeated measures ANOVA with the orienting task (semantic vs. perceptual) and ownership-assignment (self vs. other) as within-participants factors and with recognition performance as indicated by *Pr*-scores as the dependent measure. There was a main effect of orienting task, with better memory performance for items that had to be judged semantically compared to items that had to be judged perceptually, $F(1,72) = 115.83$, $p < .001$, $\eta_P^2 = .62$. There was no main effect of ownership assignment, $F < 1$. Crucially, there was a significant interaction between the factors orienting task and ownership assignment, $F(1,72) = 3.76$, p = .028 (one-tailed),[14] $\eta_P^2 = .05$. As hypothesized, there was an MOE for items in the perceptual task condition, $t(72) = 1.71$, $p = .045$ (one-tailed), $d_Z = .19$; the MOE was completely eliminated (numerically even reversed) in the semantic task condition, $t(72) = -1.33$, $p = .19$.

To rule out that the absence of the MOE after the semantic task was simply a ceiling effect due to the comparatively high performance level in that condition, we conducted an additional analysis, using Experiments 1 and 2 as comparisons for recognition performance and the MOE. We conducted a linear regression with a binary dummy variable coding Experiment (1/2 vs. 5 [semantic condition]) and overall recognition performance as indexed by the *Pr*-score as predictors and the MOE as the dependent variable. We found that the variable Experiment, but not the overall recognition performance significantly predicted the size of the MOE, $\beta = .29$, $p < .001$ and $\beta = .11$, $p = .187$, respectively. Thus, the absence of the MOE in the semantic condition of Experiment 5 does not appear to be due to the high overall performance.

[14]Since an *F*-test with 1 *df* in the enumerator is equivalent to a t-test and, given our specific predictions, a one-tailed test is permissible (see Maxwell and Delaney, 2004, p. 164).

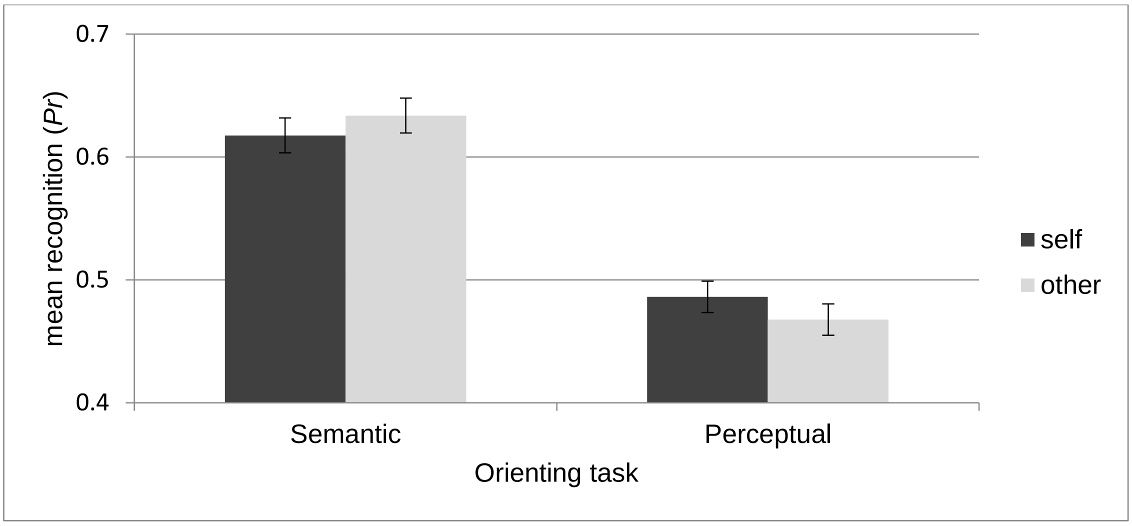

Figure 17. Mean recognition performance for self- and other-assigned items by task in Experiment 5. The *Pr*-score is computed as the difference between relative hit rate and relative false alarm rate. Error bars indicate 95%-confidence intervals for dependent measures according to Jarmasz & Hollands (2009).

Remember/Know/Guess-Procedure. Mean proportions of "remember", "know" and "guess" judgments are shown in Table 8. Recollection and familiarity estimates were computed as in Experiments 1 and 2, and entered into a 2 × 2 repeated measures ANOVA with the orienting task (semantic vs. perceptual) and ownership-assignment (self vs. other) as within-participants factors and recollection and familiarity estimates, respectively, as dependent measures. For both the recollections and the familiarity estimates, there was a main effect of orienting task: both recollection and familiarity estimates were significantly higher for pictures that had been classified conceptually rather than perceptually $F(1,71) = 38.79$, $p < .001$, $\eta_p^2 = .35$, and $F(1,70) = 8.45$, $p = .005$, $\eta_p^2 = .11$, respectively. No other effects reached significance.

Note that the main effect of orienting task for recollection is in line with earlier research whereas the main effect of orienting task for familiarity might appear to be at odds with other findings (e.g., Rajaram, 1993; Gardiner, 1998; but see, Toth, 1996, and Sheridan & Reingold, 2012, for a differing view). However, Gardiner (1998) and Rajaram (1993) simply used the corrected proportion of "know" responses as an indicator of familiarity, whereas we computed familiarity according to the independent remember/know method (Yonelinas & Jacoby, 1995; see our Experiment 1). If we follow Gardiner and Rajaram and employ the proportion of "know" responses[15] as the dependent variable, orienting task had a significant effect that was, however, reversed as compared to the independent

[15]As false alarms cannot be differentiated according to orienting task or ownership, they do not differ across conditions, making a statistical comparison of uncorrected proportions equivalent to a comparison of corrected proportions.

remember/know procedure $F(1,71) = 14.88$, $p < .001$, $\eta_p^2 = .17$. Proportion of “know” responses was higher after the perceptual task than after the semantic task, likely reflecting a tradeoff between “remember” and “know” responses. The debate on the correct method is beyond the scope of the present dissertation (e.g., Mayes, Montaldi, & Migo, 2007; Migo, Mayes, & Montaldi, 2012).

Table 8. Mean proportion of “remember”, “know” and “guess” judgments after “old” answers in Experiment 5. SD in parentheses.

	Self-assigned			Other-assigned			False alarms		
	Remember	Know	Guess	Remember	Know	Guess	Remember	Know	Guess
perceptual task	.53 (.25)	.38 (.23)	.09 (.11)	.53 (.24)	.36 (.21)	.10 (.17)	.22 (.30)	.49 (.33)	.29 (.30)
semantic task	.63 (.23)	.32 (.22)	.05 (.07)	.62 (.24)	.32 (.22)	.05 (.07)			

Note. The false alarm rate cannot be differentiated between the perceptual and the semantic encoding task and is therefore the same in both conditions.

3.7.3 Discussion

In Experiment 5, we found that the categorization of objects into meaningful semantic categories reduced the MOE to a null level: When participants made a semantic judgment before ownership was assigned, the advantage for self-assigned items disappeared, while an MOE (albeit a weak one) persisted after a non-semantic (i.e., perceptual) judgment. (However, it should be admitted that we did not obtain this pattern for the recollection estimates upon which only the type of orienting task had a significant influence.) Thus, it seems that a semantic task that already promotes organization impedes the additional advantage for self-assigned items. There is a further detail of the results that should be noted. The MOE (for items in the perceptual judgment condition) was of a smaller magnitude than in previous experiments. This could be a hint that the color task also enhanced organization of the material, albeit less effectively so. Our results suggest that the self, as a category, can be used to provide structure in the absence of a more or equally powerful organizational scheme.

3.8 Experiment 6: Testing for organization by analyzing clustering in a free recall test

The results of Experiment 5 suggest that semantic organization might be underlying the mere ownership effect. If the self is indeed used as an organizing concept, this should not simply produce superior memory but also stronger associations among self-assigned items compared to associations among other-assigned items. To test this hypothesis more directly, we employed a free recall test instead of recognition. Whereas in the case of recognition tests, the order in which items are retrieved is beyond the control of the participant, in free recall tasks, by necessity, participants themselves determine how the reproduced material is structured. Rather than being random, it can be assumed that subjects reproduce stimulus items systematically (i.e., more clustered, see Appendix A), in an order reflecting their internal organization (Einstein & Hunt, 1980; Klein & Kihlstrom, 1986; Mandler, 2011).

3.8.1 Method

Participants. Sixty-two students of Saarland University (45 female, 17 male, aged 18-34, median age = 22) took part in the experiment in exchange for a payment of six Euros.

Design. We used a within-subjects design with assignment of items as the sole factor. Four item lists were assigned to self, other, “no winner” and unstudied list (needed for the valence rating, see below) according to a Latin square design. In addition to the self, other, and new categories, we assigned a quarter of the stimuli to a “no winner” list, meaning that participants were asked to imagine that the object was not handed out. This category was added due to our interest in finding clustering differences between the self and other categories. Given this goal, more than two categories are necessary to ensure that the amount of clustering in one category is not perfectly determined by amount of clustering in the other one. Since the retrieval task was a recall test, no new items were presented during retrieval. However, we used a list of unstudied items to establish a baseline in the valence rating (see below).

Materials. Eighty pictures of objects were chosen from Zimmer (2012) to serve as stimuli in the experiment (see Appendix C6, for a list). These were assigned to four different lists which were constructed in such a way that there were no obvious between-list differences with regard to semantic category membership of the items. Furthermore, we tried to make sure that the items would all be distinctly named on the typical level of granularity used by participants during pilot testing (e.g., participants would typically recall both a rose and a dandelion as a “flower” during recall, thereby making it unclear which items was referred to; therefore, only one type of flower was kept in the final stimulus list). The shortening of lists compared to the preceding experiments seemed warranted due to the relative difficulty of the recall task and the performance of participants during pilot testing. For the valence rating task, we used the same scale as in Experiment 3 (Lang, 1980; see Figure 10).

Procedure. The study phase was identical to the study phase of Experiment 2 with the following exceptions: Participants only worked through 60 study trials and were not presented with any primacy or recency items (both the relatively low number of stimuli and the dropping of primacy- and recency items seemed warranted due to pilot testing). Furthermore, a third of the presented items now had to be classified as “no winner” items. If an item belonged to the no winner category, a black frame appeared around the picture after the 1500 ms presentation period. Participants than had to click on a box with the label “no winner” written on it in black letters, which was presented in the center between the self- and other boxes for all participant. Immediately after participants had completed the study phase, the free recall test started. Participants were handed a pen and a sheet of paper and were instructed to write down whatever items they remembered from the study phase during a period of five minutes. In order to be able to assess the order of recall, participants were instructed to write each item in a consecutive line on the sheet. They were further informed that the owner of the object was irrelevant to their task and asked to put down synonyms if they could not recall the identifying label an object had been presented with. After five minutes, the experimenter collected the sheets with the participant’s responses and instructed them to continue the experiment using the computer. Finally, participants completed a valence rating task for the 80 pictorial objects. The procedure of the rating task was identical to the procedure of the valence rating task in Experiment 3.

3.8.2 Results

Mere Ownership Effect. Mean number of recalled items for the "self", "other" and "no winner" condition, respectively, are shown in Figure 18. On average, participants recalled more self-assigned than either other-assigned or "no winner"-objects, $F(2,60) = 9.59$, $p < .001$, $\eta_p^2 = .24$, for a MANOVA for repeated measures. Bonferroni-Holm adjusted t-tests yield significant comparisons for self versus other, $t(61) = 4.14$, $p < .001$, $d = .53$ and for self versus "no winner", $t(61) = 3.91$, $p < .001$, $d_z = .50$, but no significant difference for other versus "no winner", $t(61) = .51$, $p = .61$. Thus, the MOE seems to extend to free recall tasks.

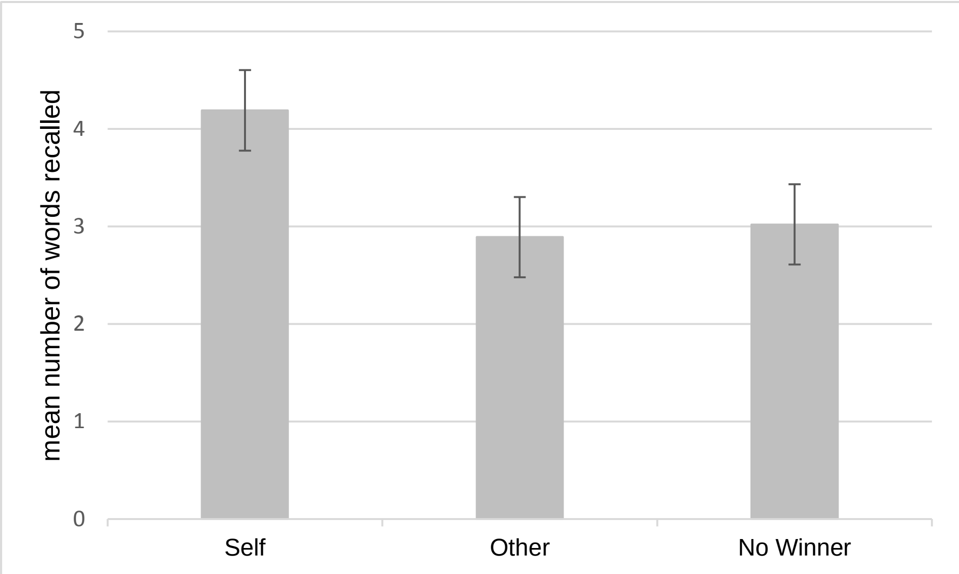

Figure 18. Mean recall performance for self- and other-assigned items as well as "no winner"-items in Experiment 6. Error bars indicate 95%-confidence intervals for dependent measures according to Jarmasz & Hollands (2009).

Clustering. For an index of clustering for single categories, we followed Bower et al. (1969) as well as Robbins and Nolan (2001) who independently suggested two indices (*MRR* by Bower et al., *c* by Robbins & Nolan; see Appendix A for a closer look at measures of clustering), which are formally equivalent. To recapitulate the rationale of the index provided by Robbins and Nolan (2001): The number of "runs" c – that is, of uninterrupted sequences of same-category items – is relativized by the number of recalled items for the given category (n) according to the following formula:

$$c = \frac{n - r}{n - 1}$$

If, for example, 4 self-assigned items are recalled in a single sequence (i.e., $r = 1$), c equals 1. If, however, the 4 self-assigned items are always followed by at least one other-assigned or “no winner”-item (i.e., $r = 4$), c equals 0. Note that the index is not biased by the total amount of recalled items for the category. That is, the fact that on average more self-assigned items are recalled compared to other-assigned items does not bias the comparison of amount of clustering. Thus, it allows for a comparison of the relative amount of clustering between different categories in the same output list of recalled items. Note that the index cannot be computed if n = 1 (and, of course, one should refrain then from computing c if n = 0). We calculated c for self-assigned and other-assigned items, leaving out the “no winner”-items both for reasons of statistical power (only n = 36 participants had recalled enough items in each category) and due to complex interdependencies between the categories precluding an ANOVA with all three indices[16]. A subsample of n = 40 participants had valid c values for both categories. Clustering scores are shown in Figure 19. The amount of clustering was larger for self-assigned ($M_{cS} = .347$) than for other-assigned ($M_{cO} = .191$) items in a Wilcoxon test (which was employed due to slight deviance from normality), $z = 2.66$, $p = .008$, $r = .30$.

[16] In our experiment, a statistical independence is only possible for two indices. Avoiding a dependence between the self- and other category was the reason why the third, “no winner”-category was added to the design in the first place. To illustrate the point, take the following example (we assume for this case that at least two items are recalled for each category): If the self-assigned items are recalled in one sequence (i.e., c = 1), the index for other-assigned items can still vary between 0 (i.e., each other-assigned item is at least followed by one “no winner”-item) and 1 (i.e., the other-assigned items are recalled in one sequence as well). However, the index for the third category is constrained: if c(self) = c(other) = 1, obviously c(“no winner”) must be 1 as well. If c(self) = 1 and c(other) = 0 then c(“no winner”) equals 0 as well if the number of recalled other-assigned items and “no winner”-items are equal. In case that the number of “no winner” items is larger than the number of other- assigned items (the converse cannot hold if c(other) = 0), 0 < c(“no winner”) < 1 holds.

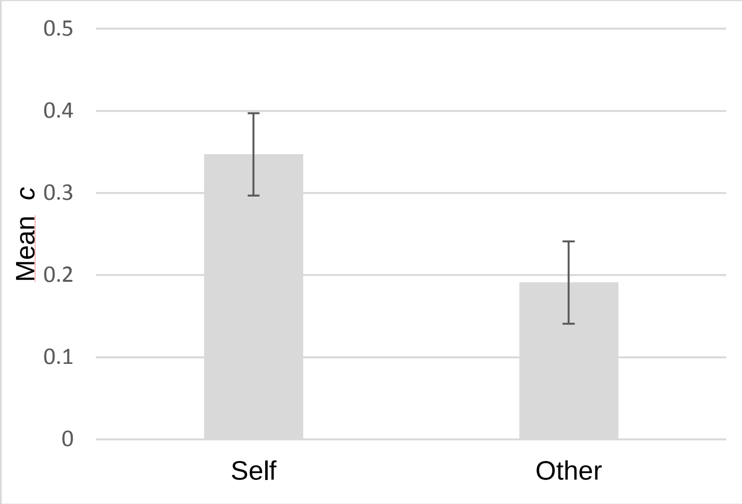

Figure 19. Clustering scores as measured by *c* for self- and other assigned items in the free recall test in Experiment 6. Error bars indicate 95%-confidence intervals for dependent measures according to Jarmasz & Hollands (2009).

Valence ratings. Valence ratings for self-assigned and other-assigned items, respectively, were averaged to obtain a mean valence score for each condition (see Figure 20). On average, participants self-assigned objects were evaluated more positively than other-assigned objects, $M = 5.87$, $SD = .53$ and $M = 5.73$, $SD = .51$, respectively, $t(61) = 2.17$, $p = .034$, $d = .28$. This finding replicates the evaluative MOE (Beggan, 1992) for meaningful stimuli.

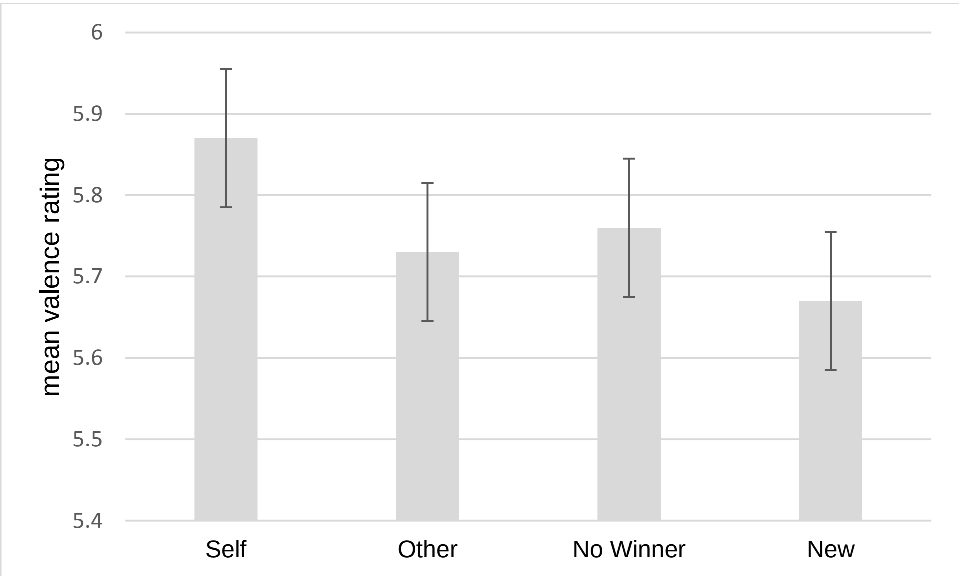

Figure 20. Mean valence ratings for self-assigned, other-assigned, "no winner", and new items in Experiment 6. Error bars indicate 95%-confidence intervals for dependent measures according to Jarmasz & Hollands (2009).

Evaluative Mere Ownership effect across Experiments. To compare the MOEs for meaningful and meaningless stimuli, the evaluative MOEs, that is the difference between valence ratings for self- and other-assigned items for Experiment 3 and 6, were contrasted in an independent samples t-test. The evaluative MOE for meaningful objects (Experiment 6) was significantly larger than the evaluative MOE for meaningless objects (Experiment 3), $t(92.20) = 2.33$, $p = .022$, $d = .40$ (see Figure 21). This conforms to the pattern found for recognition performance when comparing the MOEs of Experiments 2 and 3.

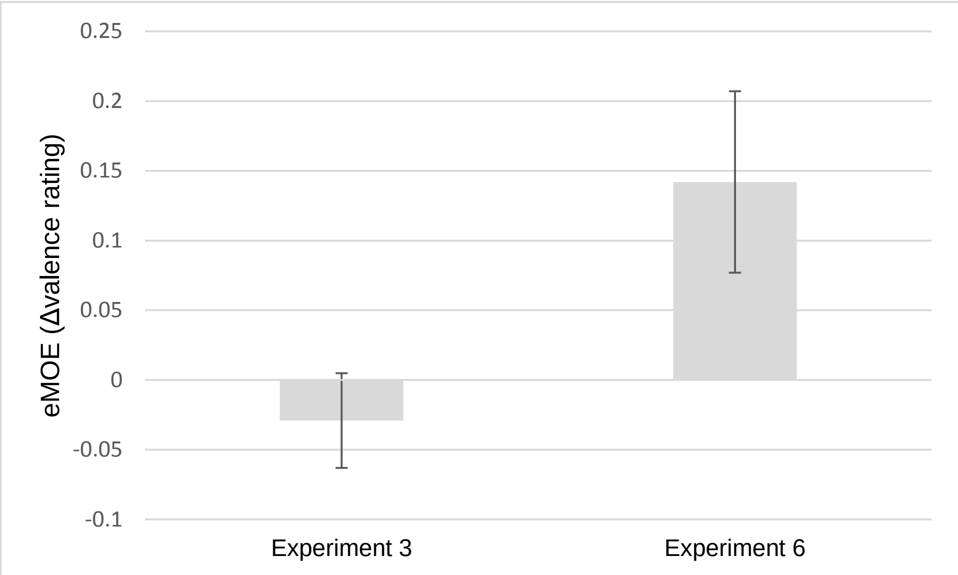

Figure 21. Mean eMOEs as computed by the difference in valence ratings between the "self"- and "other" conditions for Experiments 3 and 6. Error bars indicate mean standard error.

3.8.3 Discussion

Experiment 6 corroborates and extends the findings of Experiment 5 to a different memory task. First, we found higher recall of self-assigned as compared to other-assigned items, showing the MOE to occur not only in recognition memory, but also in free recall tasks. Second, and even more importantly, we found significantly higher clustering of self-assigned as compared to other-assigned items, suggesting that semantic organization contributes to the MOE and that the self as an organizing concept improves inter-item processing for self-assigned stimuli.

4 Self-prioritization and mere ownership: do incidental connections to the self give rise to self-memory advantages?

"We argue here that the presence of a self-representation does indeed do something for us – notably it acts as an integrative hub for information processing, helping to bind together different types of information and even different stages of processing" – Jie Sui and Glyn W. Humphreys (2015)

4.1 Pushing the limits of self-involvement: A "merest" ownership effect?

In the case of the SRE and the self-referential task, the connection with the self is meaningful and explicit. To a certain extent, this is also true for the shopping paradigm (Cunningham et al., 2008). While no conscious reflection on the self or the stimuli is required of participants, they are still instructed to imagine the study objects as their own possessions and ownership is the task-relevant dimension of the encoding task. In the introduction, I have raised the question of what it means for the MOE to be "mere", that is, in what way it could be viewed as "purely" due to a connection to the self, and little more. The shopping paradigm already eliminates confounding factors such as preference and choice, and its task demands do not call for participants to elaborate on the objects or themselves, or to retrieve knowledge of their own person from long-term memory. However, the link between the self and the to-be-learned stimuli is still made explicit and meaningful: Participants are instructed to imaging owning half of the presented objects. Furthermore, ownership is task-relevant: During the shopping task, participants are asked to assign stimuli to the correct owner. What would happen to memory performance if objects were tied to the self in a more indirect fashion and this connection was completely incidental to the task? Turk et al. (2008) looked into this question comparing the effects of self-referential stimuli when they were either task-relevant or incidental to the task. Participants were presented with either their own name or photograph or the name or photograph of a celebrity as a reference cue. Above or below this cue, a number of trait adjectives were shown one at a time. Participants had to either decide whether the adjective described the cued person (explicit self-referential condition) or whether the adjective was presented below or above the cue on the screen. This procedure was followed by a recognition memory task: In both conditions, memory performance was higher for stimuli that had been presented together with a self-cue. Therefore, a self-memory advantage can occur even if the self is irrelevant to the task at hand, and the stimuli are not explicitly linked to the self via instructions. In contrast, Cloutier and Macrae (2008) found no memory advantage of ownership alone when stimulus objects were indirectly associated with the self via lottery-like numbers. In one condition, participants could either draw several numbers which they believed would determine “their” prizes, or simply be handed out an arbitrary selection of numbers by the experimenter. Here, the MOE was conditional on perceived choice: Recognition memory for self-assigned objects was greater than for other-assigned objects only when participants were given an illusion of choice by being allowed to draw their own numbers. While the additional choice factor complicates the interpretation of these findings, this result suggests that an indirect connection between objects and the self might not always be sufficient to produce an MOE.

