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Choice-supportive misremembering: A robust phenomenon?

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Doctoral thesis

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Abstract

Although the literature on choice-supportive memory – remembering the items of chosen options as more preferential and those of non-chosen options as less preferential than they actually were – is scarce and scattered, it has widely been accepted as a solid phenomenon that could lead to biased future decisions. In the published studies to date, different types of such misremembering have been observed using rather dissimilar methods, with the large majority testing memory solely with source recognition. The characteristics of the material to be remembered have not been particularly varied and the effect of different delay levels has not been properly investigated. Thus, at the onset of this project, there was a lack of insight into the nature and robustness of the phenomenon and no systematic review of the relevant literature had been done to provide an integrative assessment of its status.

The objectives and scope of the current project are the following: (1) to conduct a systematic literature review on the phenomenon of choice-supportive misremembering; (2) to propose a new comprehensive taxonomy of the different types of memory distortions after choice, and (3) to investigate the empirical support for the proposed taxonomy and explore the conditions necessary for the choice-supportive misremembering effect.

The first experiment involved four choice scenarios and had a typical design for studies in the decision-making literature (information presented in tables with a low number of attributes and only the value of each one differing between the two options). Memory was tested with free and cued recall only, and the delay between the choice and the memory tests was manipulated on three levels (2 minutes, 20 minutes, and 2 days). The results fully supported the proposed taxonomy, but also highlighted the absence of choice-supportive misremembering despite the high statistical power of the tests.

In the second experiment, the scenarios and options were more complex and verbose, with a higher number of items. Four different scenarios were used and presented in two different formats (‘narrative’ vs list) as well as in an alignable and an unalignable version. The narrative versions presented the items of the two options in blocks of text (Option A above Option B), whereas the list versions displayed each item on a separate line (Option A adjacent to Option B). In the alignable version, the items presented had corresponding items on the same dimension in both options, while there was no such correspondence in the unalignable version. This time, memory was tested with free and cued recall in addition to a source recognition test that has

hitherto been more typical for studies on choice-supportive misremembering. In common with the first study, this second experiment provided full support for the proposed taxonomy, but it also demonstrated the existence of the choice-supportive misremembering effect regardless of the manipulated variables.

Considered in unity, the results of the two experiments suggest that the type of stimuli used is a decisive factor and confirm that the phenomenon does not occur with the kind of materials typically used in the decision-making literature. Indeed, when participants are more likely to compare the options item by item rather than rely on gist-based processing, they do not seem to exhibit choice-supportive memory effects. This observation and the findings from the literature review and the two experiments are discussed in light of the various theories that have been proposed to explain misremembering. Finally, suggestions on how to further expand the knowledge through new research studies on specific populations are put forward.

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Structure of the thesis

In this thesis, I will start by providing the general context and aims of the project in a brief introduction. In *Chapter 1*, I will then progress into a more focused background to the topic before proposing a new taxonomy and presenting a critical literature review that reveals the current state of the art. *Chapter 2* consists of a presentation of our first experiment, designed to investigate the effects of delay on choice-supportive misremembering, test the validity of the taxonomy and appraise the existence of choice-supportive misremembering in a standard choice context. After this follows *Chapter 3,* depicting our second experiment, which aims to elucidate which conditions are needed for the effect to occur. In the *Overall conclusion and discussion*, I will summarize and discuss the combined findings from the literature review and the two empirical studies. In this section, I will also deliberate upon the practical consequences of the findings and how this knowledge can be used to promote effective decision making. In the last section of the thesis – *Limitation and future directions* - I will discuss the shortcomings of our experiments and suggest directions for future research.

Introduction

The efficiency and accuracy of decision-making processes are interdisciplinary topics with wide-ranging impact on many academic fields, including psychology, economics, law and medicine. For the individual, the decisions one makes have a profound effect on everything from personal health, relationships, career and happiness. Much research concerns itself with the impact of memory and biases on the resulting decisions (e.g., Gluth, Sommer, Rieskamp, & Büchel, 2015), but significantly less on how decision-making processes may affect subsequent memory of the options. Nonetheless, if the recall of past options is inaccurate, it may influence future decisions down the line and exclude some options from even being considered at later stages. Undoubtedly, the effect of such distortions could potentially affect the entire life course of an individual.

Choice-supportive misremembering – when chosen options are remembered as more preferential and non-chosen options as less preferential than they actually were – is not a new topic in the psychological literature (e.g., Mather, Shafir, & Johnson, 2000; Mather & Johnson, 2000). However, in these times of ever-increasing polarization fueled by confirmation bias and fake news, it could be a largely relevant and influential factor. If the perceived attractiveness of chosen options increases with time and that of rejected options decreases due to their components being distorted, polarization and false confidence in the superiority of one's own standpoint inevitably follow. Furthermore, despite the widespread trust in the robustness of the phenomenon, it remains to be clarified why the effect has not been found in all experiments aimed at investigating it.