4.2 The self-prioritization effect in perceptual matching: A(nother) relative of the mere ownership effect?

One phenomenon that shows a cognitive benefit of self-assignment under very rudimentary conditions is the perceptual self-prioritization effect (Sui et al., 2012). Sui et al. found an advantage for newly learned associations between the self and arbitrary simple objects (e.g., a triangle) as compared to associations between simple objects and other persons or a neutral object. In this task, participants are instructed that they, themselves, are one geometric shape, such as a circle, while other persons or things “are” each a different shape. Often, the self-association will be compared to a condition where a shape is paired with a familiar other – such as the participant’s mother - and another more distant object or person (such as a chair or an acquaintance). After learning these pairings, participants are presented with various combinations of a geometric shape and a word labeling a person or object. Their task is to decide whether any given pairing is correct, that is, whether it corresponds to the assignment given in the instructions (see Chapter 5.1.1, Figure 22, for an illustration). Typically, participants are faster to respond with “yes” to a correct pairing that involves the self and are more accurate in deciding whether a pairing involving the self-assigned shape is correct (e.g. Sui et al., 2012; Sui & Humphreys, 2013; Schäfer, Wentura, & Frings, 2015; Schäfer, Wesslein, Spence, Wentura, & Frings, 2016). Since the pairing of self and object was completely arbitrary and did not require any elaboration on the meaning of the stimuli, it seems implausible that this effect is driven by more extensive conceptual processing of the materials. Indeed, Sui et al. (2012) locate the self-prioritization effect at the conceptual level, suggesting that associating a stimulus to the self automatically causes this stimulus to become more salient and, thus, be processed faster when it is encountered again. The self-prioritization effect is remarkable because a cognitive benefit is conveyed through a very simple, arbitrary, and, it can be argued, not very meaningful manipulation. Yet, a prioritization of the self is reliably found in the perceptual matching task. With regards to the MOE and in what sense it can be truly assumed to be “merely” an effect of self-assignment, this raises the question whether the perceptual matching task can be utilized to test the limits of the MOE. Could such an association of a shape to the self be then extended to other stimuli which, through simple co-occurrence, become linked to that shape? Could this then give rise to an MOE-like memory advantage for those objects, even though their connection to the self is indirect, implicit and task-irrelevant? Such a finding would be interesting because it would suggest that the MOE is indeed very basic, and requires very few conditions to be met. Furthermore, it could provide evidence that different tests of self-involvement on cognition capture at least partially overlapping mechanisms. It has been suggested, that the self could act as some sort of “integrative glue” (Sui & Humphreys, 2015, p. 719) allowing the binding-together of information, even across different stages of information processing. The perceptual salience thought to underlie the self-prioritization effect and explicit recognition memory can be seen as pertaining to such distinct processing stages. An impact of the type of self-assignment used in the perceptual matching task (Sui et al., 2012) on both, would provide evidence in favor of this view of the self being “integrative”. On the other hand, if no MOE was observed in the presence of a self-prioritization effect, this might be interpreted as evidence that they are based on different mechanisms and do not necessarily target the same construct. Such an observation would fit in well with views proposed by Klein (2012) or Neisser (1988) that the self is not a homogeneous entity. In a final experiment (Experiment 7), we combined the perceptual matching task (Sui et al., 2012) with the presentation of visual object stimuli which were incidental to the task. We hypothesized that objects that had been consistently presented together with the self-shape would be more likely to be remembered in a subsequent recognition test.

5 Empirical research using the perceptual matching paradigm

“The warden said, "Hey, buddy, don't you be no square

If you can't find a partner use a wooden chair"” – Jerry Leiber and Mike Stoller (1957)

5.1 Experiment 7: A mere ownership effect for incidental connections to the self?

The goal of Experiment 7 was to test whether an MOE could be obtained using a link to the self that was completely incidental and that was not explicitly established by instructions and task demands (see, e.g., Turk et al., 2008). To this end, we employed the perceptual matching task introduced by Sui et al. (2012) during encoding.[17] In this task, participants have to decide whether an identity label (e.g. self or other) presented together with a geometric shape matches with a mapping learned during instruction. We combined this matching task with incidental presentation of visual objects similar to those we used in the preceding experiments employing the shopping paradigm. We then tested whether subsequent recognition memory was improved for objects consistently presented with the shape that was assigned to the self. A brief, summary overview of the method and aim of Experiment 7 is provided in Table 9.

Table 9. A summary overview over Experiment 7, the broad method that was used, and the question it was intended to address.

Experiment	Method	Aim
Experiment 7	Perceptual Matching Task combined with incidental encoding of visual objects	What is the relationship between the MOE and the self-prioritization effect. Is an incidental connection to the self sufficient for the MOE?

[17] I would like to thank Dr. Sarah Schäfer for her collaboration in planning, designing, and implementing Experiment 7, as well as for processing the reaction time data in the matching task for further analyses, and for her help analyzing data pertaining to the self-prioritization effect.

5.1.1 Method

Participants. Thirty-eight students of Saarland University (27 female, 11 male, aged 19-31, median age = 25) took part in Experiment 7. They were compensated with a payment of six Euros. The data of one further participant was discarded as he did not follow task instructions[18]. In order to determine an appropriate sample size, an *a priori* power calculation was computed using the G.Power tool (Faul et al., 2007). The mean MOE from our Experiments 1 and 2 was $d_Z = 0.43$, which was somewhat lower than the effect found by Cunningham et al. (2008) but still roughly corresponds to what Cohen (1988) termed a medium-sized effect ($d_Z = 0.50$). To detect an effect of $d_Z = 0.43$ with $\alpha = .05$ and power $1-\beta = .80$, N = 37 participants are needed. Factual power with n=38 was $1-\beta=.82$.

Materials. For the encoding and memory test phases, one-hundred-twenty pictorial objects (Horner & Henson, 2009) were chosen, given black, instead of their original white, backgrounds, and divided into two lists containing sixty pictures each, which, in turn, were divided into three sublists containing twenty pictures, resulting in a total of six sublists. The objects were chosen in such a way that each could reasonably be a possession of the participant.

For the matching task, the geometric shapes were square, circle, and hexagon[19]. Stimuli used as identity labels were the German words “Ich” [“I”], “Mutter” [“mother”], and “Bekannter” [“acquaintance”]. Shape outlines and labels were presented in white on a black background.

For a list of the visual objects and geometric shapes used in Experiment 7, see Appendix C7.

Design. For each participant, one list of sixty items served as study list, with the other list serving as foils in the recognition task. Which list served as the “old” or the “new” item set was balanced across participants. Within each list of sixty items, a subset of twenty pictures was assigned to the circle, square and hexagon shapes, respectively. This assignment between study items and geometric shapes remained the same across participants.

[18]This participant exhibited hit and false alarm rates of 100% each, indicating only “old” responses, and performed at almost exactly chance level in the matching task, indicating “no match” responses. Since he showed no discrimination in either the matching or the memory task, this did not affect the results.

[19] Typically, a triangle is used instead of a hexagon. We made this change in order to have a larger area for placing pictures inside the geometric shape.

For each participant, each shape (i.e. square, circle and hexagon) was assigned to an identity label (“I”, “mother” and “acquaintance”) via a one-to-one mapping. The assignment between shape and label was varied between participants according to a Latin square design, resulting in three distinct combinations of “shape + identity”-assignments. Thus, the label or identity (i.e. “self”, mother or acquaintance) each picture was assigned to was varied following the assignment conditions of labels and geometric shapes. Therefore, for the matching task, we used a 2 x 3 x 3 mixed design with matching condition (matching vs. non-matching) and identity (self vs. mother vs. acquaintance) as within-subject factors, and “shape+ identity”-assignment as a between-subject factor. For the recognition task, this corresponded to a 2 x 3 x 2 design with item status (old vs. new) as a within-subject factor, and label identity (self vs. mother vs. acquaintance) as a nested factor for only the old items, and list condition (which list was used as study vs. distractor list) as a between-subject factor.

Procedure. Participants performed the task on their own in a closed cubicle, in front of a computer monitor. Written task instructions were given on the screen. The experiment consisted of a practice phase for the perceptual matching task, an encoding phase doubling as a perceptual matching task, and a surprise recognition test. Before the practice task started, the three label-stimulus assignments (one assignment for each label) were shown on the display for sixty seconds. For a given participant this instruction might have read:

“I am the hexagon.

My mother is the square.

An acquaintance is the circle.”

Participants were instructed to place the index finger of the left hand on the S-key (non-matching response) and the index finger of the right hand on the L-key (matching response).

The practice phase consisted of 96 trials. It was intended to familiarize participants with the matching task. Therefore, we presented only shapes and (matching or non-matching) identity labels, without further visual objects, during that phase. The study phase consisted of 240 trials. Half the trials were matching and the other half were non-matching trials. Each geometric shape and, thus, each type of label appeared with equal frequency. To rule out primacy effects for the experimental materials, there was for each participant an additional set of twelve practice trials, using six items that did not appear in the subsequent memory test. To rule out recency effects for the experimental materials, the study trials were also followed by twelve trials using a further six study items which, again, were not used in the test phase. There was no consistent mapping of the twelve primacy and recency items on the one hand, and geometric shape on the other hand.

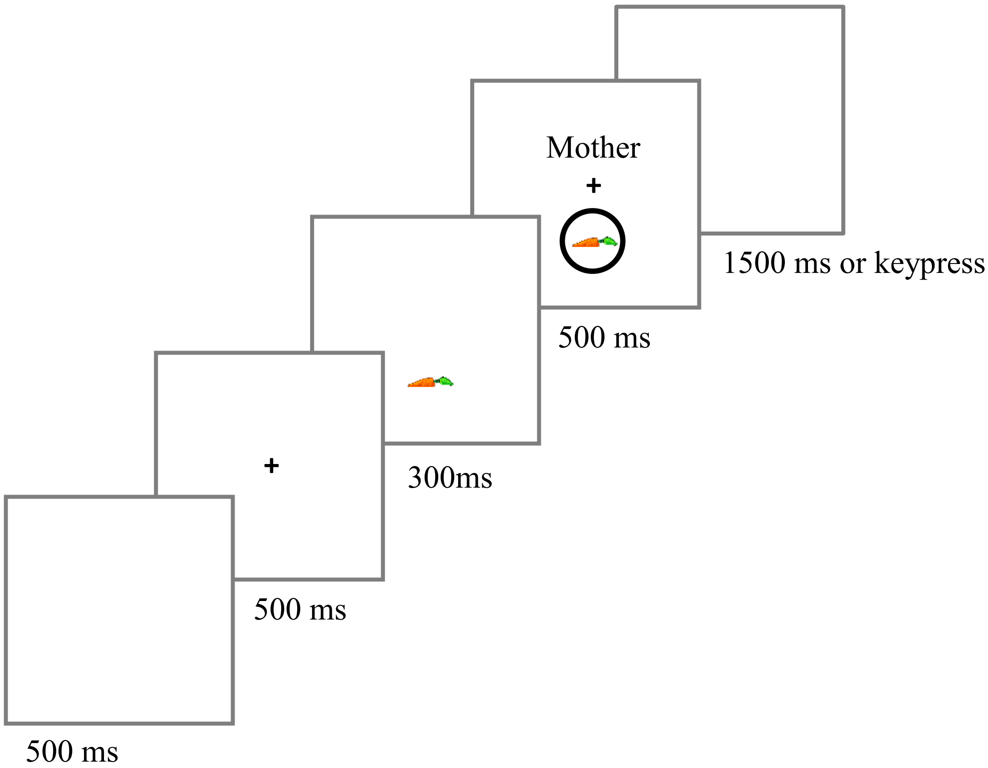

Figure 22. Overview of a perceptual matching trial. The participant's task is to decide whether the pairing of "mother" with circle is correct, that is, as learned in the instructions.

An exemplary illustration of the perceptual matching task is given in Figure 22. At the beginning of each trial, a blank screen followed by a fixation cross which was positioned slightly above the center of the screen were presented for 500 ms each. Then, one of the study images appeared slightly above the position of the fixation cross. After 300 ms, the geometric shape and a written matching or non-matching label ("I", "mother" or "acquaintance") appeared. The shape always enclosed the image and the identity label was always presented below that, slightly below the position of the fixation cross. After 500ms, this was replaced by a blank screen which remained for a maximum of 1500ms. Participants could respond to the matching combination within a time window of 2000ms, starting with onset of the geometric shape and label. Each visual object was presented four times, twice in the matching and the non-matching condition, each.

After the matching phase was completed, participants were asked to perform a surprise recognition test. At the beginning of each trial, a picture was presented at the center of the screen. Participants had to indicate per button press whether the picture was "old" or "new", that is, whether the picture had been presented in the study phase (irrespective of whether it was self-assigned or other-assigned). If a "new" response was made, the next trial started immediately. If an "old"-response was made, the recognition test was followed by a Remember/Know/Guess (RKG) procedure following the recommendations by (Gardiner et al., 1997; see also Gardiner et al., 1996). All items from the study phase as well as an additional 60 not previously encountered items were included in the test phase. Thus, participants worked through 120 recognition trials.

5.1.2 Results

Matching Task. Mean correct response times for the matching trials were computed for the self-, mother- and acquaintance-conditions respectively, after removing outliers according to the Tukey criterion (Tukey, 1977, see Table 10). A one-way MANOVA for repeated measures revealed a main effect of assignment on reaction times ($F_{2,36}$=25.56, p<.001; η^2=.59). Planned comparisons revealed marginally faster reaction times for the self-assigned shape than for the mother, $t(37) = 2.00$; $p = .027$, one-tailed, and significantly faster reaction times for the self-assigned than for the acquaintance-assigned shape, $t(37) = 6.12$; $p < .001$, as well as significantly faster matching RTs in the "mother" than the acquaintance condition , $t(37)= 5.60$; $p < .001$. Mean accuracies for both the matching and the non-matching trials were computed for the self-, mother- and acquaintance-conditions, respectively (see Table 5). A one-way MANOVA for repeated measures revealed a main effect of assignment on accuracy ($F_{2,36}$=28.82, p <.001; η^2=.62). Planned comparisons revealed significantly higher accuracies for the self-assigned shape as compared to the mother- ($t(37)= 3.25$; $p = .002$) and stranger-assigned shape ($t(37) = 7.68$; $p < .001$), as well as significantly higher accuracies for the "mother"-assigned than the stranger-assigned condition ($t(37) = 5.00$; $p < .001$). Thus, a self-prioritization effect reliably emerged for both outcome measures.

Table 10. Mean correct response times (in ms) and accuracy rates in the perceptual matching task of Experiment 7. SD in parentheses.

	Matching trials		Non-matching trials		Recognition
	RT (ms)	Accuracy	RT (ms)	Accuracy	Mean *Pr*
Self	536 (122)	.84 (.21)	617 (160)	.73 (.21)	.22 (.26)
Mother	563 (139)	.76 (.22)	626 (158)	.72 (.17)	.23 (.23)
Acquaint-ance	617 (162)	.62 (.22)	615 (156)	.74 (.17)	.21 (.26)

Recognition memory. Mean hit rates for self-assigned and other-assigned items as well as false alarm rates for new items are shown in Appendix B. *Pr*-scores (Snodgrass & Corwin, 1988) were computed by subtracting the false alarm rates for new items from the respective relative hit rates of the self-assigned and the other-assigned items (see Figure 23). Overall recognition performance was significantly above chance (M=.22, SD= .21; $t(38) = 6.58$, $p < .001$), indicating that the objects had indeed been encoded during the matching task. A one-way ANOVA for repeated measure revealed no main effect of assignment. A planned comparison revealed that the difference between the recognition performance for the self-assigned items and the other-assigned items was not significant ($F(1,37) = .003$, $p = .958$), with roughly similar memory for the self-assigned than for the other-assigned items (i.e., self-assigned items, $M = .23$, $SD = .26$, other-assigned items, $M = .23$, $SD = .23$ and stranger-assigned items, $M =.21$, $SD = .26$). Hence, there was no MOE in the recognition data. None of the individual comparisons approached significance, with $t < .58$, $p > .56$.

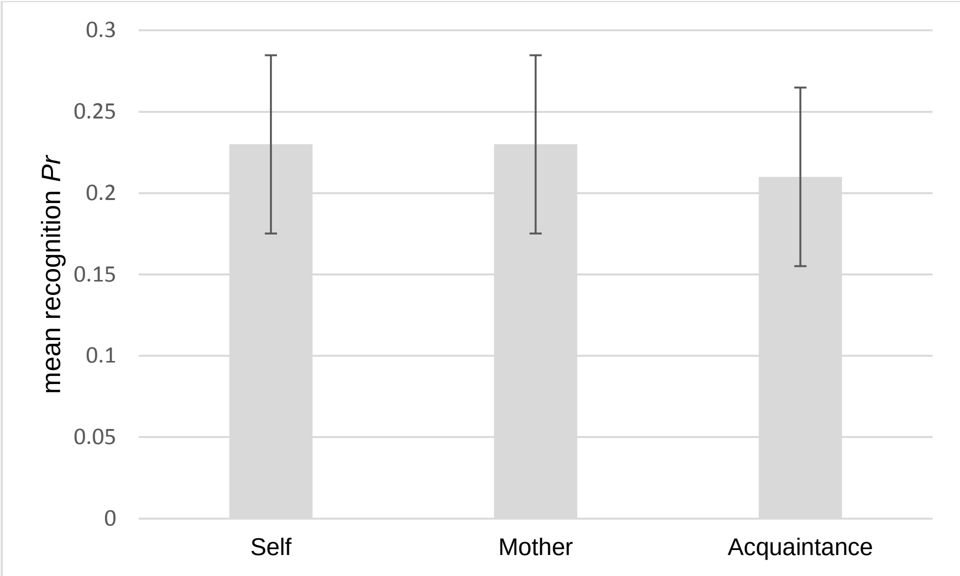

Figure 23. Mean recognition performance for self-, mother-, and acquaintance-assigned items in Experiment 7. The *Pr*-score is computed as the difference between relative hit rate and relative false alarm rate. Error bars indicate 95%-confidence intervals for dependent measures according to Jarmasz & Hollands (2009).

Remember/Know/Guess Procedure. Mean proportions of remember, know and guess judgments after "old" answers for self-shape-assigned, other-shape-assigned and new items are shown in Table 11. We used the corrected hit rates for each judgment type (van den Bos et al., 2010) by subtracting the false alarms from the hits for each. A one-way ANOVA for repeated measures revealed no main effect of assignment on the frequency of either "remember" ($F_{2,33}$ = .97, p = .388) or "know" judgments ($F_{2,33}$ = .57, p = .569).

Table 11. Mean proportion of "remember", "know" and "guess" judgments after "old" answers in Experiment 7. SD in parentheses.

Self-assigned			Other-assigned			False alarms		
Remember	Know	Guess	Remember	Know	Guess	Remember	Know	Guess
.39 (.28)	.46 (.27)	.15 (.26)	.37 (.27)	.49 (.22)	.14 (.22)	.27 (.31)	.48 (.28)	.25 (.29)

Note. "Remember", "know" and "guess" rates for "other"-assigned items in Experiment 7 are computed as the mean between the respective rates of the "mother" and the "acquaintance" condition.

5.1.3 Discussion

Using the perceptual matching paradigm introduced by Sui et al., (2012) which we combined with a presentation of visual objects and a subsequent recognition task, we replicated the self-prioritization effect, but found no evidence of an MOE using this set-up. An incidental, implicit connection to the self via matching shapes did not appear sufficient to produce a memory advantage for self-assigned items. This is compatible with earlier results by the author trying to establish an implicit link between study items and the self using the rubber hand illusion (Englert, 2013; Englert & Wentura, 2013) which showed no consistent effects of ownership on memory performance.

While interpreting a null result is difficult, one tentative conclusion from this dissociation might be that the self-prioritization effect and the MOE are in fact distinct phenomena, and driven by distinct cognitive processes. Furthermore, this result is in line with the notion that items must be processed in a meaningful way in relation to the self for an MOE to emerge.

6 General Discussion

"Possession of anything begins in the mind"- Bruce Lee (quoted in Little, 1997)

6.1 A summary of results on the mere ownership effect

In a series of eight experiments, seven of which employed the shopping paradigm (Cunningham et al., 2008), we tested for the MOE under varying conditions that might influence its occurrence (see Table 12, for a brief summary of experiments and results). Dependent variables included memory performance in recall and recognition, subjective judgments of noetic states, evaluative judgments, reaction times in a semantic matching decision and an index for category clustering in free recall. While we did not obtain an MOE for every test, we consistently observed an MOE when the following conditions were met:

(a) Experimental conditions made it likely that participants paid attention to the objects that were presented and the ownership task was not likely to be recoded into a simpler color-categorizing task by the participants.
(b) Neither the shopping nor the retrieval task were interfered with by additional tasks which required participants' attention and could plausibly interfere with the MOE.
(c) The objects that were assigned to either the participants or another person were meaningful objects that could easily be labelled.
(d) The assignment to the self was explicit and direct.

When steps were taken to ensure that the encoding task was performed as intended, we were able to replicate the recognition memory advantage for self-assigned stimuli described by Cunningham et al. (2008) in our Experiments 1 and 2. When the stimuli assigned to the participant or a real fellow player were semantically meaningful objects, an MOE reliably emerged. Experiment 2 shows that the presence of a real fellow player is not a necessary condition for the MOE. Establishing an imaginary "other" was enough to produce an MOE. Indeed, in Experiments 1 and 2, we obtained MOEs of comparable size, regardless of how the social other was implemented. Making the other person maximally abstract by being neither named nor physically present did not affect the size of the MOE.

Interestingly, we did not find any evidence for an MOE without semantic processing: Testing whether semantic processing in some form or another is required for the MOE, in Experiment 3 we conducted a shopping paradigm experiment using stimulus objects that had no discernible meaning or purpose and could be assumed to be both unfamiliar and have no corresponding lexical entry that would have enabled participants to verbally label them. Under these conditions, the MOE was eliminated. This was true for both the memory and the evaluation task. Therefore, it appears that, in order for an MOE to emerge, subjects must be able to process the meaning of the stimuli in some form. Furthermore, we did not obtain any evidence for an MOE-like phenomenon when the connection between the self and the learning material was not made explicit. In Experiment 7, we presented visual objects along with geometrical shapes, which could be linked to the self or another person, in a perceptual matching task (Sui et al., 2012). While we obtained the self-prioritization effect characterized by a faster and more accurate affirmative responses of self-assigned shapes with their respective labels, a subsequent recognition test revealed no trace of an MOE. Therefore, it seems that the self-prioritization effect and the MOE are not merely products of the same underlying process, but rather distinct phenomena. An explicit and at least minimally meaningful connection between the self and the to-be-learned object appears to be a prerequisite for the MOE. Tentative evidence for spontaneous semantic processing was found in Experiment 4 where we presented picture stimuli without a semantic label in the encoding phase. We not only again found an MOE but also evidence for spontaneous semantic processing, since

(a) response times in an object-label matching task were faster for old items compared to new ones and

(b) the MOE was restricted to matching trials.

However, we found no difference in matching response times for self- and for other-assigned objects. This means that the MOE, that is the difference in memory performance between self- and other-assigned items, cannot simply be explained in terms of such spontaneous semantic processing. While the MOE seems to be clearly situated at the semantic level, it remains to be seen exactly what types of processes underlie it. In the depth of processing literature, semantic elaboration (or intra-item processing) and semantic organization (inter-item processing) have been distinguished (Einstein & Hunt, 1980; Mandler, 2011). Organization enhances memory by facilitating associations within the to-be-learned stimulus lists or between the stimuli and their superordinate category. This type of processing can be contrasted with semantic elaboration, which is thought to foster associations between the stimuli and extant knowledge in long-term memory. Both elaborative and organizational processing are thought to drive or at least contribute to the self-reference effect (Klein & Kihlstrom, 1986; Klein & Loftus, 1998; Symons & Johnson, 1997).

With Experiments 4 to 6, we explored potential contributions of these two processes. First, the results of the matching task in Experiment 4 give some provisional evidence that elaboration might not play a major role in the MOE[20]. Second, in Experiment 5, an MOE was obtained when an arbitrary perceptual categorization principle was set in competition to the self/other-assignment during encoding, but not if a semantic categorization task was the additional competitor. The semantic orienting task can be assumed to promote semantic organization more strongly than semantic elaboration, since it required participants to group the stimulus material into different categories, but not to retrieve further information about the stimuli from long-term memory. Thus, the results fit with an interpretation of the MOE in terms of organization of self-assigned items. Experiment 6 corroborated this assumption by demonstrating greater clustering for self-assigned items than other-assigned items in a free recall task, wherein the amount of clustering can be thought to reflect the amount to which items of a certain category are grouped together (i.e., organized), in memory.

Table 12. Overview of experiments and conclusions suggested by the respective findings.

Experiment *Dependent Variable*	Results/Conclusion
Pilot Study *Recognition*	Failed replication, MOE depends on procedural parameters
Experiment 1 *Recognition*	MOE seems robust

[20]However, as there are obvious problems with drawing inferences from a null result, this conclusion should be taken with a grain of salt.

Experiment 2 *Recognition*	MOE does not require the presence of a real person
Experiment 3 *Recognition*	MOE is restricted to meaningful objects
Experiment 3 *Valence Rating*	eMOE is restricted to meaningful objects
Experiment 4 *Recognition*	MOE without verbal labels, but potentially weakened
Experiment 4 *Matching RTs*	No independent evidence for semantic elaboration as driving the MOE
Experiment 5 *Recognition*	Semantic, but not perceptual classification eliminates MOE, semantic organization might be driving the MOE
Experiment 6 *Free Recall*	MOE extends to free recall
Experiment 6 *Clustering Scores*	Further evidence organization might be driving the MOE
Experiment 6 *Valence Rating*	eMOE seems robust for meaningful material
Experiment 7 *Recognition*	No MOE in the presence of a perceptual self-prioritization effect, evidence for their distinctness

Taken together, the results show the MOE to be situated at the semantic level, thus making it seem plausible that conceptual, declarative self-knowledge plays a part in producing it. Furthermore, the results implicate organization as a likely candidate for the mechanism(s) behind the MOE. This suggests that the processes driving the MOE and the SRE are at least partially overlapping, and that, therefore, the levels of processing framework might be useful for better understanding and interpreting the MOE.

One starting point for the present line of experiments were the apparent similarities between the SRE (Rogers et al., 1977) and the MOE (Cunningham et al., 2008). Specifically, would the MOE lend itself to a depth of processing account?

We were able to replicate the recognition memory advantage for self-assigned stimuli described by Cunningham et al. (2008) with Experiment 1 and 2. To reiterate, when the stimuli assigned to the participant or a real or fictitious other person were semantically meaningful, an MOE reliably emerged, while we did not find any evidence for an MOE without semantic processing: The MOE did not emerge for semantically meaningless stimuli in Experiment 3. Therefore, it appears that, in order for an MOE to emerge, subjects must be able to process the meaning of the stimuli in some form.

Tentative evidence for spontaneous semantic processing was found in Experiment 4, where we presented pictorial objects without a semantic label in the encoding phase. We not only again found an MOE but also obtained evidence for spontaneous semantic processing, since

(a) response times in an object-label matching task were faster for old items compared to new ones and

(b) the MOE was restricted to matching trials.

While the MOE seems to be clearly situated at the semantic level, it remains to be seen exactly what types of processes underlie it. In the depth of processing literature, semantic elaboration (or intra-item processing) and semantic organization (inter-item processing) have been distinguished (Einstein & Hunt, 1980; Mandler, 2011). Organization enhances memory by facilitating associations within the to-be-learned stimulus lists or between the stimuli and the category. This type of processing can be contrasted with semantic elaboration, which is thought to foster associations between the stimuli and extant knowledge in long-term memory. Both elaboration and organization are thought to drive or at least contribute to the self-reference effect (Klein & Kihlstrom, 1986; Klein & Loftus, 1988; Symons & Johnson, 1997). With Experiments 4–6, we explored the contribution of these processes. First, the results of the matching task in Experiment 4 give some provisional evidence that elaboration does not play the major role in the MOE. Second, in Experiment 5 the MOE replicates in a condition with an arbitrary perceptual categorization as an encoding principle set in competition to the self vs. other assignment, but not if semantic categorization was the competitor. The semantic orienting task can be thought to promote semantic organization more strongly than semantic elaboration, since it required participants to group the stimulus material into different categories but not to retrieve further information about the stimuli from long-term memory. Thus, the results fit in well with the interpretation that the MOE is due to enhanced organization of self-assigned items. Experiment 6 corroborated this assumption by demonstrating greater clustering for self-assigned items than other-assigned items in a free recall task, wherein the amount of clustering can be assumed to reflect the amount to which items of a certain category are grouped together (i.e., organized) in memory. Therefore, organization remains a likely candidate mechanism behind the MOE. This seems especially plausible since the ownership assignment is essentially a task in which participants are asked to organize the stimulus material into two distinct categories. Corresponding to this assumption, in Experiment 5, the MOE was eliminated when participants performed a semantic classification task in addition to the ownership assignment (as opposed to an arbitrary perceptual classification task). Rather than being due to any specialized mechanism pertaining only to the self, we found evidence that the MOE is at least partially driven by organization, something that can be encouraged through means other than self-involvement.

6.2 Mere ownership and depth of processing: a relative of the self-reference effect?

6.2.1 The mere ownership effect and semantic processing

One starting point for the present line of experiments were the apparent similarities between the SRE (Rogers et al., 1977) and the MOE (Cunningham et al., 2008). Specifically, would the MOE lend itself to a depth of processing account?

We were able to replicate the recognition memory advantage for self-assigned stimuli described by Cunningham et al. (2008) only when the stimuli were semantically meaningful. Therefore, it appears that, in order for an MOE to emerge, subjects must be able to process the meaning of the stimuli in some form.

At first glance, the results of Experiment 3 seem at odds with findings on the self-prioritization effect (Sui et al., 2012), where a clear benefit has been demonstrated for seemingly meaningless objects that were associated with the self. However, there is reason to assume that the perceptual self-prioritization effect and the MOE are distinct phenomena. The self-prioritization effect is the fact that

(a) participants give faster correct responses in matching trials where the self-assigned shape is displayed together with the self-label and

(b) participants are more accurate in trials with the self-assigned label in separating matching from non-matching displays, always compared to trials with the other shapes.

This effect is seen predominantly as a prioritization in perceptual processes, not in memory strength. Furthermore, the tasks differ considerably: In the matching paradigm, only three shapes (e.g., rectangle, circle, triangle) are explicitly identified by the instructions either as the self, an intimate other (such as the participant’s mother), or an insignificant other (such as an unspecified acquaintance). It is taken for granted that all three assignments are accessible by participants subsequently to the instruction whereas a mere ownership-like test would be to display the three shapes mixed with three new shapes and to ask for recognition.

Experiment 7 provides evidence that the MOE and the self-prioritization effect are indeed distinct phenomena, as we obtained a standard self-prioritization effect, but no MOE. However, even if the perceptual prioritization effect and the MOE turn out to be based on partially overlapping processes, this would not necessarily mean that the MOE is not located at a semantic level, since it is far from clear that the self-prioritization effect is indeed a non-conceptual phenomenon (Schäfer, Wentura, & Frings, 2015). In either case, the findings from both paradigms are not necessarily incompatible.

6.2.2 The mere ownership effect and semantic elaboration

While the MOE seems to be clearly situated at the semantic level, it remains to be seen exactly what types of processes underlie it. As mentioned before, semantic elaboration (or intra-item processing) and semantic organization (inter-item processing) have been distinguished in the literature on levels of processing. (Einstein & Hunt, 1980; Mandler, 2011). As I have previously explained, organization enhances memory by facilitating associations within the to-be-learned stimulus lists or between the stimuli and the category. This type of processing can be contrasted with semantic elaboration, which is thought to foster associations between the stimuli and extant knowledge in long-term memory. Both elaboration and organization are thought to drive, or at least contribute to, the self-reference effect (Klein & Kihlstrom, 1986; Klein & Loftus, 1988; Symons & Johnson, 1997). With regards to the MOE, an elaboration-based account of the advantage for self-owned objects has been proposed (Cunningham et al., 2011). We investigated a potential role of semantic elaboration by using a semantic matching task. If self-assignment indeed triggers the elaboration of a stimulus and its integration with existing memory structures on the self, it should later benefit from the accessibility and interconnectedness of that integration. We hypothesized that if a self-assigned item had been elaborated on to a greater degree than an other-assigned item, its meaning should be more readily accessible later on. However, this was not the case. Participants did not access the meaning of self-assigned stimuli with greater ease than they did the meaning of other-assigned stimuli. This means that we found no evidence that semantic elaboration can account for the MOE. If this finding can be corroborated, this would be a point of divergence from the SRE, which is widely thought to be partially caused by elaboration (Klein & Loftus, 1988; Symons & Johnson, 1997). However, the importance of a single null result should not be overstated. A contribution of elaboration should be tested for using different methods, such as manipulating the extent of elaboration independently of ownership via task demands (Einstein & Hunt, 1980; Klein & Kihlstrom, 1986), before it can be conclusively ruled out as an explanation.

On the other hand, we did find evidence for organization as an underlying mechanism of the MOE, pointing to a similarity with the SRE. In Experiment 5, the MOE replicates in a condition with an arbitrary perceptual categorization as an encoding principle set in competition to the self vs. other assignment, but not if semantic categorization was the competitor. The semantic orienting task can be thought to promote semantic organization more strongly than semantic elaboration, since it required participants to group the stimulus material into different categories but not to retrieve further information about the stimuli from long-term memory. Thus, the results fit well with the interpretation that the MOE is due to enhanced organization of self-assigned items. Experiment 6 corroborated this assumption by demonstrating greater clustering for self-assigned items than other-assigned items in a free recall task, wherein the amount of clustering can be assumed to reflect the amount to which items of a certain category are grouped together (i.e., organized) in memory. Therefore, organization remains a likely candidate mechanism behind the MOE. This seems especially plausible since the ownership assignment is essentially a task in which participants are asked to organize the stimulus material into two distinct categories. Corresponding to this assumption, in Experiment 5, the MOE was eliminated when participants performed a semantic classification task in addition to the ownership assignment (as opposed to an arbitrary perceptual classification task). Therefore, a family resemblance between the MOE and the SRE can be attested for their apparent reliance on semantic organization, if not for an undifferentiated concept of “processing depth”.

6.2.3 Categorizing the world as “self” and “not self”: the mere ownership effect and semantic organization

It has long been thought that organization plays a key role in self-memory effects like the SRE. The results of Experiments 5 and 6 suggest that this applies to the MOE as well. Organization can be seen as a likely contributor to the MOE. As mentioned, the ownership assignment is essentially a task in which participants are asked to organize the stimulus material into two distinct categories: self and other. It can be seen as imposing organizational processing through task demands, making a contribution of this process especially plausible. And indeed, it seems that a competing organizational principle can interfere with the effectiveness of the ownership manipulation. In Experiment 5, the MOE was eliminated when participants performed a semantic classification task in addition to the ownership assignment (as opposed to an arbitrary perceptual classification task). This suggests that the “self”- vs. “not self”-categorization in the ownership task functions as an organizing principle according to which the study material is grouped and encoded. Within this organizing scheme, we can observe a clear asymmetry: the “self” category is a well-defined and relevant category whereas the “not self”- category (i.e., ‘‘other”) is a fuzzier and more negatively defined category (i.e., “anything not belonging to me”). Hence, the “self” category is more salient and therefore leads to enhanced attention for the category and the items that are associated with it. Evidence that binary categories are often processed in an asymmetrical fashion comes from reaction time paradigms (e.g., Wentura, 2000; Rothermund & Wentura, 2004). In the older literature on the levels of processing framework, it is often observed that memory was enhanced for items that were associated with a “yes” response in the study phase (e.g. Craik & Tulving, 1975). Insofar as the orienting task was related to semantic categories (e.g., “Is the word an animal name?”), one might see this, too, as corroborating evidence. Following an evolutionary psychological approach, Nairne, Thompson, and Pandeirada (2007) asked participants to rate all items with regard to how relevant each of these words would be in a survival situation (which can be seen as a proxy for a binary categorization of “relevant for survival” vs. “not relevant for survival”). Memory performance was positively correlated with rating scores. It is possible that attention is guided by the salience of the category during encoding, thereby – in the case of the MOE – enhancing subsequent memory for items associated with the self (Turk et al., 2008). Furthermore, within a more clearly defined and narrowly circumscribed category, it might be easier to associate items meaningfully with each other, leading to better accessibility.

6.2.4 Welcome to the family?

Our research suggests that, similar to a self-reference task (Rogers et al., 1977), the ownership assignment task enhances semantic organization. While an unspecified concept of “deep” semantic processing cannot adequately capture the MOE, a more refined take on the levels of processing (Craik and Lockhart, 1972) has proven helpful in gaining insight into the phenomenon, enabling us to link the MOE to a more general mechanism of memory. This is in line with the view that the self as a construct draws on some of the same memory processes thought to underlie a range of different tasks (e.g., Klein & Loftus, 1988; but see also Sui & Humphreys, 2013). This would seem to suggest the tentative answer that the self is not so “special” after all, at least not in the sense of drawing on cognitive mechanisms that are unique to the self only. Rather, known mechanisms and strategies might be recruited with greater efficiency when the self is concerned. In the case of the MOE, it would appear that semantic organization is facilitated. Furthermore, both self-referential encoding and the ownership task appear to strengthen recollective experience, as reflected in the rate of “remember” judgments in an RKG task (Conway & Dewhurst, 1995; Conway, Dewhurst, Pearson, & Sapute, 2001; van den Bos et al., 2010), which we again confirmed for the MOE, suggesting an involvement of episodic memory.

Of course, our findings do not touch on the possibility that other processes implicated in the self’s impact on memory and cognition, such as attention and salience, or affect and reward (Turk et al., 2011; Krigolson et al., 2013) also contribute to the MOE. Evidence for such a contribution would by no means be an indictment of levels of processing or processing depth: “Deep” processing is not synonymous with semantic processing, after all. In fact, it was never conceived as a unitary single dimension (Lockhart & Craik, 1990), and the definition allows for multiple different constituting processes. Neither should the SRE be interpreted in this manner (Klein, 2012). The SRE, too, can be viewed as a phenomenon constituted by a number of different components which the researcher is tasked to identify. It is plausible that a similar approach is apt for the MOE. In any case, it seems justified to say that the MOE and the SRE share meaningful similarities in terms of how they are brought about. However, our findings do not warrant the stronger conclusion that they are merely different instances of the same phenomenon. Crucially, while it seems that the ownership assignment enhances organization of study material, its influence with respect to semantic elaboration is less clear. Therefore, while the phenomena seem clearly related, it remains possible that there is only a partial overlap between the processes reflected in the self-reference and the mere ownership effect.

6.3 The self-prioritization effect and incidental self-involvement: the mere ownership effect has its limits

While the present series of experiments suggests that there are more than just superficial similarities between the MOE and the SRE, with semantic organization as a mechanism likely contributing to both (Klein & Loftus, 1988; Symons & Johnson, 1997), the same cannot be said for the MOE and the self-prioritization effect first described by Sui et al. (2012). In Experiment 7, we used a perceptual matching task in which geometric shapes were paired with either the self or another person. Typically, the pairing involving the self and the designated shape is confirmed as correct with greater ease by participants (e.g., Sui et al., 2012; Sui & Humphreys, 2013; Schäfer et al., 2015). This was true in our experiment as well: a self-prioritization effect reliably emerged. However, we additionally attempted to utilize this perceptual matching task as an encoding phase for a subsequent surprise recognition test. By consistently presenting visual objects with one of either the “self”-shape or the “other”-shapes, we attempted to find out whether such an incidental pairing would create something resembling an MOE. This was, however, not the case. Instead, we observed a dissociation. Participants were no better at remembering objects that had been paired with the “self”-shape than objects that had been paired with either of the “other”-shapes. There was no trace of an MOE, even though we found a clear self-prioritization effect. Our result seems to suggest that the MOE and the self-prioritization effect are distinct phenomena and are not based on the same mechanisms[21]. In Chapter 4.2, I already detailed some differences between the perceptual matching task

[21]Of course, the usual caveats about drawing inferences from null results still apply. As a potential counterpoint to this, however, it is worth noting that memory performance across the different conditions was virtually identical in Experiment 7.

and the self-prioritization effect on the one hand, and the shopping paradigm and the MOE on the other hand, all of which might contribute to these diverging results. It might be that the self-prioritization effect is indeed not situated at the semantic level. While there is some evidence for a conceptual component of the perceptual matching task[22] (Schäfer et al., 2015), the self-prioritization effect has initially been conceptualized as a prioritization in perceptual processes, not in memory strength. The general idea is that by tagging a shape as belonging to the self, its salience is increased. The self-prioritization effect typically takes the form of faster correct responses in matching trials involving the "self"-shape, and of higher accuracy rates for the matching decision in trials using the "self"-shape, as compared to trials involving the other shapes. Furthermore, the MOE and the self-prioritization effect happen on different timescales. While the MOE is measured as an aftereffect of self-involvement in a memory test that is administered after the ownership assignment task, the perceptual self-prioritization effect is more immediate. During the matching task, participants need to hold the correct pairings active in their minds. In the matching paradigm, only three shapes (e.g., rectangle, circle, triangle) are bound explicitly by instruction to a person or object (e.g. the self, the participant's mother, and an acquaintance). It is taken for granted that all three assignments are accessible by participants. If one were to use the shapes in a mere ownership-like test, one would display the three shapes mixed with three new shapes and then ask for recognition which would be likely to produce uninterpretable results due to ceiling effects.

This null finding hints at the boundary conditions of the MOE. There are apparent limits to how implicit or "mere" the MOE really is. A completely incidental pairing between an object and a shape associated with the self seems insufficient to produce an MOE (but see also Turk et al., 2008). Perhaps the connection between the self and an object has to be direct, explicit and task-relevant for an MOE to emerge. On a related note, perhaps the self-as-concept, rather than the self-as-subject needs to be targeted by the encoding task (e.g., James, 1890; Neisser, 1988). The conceptual distinction between different "selves" or facets of the self suggests that there are multiple empirical access routes when investigating self-memory advantages. At first glance it is plausible that such "self-systems", even if distinct, interact closely with each other (Boyer et al., 2005). Thus, it might be hypothesized that the processes producing the MOE might be tapped into via a route to

[22]Schäfer et al. (2015) found that the prioritization effect described by Sui et al. (2012) does not seem to be modulated by varying the perceptual features of the geometrical shapes, suggesting that an association was formed between the self and the concept of a shape rather than the specific visual stimulus, suggesting a potential role for concepts.

the self that relies neither on an explicit assignment to the self nor on declarative memory of the kind that is later called upon for retrieval. However, previous research we conducted in this vein (Englert, 2013; Englert & Wentura, 2013) has proven inconclusive. Seeking a potential bodily “access” route to the self, we employed the so-called rubber hand paradigm (Botvinick & Cohen, 1998). In brief, the rubber hand illusion is a phenomenon where a foreign object – typically a realistic fake hand – is integrated into the internal representations of a person’s body by means of sensory integration and a match with existing body representations (Armel & Ramachandran, 2003; Tsakiris & Haggard, 2005). If eliciting such a bodily illusion was sufficient to produce an MOE, this would have provided evidence that even a maximally implicit connection to the self has far-reaching cognitive consequences, it would have provided justification for the “mere” qualifier in the MOE label (see also Englert, 2013). However, no clear influence of such an illusion on memory has been shown. Combining an incidental presentation of visual objects with stimulation meant to elicit or disrupt ownership of a fake hand with a surprise recognition test, no clear evidence of an MOE could be obtained. Three experiments yielded partially conflicting results that either failed to produce a statistically significant effect or produced effects that were not (clearly) attributable to ownership. The most obvious explanation for this failure to obtain an MOE under these conditions is, of course, that there is simply “nothing there”. Such an implicit, body-based route to the self may just be insufficient to produce a memory advantage. However, it cannot be ruled out at present that this lack of conclusive evidence was due to procedural variables and the present lack of clear standards for conducting rubber hand experiments (e.g., Trojan, Riemer, & Fuchs, 2016) that precluded the effectiveness of the experimental manipulation.

In any case, further research into the boundary conditions of the MOE is needed. However, it seems clear that those limits cannot be pushed indefinitely. Apart from meaningful stimulus material, it seems that the connection between the stimulus objects needs to be explicitly spelled out to participants (e.g. “you own this”) for a self-memory advantage to emerge. For the time being it makes the most sense to me to conclude that the MOE pertains to the self as a concept in declarative memory and requires an encoding manipulation that is both direct and explicit. Put another way, the ownership task could be interpreted as predominantly targeting the “me”, rather than the “I” (James, 1890; Kihlstrom et al., 2003).

6.4 Limitations of the present experiments and directions for future research

While the present research sheds some light on the boundary conditions of the MOE, as well as the kinds of encoding mechanisms likely to underlie it – specifically, semantic organization – there are limitations and open questions to consider.

6.4.1 Robustness, size, generalizability and universality of the mere ownership effect

First off, there are now a number of results attesting to the robustness of the MOE (van den Bos et al., 2010; Cunningham et al., 2011; Turk et al., 2011; Krigolson et al., 2013; Sui & Humphreys, 2013), and I believe that confidence in the MOE is warranted. However, since the reliability of results in experimental psychology in general, and in social cognition research in particular, has increasingly been called into question during recent years (e.g., Earp & Trafimow, 2015), further solidifying these findings - or contesting them - through aggregation and replication remains desirable. Given that there is now a considerable body of research on the MOE, the field would likely benefit from approaching the phenomenon via meta-analysis. This would enable more precise predictions about the size of the MOE, as well as a more comprehensive assessment of factors that introduce variability, both of which can provide valuable guidance for researchers new to the field.

Related to the question of the overall reliability of the MOE, there is the question of its universality. That is, is there an MOE across different populations and how variable is it? Markus and Kitayama, 2010, among others, have emphasized the distinction between "interdependent" and "independent" self-concepts which they connect to the distinction between "communal" and "individualistic" cultures (see, Oyserman, Coon, & Kemmelmeier, 2002, for a meta-analysis; for a critical perspective, see Matsumoto, 1999, or Voronov & Singer, 2002). In brief, an independent self-concept can be seen as more likely to guide a person's focus on their own thoughts and feelings, and toward drawing a sharper distinction between the (social) world and the self as an entity separate from it. Someone with an interdependent self-concept, on the other hand, would be expected to view themselves first and foremost as part of a social group, and thus, give more consideration to other people in that group. They might have fuzzier boundaries between the self and the world, thus not viewing themselves as separate from other people. It would be interesting to see if such differences in self-concept indeed correspond to smaller or larger MOEs. It is also possible that a more permeable or "interdependent" self-concept is associated with a reduced or eliminated MOE, but only in the case of close others. This has already been demonstrated in the case of the SRE: For example, in at least two studies involving a Chinese population, the SRE was eliminated when the other-referential task was about a close friend or a parent (Zhu & Han, 2015). Previous research has shown that when the self-reference task is compared to a task referencing an intimate other, as opposed to a distant stranger, the SRE is reduced even in a Western sample (Symons & Johnson, 1997). In the case of the SRE, a plausible explanation for this would be the amount of knowledge one has about the person one is referencing: In the case of semantic elaboration, the existence of rich and accessible memory structures about that other person would be assumed to strengthen memory in the same way as the self does. However, arguably an analogous phenomenon exists in the case of the perceptual prioritization effect (Sui et al., 2012). Typically, response times and accuracy rates in the matching task take an intermediary position for the intimate other (e.g. “mother”) condition. Participants do not affirm correct “shape + mother” pairings with the same ease as they do correct “shape + self” pairings, but performance is still significantly better than for “shape + distant other” pairings. Given the shallow nature of the matching task, an explanation involving the rich memory representations of both the self and the people close to us, seems less plausible here. Similar gradations might exist for the MOE, as some preliminary evidence suggests (Sparks et al., 2016). If the MOE turned out to be reduced when the other recipient in the shopping task was one’s mother or best friend, this would then raise the question of why this is the case. Perhaps the self-concept is permeable enough to allow the integration of an intimate other. Perhaps our concept of an intimate other is so well-structured that it, too, gives rise to semantic elaboration and organization processes that strengthen memory.