Aims

As no thorough review of the literature - or even a categorization of the different types of distortions - had been done, the aims of this project are three-fold: (1) to propose a taxonomy of the different types of potentially choice-supportive distortions, (2) to assess the robustness of the current evidence in support of the phenomenon, and finally, (3) to illuminate its boundaries and the conditions necessary for it to manifest. To address the first two aims, we reviewed the relevant literature and proposed a new taxonomy of the various types of choice-supportive misremembering observed. (Note that this part of the thesis – *Chapter 1* - has been previously published in *Frontiers in Psychology*). In two large empirical studies, we then proceeded to investigate gaps that we had found in the literature and to elucidate which conditions may be required for the phenomenon to appear.

Decision-making rationality

Numerous descriptive and prescriptive theories on decision making have been put forward since time immemorial, but the progress in the field does not follow a straight course towards ultimate rationality (for an enlightening time line describing the history of decision making, see Buchanan & O'Connell, 2006). Constraints have been recognized and while some theorists have argued that people would decide rationally if they could gather sufficient information and possessed unlimited processing capacity (the theory of bounded rationality, see e.g., Simon, 1956), others present factors that can cause individuals to decide against their own economic interest (e.g., prospect theory, Tversky & Kahneman, 1986). Evidence that emotions are a necessary ingredient for decision making has also been put forward (e.g., Damasio, 1994).

Rational choice is often assumed to involve a number of elements. For example, the process is expected to follow an orderly path from problem (or presentation of the options) to decision, seeking to maximize the expected utility. According to the expected utility theory, four axioms define rational decision making: completeness, transitivity, independence and continuity (Von Neumann & Morgenstern, 2007). Completeness denotes that the decision maker has clear preferences and is always able to decide between any two alternatives. Transitivity refers to the idea that deciding according to the completeness axiom will lead to consistent decision making over time. Independence assumes that introducing an irrelevant alternative will not change the order of preferences of pre-existing (relevant) alternatives. Finally, continuity implies that if an individual prefers A to B to C, there should be a possible combination of A and C in which that individual is indifferent between a lottery of A and C, and receiving B with certainty. Satisfaction of all these axioms signifies that the individual is rational. The final, rational, choice should then correspond to the preferences of the decision maker, as well as be logically consistent and based on objective facts only. However, studies in such varied fields as psychology, mathematics, sociology, economics and political science show that this does not provide an accurate description of human decision making and that it would, indeed, not even be optimal in all situations. Instead, in some cases, an integral part of deciding involves a creation of an acceptable cognitive structure, reached by reordering and reconstructing the information in a way that makes sense to the decision maker. Not until that is accomplished can a decision be reached.

Memories of earlier decisions – as well as decisions that are based on memories, such as eyewitness testimonies – will unavoidably be affected by these processes regardless of whether they are adaptive or detrimental. This is particularly the case for the restructuring that continue or start after the choice is made. For this reason, it is important to identify factors that can have an impact on the processes occurring during and after decision making.

Self-serving bias

Numerous types of biases are likely to affect both decision making and memory (see e.g., Hastie & Dawes, 2001). One that is especially relevant to choice-supportive misremembering is the self-serving bias, which can be described as a tendency to interpret the world in a manner conducive to maintaining self-confidence and a positive outlook. Most commonly, it refers to the tendency to attribute favourable events to one's own character and unfavourable events to external factors. In the context of memory, however, it may also refer to other ways that emotional needs can shape memories. High-school grades may be remembered as better than they were (Bahrick, Hall, & Berger, 1996) or - as discussed in this thesis – a chosen option as more advantageous than it actually was. Clearly, memory retrieval may be influenced by goals other than accuracy. Accurate memories that indicate that we are incompetent decision makers and/or that we have to live with the outcome of a bad choice satisfy our desire to form a correct model of the universe, whereas any desirable but inaccurate memories may serve a need to preserve our mental well-being.

The question whether memory distortions are products of deficient cognitive processing has been widely studied and the conclusions are varied. Associations between higher proportions of false memories and false recognition with low intelligence as well as with brain damage and disorders have been found in several studies (e.g., Goodman et al., 2011; Moulin, Conway, Thompson, James, & Jones, 2005; Zhu et al., 2010). Nonetheless, it has also been demonstrated that in healthy individuals, self-serving memory distortions may be a product of a well-functioning adaptive memory system (e.g., Boyer, 2009; Brainerd & Reyna, 2005; Schacter & Coyle, 1997; Sutton, 2009). Indeed, choice-supportive memory errors could be both motivation-driven (to serve the goal of self-enhancement) and cognition-driven (to maintain an existing self-view).