6.4.2 The mere ownership effect and the self-reference effect: open questions on depth of processing and episodic memory

Similarities and differences between the SRE and the MOE, as well as their theoretical implications, should provide ample directions for further investigation. As mentioned above, the present research suggests a strong involvement of semantic processing in producing the MOE. The same has long been believed of the SRE, both due to the nature of the self-referential task, and the large amount of empirical research into the nature of the SRE (Rogers et al., 1977; Symons & Johnson, 1997). However, semantic processing is a broad concept which can be further refined into semantic elaboration and organization

(Einstein & Hunt, 1980). In the case of the SRE, the self-reference task is assumed to support both processes at once, which then combine to produce exceptionally good memory performance after self-referential encoding (Klein & Loftus, 1988; Symons & Johnson, 1997). While we obtained positive evidence for an influence of semantic organization on the MOE, the evidence presents a much less clear case for semantic elaboration: In an experiment designed to pick up on aftereffects of semantic elaboration (Experiment 4), we found no indication that self-assigned items had indeed been elaborated upon to a greater degree than other-assigned items. Of course, one possible explanation is that there is simply nothing to detect and that ownership does not increase semantic elaboration. However, such a conclusion would be based on a single null result, involving a paradigm that, to my knowledge, has not been widely used as a sensitive test of semantic elaboration. This single negative result is, to my mind, insufficient to rule out a contribution of semantic elaboration to the MOE. Therefore, research into a potential contribution of this mechanism should not yet be abandoned altogether. Rather, it should be investigated using different designs. The most straightforward way to do this would be to manipulate the extent of elaboration experimentally at encoding, via the orienting task. Such an experiment would have the additional advantage of providing another test for semantic organization. An investigation along those lines could follow the methods of Klein and Kihlstrom (1986) or Klein and Loftus (1988), who used tasks and stimulus materials designed to selectively encourage organization, elaboration, or both and found evidence that indeed both contribute to the SRE. Since this type of research into the SRE typically employs word stimuli (see, e.g., Symons & Johnson, 1997), MOE experiments might have to be adapted for verbal material. Experiment 6, where participants had to write down the names of objects encountered during encoding, shows that at least retrieving stimuli in verbal form presents no obstacle for the MOE.

Apart from the relative contributions semantic elaboration and organization, there is a further characteristic of the SRE which it shares with the MOE. Self-referential encoding has been shown to strengthen recollective experience, and self-referentially encoded items tend to be associated with higher rates of “remember” judgments at retrieval than semantically encoded items (Conway & Dewhurst, 1995; Conway, Dewhurst, Pearson, & Sapute, 2001). This self-reference recollection effect also seems to persist over longer retention intervals. Remarkably, it was also present when no significant SRE in terms of general recognition memory performance was found. As there is already some evidence that ownership appears to disproportionately improve source memory and episodic memory more generally (van den Bos et al., 2010; Cunningham et al., 2011), one question would be if this tendency remains stable or even increases over longer retention intervals, as is the case for the self reference recollection effect. A speculative theoretical connection could be drawn from evidence regarding the MOE and source memory and recollective experience on the one hand, and the MOE and organization on the other: Both types of encoding involve associative connections between the material and the learning context in the widest sense. For example, organization can imply that stimulus materials are associated with each other, but also that they are associated with their superordinate category. This superordinate category, that is, the self, is one of the potential sources participants need to remember in a source memory task. As for episodic recollection, one might view the remember option as testing for source memory, where the participant is completely free to pick any source. The fact that divided attention at encoding can eliminate the MOE (Turk et al., 2008) is precisely what one would predict from an effect that is based on the binding-together of to-be-learned information. Therefore, the relationship between episodic memory and organization in the MOE, and whether the ownership assignment causes both in essentially the same manner, could constitute an interesting line of research.

6.4.3 The mere ownership effect and forgetting

The SRE is both a reliable and sizeable finding, but how resistant are self-referentially encoded memories to the passing of time and disruptive influences? Across studies, the SRE increases in size as retention intervals get longer (Symons & Johnson, 1997). As mentioned in the previous section, the self-reference recollection effect persists over longer retention intervals (Conway & Dewhurst, 1995; Conway et al., 2001). Furthermore, it seems that self-referential encoding can impede forgetting even when participants try to intentionally suppress an item (Tempel, 2010; Yang et al., 2013). Thus, it seems that self-referential encoding indeed has the power to ward off forgetting to a greater degree than, for instance, semantic encoding. But what happens to self-referentially encoded memories when they come “under attack” by an experimental manipulation designed to lead to their forgetting?

One way to address this question is via retrieval induced forgetting. This refers to the observation that retrieving a subset of recently learned stimuli can cause the forgetting of other stimuli from that set (Anderson, Bjork, & Bjork, 1994; Murayama, Myatsu, Buchli, & Storm, 2014). Typically, participants are instructed to learn lists of words pertaining to different semantic categories. Afterwards, there is a “retrieval” practice during which participants need to remember a subset of items, typically, half the items of a subset of the categories. This is usually followed by a recall task. Interestingly, unpracticed items from practiced categories are less likely to be remembered than items from categories that were not practiced. That is, retrieval of some items causes the forgetting of other items in the same stimulus subset. Self-referential encoding might counteract this. For example, a study by Macrae and Roseveare (2002), which I describe in detail below, did not find any retrieval-induced forgetting when the encoding task involved the self. However, despite findings suggesting greater durability of self-referentially encoded memories, the data on retrieval –induced forgetting suggests that the situation is complicated. One should steer clear of any blanket statements that self-reference categorically immunizes memories against retrieval-induced forgetting. For example, Barnier, Hung, and Conway (2004)[23] obtained standard retrieval-induced forgetting for autobiographical memories, while Wessel and Hauer (2006) did not observe retrieval-induced forgetting for positive memories, but did obtain it for negative ones. While the pattern of results on self-encoding tasks and retrieval induced forgetting hints at a somewhat complicated picture, it seems that self-reference can reduce forgetting to some extent, provided that certain conditions are met (Tempel, 2010). Anderson (2003) explains retrieval-induced forgetting in terms of inhibitory control: It is argued that, during retrieval practice, when an item from a given category is practiced, the other items from the same category are also activated because they share the same retrieval cue as the target. Therefore, these items need to be suppressed in order to avoid their erroneous retrieval. Subsequent poorer memory of unpracticed items from practiced categories could thus be interpreted as an aftereffect of that suppression. In line with this view, there is some evidence that forgetting self-referentially encoded information is more effortful when attempted on purpose (Yang et al., 2013). This would be in line with the suggestion that a lack of, or greater demand for, inhibitory control is behind an immunizing effect of self-reference on retrieval induced forgetting. Regardless of whether this is indeed the driving mechanism, the impact of the self on forgetting merits further exploration. One question is whether similar effects on forgetting can be observed in the case of a mere ownership situation. The aforementioned study by Macrae and Roseveare (2002) on retrieval-induced forgetting, which used an encoding

[23]However, they did not contrast this with a different type of encoding, leaving open the possibility that the amount of retrieval-induced forgetting in a suitable comparison task would have been larger.

manipulation very similar to the shopping paradigm, suggests that it might. When participants were instructed to imagine that they themselves had purchased the item as a gift, these items did not suffer from the usual retrieval-induced forgetting effect in a subsequent recall test. In this condition, memory performance for unpracticed items from practiced categories was no worse than memory performance for items from entirely unpracticed categories. For participants who had instead been instructed to imagine that another person was buying the gifts, the usual retrieval-induced forgetting effect was observed. This finding has since been replicated by (Hongsheng & Zhu, 2004, qtd. in Tempel, 2010).

Adapting our ownership task for the retrieval-induced forgetting paradigm seems like a straightforward next step in investigating the role ownership plays in forgetting. Categories, such as the origin of an object, could be directly linked to either the self or another person. That way, the category of the item could replace the color cue in the ownership task. This would permit manipulating both ownership and retrieval practice as within-factors, rather than varying self- or other-relevance between subjects, by means of different encoding tasks (Macrae & Roseveare, 2002). It should also be considered that Macrae and Roseveare used semantic categories (indoor and outdoor items) as cues in their retrieval practice task. This type of meaningful classification can be assumed to promote organization and to interfere with ownership-induced memory facilitation based on the self as an organizing structure. In our Experiment 5, we found that an additional encoding task involving semantic categorization, but not a task involving non-semantic categorization, eliminated the MOE. Hence, experimenters should avoid that the categories according to which items are grouped in a retrieval-induced forgetting task are meaningfully connected to the items themselves. One possibility to implement such categories could be by having participants imagine that they are buying from fictional stores[24]. Different items could originate from those different sources, which in turn, could thus be directly and consistently associated with a particular owner (e.g. items from certain shops are owned by the oneself, items from other stores are owned by the other person). In such a design, ownership would be task-relevant during encoding and retrieval, but could be varied orthogonally to the presence or absence of retrieval practice.

[24] I would like to thank Dr. Tobias Tempel for this suggestion.

Finally, the role of valence in this context should be investigated more clearly. For the self-reference task, previous research suggests that it can eliminate retrieval-induced forgetting for positive, but not negative, learning material (Barnier et al., 2004; Wessel & Hauer, 2006). Since the cover story by Macrae and Roseveare (2002) involved gift-buying, they arguably restricted themselves to testing for retrieval-induced forgetting for positive valence. Experiments using the shopping paradigm to study retrieval-induced forgetting could vary the affective content of the stimulus material and test whether the pattern observed with a self-referential encoding task holds true for the ownership manipulation as well. The hypothesis then would be that ownership would reduce retrieval-induced forgetting for desirable, but not undesirable objects.

6.4.4 Multiple conceptions of the self: What can we learn from the mere ownership effect?

It might also prove fruitful to contrast the MOE with other phenomena pertaining to the impact of the self on cognition. In Experiment 7, there was a dissociation between the perceptual self-prioritization effect (Sui et al., 2012) and the MOE. Similarly, previous research we conducted (Englert, 2013; Englert & Wentura, 2013) did not yield evidence that an MOE can be produced by establishing an implicit, bodily connection to the self via a rubber hand illusion (Botvinick & Cohen, 1998). It is worth noting that trivial explanations for these findings, such as an ineffective experimental manipulation, or an insufficiently distinct control condition cannot be ruled out yet. This is due to the fact that many procedural questions regarding the rubber hand paradigm are not yet resolved and there is no clear consensus on how best to conduct a rubber hand experiment (e.g. Trojan et al., 2016). However, in the absence of clear-cut evidence, it seems sensible to provisionally assume that the shopping task taps into different cognitive processes than both the perceptual matching task or the rubber hand illusion. On the other hand, there appears to be a fair bit of overlap between the processes driving the MOE and the SRE (Rogers et al., 1977). Such dissociations and convergences have potentially interesting implications for theories of the self. It has been widely suggested that, far from being a single homogeneous entity, there really are multiple facets of the self, underpinned by different cognitive systems (Neisser, 1988; Boyer et al., 2005; Klein, 2012). Studying discrepancies and similarities in the effects of different tasks designed to tap into the "self" could help with more clearly identifying and characterizing different facets of the self, as well as with explicating the cognitive functions they are tied to. An understanding of which type of self-related task has which effect on cognition, and how these tasks interact with each other, could provide insight into what, precisely, constitutes the self, or “selves”. For example, in the case of independent systems, we would expect double dissociations between tasks that only target one system, whereas a single dissociation (e.g., if we sometimes observed perceptual self-prioritization without an MOE, but never an MOE in the absence of perceptual self-prioritization) could point to a more hierarchical relationship.

6.4.5 Theorizing on memory, the self and the mere ownership effect

Finally, both the construct of the self and the kind of “deep” processing implicated in a self-reference task would benefit from further explication and attempts at theoretical reduction. As Lockhart and Craik (1990) have themselves felt compelled to point out, depth of processing should be viewed as a concept that itself needs explanation and specification, rather than something that can, by itself, account for memory phenomena. To me, this appears at least equally true of the concept of “self”. While at first glance, it may seem self-evident what precisely is meant by “depth of processing”, “self” or even “ownership”, they are ultimately broad and fuzzy terms. They may serve as stand-ins for other processes, that could explain more precisely how ownership gives rise to memory advantages, but are yet to be determined. But by themselves, these broad concepts have little to offer in the way of explanatory power and testable predictions. At worst, they could be misunderstood as full-fledged theoretical accounts that neither need nor permit further explanation. If we take this view, these broad theoretical constructs might well obscure more than they elucidate. A more reductionist, mechanistic approach to psychology seems more promising to me. Similar arguments have been made by Herschbach and Bechtel (2014), as well as Kim and Hommel (2015). Breaking down a construct such as “deep processing” into smaller constituent parts and the functions they perform seems necessary to gain insight into it. To some extent, the posited mechanisms of semantic “elaboration” and “organization” accomplish this in the case of processing depth. They specify routes through which memories are formed and yield testable hypotheses about how their effects on memory output should look like. For instance, positing organization as a driving mechanism behind the MOE yielded the straightforward prediction of increased clustering of self-owned items in a free recall task. Positing elaboration yielded the similarly straightforward – yet unconfirmed - prediction that the meaning of a self-assigned object should be accessible with greater ease. As mentioned, the same holds true for the self. If the self as a psychological construct – or indeed, a collection of constructs

(Klein, 2012) – and its impact on human memory are to be better understood, research into underlying mechanisms needs to be pursued further, and reductionist theoretical accounts of how these mechanisms could operate need to be spelled out in detail and put to the test.

7 Conclusion

"Self-pity can make one weep, but so can onions." – Jerry Fodor (quoted in Pinker, 1997)

The mere ownership effect (Cunningham et al., 2008) is an example of how involvement of the self can impact memory. The MOE is remarkable because it is brought about by means of a very simple experimental manipulation. Imagining that we ourselves, as opposed to somebody else, become the owner of a randomly-selected object, is sufficient to make us more likely to remember it. However, the mere ownership effect still depends on some crucial boundary conditions: For instance, the MOE seems to be situated at the semantic level: Both meaningful study material and a direct, explicit assignment of stimuli to their respective "owner" seem to be required for an MOE to emerge. There are a number of experimental observations in psychology that might be termed self-memory-effects, some of which share more similarities with the MOE than others. For example, we did not obtain evidence for a shared basis of the MOE and the perceptual self-prioritization effect (Sui et al., 2012). However, there is good reason to view the MOE as a close relative of the SRE (Rogers et al., 1977). Like the SRE, it has proven fruitful to view the MOE from a levels of processing perspective (Craik & Lockhart, 1972). This is how I approached the phenomenon in the series of experiments presented in this thesis. Specifically, I looked into the role that semantic processing plays for the MOE, with particular interest in semantic elaboration and organization (Einstein & Hunt, 1980), both of which are thought to underlie the SRE (Klein & Loftus, 1988; Symons & Johnson, 1997). As mentioned above, the experiments presented here suggest that the MOE is situated at the conceptual level and that both an explicit self-assignment and some form of semantic "processability" is required for a memory advantage to emerge. Furthermore, the results suggest that semantic organization clearly contributes to the MOE. The self might function as an organizing principle, enabling us to clearly distinguish between "me" and "not me" and to more efficiently structure the content of the "me" category (Englert & Wentura, 2016). Unsurprisingly, there is no definite answer to the question asked at the outset, namely, whether the self is special. However, in terms of accounting for the MOE, the evidence we found points toward more general mechanisms of memory being at least partially responsible for the MOE. These are processes that can, at least in principle, also be encouraged by encoding tasks that do not involve the self. Further research is required to determine or rule out the respective contributions of other processes, such as semantic elaboration or reward, and to give a more detailed account of how the self engages these mechanisms to cause improved memory performance.

8 References

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Appendices[25]

Appendix A: Quantifying organization: measures of clustering in free recall

If organizational processing is assumed to have taken place during encoding, it can be predicted that this will affect the order of the output in a free recall task. Such a task is required since, in the case of recognition tests, the order in which items are retrieved are beyond the control of the subject. However, in a free recall task, by necessity, participants themselves determine how the retrieved material is structured. Rather than being random, it is assumed that subjects reproduce stimulus items systematically, in an order reflecting their internal organization. Specifically, it is thought that if items are grouped together in memory, they will be more likely to be reproduced in close proximity to each other. For example, if one particular item is reproduced, it could then function as a memory cue for further related items. If one wants to assess or compare the amount of such clustering in a given memory output, or compare clustering between different tasks, a formal way of computing the amount of clustering is necessary. Several ways of quantifying and comparing clustering have been proposed. I will introduce some of them in the following, and discuss them with regard to their suitability for quantifying the amount organization in the mere ownership paradigm.

Some measures focus on the overall amount of clustering in a given output, comparing it to the amount of clustering that would be expected by chance. In its simplest form, pair frequencies are taken as the indicator of clustering, whereas other measures also take into account the length of a given progression of items of the same category (Mandler, 2011). Thompson and Abramczyk (1975) provide an overview and a comparison of classical measures of clustering used in free recall tasks.

[25] For references cited in the appendices, see the general list of references of this dissertation.

Table A 1. Examples of clustering indices and their anchoring values adapted from (Thompson & Abramczyk, 1975).

Measure	Observed = Expected		Observed = Maximum	
	3x6	2x9	3x6	2x9
MRR (Bower Lesgold & Tieman)	0.33	0.50	1.00	1.00
Bousfield & Bousfield	0.00	0.00	10.00	8.00
Gerjuoy & Spitz	0.00	0.00	1.00	1.00

Note. The respective values taken on by each index are given when clustering is either at expected or maximum level, and measured in either a list of either 6 recalled items from 3 different categories, or a list of 9 recalled items from two different categories.

These indices differ mainly with respect to whether and how they take different factors into account, including:

(a) the expected amount of clustering that should occur by chance;
(b) the overall memory performance for a given category, i.e. the number of category items recalled;
(c) the intra-list-dependence of clustering between different categories.

For the purposes of the research presented in this dissertation, the hypothesis is that the self would function as an organizing concept and that therefore, there would be a greater amount of clustering for self-owned items than for other-owned items. Therefore, the relative difference between self- and other-assigned items is main focus of interest, rather than the specific amount of clustering in a category itself or whether clustering is significantly different from a hypothetical chance level. Importantly, the overall frequency of items recalled should be accounted for, since memory performance for self-owned items is generally higher than for other-assigned items and our clustering index should not simply reflect the mere ownership effect itself.

Measures of above-chance clustering

Even if there is no systematic organization of memory using the categories of interest to the researcher, statistically some repetitions are to be expected purely by chance. If this is not taken into account, a measure of clustering is likely to overestimate the overall amount of memory organization it is intended to assess. Therefore, the expected amount of chance repetition has to be subtracted from the amount of clustering that is empirically observed.

Such measures are most suitable to address the question whether or not a an above-chance amount of clustering has occurred at all, that is whether the order of the output reflects the systematic grouping of the items in memory. The relevant statistical comparison would then be between the value of such an index and zero (or whichever value corresponds to perfect chance clustering). Significant positive differences and would be indicative of memory organization.

Expected number of repetitions according to Bousfield and Bousfield (1966)

Bousfield and Bousfield (1966, cited from Hunt, 1971) proposed a measure for the expected amount of clustering in randomly distributed output. By using the expected frequency of pairs as a baseline, it is possible to test whether the empirically observed frequency of pairs exceeds the number of pairings that occur randomly, that is if there is clustering of items. They proposed the following equations for calculating the expected frequency of repetitions $E(R_i)$ in a given category i:

$$E(R) = \sum R_i = \sum \frac{m_i(m_i-1)}{n} = \left(\sum_{i=1}^{k} \frac{m_i^2}{n}\right) - 1 \qquad (1)$$

$$E(R_i) = \frac{m_i(m_i-1)}{n} \qquad (2)$$

where R is the number of repetitions overall, R_i is the number of repetitions for a given category i, m_i is the number of items recalled from category i, n is the total number of items recalled, and k is the number of categories.

The advantage of this measure is that it is independent of overall number of category items recalled, as the absolute frequency of pairs would be expected to increase with the absolute frequency of recalled items.

A limitation of this approach is, however, that it does not accurately capture differences in chance clustering between categories of the same list. According to Hunt (1971), even though equations (1) and (2) provided separate expected values for each category, they are only suited to assess overall clustering of a list.

Clustering in free recall according to Gerjuoy & Spitz (1966)

A commonly used clustering measure was proposed by Gerjuoy and Spitz (1966, cited from Thompson & Abramczyk, 1975).

The clustering score is computed as follows:

$$C_i = \frac{R_i - E(R_i)}{Max\ R_i - E(R_i)} \qquad (3)$$

where R_i is the observed number of repetitions for a given category i, $E(R_i)$ is the expected number of repetitions when there is no non-random clustering and max Ri is the maximum number of repetitions of category i items given the number of category i items recalled.

For the overall amount of clustering in a given output, this gives the ARC-Index (Roenker, Thompson, & Brown, 1971) which is computed as follows:

$$ARC = \frac{R - E(R)}{max\ R - E\ (R)} \qquad (4)$$

Where R is the observed number of category repetitions for the entire list, E(R) is the expected number of repetitions when there is no non-random clustering and max R is the maximum number of category repetitions given the number of category items recalled, and the number of categories.

For the overall score, max R is computed as

$$maxR = n - k \qquad (5)$$

(Where n is the number of items recalled and k the number of different categories in the output).

The amount of clustering is calculated as the ratio of the number of observed above chance repetitions and the maximum number of above-chance repetitions. A value of zero indicates chance clustering, whereas a value close to 1 represents high clustering. Estimating the number of expected repetitions is not without difficulties, however. Different approaches to obtain an adequate index for $E(R_i)$ in the case of between- and within-list comparisons are discussed in later sections. An important limitation of the commonly used measure is that it is appropriate for quantifying clustering across an entire list but not specific subsets of lists (Hunt, 1971; Klein & Kihlstrom, 1986).

Correction for dependency according to Hunt (1971)

Hunt (1971) proposed a measure for the expected number of pairs that allowed within-list comparisons of clustering of different categories. When making within-list comparisons, it needs to be taken into account that the amount of clustering in one category is no longer independent from the amount of clustering in the other category. Specifically, the more repetitions there are of one category with a given frequency of items of that category recalled, the more clustering there will be for the remaining categories. Therefore, repetitions of non-i items that exceed chance should be subtracted from the number of items in the denominator. The following equations for determining $E(R_i)$ were proposed.

$$E(R_i)' = \frac{m_i(m_i-1)}{n_i'} \qquad (6)$$

Where

$$n_i' = n - [R - E(R)] + [R_i - E(R_i)] \qquad (7)$$

(Where R is the number of repetitions overall, R_i is the number of repetitions for a given category i, m_i is the number of items recalled from category i and n is the total number of items recalled).

Below, indexes of above-chance clustering are presented. The basic rationale of the clustering measure is the same for both Gerjuoy and Spitz (1966) and in Klein and Kihlstrom (1986). However, they differ with regard to how the expected amount of chance clustering, which forms part of the equation, is calculated.

Quantifying clustering in a self-reference task (Klein & Kihlstrom, 1986)

In their Experiment 1, Klein and Kihlstrom (1986) used the expected amount of pairs per category in order to obtain a baseline for clustering that should occur randomly. Importantly, they aimed to compare the amount of clustering between different categories that were recalled on the same trial. In previous studies, typically only the amount of clustering for an entire recall list was calculated.

They utilized the rationale proposed by Bousfield and Bousfield (1966), applying Hunt's (1971) correction for expected pairings between different categories of the same list which is designed to take into account the fact that the within-list amount of clustering of a given category is not independent from the amount of clustering in the other categories.

They applied the basic rationale from Gerjuoy and Spitz (1966) in order to quantify the amount of clustering per category, where the amount of clustering was defined as follows:

$$C = \frac{R_i - E(R_i)}{Max\ R_i - E(R_i)} \qquad (8)$$

(Where R_i is the observed number of repetitions for a given category i, $E(R_i)$ is the expected number of repetitions when there is no non-random clustering and max Ri is the maximum number of repetitions of category i items given the number of category i items recalled.)

Here, a value of 0 indicates clustering at perfect chance level, whereas higher values indicate a greater amount of clustering.

Measuring clustering relative to overall memory performance

Bower, Lesgold and Tiemann (1969): Modified ratio of repetitions

The modified ratio of repetition proposed by Bower et al. (1969) is the proportion of pairs of same-category items relative to the number of items in that category.

It is defined as

$$MRR = \frac{\sum_j n_{jj}}{\sum_j n_i - 1}, for\ all\ n_j > 1 \qquad (9)$$

"Where n_j is the number of words recalled from category or group j, n_{jj} is the number of pairs

of the n_j words which are recalled in consecutive order , and the summation ranges over

the various categories or groups" (p.482).

For a single category the MRR_i is computed as

$$MRR_i = \frac{n_{ii}}{ni - 1} \qquad (10)$$

In the case of perfect clustering, the MRR equals 1, in the absence of repetitions it takes on a value of 0.

While this measure takes into account the number of items recalled, it is not anchored at chance level. Indeed, chance clustering may correspond to different scores depending on the specific output list.

However, since our main focus was the difference in clustering between self- and other-assigned items, this particular feature of the MRR need not be problematic.

Robbins and Nolan (2001): Number of runs

More recently, an alternative rationale was proposed by Robbins and Nolan (2001). Their clustering index c is equivalent to the MRR for a single category. While not developed in the context of recall tasks, specifically, it is adequate for the type of data produced by our task. Albeit mathematically equivalent to measures looking at the frequencies of simple pairs, the calculation for this clustering index has the advantage of requiring a more direct look at the length of an uninterrupted string of same-category items.

The reasoning behind this way of calculating clustering is that the more clustering there is, the fewer uninterrupted runs of same-category items there will be for a given amount of items recalled. A run is defined as an uninterrupted sequence of consecutive same-category items.

For items of a given subcategory, the clustering index is defined as

$$C = \frac{min - obs}{min - max} = \frac{n-r}{n-1} \qquad (11)$$

where n is the number of items in a given category and r is the number of runs.

C is the ratio of the difference of the number of items in a given category (if at least the same number-1 of items from other categories have been recalled, this corresponds to minimal clustering) and the number of observed runs in that same category to the difference between the number of items in that category and the number of runs given maximum clustering (if any category items are recalled, said maximum will be exactly 1 run). Values close to 0 indicate an absence of clustering, values close to 1 indicate high clustering.

As can be easily demonstrated[26], the sum of Cs over all categories equals the MRR, just as the modified repetition ratio with only one category j in the enumerator is equivalent to C.

Ultimately, this measure permits a comparison between the amount of clustering in different categories within the same list, while controlling for overall memory performance. A potential criticism of this measure is that it does not control for the amount of clustering that would be expected by chance alone. However, this was not the focus of our research.

[26] There is a simple relationship between the number of runs and the number of pairs of items for a given category. Let n_i be the number of items of category i and r_i the number of runs of category i. Let be the length of the k-th run, i.e. the k-th run contains $l_i^{(k)}$ consecutive items of cateogory i. Thus, it contains $l_i^{(k)} - 1$ pairs. The total number of pairs is thus given by

$$\sum_{k=1}^{r_i} \left(l_i^{(k)} - 1\right) = \sum_{k=1}^{r_i} l_i^{(k)} - \sum_{k=1}^{r_i} 1 = n_i - r_i \qquad (12)$$

as the sum of all items contained in all runs has to be the total number of items n_i. Therefore, the total number of pairs of category i is $n_i - r_i$, the number of items of this category minus the number of runs of items of this category. *The author would like to thank Dr. Matthias Augustin for providing this proof.*

We chose the MRR/ C-Index in order to be able to compare clustering between categories within the same output.

Appendix B. Overview of hit and false alarm rates for the pilot study, Experiments 1-5, and Experiment 7

Table B 1. Mean hit rates for self- and other-assigned items and false alarm rates for new items for the pilot study, Experiments 1-5, and Experiment 7. SD in parentheses.

	Self-assigned (Hits)	Other-assigned (Hits)	New Items (False Alarms)
Pilot study	.39 (.19)	.39 (.20)	.11 (.09)
Experiment 1	.70 (.20)	.66 (.17)	.13 (.14)
Experiment 2	.71 (.16)	.66 (.17)	.13 (.14)
Experiment 3	.31 (.17)	.32 (.17)	.11 (.11)
Experiment 4 (matching trials)	.55 (.16)	.52 (.14)	.13 (.12)
Experiment 4 (non-matching trials)	.53 (.17)	.51 (.15)	.23 (.14)
Experiment 5 (perceptual)	.55 (.20)	.53 (.21)	.07 (.06)[a]
Experiment 5 (semantic)	.68 (.21)	.70 (.19)	
Experiment 7	.47 (.25)	.47 (.24)[b]	.25 (.18)

Note. [a] False alarm rates cannot be differentiated between the semantic and conceptual encoding task and are the same for both conditions. [b] Hit rates for "other"-assigned items in Experiment 7 are computed as the mean hit rates between the hit rates in the "mother" and the "acquaintance" condition.

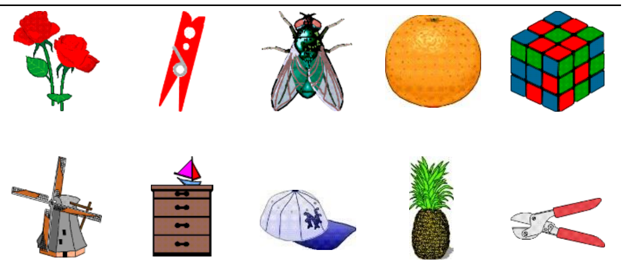
Appendix C. Stimulus Objects used in the Experiments

Appendix C1. List of visual stimuli used in the Pilot Study

Set 1

Meaningful stimuli	
Meaningless pseudo objects	

Set 2

Meaningful stimuli	

Meaningless pseudo objects

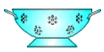
Set 3

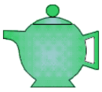
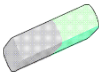
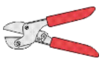
Meaningful stimuli

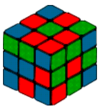
Meaningless pseudo objects

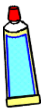
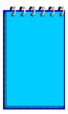
Appendix C2. List of visual stimuli and labels used in Experiments 1 and 2

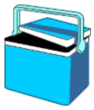
Set 1

Item	Label	*Translation*
	Kürbis	*pumpkin*
	Brokkoli	*broccoli*
	Chili	*chili pepper*
	Zitrone	*lemon*
	Rose	*rose*
	Nudelsieb	*strainer*
	Schere	*scissors*

	Teekanne	*teapot*
	Waschmaschine	*washing machine*
	Fernseher	*television set*
	Croissant	*croissant*
	Fußball	*football*
	Luftballons	*balloons*
	Radiergummi	*eraser*
	Sparschwein	*piggy bank*
	Feuerzeug	*cigarette lighter*
	Hammer	*hammer*
	Zange	*tongs*
	Fahrrad	*bicycle*
	Kerze	*candle*

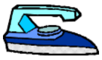
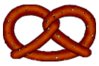
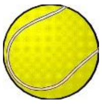
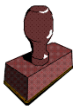
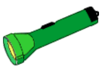
	Kochtopf	*cooking pot*
	Drehstuhl	*swivel chair*
	Glühbirne	*light bulb*
	Apfel	*apple*
	Erdbeere	*strawberry*
	Ananas	*pineapple*
	Bonbon	*piece of candy*
	Bier	*beer*
	Rubikwürfel	*Rubik's Cube*
	Sporttasche	*gym bag*
	Hantel	*dumbbell*
	Senf	*mustard*
	Pizza	*slice of pizza*

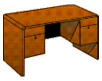
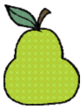
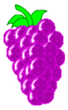
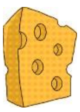
	Schraube	*screw*
	Pinsel	*paintbrush*
	Sonnenbrille	*sunglasses*
	Kaktus	*cactus*
	Hut	*hat*
	Schlittschuhe	*ice skates*
	Zahnpasta	*toothpaste*
	Putzmittel	*cleaning agent*
	Donut	*doughnut*
	Eiscreme	*ice cream*
	Notizblock	*notepad*
	Malkasten	*paintbox*
	Teddybär	*teddy bear*

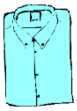
	Saxophon	*saxophone*
	Kühlbox	*cooling box*
	Pfefferstreuer	*pepper pot*
	Vase	*vase*

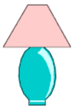
Set 2

Item	Label	*Translation*
	Paprika	*bell pepper*
	Tomate	*tomato*
	Steinpilz	*porcino*
	Salat	*lettuce*
	Sonnenblume	*sunflower*
	Schneebesen	*egg whisk*
	Lupe	*magnifying glass*

	Kaffeetasse	*coffee cup*
	Bügeleisen	*flat iron*
	Kamera	*camera*
	Brezel	*pretzel*
	Tennisball	*tennis ball*
	Fächer	*hand fan*
	Textmarker	*highlighter*
	Stempel	*rubber stamp*
	Taschenlampe	*flashlight*
	Bohrer	*power drill*
	Schraubenzieher	*screwdriver*
	Tretroller	*scooter*
	Schlüssel	*key*

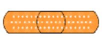
	Pfanne	*pan*
	Schreibtisch	*desk*
	Wäscheklammer	*clothespin*
	Birne	*pear*
	Trauben	*bunch of grapes*
	Melone	*melon*
	Kuchen	*cake*
	Sekt	*sparkling wine*
	Puzzle	*jigsaw puzzle*
	Koffer	*suitcase*
	Kegel	*bowling pin*
	Käse	*cheese*
	Pommes Frites	*fries*

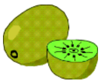
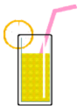
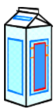
	Mutter	*screw nut*
	Leiter	*ladder*
	Krawatte	*necktie*
	Topfpflanze	*potted plant*
	Hemd	*shirt*
	Campingzelt	*camping tent*
	Kamm	*comb*
	Putzeimer	*cleaning bucket*
	Hotdog	*hotdog*
	Schokopudding	*chocolate pudding*
	Kalender	*calendar*
	Dartbrett	*dartboard*
	Schaukelpferd	*rocking horse*

	Keyboard	*keyboard*
	Picknickkorb	*picnic basket*
	Löffel	*spoon*
	Stehlampe	*floor lamp*

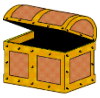
Set 3

Item	Label	*Translation*
	Karotte	*carrot*
	Aubergine	*eggplant*
	Knoblauch	*garlic*
	Erdnüsse	*peanuts*
	Veilchen	*violet*
	Wanduhr	*wall clock*
	Füller	*fountain pen*

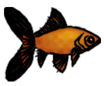
	Mörser	*mortar*
	Kaffeemaschine	*coffee maker*
	Telefon	*telephone*
	Toast	*toast*
	Golfball	*golf ball*
	Glöckchen	*little bells*
	Geodreieck	*triangle ruler*
	Schreibtischlampe	*desk lamp*
	Teppichmesser	*box cutter*
	Axt	*axe*
	Spaten	*spade*
	Rasenmäher	*lawn mower*
	Pflaster	*band-aid*

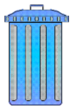
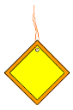
	Eieruhr	*squirrel*
	Schränkchen	*cabinet*
	Kleiderbügel	*coat hanger*
	Banane	*banana*
	Kirsche	*cherry*
	Kiwi	*kiwi*
	Limonade	*lemonade*
	Wein	*wine*
	Jojo	*yo-yo*
	Regenschirm	*umbrella*
	Pingpongset	*ping-pong*
	Milch	*milk*
	Hamburger	*hamburger*

	Spachtel	*scraper*
	Schubkarre	*wheelbarrow*
	Armbanduhr	*wristwatch*
	Bäumchen	*small tree*
	Schuhe	*shoes*
	Golfschläger	*golf club*
	Lippenstift	*lipstick*
	Ascheschaufel	*dustpan*
	Sandwich	*sandwich*
	Cola	*coke*
	Bilderrahmen	*picture frame*
	Billardset	*billard balls*
	Badeente	*rubber duck*

	E-Gitarre	*electric guitar*
	Gießkanne	*watering can*
	Gabel	*fork*
	Holztruhe	*wooden chest*

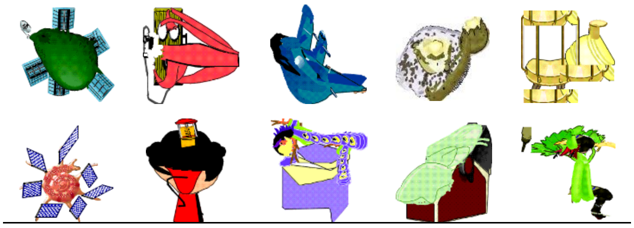
Primacy and recency items

Item	Label	*Translation*
	Hamster	*hamster*
	Goldfisch	*goldfish*
	Papagei	*parrott*
	Masken	*masks*
	Fähnchen	*little flag*
	Drachen	*kite*
	Mütze	*cap*

	Trommel	*drum*
	Mülleimer	*garbage can*
	Briefmarke	*stamp*
	Etikett	*tag*
	Briefumschlag	*envelope*

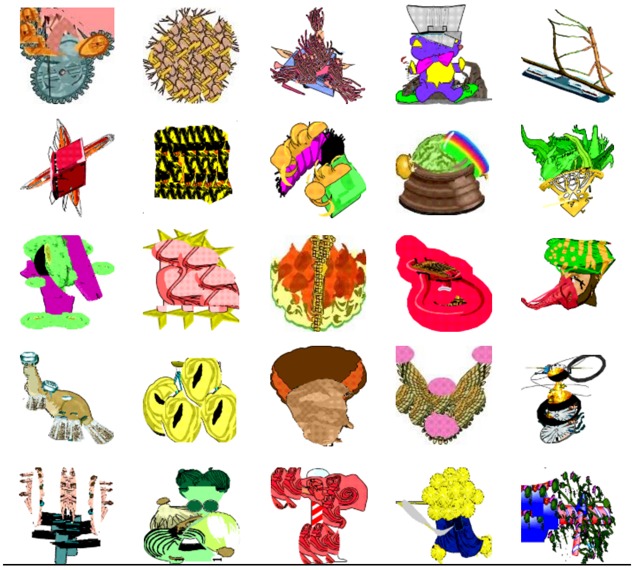
Appendix C3. List of visual stimuli used in Experiment 3

Set 1



Set 2

Set 3

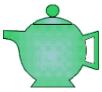


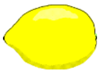
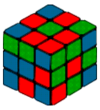
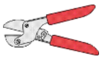
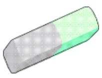
Primacy and recency items

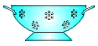
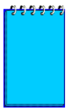
Appendix C4. List of visual stimuli with matching and non-matching verbal labels used in Experiment 4

Set 1

Item	Match	*Translation*	Mismatch	*Translation*
	Malkasten	*paintbox*	Sandkasten	*sandbox*
	Broccoli	*broccoli*	Sellerie	*celery*
	Pfefferstreuer	*pepper pot*	Essig	*vinegar*

	Putzmittel	*cleaning agent*	Schwamm	*sponge*
	Vase	*vase*	Fackel	*torch*
	Teekanne	*teapot*	Wasserglas	*glass of water*
	Glühbirne	*light bulb*	Stoppuhr	*stop watch*
	Fernseher	*television set*	Kamin	*chimney*
	Hut	*hat*	Kleid	*dress*
	Saxophon	*saxophone*	Klavier	*piano*
	Bonbon	*piece of candy*	Kaugummi	*chewing gum*
	Senf	*mustard*	Ketchup	*ketchup*
	Pizza	*slice of pizza*	Schnitzel	*escalope*
	Eiscreme	*ice cream*	Joghurt	*yoghurt*
	Erdbeere	*strawberry*	Praline	*chocolate candy*

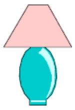
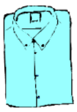
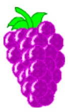
	Zitrone	*lemon*	Mandarine	*tangerine*
	Kaktus	*cactus*	Herbstlaub	*autumn leaves*
	Hantel	*dumbbell*	Schaukel	*swing*
	Schlittschuhe	*ice skates*	Surfbrett	*surfboard*
	Rubikwürfel	*Rubik's Cube*	Spielkarten	*deck of cards*
	Zange	*tongs*	Zirkel	*pair of compasses*
	Pinsel	*paintbrush*	Farbeimer	*paint bucket*
	Luftballons	*balloons*	Teelicht	*tea candle*
	Radiergummi	*eraser*	Bleistift	*pencil*
	Drehstuhl	*swivel chair*	Couch	*couch*
	Rose	*rose*	Orchidee	*orchid*
	Kürbis	*pumpkin*	Kohlkopf	*cabbage*
	Chili	*chili pepper*	Ingwer	*ginger*

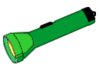
	Waschmaschine	*washing machine*	Nähmaschine	*sewing machine*
	Schere	*scissors*	Stricknadel	*knitting needle*
	Nudelsieb	*strainer*	Fleischwolf	*meat chopper*
	Kochtopf	*cooking pot*	Schüssel	*bowl*
	Kühlbox	*cooling box*	Tüte	*shopping bag*
	Zahnpasta	*toothpaste*	Seife	*soap*
	Sonnenbrille	*sunglasses*	Ohrringe	*earrings*
	Notizblock	*notepad*	Zeitung	*newspaper*
	Croissant	*croissant*	Brötchen	*bread roll*
	Bier	*beer*	Fruchtsaft	*fruit juice*
	Donut	*doughnut*	Berliner	*bismarck*
	Ananas	*pineapple*	Avocado	*avocado*
	Apfel	*apple*	Rosine	*raisin*

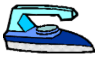
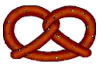
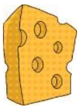
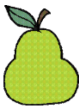
	Sporttasche	*gym bag*	Federball	*shuttlecock*
	Fußball	*football*	Murmelspiel	*game of marbles*
	Teddybär	*teddy bear*	Drachen	*kite*
	Fahrrad	*bicycle*	Schlitten	*sleigh*
	Schraube	*screw*	Tacker	*stapler*
	Hammer	*hammer*	Feile	*file*
	Kerze	*candle*	Teller	*plate*
	Feuerzeug	*cigarette lighter*	Batterie	*battery*
	Sparschwein	*piggy bank*	Aschenbecher	*ashtray*

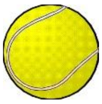
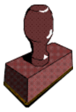
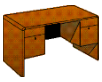
Set 2

Item	Match	*Translation*	Mismatch	*Translation*
	Salat	*lettuce*	Mais	*corn*
	Tomate	*tomato*	Radieschen	*garden radish*

	Löffel	*spoon*	Streichholz	*match*
	Putzeimer	*cleaning bucket*	Bürste	*paper clip*
	Wäscheklammer	*clothespin*	Zahnbürste	*toothbrush*
	Stehlampe	*floor lamp*	Briefkasten	*mailbox*
	Kaffeetasse	*coffee cup*	Untertasse	*saucer*
	Kamera	*camera*	Kopfhörer	*headphones*
	Picknickkorb	*picnic basket*	Serviette	*napkin*
	Hemd	*shirt*	Hose	*trousers*
	Pommes Frites	*fries*	Nudeln	*pasta*
	Schokopudding	*chocolate pudding*	Mayonnaise	*mayonnaise*
	Kuchen	*cake*	Sahne	*cream*
	Sekt	*sparkling wine*	Zuckerstück	*lump of sugar*
	Trauben	*bunch of grapes*	Brombeere	*blackberry*

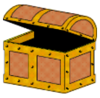
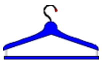
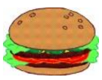
	Topfpflanze	*potted plant*	Palme	*palm tree*
	Campingzelt	*camping tent*	Rucksack	*backpack*
	Kegel	*bowling pin*	Flummi	*bouncy ball*
	Schaukelpferd	*rocking horse*	Weihnachtsbaum	*Christmas tree*
	Schraubenzieher	*screwdriver*	Fliegenklatsche	*fly swatter*
	Taschenlampe	*flashlight*	Taschenrechner	*hand calculator*
	Leiter	*ladder*	Türknauf	*door knob*
	Fächer	*hand fan*	Halstuch	*bandana*
	Textmarker	*highlighter*	Büroklammer	*paper clip*
	Koffer	*suitcase*	Handtasche	*handbag*
	Sonnenblume	*sunflower*	Löwenzahn	*dandelion*
	Dartbrett	*dartboard*	Pokal	*trophy cup*
	Paprika	*bell pepper*	Bohnen	*beans*

	Steinpilz	*porcino*	Kartoffel	*potato*
	Bügeleisen	*flat iron*	Toaster	*toaster*
	Lupe	*magnifying glass*	Fernglas	*spyglass*
	Pfanne	*pan*	Krug	*mug*
	Kamm	*comb*	Handtuch	*towel*
	Schneebesen	*egg whisk*	Kochlöffel	*cooking spoon*
	Krawatte	*necktie*	Jackett	*suit coat*
	Keyboard	*keyboard*	Schlagzeug	*drum kit*
	Brezel	*pretzel*	Keks	*cookie*
	Käse	*cheese*	Schinken	*ham*
	Hotdog	*hotdog*	Schokoriegel	*chocolate bar*
	Melone	*melon*	Aprikose	*apricot*
	Birne	*pear*	Pflaume	*plum*

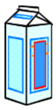
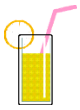
	Tennisball	*tennis ball*	Skateboard	*skateboard*
	Tretroller	*scooter*	Rollstuhl	*wheelchair*
	Bohrer	*power drill*	Kettensäge	*chainsaw*
	Mutter	*screw nut*	Münze	*coin*
	Puzzle	*jigsaw puzzle*	Kreisel	*spinning top*
	Schlüssel	*key*	Zigarre	*cigar*
	Stempel	*rubber stamp*	Etikett	*tag*
	Addressbuch	*address book*	Klemmbrett	*clipboard*
	Schreibtisch	*desk*	Bett	*bed*

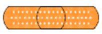
Set 3

Item	Match	*Translation*	Mismatch	*Translation*
	Veilchen	*violet*	Tulpe	*tulip*
	Billardset	*billard balls*	Mikrofon	*microphone*

	Aubergine	*eggplant*	Zucchini	*zucchini*
	Gießkanne	*watering can*	Gartenschlauch	*garden hose*
	Gabel	*fork*	Zahnstocher	*toothpick*
	Holztruhe	*wooden chest*	Kleiderständer	*hat stand*
	Schränkchen	*chocolate bar*	Esstisch	*dining table*
	Eieruhr	*hourglass*	Waage	*scales*
	Kleiderbügel	*coat hanger*	Gürtel	*belt*
	Armbanduhr	*wristwatch*	Halskette	*necklace*
	Telefon	*telephone*	Radio	*radio*
	Hamburger	*hamburger*	Eintopf	*stew*
	Sandwich	*sandwich*	Würstchen	*sausage*
	Cola	*coke*	Schnaps	*liquor*
	Wein	*wine*	Cocktail	*cocktail*

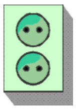
	Kirsche	*cherry*	Orange	*orange*
	Erdnüsse	*peanuts*	Erbsen	*peas*
	Golfschläger	*golf club*	Gehstock	*walking stick*
	Schuhe	*shoes*	Socken	*socks*
	Badeente	*rubber duck*	Waschlappen	*washcloth*
	Spachtel	*scraper*	Nägel	*nails*
	Rasenmäher	*lawn mower*	Staubsauger	*vacuum cleaner*
	Glöckchen	*little bells*	Triangel	*triangle*
	Geodreieck	*triangle ruler*	Spitzer	*sharpener*
	Schreibtisch-lampe	*desk lamp*	Monitor	*monitor*
	Karotte	*carrot*	Spargel	*asparagus*
	Knoblauch	*garlic*	Zwiebel	*onion*
	Kaffeemaschine	*coffee maker*	Korkenzieher	*corkscrew*

	Ascheschaufel	*dustpan*	Besen	*broom*
	Lippenstift	*lipstick*	Puderdose	*powder compact*
	Bilderrahmen	*picture frame*	Spiegel	*mirror*
	Wanduhr	*wall clock*	Regal	*shelves*
	Regenschirm	*umbrella*	Anorak	*anorak*
	E-Gitarre	*electric guitar*	Violine	*violin*
	Toast	*toast*	Spiegelei	*fried egg*
	Milch	*milk*	Butter	*butter*
	Limonade	*lemonade*	Cappucino	*cappuccino*
	Banane	*banana*	Mango	*mango*
	Kiwi	*kiwi*	Himbeere	*raspberry*
	Bäumchen	*small tree*	Hecke	*hedge*
	Golfball	*golf ball*	Springseil	*skipping rope*

	Pingpongset	*ping-pong*	Basketball	*basketball*
	Jojo	*yo-yo*	Puppe	*doll*
	Teppichmesser	*box cutter*	Pinzette	*tweezers*
	Schubkarre	*wheelbarrow*	Bagger	*excavator*
	Axt	*axe*	Rechen	*rake*
	Spaten	*spade*	Schraubstock	*bench vise*
	Pflaster	*band-aid*	Wattebausch	*cotton ball*
	Mörser	*mortar*	Mixer	*blender*
	Füller	*fountain pen*	Wecker	*alarm clock*

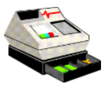
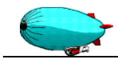
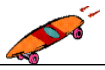
Practice items

Item	Match	*Translation*	Mismatch	*Translation*
	Panda	*panda*	---	---
	Hubschrauber	*helicopter*	---	---

	Rutschbahn	*slide*	---	---
	Kirche	*church*	---	---
	Steckdose	*power socket*	---	---
	Schneemann	*snowman*	---	---
	Krokodil	*crocodile*	---	---
	Brücke	*bridge*	---	---
	Fuchs	*fox*	---	---
	Roulette	*roulette*	---	---
	---	---	Elefant	*elephant*
	---	---	Zeppelin	*zeppelin*
	---	---	Fallschirm	*parachute*
	---	---	Kraftwerk	*power plant*
	---	---	Kasse	*checkout*

	---	---	Straßenbahn	*tram*
	---	---	Tiger	*tiger*
	---	---	Pyramiden	*pyramids*
	---	---	Eichhörnchen	*squirrel*
	---	---	Skateboard	*skateboard*