Furthermore, as gist-based memory cues support the retention of meaning that enables generalizations and abstractions, and associative memory processes contribute with structure to facilitate retrieval, the same processes that may cause distortions also serve to improve memory performance. Some authors argue that cognitive and motivational theories are empirically indistinguishable and that so called motivated bias may in virtually all cases be explained in terms of information processing (see e.g., Kruglanski, 1999; Tetlock & Levi, 1982). As expressed by Kruglanski: "most organized cognition - that is, cognition involved in judgment, reasoning, problem solving, or impression formation - is purposeful and motivated" (Kruglanski, 1999, p. 55). Thus, instead of focusing on whether emotion or cognition is the main driver, it may be more useful to turn the attention to the factors needed for the effect and to the mental processes to which they give rise.

Chapter 1: Choice-supportive misremembering: A new taxonomy and review[1]

1.1 Introduction

Time and memory are true artists; they remold reality nearer to the heart's desire (Dewey, 1920).

Decision-making processes have been widely studied both in basic research and in applied contexts, with a significant part of recent research concerning the impact of memory processes and memory-related biases on decisions (see e.g., Del Missier et al., 2013; Del Missier, Mäntylä, & Nilsson, 2015; Dougherty, Gronlund, & Gettys, 2003; Hoffmann, von Helversen, & Rieskamp, 2014; Tomlinson, Marewski, & Dougherty, 2011). Despite this interest in the relationships between memory and decision making, only a limited number of studies have investigated how decision making affects memory, and, more specifically, how the act of choosing and the actual choice one has made influence subsequent memory of the options (e.g., Mather, Shafir, & Johnson, 2000; Mather & Johnson, 2000; Mather, Shafir, & Johnson, 2003). Although the issue of choice-supportive misremembering has both theoretical interest for cognitive and decision scientists and applied implications for practitioners in a variety of fields, research has been sparse and non-systematic and a unifying review is currently lacking. Moreover, each relevant paper tends to focus mainly on one of the different types of misremembering, but there has been no overarching attempt to clarify the categories into which such systematic distortions may be divided and their relationships. Finally, for some of these effects, results are not fully consistent across studies and diverse explanations have been proposed.

Given this state of affairs, the present review has two aims: (1) to introduce a new taxonomy useful for understanding choice-supportive memory effects and their underlying processes; (2) to review the literature on choice-supportive memory and appraise the degree of support for the different aspects of the phenomenon and for the existing explanations. We will start by proposing a new theoretically motivated and empirically grounded taxonomy describing the

[1] This paper has been published in the open access journal *Frontiers in Psychological Science:* Lind, Visentini, Mäntylä, & Del Missier (2017).

possible types of systematic choice-supportive misremembering that decision making may induce. Then, we will review papers accounting for the influence of potentially moderating factors on choice-related misremembering after decision making (i.e., alignability of attributes, delay before memory test, valence of stimuli, individual differences, and type of memory test). After that, following our taxonomy, we will appraise whether choice-supportive misremembering is a robust and well-supported phenomenon both within each category and overall. We will also discuss the proposed explanations for choice-related misremembering in terms of underlying cognitive and affective processes.

From the theoretical viewpoint, the novel taxonomy and the associated review offer a new unifying and clarifying perspective on rather disconnected effects and phenomena, and the potential reasons behind them. This will highlight the similarities and differences between various kinds of misremembering after choice, allow an appraisal of their respective degree of empirical support, and provide more insight into the underlying processes. Furthermore, it will shed light on under-investigated aspects, unresolved issues, and the more promising new research directions. From the applied research viewpoint, gaining insight into whether, when, and why decision-making processes distort our memory could eventually help us determine to what extent human memory can be trusted and give indications on how to improve memory-based decision making. Indeed, a strongly altered memory of past choices may affect future choices and hinder proper learning from experience and adaptation to reality.

1.1.1 A new taxonomy of misremembering after decision making

Starting from a theoretical analysis and a review of the literature connecting memory and decision making, we propose a new taxonomy and analysis systematically addressing choice-supportive misremembering after decision making (i.e., misremembering choice-related information in a way that boosts the chosen option and/or demotes the foregone options). We identified four conceptually distinct types of choice-supportive misremembering, with clear face validity, corresponding to diverse research streams in the decision-making and memory literatures: *misattribution, fact distortion, false memory*, and *selective forgetting* (*Figure 1*).