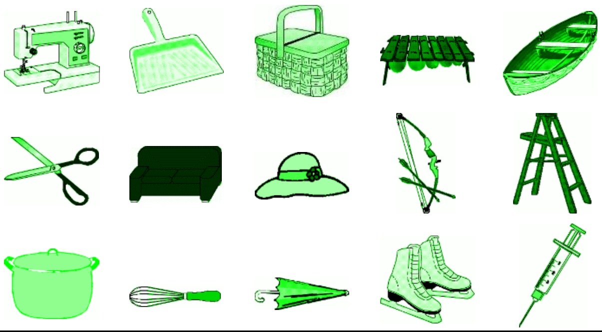
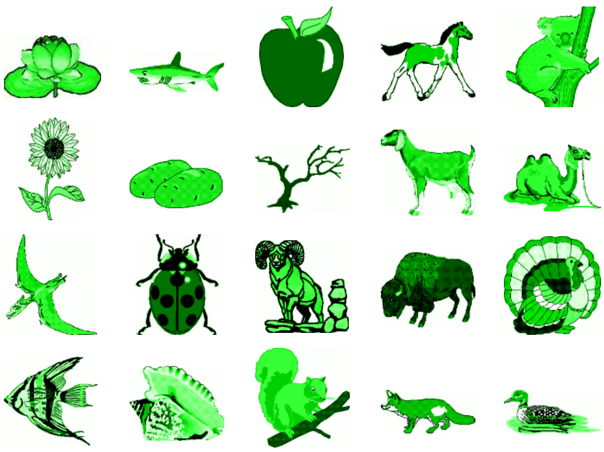
Primacy and recency items

Appendix C5. List of visual stimuli used in Experiment 5 by set, semantic category, and color

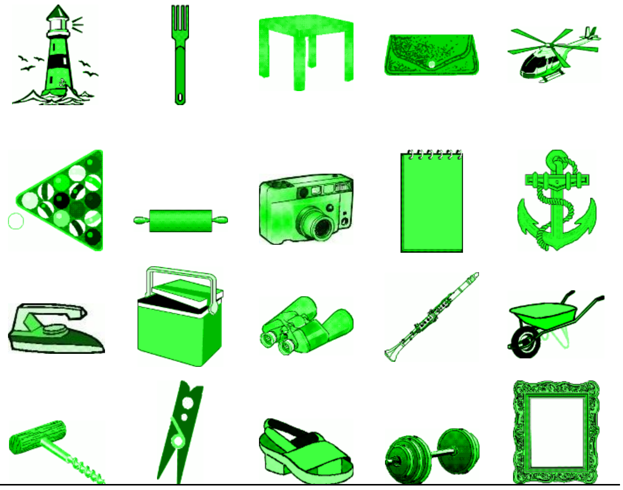
Set 1

Artificial	Green					

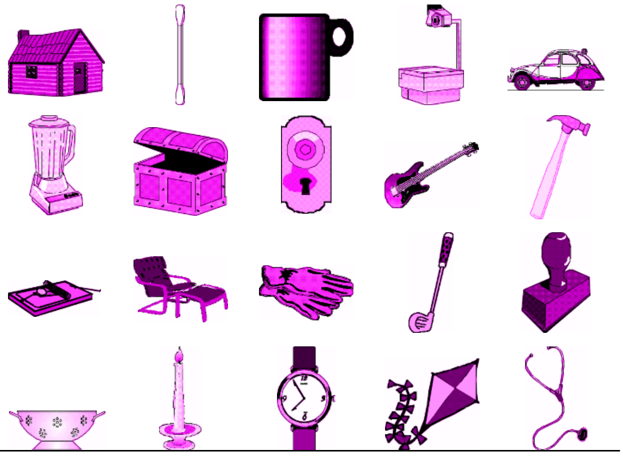
		
Artificial	Purple	
Natural	Green	
Natural	Purple	

Set 2

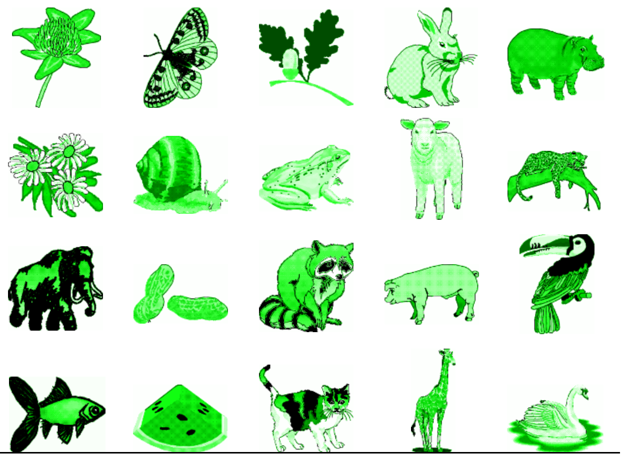
Artificial Green



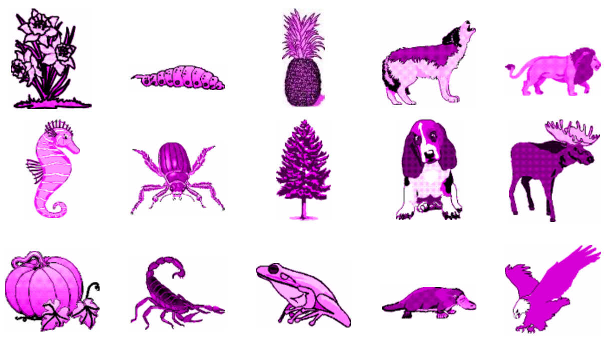
Artificial Purple

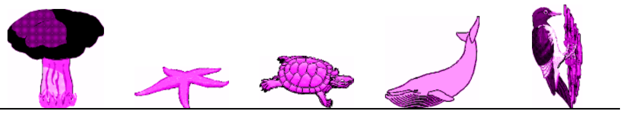


Natural Green



Natural Purple



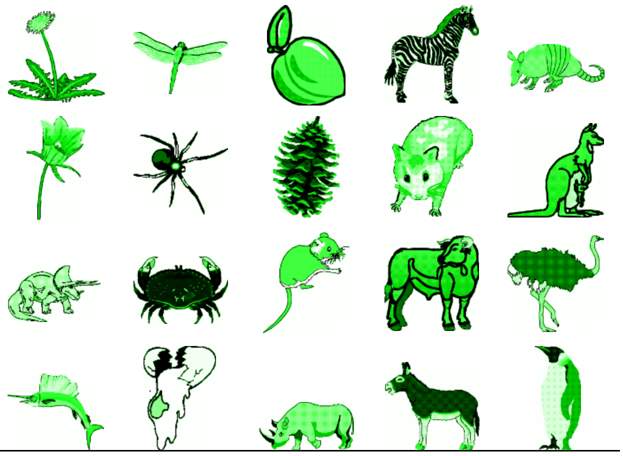


Set 3

Artificial Green

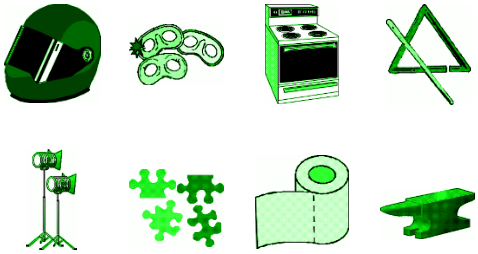
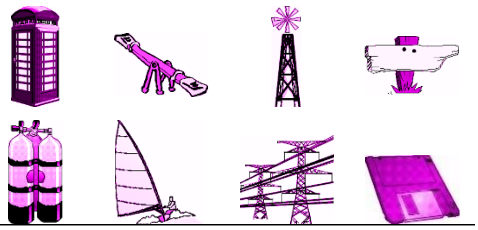
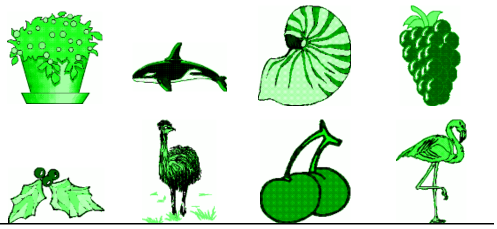
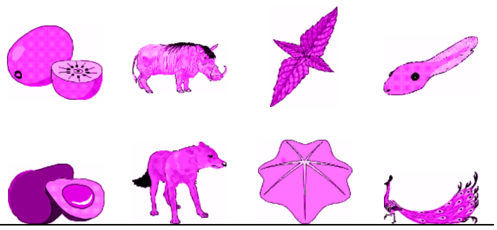
Artificial Purple

Natural Green



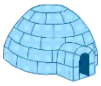
Natural Purple

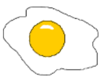
Primacy and recency items

Artificial	Green	
Artificial	Purple	
Natural	Green	
Natural	Purple	

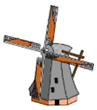
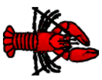
Appendix C6. List of visual stimuli and veral labels used in Experiment 6

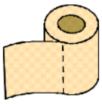
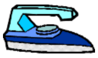
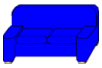
Set 1

Item	Label	*Translation*
	Iglu	*igloo*
	Tannenzapfen	*pinecone*
	Goldfisch	*goldfish*
	Wäscheklammer	*clothespin*
	Kamm	*comb*
	Spülmaschine	*dishwasher*
	Nudelholz	*rolling pin*
	Tisch	*table*
	Regal	*shelves*
	Kerze	*candle*
	Kleiderbügel	*coat hanger*
	Rucksack	*backpack*

	Armbanduhr	*wristwatch*
	Telefon	*telephone*
	Trommel	*drum*
	Croissant	*croissant*
	Spiegelei	*fried egg*
	Kürbis	*pumpkin*
	Wassermelone	*watermelon*
	Kaktus	*cactus*

Set 2

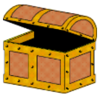
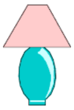
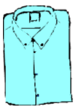
Item	Label	*Translation*
	Windmühle	*windmill*
	Rose	*rose*
	Hummer	*lobster*

	Toilettenpapier	*toilet paper*
	Schere	*scissors*
	Bügeleisen	*flat iron*
	Toaster	*toaster*
	Sofa	*sofa*
	Bank	*bench*
	Fernseher	*television set*
	Wanduhr	*wall clock*
	Sonnenbrille	*sunglasses*
	Ring	*ring*
	Notizbuch	*notebook*
	Schallplatten	*records*

	Hotdog	*hotdog*
	Suppe	*soup*
	Banane	*banana*
	Knoblauch	*garlic*
	Fahrrad	*bicycle*

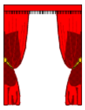
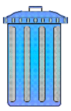
Set 3

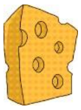
Item	Label	*Translation*
	Hütte	*hut*
	Löwenzahn	*dandelion*
	Schwan	*swan*
	Lippenstift	*lipstick*
	Eimer	*bucket*
	Staubsauger	*vacuum cleaner*

	Korkenzieher	*corkscrew*
	Truhe	*chest*
	Lampe	*lamp*
	Kamera	*camera*
	Glühbirne	*light bulb*
	Regenschirm	*umbrella*
	Hemd	*shirt*
	Briefkasten	*mailbox*
	Saxophon	*saxophone*
	Eis	*ice cream*
	Kuchen	*cake*
	Erdbeere	*strawberry*
	Erdnüsse	*peanuts*

	Boot	*boat*

Set 4

Item	Label	*Translation*
	Brücke	*bridge*
	Topfpflanze	*potted plant*
	Kaninchen	*bunny*
	Wattestäbchen	*cotton swab*
	Lupe	*magnifying glass*
	Kaffeemaschine	*coffee maker*
	Gießkanne	*watering can*
	Gardinen	*curtains*
	Mülltonne	*garbage can*
	Vase	*vase*

	Kopfhörer	*headphones*
	Mütze	*cap*
	Handtasche	*handbag*
	Radio	*radio*
	E-Gitarre	*electric guitar*
	Käse	*cheese*
	Sekt	*sparkling wine*
	Chilischote	*chili pepper*
	Kopfsalat	*lettuce*
	Drachen	*kite*

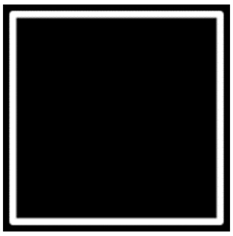
Primacy and recency items

Item	Label	*Translation*
	Mausefalle	*mouse trap*

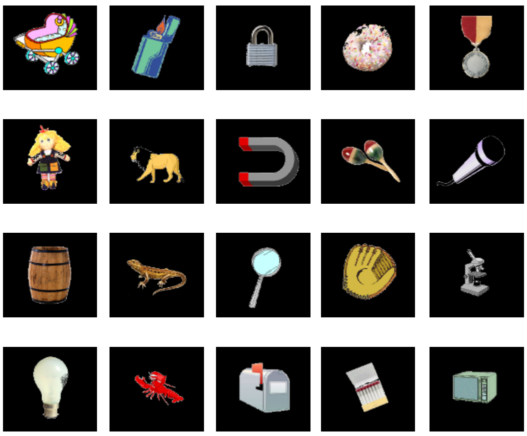
	Sparschwein	*piggy bank*
	Fächer	*hand fan*
	Bagger	*excavator*
	Heißluftballon	*hot-air balloon*
	Bett	*bed*

Appendix C7. List of visual stimuli used in Experiment 7

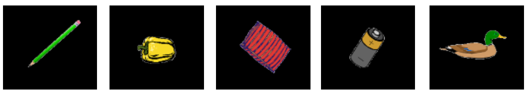
Assigned Shape

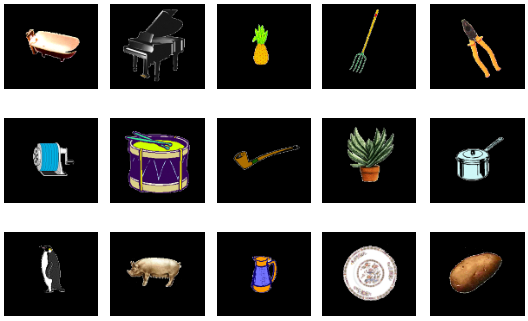


List 1

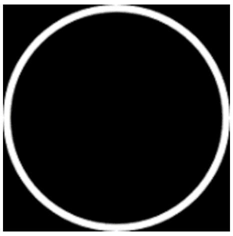


List 2

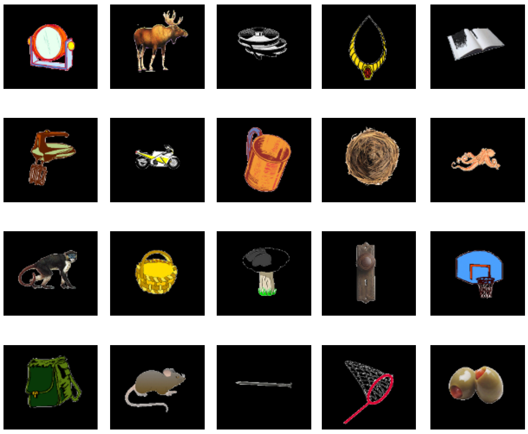




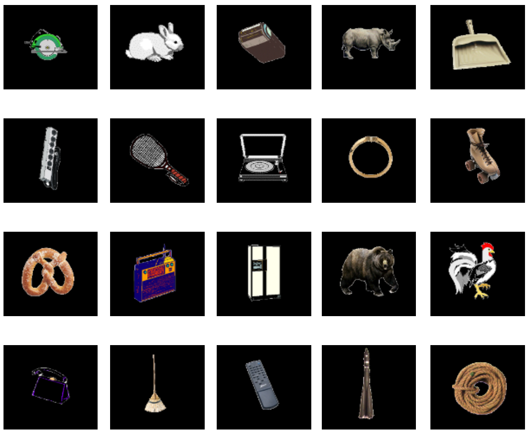
Assigned Shape



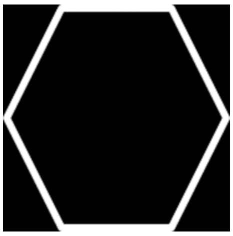
List 1



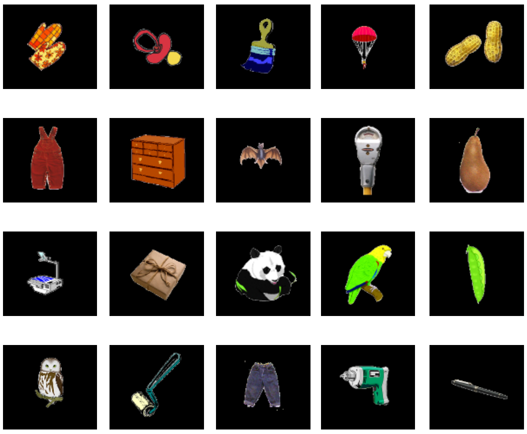
List 2



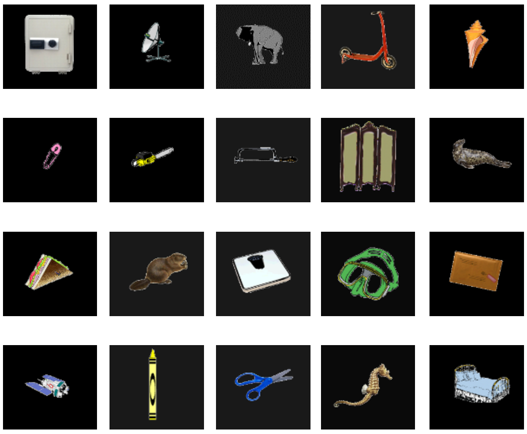
Assigned Shape



List 1



List 2



Appendix D: List of instructions used in the experiments

All instructions were given in German language and are reproduced here as such. Additional clarifying information is provided in italics in English language. For the sake of space and grouping that makes sense with regards to content, line breaks and paragraph breaks that existed in the slides of the experiments have been removed. Remaining breaks signify a new slide. Similarly, only the text of the written instructions is reproduced here, not its visual style. Fonts, font sizes and formatting may differ from the experiments.

Appendix D1: Instructions used in the pilot study

Welcome and encoding phase (shopping task):

Herzlich Willkommen, liebe Versuchsperson! In diesem Versuch möchten wir Sie bitten, sich vorzustellen, dass Sie an einem Kartenspiel teilnehmen. Dabei gibt es außer Ihnen noch einen zweiten Mitspieler. Bevor es losgehen kann, müssen die Karten ausgeteilt werden: Jeder erhält die Hälfte der Karten, sodass Sie und Ihr Mitspieler beide einen Stapel von Karten bekommen. Weiter mit der Leertaste.

Es gibt zwei Sorten von Karten: Nämlich solche, mit einer blauen Rückseite und solche mit einer roten Rückseite. Jeder Spieler bekommt alle Karten derselben Sorte. Der Zufall hat entschieden, dass Sie den ersten Zug machen dürfen. Sie dürfen nun entscheiden, welche Sorte von Karten Sie für sich in Anspruch nehmen möchten. Weiter mit der Leertaste.

Wenn Sie gerne mit dem Stapel roter Karten spielen möchten, so drücken Sie gleich auf die Taste "r" für rot. Wenn Sie gerne mit dem Stapel blauer Karten spielen möchten, so drücken Sie gleich auf die Taste "b" für blau. Weiter mit der Leertaste, um sich die beiden Stapel anschauen zu können.

Mit welcher Farbe möchten Sie spielen?

Sie haben sich für ROT/BLAU entschieden! Damit sind Sie nun der Rote/Blaue Spieler bzw. die Rote/Blaue Spielerin. Ihr Mitspieler bekommt die Blauen/Roten Karten zugewiesen und ist somit der Blaue/Rote Spieler. Weiter mit der Leertaste.

Gleich werden Ihnen nacheinander eine Reihe von Karten präsentiert, auf denen farbige Bilder zu sehen sind. Außerdem hat jede Karte entweder einen roten oder einen blauen Rand. Zur Erinnerung: Die blauen/roten Karten gehören Ihrem Mitspieler, die roten/blauen Karten Ihnen selbst. Weiter mit der Leertaste.

Zunächst müssen alle Karten richtig einsortiert werden. Dies bedeutet, dass Ihre eigenen Karten auf Ihrem Stapel und die Karten des Mitspielers auf dem anderen Stapel abgelegt werden müssen. Ob eine Karte Ihnen oder dem Mitspieler gehört, erkennen Sie daran, ob sie einen roten oder einen blauen Rand hat. Eine Karte mit rotem/blauem Rand gehört zu Ihnen. Eine Karte mit einem blauen/roten Rand gehört zum Mitspieler. Weiter mit der Leertaste.

Wenn Ihnen eine Karte gezeigt wird, die zu Ihnen gehört, drücken Sie bitte die Taste „f/j“. Damit wird die Karte Ihrem Stapel hinzugefügt. Wenn Ihnen eine Karte gezeigt wird, die zu Ihrem Mitspieler gehört, drücken Sie bitte die Taste „j/f“. Damit wird die Karte dem Stapel des Mitspielers hinzugefügt. Wichtig ist, dass Sie dabei richtig antworten und so wenig Fehler wie möglich machen. Um mit dem Austeilen der Karten zu beginnen, drücken Sie bitte die Leertaste.

Recognition memory task and remember/know guess task:

Sie haben den ersten Teil der Untersuchung überstanden. Im folgenden Teil unserer Untersuchung geht es darum, wie gut Sie sich die Bilder auf den Karten im vorangegangenen Teil der Untersuchung merken konnten. Dabei spielt es keine Rolle, wem die Karten zugeordnet waren. Sie benötigen weiterhin die Tastatur. Sie haben nun zwei Aufgaben. Weiter mit der Leertaste.

Aufgabe 1: Gleich werden Ihnen auf dem Bildschirm eine Reihe von bunten Bildern präsentiert. Einige davon könnten Sie bereits aus der Sortieraufgabe kennen: Denn ein Teil dieser Bilder waren als Motive auf den blauen und den roten Karten zu sehen. Die Bilder, die bereits in der Sortieraufgabe vorkamen gelten somit als ALT. Die Bilder, die nicht in der Sortierphase vorkamen gelten somit als NEU. Weiter mit der Leertaste.

Ihre Aufgabe ist es, zu entscheiden, ob ein Bild ALT oder NEU ist: Wenn Sie glauben, dass ein Bild bereits in der Sortieraufgabe gesehen haben, also ALT ist, so drücken Sie bitte die Taste "f". Wenn Sie glauben, dass ein Bild nicht in der Sortieraufgabe vorkam, also NEU ist, so drücken Sie bitte die Taste "j". Weiter mit der Leertaste.

Aufgabe 2: Beurteilen Sie ein Objekt als „neu“ wird im Anschluss sofort ein weiteres Objekt präsentiert. Beurteilen Sie ein Objekt hingegen als „alt“, möchten wir Sie bitten, noch eine weitere Unterscheidung vorzunehmen: Weiter mit der Leertaste.

Bei manchen Bildern werden Ihnen wahrscheinlich Details aus der Sortierphase einfallen: z.B. die Farbe des Rahmens, Ihre eigene Reaktion, ein Geräusch außerhalb des Labors oder ob dieses Bild im Film eher am Anfang oder am Ende der Aufgabe vorkam etc. Das heißt, Sie ERINNERN sich in diesem Fall an das Objekt in der Situation. In dem anderen Fall wird Ihnen ein Objekt einfach VERTRAUT vorkommen. Sie wissen dann, dass Sie dieses Objekt schon einmal gesehen haben, aber Sie können keine weiteren mit dem Objekt verbundenen Details abrufen. Weiter mit der Leertaste.

Drücken Sie auf dem Zahlenblock auf die "1", wenn Sie sich bewusst an Aspekte der Situation Erinnern, in der das Bild. vorkam. Drücken Sie auf dem Zahlenblock auf die "2" , wenn Ihnen das Objekt einfach nur vertraut vorkommt, d.h., wenn Sie keine bewusste Erinnerung an die Lernsituation haben, aber trotzdem wissen, dass das Objekt vorkam. Falls Sie bei Ihrer Entscheidung nur geraten haben sollten, dann drücken Sie auf dem Zahlenblock auf die "3". Mit der Leertaste können Sie die Gedächtnisaufgabe nun starten.

If an „old“ response was selected:

Sie haben mit "alt" geantwortet. Warum?

Thank you and goodbye:

Sie haben es geschafft! Die Untersuchung ist nun zu Ende. Bitte wenden Sie sich an den Versuchsleiter. Vielen Dank für ihre Teilnahme.

Appendix D2: Instructions used in Experiment 1

Welcome and encoding phase (shopping task):

Herzlich Willkommen, liebe Versuchspersonen! In diesem Experiment sollen Sie sich vorstellen, dass Sie bei einer Verlosung eine Reihe verschiedenster Preise gewonnen zu haben. Da verschiedene Sponsoren an unserer imaginären Tombola teil genommen haben, sind die Preise Produkte aus den verschiedensten Geschäften und Gaststätten. Sie entstammen verschiedenen Preisgruppen und sind für verschiedene Zielgruppen interessant. Weiter mit der Leertaste.

Eine Sache ist dabei wichtig zu wissen: Sie haben einen Mitspieler, der ebenfalls an der Verlosung teilgenommen hat. Stellen Sie sich vor, dass dieser Mitspieler genauso viele Preise gewonnen hat wie Sie. Dieser Mitspieler sitzt Ihnen gegenüber und nimmt mit ihnen am Experiment teil. Bitte reden Sie trotzdem nicht miteinander. Merken Sie sich bitte Folgendes: Sie sind SPIELER1 / SPIELER 2. Ihre Farbe ist BLAU / ROT. Ihr Mitspieler ist SPIELER 1 / SPIELER 2. Seine oder ihre Farbe ist ROT / BLAU. Weiter mit der Leertaste.