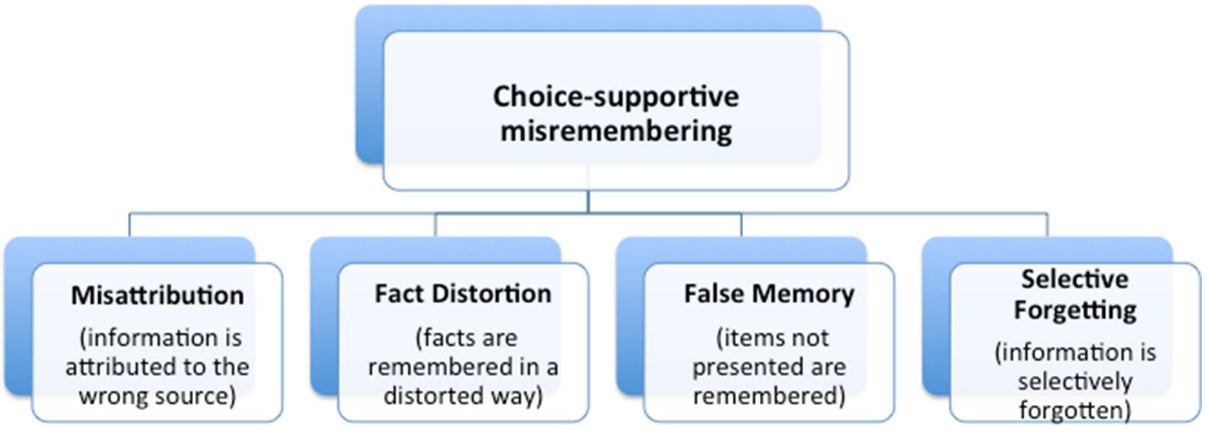

Figure 1: The taxonomy of choice-supportive misremembering

Support for the proposed taxonomy comes from three different sources: (1) the a-priori grounding of the taxonomy categories in diverse and complementary theoretical views, (2) the face validity of the different types of misremembering that can be logically disentangled, (3) the empirical support coming from the studies that will be reviewed in the present paper. We introduce the taxonomy before presenting the review in order to provide a clear organizing principle for the description of the studies.

Misattribution is when positive attributes are remembered as belonging to the chosen option when they in fact belonged to the foregone option, or when negative attributes are remembered as belonging to the foregone option when they in fact belonged to the chosen option. For example, if the choice is between two houses and the chosen house has a hole in the roof and the foregone one has a wonderful view, the chosen house is remembered as having a wonderful view or the foregone one as having a hole in the roof. Misattribution is a well-known type of commission error, where a memory is misattributed to the wrong source, and one of Schacter's "seven sins of memory" (Schacter, 1999). In line with research in the decision-making field (Mather & Johnson, 2000; Mather et al., 2003), however, our operational definition is narrower than Schacter's, specifically referring to the attribution of a correctly recalled feature to the wrong option. Indeed, misattribution presupposes correct encoding and recall of the actual information – only its source is confused – while false memory represents a separate category in our taxonomy, since it is a qualitatively different type of error (remembering information never presented), which may even be related to different underlying processes (e.g., Reyna & Lloyd, 1997), an issue that will be discussed later in the paper.

Fact distortion is when the objective values of features belonging to the chosen option are misremembered as more preferential than their actual values, and values of features belonging to the foregone option as less preferential. An example would be if in the choice between the two houses both were located 1 km from the work place, but the chosen one is remembered as being 500 m away and/or the foregone one as being 1.5 km away. This actual distortion of facts is distinct from changes in the subjective evaluation or attractiveness of options during the decision-making process, which are widely studied phenomena in the decision-making literature (e.g., Holyoak & Simon, 1999; Russo, Medvec, & Meloy, 1996; Shamoun & Svenson, 2002; Svenson & Benthorn, 1992). Altering specific pieces of information is an error of commission possibly related to the biasing influence of current beliefs on memory (Schacter, 1999). Fact distortion in memory after choice has been specifically postulated by the differentiation-consolidation theory (Svenson, 1992) and investigated by Svenson, Salo, & Lindholm (2009) and DeKay et al. (2014) in studies that will be discussed later in this review.

False memory in the context of choice-supportiveness is when new attributes that were not part of the original options are 'remembered' as presented and, if their values are considered positive, as belonging to the chosen option, and if negative, as belonging to the foregone option. For example, the chosen house might be remembered as being well insulated even though no information about the insulation of either house had been presented. False memories have been widely investigated in the memory literature, for instance in relation to the misinformation paradigm (e.g., Ayers & Reder, 1998; Bernstein & Loftus, 2009; Cochran, Greenspan, Bogart, & Loftus, 2016; Laney, Morris, Bernstein, Wakefield, & Loftus, 2008). Some research has also been carried out on false memories in relation to decision making (e.g., Lindholm, Sjöberg, & Memon, 2014; Pennington & Hastie, 1988; Sharman, Garry, Jacobsen, Loftus, & Ditto, 2008; Corbin, Reyna, Weldon, & Brainerd, 2015). They represent a more dramatic and radical departure from reality than simple fact distortions, in that an entire new piece of non-existing evidence is remembered. Moreover, this type of error is not attributable to a properly encoded but later confused feature, thus it is conceptually distinct from misattributing a correctly recalled feature to one of the presented options (for a classification of memory errors and false memory phenomena see also Reyna & Lloyd, 1997).