Gleich wird Ihnen auf dem Bildschirm nacheinander eine Reihe von Gegenständen präsentiert. Die Hälfte dieser Gegenstände stellen die Preise dar, die Sie gewonnen haben. Die andere Hälfte sind die Preise Ihres Mitspielers. Darüber, wer nun genau was bekommt, entscheidet einzig und allein das Los. Tauschen ist nicht erlaubt. Zunächst muss aber jeder Preis seinem neuen Besitzer zugewiesen werden. Weiter mit der Leertaste.

Ihre Aufgabe wird nun darin bestehen, die Preise richtig zu SORTIEREN. Dafür benötigen Sie die MAUS. Dazu werden gleich alle Preise einzeln auf dem Bildschirm erscheinen. Nach einer Weile wird jedes Bild entweder einen BLAUEN / ROTEN oder einen ROTEN / BLAUEN Rahmen erhalten – dieser Rahmen zeigt an, welchem Teilnehmer das Bild gehört. Darunter werden Sie links und rechts zwei Container sehen, die als Aufschrift „MITSPIELER“ oder „ICH“ tragen. Der Schriftzug „MITSPIELER“ ist in ROT / BLAU, der Schriftzug „ICH“ ist in BLAU / ROT geschrieben. Weiter mit der Leertaste.

Die FARBE des RAHMENS zeigt den BESITZER des jeweiligen Preises an. Die Preise, die einen ROTEN / BLAUEN Rahmen erhalten, gehören in den Container von SPIELER 1 /SPIELER 2. Damit handelt es sich um die Preise Ihres Mitspielers. Die Preise, die einen BLAUEN / ROTEN Rahmen erhalten, gehören in den Container von SPIELER 2 / SPIELER 1. Damit handelt es sich um IHRE Preise. Weiter mit der Leertaste.

Wenn Sie sehen, dass einer der Preise einen ROTEN / BLAUEN Rahmen erhält, so KLICKEN Sie bitte mit dem Mauszeiger in das Kästchen, das den Container von SPIELER 1 / SPIELER 2 – also Ihres MITSPIELERS – darstellen soll. Wenn Sie sehen, dass einer der Preise einen BLAUEN / ROTEN Rahmen erhält, so KLICKEN Sie bitte mit dem Mauszeiger in das Kästchen, das den Container von SPIELER 2 / SPIELER 1 – also IHNEN – darstellen soll. Weiter mit der Leertaste.

Gleich geht es los. Wenn Sie noch Fragen haben, wenden Sie sich bitte jetzt an den Versuchsleiter. Bitte bearbeiten Sie die Aufgabe allein, ohne Kommunikation mit dem Mitspieler. (Beachten Sie außerdem, dass es sich hier um ein reines Fantasie-Spiel handelt. Am Ende des Versuchs werden Sie die angekündigte Entlohnung, aber keinen der Ihnen zugelosten Preise erhalten.) Drücken Sie bitte die Leertaste, um mit dem Sortieren der Preise zu beginnen.

Recognition memory and remember/know/guess task:

Dies war der erste Teil der Untersuchung. Im nächsten Teil des Versuchs geht es darum, wie gut Sie sich die Preise aus dem vorangegangenen Teil merken konnten. Dazu benötigen Sie nur die TASTATUR. Dabei spielt es keine Rolle, wer welchen Preis bekommen hat. Sie sollen einfach nur angeben, ob Sie einen Gegenstand während dieses Versuchs schon einmal gesehen haben oder nicht. Sie haben nun zwei Aufgaben. Weiter mit der Leertaste.

Aufgabe 1: Gleich werden Ihnen nacheinander Bilder verschiedener Gegenstände auf dem Bildschirm gezeigt. Einige sind Ihnen während der Sortieraufgabe bereits als Preise begegnet. Einige werden neu hinzu kommen. Darunter werden Sie zwei Kästchen sehen, die jeweils die Aufschrift „ALT“ oder „NEU“ tragen. Weiter mit der Leertaste.

Wenn Sie glauben, einen Gegenstand während des Versuchs schon einmal gesehen zu haben, gilt er als ALT. Drücken Sie dann bitte die Taste, die dem Feld „ALT“ zugeordnet ist. Dabei handelt es sich um die Taste „F“. Wenn Sie glauben, einen Gegenstand während des Versuchs nicht gesehen zu haben, gilt er als NEU. Drücken Sie dann bitte die Taste, die dem Feld „NEU“ zugeordnet ist. Dabei handelt es sich um die Taste „J“. Weiter mit der Leertaste.

Aufgabe 2: Bei manchen Bildern werden Ihnen wahrscheinlich DETAILS aus der Sortierphase einfallen: z.B. die Farbe des Rahmens, Ihre eigene Reaktion, ein Geräusch außerhalb des Labors oder ob dieses Bild im Film eher am Anfang oder am Ende der Aufgabe vorkam etc. Das heißt, Sie ERINNERN sich in diesem Fall an das Objekt in der Situation. In dem anderen Fall wird Ihnen ein Objekt einfach VERTRAUT vorkommen. Sie wissen dann, dass Sie dieses Objekt schon einmal gesehen haben, aber Sie können keine weiteren mit dem Objekt verbundenen Details abrufen. Weiter mit der Leertaste.

Drücken Sie auf dem Zahlenblock auf die "1", wenn Sie sich bewusst an Aspekte der Situation ERINNERN, in der das Bild vorkam. Drücken Sie auf dem Zahlenblock auf die "2", wenn Ihnen das Objekt einfach nur VERTRAUT vorkommt, d.h., wenn Sie keine bewusste Erinnerung an die Lernsituation haben, aber trotzdem wissen, dass das Objekt vorkam. Falls Sie bei Ihrer Entscheidung nur GERATEN haben sollten, dann drücken Sie auf dem Zahlenblock auf die "3". Mit der Leertaste können Sie die Gedächtnisaufgabe nun starten.

If an „old“ response was selected:

Sie haben mit "alt" geantwortet. Warum?

Thank you and goodbye:

Sie haben es geschafft! Die Untersuchung ist nun zu Ende. Bitte wenden Sie sich an den Versuchsleiter. Vielen Dank für ihre Teilnahme.

Appendix D3: Instructions used in Experiment 2

Welcome and encoding phase (shopping task):

Herzlich Willkommen, liebe Versuchspersonen! In diesem Experiment sollen Sie sich vorstellen, dass Sie bei einer Verlosung eine Reihe verschiedenster Preise gewonnen haben. Da verschiedene Sponsoren an unserer imaginären Tombola teil genommen haben, sind die Preise Produkte aus den verschiedensten Geschäften. Sie entstammen verschiedenen Preisgruppen und sind für verschiedene Zielgruppen interessant. Weiter mit der Leertaste.

Dabei sollen Sie sich Folgendes vorstellen: Sie haben einen Mitspieler, der ebenfalls an der Verlosung teilgenommen hat. Stellen Sie sich vor, dass dieser Mitspieler genauso viele Preise gewonnen hat wie Sie. Merken Sie sich bitte Folgendes: Ihre Farbe ist ROT / BLAU. Die Farbe Ihres Mitspieler ist BLAU / ROT. Weiter mit der Leertaste.

Gleich wird Ihnen auf dem Bildschirm nacheinander eine Reihe von Gegenständen präsentiert. Die Hälfte dieser Gegenstände stellen die Preise dar, die Sie gewonnen haben. Die andere Hälfte sind die Preise Ihres Mitspielers. Darüber, wer nun genau was bekommt, entscheidet einzig und allein das Los. Tauschen ist nicht erlaubt. Zunächst muss aber jeder Preis seinem neuen Besitzer zugewiesen werden. Weiter mit der Leertaste.

Ihre Aufgabe wird nun darin bestehen, die Preise richtig zu SORTIEREN. Dafür benötigen Sie die MAUS. Dazu werden gleich alle Preise einzeln auf dem Bildschirm erscheinen. Nach einer Weile wird jedes Bild entweder einen BLAUEN oder einen ROTEN Rahmen erhalten – dieser Rahmen zeigt an, welchem Teilnehmer der Preis gehört. Darunter werden Sie links und rechts zwei Container sehen, die als Aufschrift „ICH“ oder „MITSPIELER“ tragen. Jede dieser Aufschriften ist in der Farbe des jeweiligen Spielers geschrieben. Weiter mit der Leertaste.

Die FARBE des RAHMENS zeigt den BESITZER des jeweiligen Preises an. Die Preise, die einen ROTEN / BLAUEN Rahmen erhalten, gehören in Ihren Container. Damit handelt es sich um IHRE eigenen Preise. Die Preise, die einen BLAUEN / ROTEN Rahmen erhalten, gehören in den Container Ihres MITSPIELERS. Damit handelt es sich um die Preise des Mitspielers. Weiter mit der Leertaste.

Wenn Sie sehen, dass einer der Preise einen ROTEN Rahmen erhält, so KLICKEN Sie bitte mit dem Mauszeiger in das Kästchen, das Ihren Container darstellen soll. Wenn Sie sehen, dass einer der Preise einen BLAUEN Rahmen erhält, so KLICKEN Sie bitte mit dem Mauszeiger in das Kästchen, das den Container Ihres MITSPIELERS darstellen soll. Weiter mit der Leertaste.

Gleich geht es los. Wenn Sie noch Fragen haben, wenden Sie sich bitte jetzt an den Versuchsleiter. (Beachten Sie außerdem, dass es sich hier um ein reines Fantasie-Spiel handelt. Am Ende des Versuchs werden Sie die angekündigte Entlohnung, aber keinen der Ihnen zugelosten Preise erhalten.) Drücken Sie bitte die Leertaste, um mit dem Sortieren der Preise zu beginnen.

Recognition memory and remember/know/guess task:

Dies war der erste Teil der Untersuchung. Im nächsten Teil des Versuchs geht es darum, wie gut Sie sich die Preise aus dem vorangegangenen Teil merken konnten. Dazu benötigen Sie nur die TASTATUR. Dabei spielt es keine Rolle, wer welchen Preis bekommen hat. Sie sollen einfach nur angeben, ob Sie einen Gegenstand während dieses Versuchs schon einmal gesehen haben oder nicht. Sie haben nun zwei Aufgaben. Weiter mit der Leertaste.

Aufgabe 1: Gleich werden Ihnen nacheinander Bilder verschiedener Gegenstände auf dem Bildschirm gezeigt. Einige sind Ihnen während der Sortieraufgabe bereits als Preise begegnet. Einige werden neu hinzu kommen. Darunter werden Sie zwei Kästchen sehen, die jeweils die Aufschrift „ALT“ oder „NEU“ tragen. Weiter mit der Leertaste.

Wenn Sie glauben, einen Gegenstand während des Versuchs schon einmal gesehen zu haben, gilt er als ALT. Drücken Sie dann bitte die Taste, die dem Feld „ALT“ zugeordnet ist. Dabei handelt es sich um die Taste „F“. Wenn Sie glauben, einen Gegenstand während des Versuchs nicht gesehen zu haben, gilt er als NEU. Drücken Sie dann bitte die Taste, die dem Feld „NEU“ zugeordnet ist. Dabei handelt es sich um die Taste „J“. Weiter mit der Leertaste.

Aufgabe 2: Bei manchen Bildern werden Ihnen wahrscheinlich DETAILS aus der Sortierphase einfallen: z.B. die Farbe des Rahmens, Ihre eigene Reaktion, ein Geräusch außerhalb des Labors oder ob dieses Bild im Film eher am Anfang oder am Ende der Aufgabe vorkam etc. Das heißt, Sie ERINNERN sich in diesem Fall an das Objekt in der Situation. In dem anderen Fall wird Ihnen ein Objekt einfach VERTRAUT vorkommen. Sie wissen dann, dass Sie dieses Objekt schon einmal gesehen haben, aber Sie können keine weiteren mit dem Objekt verbundenen Details abrufen. Weiter mit der Leertaste.

Drücken Sie auf dem Zahlenblock auf die "1", wenn Sie sich bewusst an Aspekte der Situation ERINNERN, in der das Bild vorkam. Drücken Sie auf dem Zahlenblock auf die "2", wenn Ihnen das Objekt einfach nur VERTRAUT vorkommt, d.h., wenn Sie keine bewusste Erinnerung an die Lernsituation haben, aber trotzdem wissen, dass das Objekt vorkam. Falls Sie bei Ihrer Entscheidung nur GERATEN haben sollten, dann drücken Sie auf dem Zahlenblock auf die "3". Mit der Leertaste können Sie die Gedächtnisaufgabe nun starten.

If an „old" response was selected:

Sie haben mit "alt" geantwortet. Warum?

Thank you and goodbye:

Sie haben es geschafft! Die Untersuchung ist nun zu Ende. Bitte wenden Sie sich an den Versuchsleiter. Vielen Dank für ihre Teilnahme.

Appendix D4: Instructions used in Experiment 3

Welcome and encoding phase (shopping task):

Herzlich Willkommen, liebe Versuchspersonen! Bei diesem Versuch möchten wir Sie bitten, sich eine etwas ungewöhnliche Situation vorzustellen: Und zwar, dass sie bei einer besonderen Verlosung eine Reihe von Preisen gewonnen haben. Ein Kunstliebhaber hat seine Kollektion aufgelöst und eine Reihe von surrealistischen und abstrakten Bildern gehört nun Ihnen. Weiter mit der Leertaste.

Dabei sollen Sie sich Folgendes vorstellen: Sie haben einen Mitspieler, der ebenfalls an der Verlosung teilgenommen hat. Stellen Sie sich vor, dass dieser Mitspieler genauso viele Bilder gewonnen hat wie Sie. Merken Sie sich bitte Folgendes: Ihre Farbe ist ROT / BLAU. Die Farbe Ihres Mitspieler ist BLAU / ROT. Weiter mit der Leertaste.

Gleich wird Ihnen auf dem Bildschirm nacheinander eine Reihe von Bildern präsentiert. Die Hälfte dieser Bilder stellen die Preise dar, die Sie gewonnen haben. Die andere Hälfte sind die Preise Ihres Mitspielers. Darüber, wer nun genau was bekommt, entscheidet einzig und allein das Los. Tauschen ist nicht erlaubt. Zunächst muss aber jeder Preis seinem neuen Besitzer zugewiesen werden. Weiter mit der Leertaste.

Ihre Aufgabe wird nun darin bestehen, die Preise richtig zu SORTIEREN. Dafür benötigen Sie die MAUS. Dazu werden gleich alle Bilder einzeln auf dem Bildschirm erscheinen. Nach einer Weile wird jedes Bild entweder einen BLAUEN / ROTEN oder einen ROTEN / BLAUEN Rahmen erhalten – dieser Rahmen zeigt an, welchem Teilnehmer der Preis gehört. Darunter werden Sie links und rechts zwei Container sehen, die als Aufschrift „ICH“ oder „MITSPIELER“ tragen. Jede dieser Aufschriften ist in der Farbe des jeweiligen Spielers geschrieben. Weiter mit der Leertaste.

Die FARBE des RAHMENS zeigt den BESITZER des jeweiligen Preises an. Die Preise, die einen ROTEN / BLAUEN Rahmen erhalten, gehören in Ihren Container. Damit handelt es sich um IHRE eigenen Preise. Die Preise, die einen BLAUEN / ROTEN Rahmen erhalten, gehören in den Container Ihres MITSPIELERS. Damit handelt es sich um die Preise des Mitspielers. Weiter mit der Leertaste.

Wenn Sie sehen, dass einer der Preise einen ROTEN / BLAUEN Rahmen erhält, so KLICKEN Sie bitte mit dem Mauszeiger in das Kästchen, das Ihren Container darstellen soll. Wenn Sie sehen, dass einer der Preise einen BLAUEN / ROTEN Rahmen erhält, so KLICKEN Sie bitte mit dem Mauszeiger in das Kästchen, das den Container Ihres MITSPIELERS darstellen soll. Weiter mit der Leertaste.

Gleich geht es los. Wenn Sie noch Fragen haben, wenden Sie sich bitte jetzt an den Versuchsleiter. (Beachten Sie außerdem, dass es sich hier um ein reines Fantasie-Spiel handelt. Am Ende des Versuchs werden Sie die angekündigte Entlohnung, aber keines der Ihnen zugelosten Bilder erhalten. Und lassen Sie sich nicht beirren, wenn ihnen einige Bilder merkwürdig erscheinen.) Drücken Sie bitte die Leertaste, um mit dem Sortieren der Preise zu beginnen.

Recognition memory and remember/know/guess task:

Dies war der erste Teil der Untersuchung. Im nächsten Teil des Versuchs geht es darum, wie gut Sie sich die Bilder aus dem vorangegangenen Teil merken konnten. Dazu benötigen Sie nur die TASTATUR. Dabei spielt es keine Rolle, wer welches Bild als Preis bekommen hat. Sie sollen einfach nur angeben, ob Sie ein Bild während dieses Versuchs schon einmal gesehen haben oder nicht. Sie haben nun zwei Aufgaben. Weiter mit der Leertaste.

Aufgabe 1: Gleich werden Ihnen nacheinander Bilder verschiedener Gegenstände auf dem Bildschirm gezeigt. Einige sind Ihnen während der Sortieraufgabe bereits als Preise begegnet. Einige werden neu hinzu kommen. Darunter werden Sie zwei Kästchen sehen, die jeweils die Aufschrift „ALT“ oder „NEU“ tragen. Weiter mit der Leertaste.

Wenn Sie glauben, ein Bild während des Versuchs schon einmal gesehen zu haben, gilt es als ALT. Drücken Sie dann bitte die Taste, die dem Feld „ALT“ zugeordnet ist. Dabei handelt es sich um die Taste „F“. Wenn Sie glauben, ein Bild während des Versuchs nicht gesehen zu haben, gilt es als NEU. Drücken Sie dann bitte die Taste, die dem Feld „NEU“ zugeordnet ist. Dabei handelt es sich um die Taste „J“. Weiter mit der Leertaste.

Aufgabe 2: Beurteilen Sie ein Bild als „NEU“, wird sogleich das nächste Bild auf dem Bildschirm erscheinen. Beurteilen Sie hingegen ein Bild als „ALT“, so möchten wir Sie bitten, eine weitere Unterscheidung vorzunehmen. Weiter mit der Leertaste.

Bei manchen Bildern werden Ihnen wahrscheinlich DETAILS aus der Sortierphase einfallen: z.B. die Farbe des Rahmens, Ihre eigene Reaktion, ein Geräusch außerhalb des Labors oder ob dieses Bild eher am Anfang oder am Ende der Aufgabe vorkam etc. Das heißt, Sie ERINNERN sich in diesem Fall an das Objekt in der Situation. In dem anderen Fall wird Ihnen ein Objekt einfach VERTRAUT vorkommen. Sie wissen dann, dass Sie dieses Objekt schon einmal gesehen haben, aber Sie können keine weiteren mit dem Objekt verbundenen Details abrufen. Weiter mit der Leertaste.

Drücken Sie auf dem Zahlenblock auf die "1", wenn Sie sich bewusst an Aspekte der Situation ERINNERN, in der das Bild vorkam. Drücken Sie auf dem Zahlenblock auf die "2", wenn Ihnen das Objekt einfach nur VERTRAUT vorkommt, d.h., wenn Sie keine bewusste Erinnerung an die Lernsituation haben, aber trotzdem wissen, dass das Objekt vorkam. Falls Sie bei Ihrer Entscheidung nur GERATEN haben sollten, dann drücken Sie auf dem Zahlenblock auf die "3". Mit der Leertaste können Sie die Gedächtnisaufgabe nun starten.

If an „old“ response was selected:

Sie haben mit "alt" geantwortet. Warum?

Valence rating task:

Im letzten Teil der Untersuchung geht es darum, zu beurteilen, wie angenehm (positiv) oder unangenehm (negativ) Ihnen die gezeigten Bilder erscheinen. Dazu brauchen Sie die Maus. Gleich werden Ihnen nach und nach noch einmal die Bilder gezeigt, die sie aus den vorangehenden Teilen der Untersuchung bereits kennen. Außerdem werden sie auf dem Bildschirm eine Skala mit neun Kästchen sehen. Auf den Kästchen sind Figuren mit fröhlichem oder traurigem Gesichtsausdruck abgebildet. Ihre Aufgabe wird nun darin bestehen, die Bilder anhand dieser Skala zu bewerten. Weiter mit der Leertaste.

Dabei steht das linke Kästchen mit dem fröhlichen Gesicht für ein sehr positives oder angenehmes Bild und das rechte Kästchen mit dem traurigen Gesicht für ein sehr negatives oder unangenehmes Bild. Das mittlere Kästchen mit dem neutralen Gesichtsausdruck steht für ein neutrales Bild. Bitte klicken Sie mit der Maus in das Kästchen, das Ihrer Meinung nach am besten widergibt, als wie positiv oder negativ sie das gezeigte Bild empfinden. Weiter mit der Leertaste.

Auch die Kästchen zwischen den Figuren sind gültige Wahlmöglichkeiten. Sie sind Zwischenstufen und können genauso wie die Kästchen mit den Figuren angeklickt werden. Bitte beachten Sie, dass es bei dieser Aufgabe keine richtigen oder falschen Antworten gibt. Es geht allein um Ihre persönliche Einschätzung. Bitte versuchen Sie ihre Entscheidung möglichst spontan zu treffen. Wenn Sie keine weiteren Fragen haben, können Sie den nächsten Teil des Experiments nun mit der Leertaste starten.

Thank you and goodbye:

Sie haben es geschafft! Die Untersuchung ist nun zu Ende. Bitte wenden Sie sich an den Versuchsleiter.

Vielen Dank für ihre Teilnahme.

Appendix D5: Instructions used in Experiment 4

Welcome and encoding phase (shopping task):

Herzlich Willkommen, liebe Versuchsperson! In diesem Experiment sollen Sie sich vorstellen, dass Sie bei einer Verlosung eine Reihe von Preisen gewonnen haben. Da verschiedene Sponsoren an unserer imaginären Tombola teil genommen haben, sind die Preise Produkte aus den verschiedensten Bereichen. Weiter mit der Leertaste.

Dabei sollen Sie sich Folgendes vorstellen: Sie haben einen Mitspieler, der ebenfalls an der Verlosung teilgenommen hat. Dieser Mitspieler hat genau so viele Preise gewonnen wie Sie. Merken Sie sich bitte Folgendes: Ihre Farbe ist ROT / BLAU. Die Farbe Ihres Mitspieler ist BLAU / ROT. Weiter mit der Leertaste.

Zunächst muss jeder Preis seinem neuen Besitzer zugewiesen werden. Gleich wird Ihnen auf dem Bildschirm nacheinander eine Reihe von Gegenständen präsentiert. Die Hälfte dieser Gegenstände stellen die Preise dar, die Sie gewonnen haben. Die andere Hälfte sind die Preise Ihres Mitspielers. Darüber, wer nun genau was bekommt, entscheidet einzig und allein das Los. Weiter mit der Leertaste.

Ihre Aufgabe wird nun darin bestehen, die Preise richtig zu SORTIEREN. Dafür benötigen Sie die MAUS. Dazu werden gleich alle Preise einzeln auf dem Bildschirm erscheinen. Nach einer Weile wird jedes Bild entweder einen BLAUEN oder einen ROTEN Rahmen erhalten. Darunter werden Sie links und rechts zwei Container sehen, die die Aufschrift „ICH“ oder „MITSPIELER“ in der Farbe des jeweiligen Spielers tragen. Weiter mit der Leertaste.

Die FARBE des RAHMENS zeigt den BESITZER des jeweiligen Preises an. Die Preise, die einen ROTEN / BLAUEN Rahmen erhalten, gehören in Ihren Container. Damit handelt es sich um IHRE eigenen Preise. Die Preise, die einen BLAUEN / ROTEN Rahmen erhalten, gehören in den Container Ihres MITSPIELERS. Damit handelt es sich um die Preise des Mitspielers. Weiter mit der Leertaste.

Wenn Sie sehen, dass einer der Preise einen ROTEN / BLAUEN Rahmen erhält, so KLICKEN Sie bitte mit dem Mauszeiger auf Ihren Container. Wenn Sie sehen, dass einer der Preise einen BLAUEN / ROTEN Rahmen erhält, so KLICKEN Sie bitte mit dem Mauszeiger auf den Container Ihres MITSPIELERS. Weiter mit der Leertaste.

Gleich geht es los. Wenn Sie noch Fragen haben, wenden Sie sich jetzt an den Versuchsleiter. (Beachten Sie außerdem, dass es sich um ein reines Fantasie-Spiel handelt. Am Ende des Versuchs werden Sie die angekündigte Entlohnung, aber keinen der Preise erhalten.) Drücken Sie die Leertaste, um zu beginnen.

Semantic matching task:

Dies war der erste Teil der Untersuchung. Im nächsten Teil des Versuchs geht es darum, wie gut Sie Objekten einen Namen zuordnen können. Gleich werden Ihnen nacheinander Bilder verschiedener Gegenstände auf dem Bildschirm gezeigt. Unter jedem Bild wird ein Wort als Unterschrift stehen, das entweder zum Bild passt oder nicht. Weiter mit der Leertaste.