Selective forgetting is when the positive attributes of the chosen option and the negative attributes of the foregone option are remembered at a higher rate than vice versa. An example would be correctly remembering that the chosen house was close to the work place, but forgetting its leaking roof. This is a typical omission error, possibly fostered by the decreasing accessibility of memory over time (“transience”: Schacter, 1999; Schacter, Chiao, & Mitchell, 2003). Selective forgetting and remembering has traditionally been studied in relation to the confirmation bias (e.g., Levine & Murphy, 1943; Nickerson, 1998). Mather et al. (2000) and Depping & Freund (2013) have investigated the occurrence of this phenomenon after choice. Moreover, selective forgetting has been studied more generally as the outcome of incidental or motivated forgetting processes in the memory literature (e.g., Anderson & Hanslmayr, 2014; Anderson & Huddleston, 2012; Bäuml & Kliegl, 2013; Hirst & Echterhoff, 2012).[2]

1.1.2 Eligibility criteria for the review

We included in the review only studies in which participants were presented with at least two options with multiple features, thus focusing on traditional multi-attribute choice problems, which represent the typical scenarios investigated in decision making (e.g., Payne, Bettman, & Johnson, 1993). Moreover, in the selected studies, participants were asked to make a deliberate preferential choice between the options after reviewing these features, which qualifies only proper decision-making studies (e.g., Hastie & Dawes, 2001). Based on evidence of important differences between judgment and choice processes (see e.g., Lichtenstein & Slovic, 2006; Payne et al., 1993), any study where the participants are asked to make a judgment rather than a choice (e.g., Dellarosa & Bourne, 1984; Lindholm et al., 2014) or the decision is based on a mere esthetic preference (e.g., Johansson, Hall, Sikström, & Olsson, 2005; Lieberman, Ochsner, Gilbert, & Schacter, 2001) was also excluded from this review.

In addition to these structural selection criteria, which adhere to traditional distinctions in judgment and decision-making research, we adopted some additional criteria with the specific aim to exert more control over the possibility that the conclusions drawn from the literature review are actually attributable to the influence of choice making on memory processes and not affected by extraneous factors. In particular, we excluded studies in which additional

[2] The same misremembering classification can be applied in a straightforward way to attribute values that are not just perceived as positive or negative, but simply as better or worse along a common evaluation dimension. For instance, assuming that a lower price is preferable to a higher price for a product, but that a decision maker has chosen the product with the higher price due to its (other) better features, choice-supportive misattribution would imply switching the association between options and prices when remembering them. Choice-supportive fact distortion would imply remembering a price lower than the true one for the chosen option and/or a higher one for the foregone option. If price had not been presented at all, remembering that the chosen option had a lower price than the alternative one would represent a case of choice-supportive false memory. Finally, forgetting the price would represent an example of choice-supportive selective forgetting.

information (including misinformation) was introduced between the choice and the memory test. This left out from the review research on other types of distortions, such as those resulting from well-known hindsight paradigms. Indeed, in these conceptually different types of situations, the memory distortion is at least partly produced by the provision of information after the decision or the experience and not by the decision *per se* (for reviews see e.g., Bernstein, Erdfelder, Meltzoff, Peria, & Loftus, 2011; Calvillo, 2012; Erdfelder, Brandt, & Bröder, 2007; Louie, Rajan, & Sibley, 2007). Furthermore, in this review we are concerned solely with preferential choice and not with the predictability of an event or outcome, which is the main issue investigated in studies on the hindsight bias (Roese & Vohs, 2012). We also excluded studies in which participants themselves select which information to access (as in, e.g., Meffert, Chung, Joiner, Waks, & Garst, 2006; Redlawsk, 2001).

Finally, the memory test had to be of the information provided and not of the influence of prior knowledge (see e.g., Biehal & Chakravarti, 1986; Dellarosa & Bourne, 1984) or merely of the choice made (e.g., Hall, Johansson, Tärning, Sikström, & Deutgen, 2010; Holyoak & Simon, 1999), because these latter tests do not allow investigating choice-supportive misremembering.

One study that appeared to qualify was excluded on the basis of lack of details (Davidson & Kiesler, 1964), since our attempt to obtain more information from the authors was unsuccessful. Another study with partial information was included (Chen & Zhang, 2003) but, due to the lack of detail, our review of that study is limited.

Thorough searches using the key words "memor*," "recall*," "recog*," "remem*," and "recoll*" combined with "decision," "choice," "option," and "prefer*" were conducted in the databases ERIC, Psycarticles and PsycINFO, as well as in Google Scholar. Additionally, after assessing the eligibility of the articles or proceedings found, all backward and forward references of the eligible papers were assessed using both Web of Science and Scopus. The time period covered by the search was until July 2017. Postings were made to relevant decision-making mailing lists (Society of Judgment and Decision Making, and European Association for Judgment and Decision Making) asking for both published and unpublished papers on memory biases or distortions or misremembering after choice. Table 1 summarizes the main features of the studies satisfying our inclusion criteria.

Table 1: *Summary of the eligible studies*

Study • *Eligible experiment(s)*	**Main misremembering category** *[other categories potentially relevant]*	**Participants[3] (age)**	**Conditions or groups**	**Scenarios**	**Attribute alignability**	**Delay**	**Memory test**
Benney & Henkel (2006)	Misattribution *[Selective forgetting, False memory]*	172 adults (18–52)	Best interest vs. free choice vs. assigned option	• Restaurants • Movie theaters • Department stores • Gum	Mainly unalignable, but gum options partly alignable	30 min	Recognition (source recognition)
Chen & Zhang (2003) • *Experiment 1* • *Experiment 2*	Misattribution *[Selective forgetting]*	Number and age of participants not known	High vs. low conflict scenarios Delay levels	Not known	Not known	“Short” and “long” (details not known)	Free recall and source recognition (details not known)
DeKay et al. (2014) • *Experiment 1* • *Experiment 2* • *Experiment 4*	Fact distortion	• Experiment 1: 169 adults (18–68) • Experiment 2: 470 adults (18–71) • Experiment 4: 255 adults (18–74)	Choice vs. no choice	• Apartments	All alignable	No delay	Recognition (forced-choice recognition)
Depping & Freund (2013) • *Experiment 1* • *Experiment 2*	Selective forgetting *[Misattribution]*	• Experiment 1: 66 young (19–30), 73 older (60–88) • Experiment 2: 62 young (18–31), 60 older (64–86)	Choice vs. readability (no choice) Age	• Travel packages • Hospitals (for surgery)	Mainly not alignable	7 min	Free recall

[3] Participants included in the analyses.

Henkel & Mather (2007) • *Experiment 1*	Misattribution *[Selective forgetting, False memory]*	80 young adults (18–24)		• Roommates • Internships • Apartments • Cars • Dating partners	Mainly not alignable	2 days	Recognition (source recognition)
Hess & Kotter-Grühn (2011) • *Experiment 1*	Misattribution *[Selective forgetting]*	54 young (20–44), 52 middle-age (45–64), 54 older (65–85)	Impression (no choice) vs. interaction (and choice) Age	• Persons with whom to spend a day (social partner)	Not known, but the examples provided in the paper suggest mainly unalignable	Short, length not specified	Recognition (source recognition)
Hess, Queen, & Patterson (2012)	Misattribution	54 young (20–44), 55 middle age (45–64), 54 older (65–85)	Active deliberation vs. no deliberation Alignable vs. unalignable attribute focus Age	• Grocery store • Apartment to rent	Half alignable	Relatively short, length not specified	Recognition (source recognition)
Mather & Johnson (2000)	Misattribution *[Selective forgetting, False memory]*	54 young (18–26), 108 older (64–83)	Affective review vs. factual review vs. no review Delay levels Age	• Houses • Job candidates • Flights • Blind dates	Mainly not alignable	30 min, 2 days	Recognition (source recognition)
Mather et al. (2000) • *Experiment 1* • *Experiment 2* • *Experiment 3a* • *Experiment 3b*	Misattribution *[Selective forgetting, False memory]*	• Experiment 1: 142 students[4] • Experiment 2: 75 under-graduates • Experiment 3a: 77 undergraduates • Experiment 3b: 379 students	Experiment 3b: Choice vs. rejection	• Job candidates • Blind dates • Roommate	Mainly not alignable	Experiment 1: 5 min Experiments 2 and 3a: 45 min Experiment 3b: 5 min	Recognition (source recognition)

[4] The age of the participants is not specified for any of the experiments in this paper.