Auf der TASTATUR sehen Sie zwei Tasten mit Aufklebern. Wenn Sie ein Paar aus einem Bild und einem passenden Wort, also einer korrekten Bezeichnung, sehen, so drücken Sie bitte die rechte Taste. Wenn Sie ein Paar aus einem Bild und einem unpassenden Wort, also einer falschen Bezeichnung, sehen, so drücken Sie bitte die linke Taste. Weiter mit der Leertaste.

Versuchen Sie bitte, so schnell wie möglich zu antworten, aber gleichzeitig auch Fehler zu vermeiden. Platzieren Sie Ihren linken Zeigefinger auf der linken Taste (für "Nein") und ihren rechten Zeigefinger auf der rechten Taste (für "Ja") und behalten Sie Ihre Finger möglichst die ganze Zeit über dort. Weiter mit der Leertaste. Nach jedem Durchgang erhalten Sie eine kurze Rückmeldung. Zunächst gibt es eine kurze Übungsphase, damit Sie sich mit der Aufgabe vertraut machen können. Wenn Sie keine Fragen mehr haben, können Sie diese mit der Leertaste starten.

Passt die Beschriftung zum Bild? Halten Sie sich bereit.

Recognition memory task in addition to semantic matching task:

Dies war die Übungsphase. Nun folgt der eigentliche Test. An der Zuordnungs-Aufgabe und der Tastenbelegung ändert sich nichts. Allerdings kommt nun eine weitere Aufgabe hinzu: Einige der Objekte, die Sie als Bilder sehen werden, sind vorhin bereits als Preise in der Verlosung aufgeteilt. Wir möchten von Ihnen nach jedem Durchgang wissen, ob Sie sich an ein Bild aus der Sortierphase erinnern können. Weiter mit der Leertaste.

Wenn Sie glauben, dass Sie ein Bild bereits in der Sortierphase gesehen haben, so drücken Sie bitte die „Ja“-Taste (rechte Taste). Wenn Sie glauben, dass Sie ein Bild bereits in der Sortierphase nicht gesehen haben, so drücken Sie bitte die „Nein“-Taste (linke Taste). Wenn Sie sich unsicher sind, raten Sie einfach. Dabei ist es egal, ob Sie oder der Mitspieler einen Preis erhalten haben. Bitte behalten Sie während der Aufgabe die Zeigefinger auf den Tasten und versuchen Sie weiterhin, so schnell und korrekt wie möglich zu antworten. Wenn Sie keine Fragen mehr haben, können Sie den Test mit der Leertaste starten.

Passt die Beschriftung zum Bild? Halten Sie sich bereit.

Kam das Bild schon in der Sortierphase vor?

After the first block of the matching and recognition memory task:

Pause... Sobald Sie mit der zweiten Hälfte der Aufgabe fortfahren möchten, drücken Sie die Leertaste.

Thank you and goodbye:

Sie haben es geschafft! Die Untersuchung ist nun zu Ende. Bitte wenden Sie sich an den Versuchsleiter. Vielen Dank für ihre Teilnahme.

Appendix D6: Instructions used in Experiment 5

Welcome and encoding phase (shopping task and perceptual or semantic classification task):

Herzlich Willkommen, liebe Versuchspersonen! In diesem Experiment sollen Sie sich vorstellen, dass Sie bei einer Verlosung eine Reihe verschiedenster Preise gewonnen haben. Da verschiedene Sponsoren an unserer imaginären Tombola teil genommen haben, sind die Preise Produkte aus verschiedenen Kategorien. Weiter mit der Leertaste.

Zu jedem der Gegenstände sollen Sie nacheinander zwei verschiedene Aufgaben ausführen. Dabei handelt es sich um einfache Kategorisierungen. Für die erste Aufgabe gibt es zwei Möglichkeiten. Davon sollen Sie für jeden Gegenstand nur jeweils eine ausführen. Um welche Aufgabe es sich handelt, wird Ihnen jedes Mal auf dem Bildschirm angezeigt, bevor wir Ihnen einen neuen Gegenstand präsentieren. Weiter mit der Leertaste.

Die Gegenstände, die Sie gleich sehen, können sich auf zwei Arten voneinander unterscheiden. Zum einen können Sie eine unterschiedliche FARBE haben. Ein Teil der Gegenstände wird in GRÜN, der andere in LILA dargestellt. Zum anderen können Sie auf unterschiedliche Weise entstanden sein. So entstammt ein Teil der Objekte der NATUR, während der andere Teile der Objekte KÜNSTLICH hergestellt ist . Zu Beginn jedes Durchgangs sollen Sie eine dieser beiden Unterscheidungen treffen. Weiter mit der Leertaste.

Erscheint zu Beginn eines Durchgangs die Frage, „Ist das Objekt grün oder lila?“, so sollen Sie genau dies entscheiden, nachdem das Objekt auf dem Bildschirm gezeigt wurde. Dazu benötigen Sie die beklebten Tasten auf der linken Seite der TASTATUR. Drücken Sie auf die Taste mit dem GRÜNEN Aufkleber (obere Taste), wenn es sich um ein grünes Objekt handelt. Drücken Sie auf die Taste mit dem LILA Aufkleber (untere Taste), wenn es sich um ein lila Objekt handelt. Sie können die Taste drücken, sobald das Objekt wieder vom Bildschirm verschwunden ist. Weiter mit der Leertaste.

Erscheint zu Beginn eines Durchgangs die Frage, „Ist das Objekt natürlich oder künstlich?“, so sollen Sie genau dies entscheiden, nachdem das Objekt auf dem Bildschirm gezeigt wurde. Dazu brauchen Sie die beklebten Tasten auf der rechten Seite der Tastatur. Drücken Sie auf die Taste mit der Aufschrift NAT (obere Taste), wenn es sich um ein NATÜRLICHES Objekt handelt. Drücken Sie auf die Taste mit der Aufschrift KÜN (untere Taste), wenn es sich um ein KÜNSTLICHES Objekt handelt. Sie können die Taste drücken, sobald das Objekt wieder vom Bildschirm verschwunden ist. Weiter mit der Leertaste.

Für die zweite Aufgabe sollen Sie sich Folgendes vorstellen: Sie haben einen Mitspieler, der mit Ihnen an unserer Verlosung teilgenommen hat. Stellen Sie sich vor, dass dieser Mitspieler genauso viele Preise gewonnen hat wie Sie. Merken Sie sich bitte Folgendes: Ihr Symbol ist der KREIS / das QUADRAT. Das Symbol Ihres Mitspieler ist das QUADRAT / der KREIS. Weiter mit der Leertaste.

Jeder Gegenstand wird Ihnen ein zweites Mal auf dem Bildschirm präsentiert. Die Hälfte dieser Gegenstände stellen die Preise dar, die Sie gewonnen haben. Die andere Hälfte sind die Preise Ihres Mitspielers. Darüber, wer welche Preise gewinnt, entscheidet einzig und allein das Los. Tauschen ist nicht erlaubt. Zunächst muss aber jeder Preis seinem neuen Besitzer zugewiesen werden. Weiter mit der Leertaste.

Ihre zweite Aufgabe wird immer darin bestehen, die Preise richtig zu SORTIEREN. Dafür benötigen Sie die MAUS. Jeder Preise wird dazu ein zweites Mal auf dem Bildschirm erscheinen. Nach einer Weile wird jedes Bild entweder einen KREISFÖRMIGEN oder einen QUADRATISCHEN Rahmen erhalten – dieser Rahmen zeigt an, welchem Teilnehmer der Preis gehört. Darunter werden Sie links und rechts zwei Container sehen, die als Aufschrift „ICH“ oder „MITSPIELER“ tragen. Jeder dieser Container ist mit dem Symbol des jeweiligen Spielers versehen. Weiter mit der Leertaste.

Wenn Sie sehen, dass einer der Preise einen KREISFÖRMIGEN / QUADRATISCHEN Rahmen erhält, so handelt es sich um Ihren Preis. KLICKEN Sie bitte mit dem Mauszeiger in das Kästchen, das Ihren Container darstellen soll. Wenn Sie sehen, dass einer der Preise einen QUADRATISCHEN / KREISFÖRMIGEN Rahmen erhält, so handelt es sich um den Preis des Mitspielers. KLICKEN Sie bitte mit dem Mauszeiger in das Kästchen, das den Container Ihres MITSPIELERS darstellen soll. Weiter mit der Leertaste.

Gleich geht es los. Die Kategorisierungsaufgabe (also GRÜN/LILA oder NATÜRLICH/KÜNSTLICH) wird sich immer mit der Gewinnspielaufgabe abwechseln. Bitte beachten Sie, dass es nicht auf Schnelligkeit ankommt. Lassen Sie sich so viel Zeit, wie Sie brauchen. Wenn Sie noch Fragen haben, wenden Sie sich bitte jetzt an den Versuchsleiter. Drücken Sie bitte die Leertaste, um zu beginnen.

Ist das Objekt natürlich oder künstlich? Halten Sie sich bereit.

Ist das Objekt grün oder lila? Halten Sie sich bereit.

Wer bekommt das Objekt? Halten Sie sich bereit.

Recognition memory and remember/know/guess task:

Dies war der erste Teil der Untersuchung. Im nächsten Teil des Versuchs geht es darum, wie gut Sie sich die Preise aus dem vorangegangenen Teil merken konnten. Dazu benötigen Sie nur die TASTATUR. Dabei spielt es keine Rolle, wer welchen Preis bekommen hat. Sie sollen einfach nur angeben, ob Sie einen Gegenstand während dieses Versuchs schon einmal gesehen haben oder nicht. Sie haben nun zwei Aufgaben. Weiter mit der Leertaste.

Aufgabe 1: Gleich werden Ihnen nacheinander Bilder verschiedener Gegenstände auf dem Bildschirm gezeigt. Einige sind Ihnen während der Sortieraufgabe bereits als Preise begegnet. Einige werden neu hinzu kommen. Darunter werden Sie zwei Kästchen sehen, die die Aufschrift „ALT“ bzw. „NEU“ tragen. Weiter mit der Leertaste. Wenn Sie glauben, einen Gegenstand während des Versuchs schon einmal gesehen zu haben, gilt er als ALT. Drücken Sie dann bitte die Taste, die dem Feld „ALT“ zugeordnet ist. Dabei handelt es sich um die Taste „F“. Wenn Sie glauben, einen Gegenstand während des Versuchs nicht gesehen zu haben, gilt er als NEU. Drücken Sie dann bitte die Taste, die dem Feld „NEU“ zugeordnet ist. Dabei handelt es sich um die Taste „J“. Weiter mit der Leertaste.

Aufgabe 2: Beurteilen Sie einen Gegenstand als „NEU“, wird sogleich der nächste Gegenstand auf dem Bildschirm erscheinen. Beurteilen Sie hingegen einen Gegenstand als „ALT“, so möchten wir Sie bitten, eine weitere Unterscheidung vorzunehmen. Weiter mit der Leertaste.

Bei manchen Bildern werden Ihnen wahrscheinlich DETAILS aus der Sortierphase einfallen: z.B. die Farbe des Rahmens, Ihre eigene Reaktion, ein Geräusch außerhalb des Labors oder ob dieses Bild im Film eher am Anfang oder am Ende der Aufgabe vorkam etc. Das heißt, Sie ERINNERN sich in diesem Fall an das Objekt in der Situation. In dem anderen Fall wird Ihnen ein Objekt einfach VERTRAUT vorkommen. Sie wissen dann, dass Sie dieses Objekt schon einmal gesehen haben, aber Sie können keine weiteren mit dem Objekt verbundenen Details abrufen. Weiter mit der Leertaste.

Drücken Sie die Zahlentaste "1", wenn Sie sich bewusst an Aspekte der Situation ERINNERN, in der das Bild vorkam. Drücken Sie die Zahlentaste "2", wenn Ihnen das Objekt einfach nur VERTRAUT vorkommt, d.h., wenn Sie keine bewusste Erinnerung an die Lernsituation haben, aber trotzdem wissen, dass das Objekt vorkam. Falls Sie bei Ihrer Entscheidung nur GERATEN haben sollten, dann drücken Sie die Zahlentaste "3". Mit der Leertaste können Sie die Gedächtnisaufgabe jetzt starten.

If an „old“ response was selected:

Sie haben mit "alt" geantwortet. Warum?

Thank you and goodbye:

Sie haben es geschafft! Die Untersuchung ist nun zu Ende. Bitte wenden Sie sich an den Versuchsleiter. Vielen Dank für ihre Teilnahme.

Appendix D7: Instructions used in Experiment 6

Welcome and encoding phase (shopping task):

Herzlich Willkommen, liebe Versuchspersonen! In diesem Experiment sollen Sie sich vorstellen, dass Sie bei einer Verlosung eine Reihe verschiedenster Preise gewonnen haben. Da verschiedene Sponsoren unsere imaginären Tombola unterstützen, sind die Preise Gegenstände aus den verschiedensten Bereichen. Weiter mit der Leertaste.

Dabei sollen Sie sich Folgendes vorstellen: Sie haben einen Mitspieler, der ebenfalls an der Verlosung teilgenommen hat. Stellen Sie sich vor, dass dieser Mitspieler genauso viele Preise gewonnen hat wie Sie. Merken Sie sich bitte Folgendes: Ihre Farbe ist ROT / BLAU. Die Farbe Ihres Mitspieler ist BLAU / ROT. Weiter mit der Leertaste.

Gleich wird Ihnen auf dem Bildschirm nacheinander eine Reihe von Gegenständen präsentiert. Ein Drittel der Gegenstände stellt die Preise dar, die Sie gewonnen haben. Ein weiteres Drittel der Gegenstände sind die Preise Ihres Mitspielers. Das verbleibende Drittel sind die Preise, die niemand gewonnen hat. Sie werden zurück behalten. Preise, für die es keinen Gewinner gibt, haben keine eigene Farbe. Darüber, wer welchen Preis bekommt, entscheidet das Los. Tauschen ist nicht erlaubt. Zunächst muss jeder Preis seinem neuen Besitzer zugewiesen werden. Weiter mit der Leertaste.

Ihre Aufgabe wird nun darin bestehen, die Preise richtig zu SORTIEREN. Dafür benötigen Sie die MAUS. Dazu werden gleich alle Preise einzeln auf dem Bildschirm erscheinen. Nach einer Weile wird jedes Bild entweder einen BLAUEN oder einen ROTEN oder einen SCHWARZEM Rahmen erhalten – dieser Rahmen zeigt an, wohin der Preis gehört. Darunter werden Sie links und rechts zwei Container sehen, die als Aufschrift „ICH“ oder „MITSPIELER“ tragen. Jede dieser Aufschriften ist in der Farbe des jeweiligen Spielers geschrieben. In der Mitte befindet sich ein Container mit der Aufschrift "Kein Gewinner" in schwarzer Farbe. Weiter mit der Leertaste.

Die FARBE des RAHMENS zeigt den BESITZER an. Die Preise, die einen ROTEN / BLAUEN Rahmen erhalten, gehören in Ihren Container. Damit handelt es sich um IHRE eigenen Preise. Die Preise, die einen BLAUEN / ROTEN Rahmen erhalten, gehören in den Container Ihres MITSPIELERS. Damit handelt es sich um die Preise des Mitspielers. Die Preise, die einen SCHWARZEN Rahmen erhalten, gehören in den mittleren Container mit der schwarzen Aufschrift. Diese Preise hat diesmal niemand gewonnen. Weiter mit der Leertaste.

Wenn Sie sehen, dass einer der Preise einen ROTEN / BLAUEN Rahmen erhält, so KLICKEN Sie bitte mit dem Mauszeiger in das Kästchen, das Ihren Container darstellen soll. Wenn Sie sehen, dass einer der Preise einen BLAUEN / ROTEN Rahmen erhält, so KLICKEN Sie bitte mit dem Mauszeiger in das Kästchen, das den Container Ihres MITSPIELERS darstellen soll. Wenn Sie sehen, dass einer der Preise einen SCHWARZEN RAHMEN erhält, so KLICKEN Sie bitte mit dem Mauszeiger in das Kästchen, auf dem "Kein Gewinner" steht. Weiter mit der Leertaste.

Gleich geht es los. Wenn Sie noch Fragen haben, wenden Sie sich bitte jetzt an den Versuchsleiter. Drücken Sie bitte die Leertaste, um mit dem Sortieren der Gegenstände zu beginnen.

Recall task:

Dies war der erste Teil der Untersuchung. Im nächsten Teil des Versuchs geht es darum, wie gut Sie sich die Preise aus dem vorangegangenen Teil merken konnten. Dabei spielt es keine Rolle, wer welchen Preis bekommen hat. Sie sollen einfach nur wiedergeben, an welche Gegenstände aus dem Gewinnspiel Sie sich erinnern. Weiter mit der Leertaste.

Bitte wenden Sie sich an die Versuchsleiterin. Sie wird Ihnen erklären, wie der Gedächtnistest ablaufen wird. Wenn alle Teilnehmer mit dem Sortieren der Gegenstände fertig sind, kann es mit dem Gedächtnistest losgehen.

Detailed instructions for the recall task were given by the experimenter who asked participants to write down whichever items they remembered from the sorting task on a sheet of paper, without taking the owner into account, to list items below each other with a new row for every single item. The experimenter also informed participants that they had five minutes to complete the task, that synonyms were permissible and answered questions regarding the task if necessary.

Valence ratings:

Im letzten Teil der Untersuchung geht es darum, zu beurteilen, wie angenehm (positiv) oder unangenehm (negativ) Sie die gezeigten Objekte finden. Dazu brauchen Sie die Maus. Gleich werden Ihnen nach und nach noch einmal Bilder gezeigt, von denen Sie einige schon aus vorherigen Teilen der Untersuchung kennen. Außerdem werden Sie auf dem Bildschirm eine Skala mit neun Kästchen sehen. Auf den Kästchen sind Figuren mit fröhlichem oder traurigem Gesichtsausdruck abgebildet. Ihre Aufgabe wird nun darin bestehen, die Bilder anhand dieser Skala zu bewerten. Weiter mit der Leertaste.

Dabei steht das linke Kästchen mit dem fröhlichen Gesicht für etwas sehr Positives oder Angenehmes und das rechte Kästchen mit dem traurigen Gesicht für etwas sehr Negatives oder Unangenehmes. Das mittlere Kästchen mit dem neutralen Gesichtsausdruck steht für etwas, das Sie als neutral empfinden. Bitte klicken Sie mit der Maus in das Kästchen, das Ihrer Meinung nach am besten widergibt, als wie positiv oder negativ sie das gezeigte Bild empfinden. Weiter mit der Leertaste.

Auch die Kästchen zwischen den Figuren sind gültige Wahlmöglichkeiten. Sie stellen Zwischenstufen dar und können genauso wie die Kästchen mit den Figuren angeklickt werden. Bei dieser Aufgabe gibt es keine richtigen oder falschen Antworten. Es geht allein um Ihre persönliche Einschätzung. Bitte versuchen Sie, Ihre Entscheidung möglichst spontan zu treffen. Wenn Sie keine weiteren Fragen haben, können Sie den letzten Teil des Versuchs nun mit der Leertaste starten.

Thank you and goodbye:

Sie haben es geschafft! Die Untersuchung ist nun zu Ende. Bitte wenden Sie sich an den Versuchsleiter. Vielen Dank für Ihre Teilnahme.

Appendix D8: Instructions used in Experiment 7

Welcome:

Herzlich willkommen! Vielen Dank für deine Bereitschaft, an dieser Untersuchung teilzunehmen und damit einen wichtigen Beitrag zur Wissenschaft zu leisten. Wenn du soweit bist, drücke bitte die Leertaste, um zu den Instruktionen zu gelangen.

Perceptual matching task:

Diese Untersuchung besteht aus zwei Teilen. Im ersten Teil werden dir Kombinationen von Begriffen und Formen präsentiert und Du sollst entscheiden, ob die jeweilige Kombination zuvor gelernten Zuordnungen entspricht oder nicht. Zum Fortfahren drücke bitte die Leertaste.

Für den ersten Teil sollst Du zuerst die Zuordnungen lernen. Sobald Du die Leertaste drückst, erscheinen die Zuordnungen für 60 Sekunden. Es ist sehr wichtig, dass Du Dir die Zuordnung gut einprägst. Bist Du bereit? Dann drücke bitte die Leertaste...

Ich bin der KREIS / das QUADRAT / das SECHSECK.

Meine Mutter ist das QUADRAT / das SECHSECK / der KREIS.

Ein Bekannter ist das SECHSECK / der KREIS / das QUADRAT.

Im Folgenden werden dir nacheinander mehrere Kombinationen von Begriffen und Formen präsentiert. Du sollst für jede Kombination entscheiden, ob diese den eben gelernten Zuordnungen entspricht oder nicht. Ist die Kombination korrekt, drücke die Taste L ("Ja"; lege jetzt Deinen rechten Zeigefinger auf diese Taste). Ist die Kombination falsch, drücke die Taste S ("Nein"; lege jetzt Deinen linken Zeigefinger auf diese Taste). Bitte reagiere so schnell wie möglich, ohne Fehler zu machen. Mit der Leertaste startest du eine entsprechende Übung...

Das waren die Übungsdurchgänge... Zusätzlich zu den Formen werden nun verschiedene Bilder verschiedener Objekte auf dem Bildschirm erscheinen. Auf diese Objekte selbst sollst du nicht reagieren. Da diese Objekte aber an derselben Stelle erscheinen wie die Formen, ist es sinnvoll, sie dir anzusehen. Deine Aufgabe bleibt aber gleich: Drücke die Taste L für passende Kombinationen und die Taste S für unpassende Kombinationen. Bitte arbeite weiterhin so schnell wie möglich, ohne Fehler zu machen. Drücke nun die Leertaste, um die nächsten Durchgänge zu starten.

Recognition memory and remember/know/guess task:

Im nächsten Teil des Versuchs geht es darum, wie gut du dir die Bilder aus dem vorangegangenen Teil merken konntest. Dabei spielt es keine Rolle, wo du das Bild gesehen hast (z.B. im Kreis). Du sollst sollen einfach nur entscheiden, ob du einen Gegenstand während dieses Versuchs schon einmal gesehen hast oder nicht. Dazu hast du zwei Aufgaben. Die Instruktionen für die beiden Aufgaben startest du mit der Leertaste.

Aufgabe 1: Gleich werden dir nacheinander Bilder verschiedener Gegenstände auf dem Bildschirm gezeigt. Einige sind dir während der Zuordnungsaufgabe bereits begegnet. Einige werden neu hinzu kommen. Darunter wirst du zwei Kästchen sehen, die jeweils die Aufschrift „ALT“ oder „NEU“ tragen. Weiter mit der Leertaste.

Wenn du glaubst, einen Gegenstand während des Versuchs schon einmal gesehen zu haben, gilt er als ALT. Drücke dann bitte die Taste, die dem Feld „ALT“ zugeordnet ist. Dabei handelt es sich um die Taste „G“. Wenn du glaubst, einen Gegenstand während des Versuchs noch nicht gesehen zu haben, gilt er als NEU. Drücke dann bitte die Taste, die dem Feld „NEU“ zugeordnet ist. Dabei handelt es sich um die Taste „J“. Weiter mit der Leertaste.

Aufgabe 2: Beurteilst du einen Gegenstand als „NEU“, wird sofort der nächste Gegenstand auf dem Bildschirm erscheinen. Beurteilst du hingegen einen Gegenstand als „ALT“, so möchten wir dich bitten, eine weitere Unterscheidung vorzunehmen. Weiter mit der Leertaste.

Bei manchen Bildern werden dir wahrscheinlich DETAILS aus der vorherigen Phase des Versuchs einfallen: z.B. die Form, in der das Bild gezeigt wurde, deine eigene Reaktion oder ein Geräusch von außerhalb des Labors etc. Das heißt, du ERINNERST dich in diesem Fall an das Objekt in der Situation. In anderen Fällen wird dir ein Objekt einfach VERTRAUT vorkommen. Du weißt dann, dass du dieses Objekt schon einmal gesehen hast, aber du kannst keine weiteren mit dem Objekt verbundenen Details abrufen. Weiter mit der Leertaste.

Drücke auf die Taste "1", wenn du dich bewusst an Aspekte der Situation ERINNERST, in der das Bild vorkam. Drücke auf die Taste "2", wenn dir das Objekt einfach nur VERTRAUT vorkommt, d.h., wenn du keine bewusste Erinnerung an die Auftretenssituation hast, aber trotzdem weißt, dass das Objekt vorkam. Falls du bei deiner Entscheidung einfach nur GERATEN haben solltest, dann drücke auf die Taste "3". Mit der Leertaste startest du die Gedächtnisaufgabe.

If an „old“ response was selected:

Du hast mit "alt" geantwortet. Warum?

Thank you and goodbye:

Das war´s...Vielen Dank für deine Teilnahme! Bitte melde dich nun bei der Versuchsleitung.