Mather et al. (2003) • *Experiment 2*	Misattribution *[Selective forgetting, False memory]*	94 undergraduates (age not known)	Choice vs. assignment	• Houses • Roommates • Cars	Mainly not alignable	45 min	Recognition (source recognition)
Queen & Hess (2010)	Misattribution *[Selective forgetting]*	62 young adults (17–28), 75 older adults (60–86)	Age Conscious vs. unconscious thought Deliberative vs. Intuitive information	• Apartments • Banks	All attributes alignable	Relatively short, not specified	Recognition (source recognition)
Svenson et al. (2009) • *Experiment 1* • *Experiment 2* • *Experiment 3*	Fact distortion	• Experiment 1: 64 students (21–42) • Experiment 2: 35 students familiar with scenario type (23–48) • Experiment 3: 77 students (19–39)		Patients needing surgery	All attributes alignable	Experiments 1 and 2: Not known Experiment 3: 1 h	Cued recall

1.1.3 Influence of choice on choice-supportive misremembering

Before discussing research on choice-supportive misremembering, it is necessary to appraise whether a necessary condition for the existence of this phenomenon holds: the very act of making a choice should influence subsequent memory of the options. Thus, it is essential to assess whether the effects are only observed after choice or whether they are also found when no active choice has been made. For this reason, several of the experiments use a design with a control group whose participants do not make a choice but are simply assigned an option (Benney & Henkel, 2006; Hess & Kotter-Grühn, 2011; Mather et al., 2003). In other studies participants are provided a “best interest” option (Benney & Henkel, 2006), or asked to focus on “readability” of a text rather than its contents (Depping & Freund, 2013).

All of these studies, apart from the latter, found that making a choice induces choice-supportive misremembering. Such misremembering was found for assigned options only when the participants had been led to believe that the assignment was based on their best interest (Benney & Henkel, 2006). When participants had not been told that the assignment was in their best interest, participants’ memory slightly favoured the option they had not been assigned. In particular, Benney and Henkel did not observe choice-supportive misremembering in the assignment group and they observed the effect both in the free choice group and the best interest group, with these two latter groups not differing significantly.

Likewise, Mather et al. (2003) found choice-supportiveness in their choice group, but not in the assignment group. Hess and Kotter-Grühn (2011) also found significantly higher level of choice-supportiveness of memory in the social interaction (choice) condition than in the impression (no choice) condition, but as the participants in the impression group were not told which option they had been assigned, the design did not enable an analysis of the effect on memory of being assigned an option. It is also worth noting that Mather et al. (2000) observed similar choice-supportiveness when participants had to choose one option vs. when they had to reject one option. Interestingly, Henkel and Mather (2007) observed misattribution to be supportive of the choice they thought they had made rather than of their actual choice. As pointed out by the authors, this indicates that belief at the time of retrieval can influence memory accuracy and thus that the observed misremembering cannot be entirely due to encoding processes. Only Depping and Freund (2013) did not find choice-supportive memory in the groups making a choice.

1.2 Factors potentially influencing memory choice-supportiveness

Before reviewing the studies within each category of choice-supporting memory, we will discuss some factors potentially moderating misremembering, given that these factors may be influential across the four proposed categories. The main potential moderating factors are alignability of the attribute values, delay between presentation of the options and memory test, valence (of the scenarios, options and attributes), individual differences, and type of memory test. These factors have been found to affect decision making or memory significantly (e.g., Markman & Medin, 1995; Payne et al., 1993; Schacter, 1999; Schacter & Coyle, 1997) and thus they may play also a role in choice-supportive misremembering.

1.2.1 Alignability

A factor that may influence misremembering after choice is alignability (i.e., whether both options have directly comparable features). For example, when choosing between houses, an attribute value belonging to one option may be that it is 1 km from the city center and one belonging to the other option that it is located 2 km from the city center. These attribute values are alignable (or commensurable), whereas those features that do not have a comparable one in the other option are not.

The effects of alignability on decision making or memory have been investigated in a number of studies (e.g., Markman & Gentner, 1997; Markman & Medin, 1995; Mather, Knight, & McCaffrey, 2005), and the degree of alignability varies across the studies we reviewed. All attributes of the options in Svenson et al. (2009), Queen and Hess (2010) and DeKay et al. (2014) were alignable, whereas others employed a design where half of the attributes were alignable and the other half unalignable (Budson, Mather, & Chong, 2006; Hess et al., 2012). The remaining studies did not specifically assess the importance of alignability and did not specify the alignability of the attributes. From the evidence available, it appears that none of the remaining papers used scenario features that were entirely or substantially alignable.

Choice-supportive memory has been observed both in studies with alignable attributes and in studies with non-alignable attributes (see Table 1). However, Hess et al. (2012) observed an interaction between age and alignability, with choice-supportiveness scores increasing from the young to middle-aged to older groups for alignable attributes but not for unalignable attributes.

This effect was no longer significant when a composite ability measure was used as a covariate. Generally, they observed greater choice-supportiveness for alignable attributes. This suggests that the effect can be greater for alignable features, at least in some populations (see also Budson et al., 2006; Mather et al., 2005), and that this difference can be related to cognitive skills. However, more studies are needed to fully clarify the role of alignability in choice-supportive misremembering, especially in relation to the category of false memories and in different populations.

1.2.2 Delay

An important factor affecting memory is the extent of the delay between encoding (i.e., viewing the information about the options) and retrieval (i.e., the memory test). An increased delay is likely to result in more misremembering, but it is possible that delay affects different types of memory distortions differently. Unfortunately, although some memory studies have found false memories to increase over time (e.g., Howe, Candel, Otgaar, Malone, & Wimmer, 2010; Sulin & Dooling, 1974), the relative influence of delay, memory test, and material used on choice-supportive misremembering has not been properly scrutinized. Indeed, none of the studies reviewed allow us to draw strong conclusions about this, as they did not systematically investigate types of misremembering vs. delay. However, some used a design with different delay levels in the same study (Chen & Zhang, 2003; Mather & Johnson, 2000), showing how delay affected the particular type of memory distortion studied. The other experiments all used rather short but variable time lags (Budson et al., 2006; DeKay et al., 2014).

Chen and Zhang (2003) found that when using a "long" delay, positive attributes were more likely to be attributed to the chosen option in their high-conflict condition than in their low conflict condition (similar vs. diverse attractiveness of the choice options). Unfortunately, that paper does not specify exactly the length of the delays used, and we have not been able to obtain more information about the experiment from the authors. Mather and Johnson (2000) found that, although most participants exhibited a source attribution bias favouring their chosen option, there was no significant effect of delay (30 min vs. 2 days) other than the group with older participants and the longest delay (2 days) showing the weakest memory for every measure. It is clear that studies further investigating the effect of delay on choice-supportive misremembering are needed. Not only would it be interesting to see whether delays longer than

2 days (the longest delay after which choice-supportiveness was assessed) produce more choice-supportive misremembering compared with shorter delays, but also whether delay specifically affects the different types of distortions observed.

1.2.3 Sequential vs. simultaneous presentation of information

Choice-supportive memory phenomena can be the product of biased encoding or biased recall of the information presented (or both). In the former case, the decision maker may have encoded altered or partial information before making a choice (predecisional distortion: DeKay, 2015). In the latter case, choice-supportive memory originates from processes occurring after a decision has been made. Sequential presentation of information (vs. simultaneous presentation) might favour predecisional distortion (DeKay et al., 2014).

The studies we reviewed vary in relation to the information presentation type. Some of them used a sequential presentation of the options or attributes (DeKay et al., 2014; Hess & Kotter-Grühn, 2011; Hess et al., 2012; Queen & Hess, 2010), whereas the participants in the remaining studies made their choice with the information simultaneously and externally available. Choice-supportive misremembering has been observed both with sequential and with simultaneous presentation of information. However, given that no study appraised systematically the influence of information presentation on choice-supportive memory, more research is needed.

1.2.4 Valence

The impact of valence in relation to misremembering after choice can be evaluated at three levels: scenario, option, and attribute. Making a choice in a positive scenario or situation (e.g., going on *Holiday* and choosing between two different destinations) may not result in the same degree and kind of misremembering as a choice in a negative scenario or situation (e.g., being seriously ill and choosing between two different methods of surgery). Similarly, a desirable and an undesirable option, or positive and negative attributes, may be distorted to different degrees. Out of the studies reviewed, only Depping and Freund (2013) attempted to clarify whether the valence of the scenarios/situation influence memory distortion. They conducted two experiments with older and younger participants to investigate the impact of valence and choice on memory. Unfortunately, Depping and Freund failed to observe significant choice-supportive misremembering in their studies, regardless of the age group investigated, and therefore no interaction with valence was detectable. However, the other studies we reviewed found significant choice-supportive memory using positively, neutrally and negatively valence settings, although only Svenson et al. (2009) used a clearly negative scenario. This implies that valence may not be critical for observing choice-supportive memory effects, although more studies systematically investigating its influence on choice-supportive misremembering are needed.

1.2.5 Individual differences

Not everyone may misremember to the same degree. Age as well as individual differences in terms of cognitive abilities and personality are likely to be influential. Thus, several of the studies included different age groups (Depping & Freund, 2013; Hess & Kotter-Grühn, 2011; Hess et al., 2012; Mather & Johnson, 2000; Mather et al., 2005; Queen & Hess, 2010), and some also individual differences in cognitive ability (Hess & Kotter-Grühn, 2011; Hess et al., 2012; Mather & Johnson, 2000; Queen & Hess, 2010).

As far as overall choice-supportiveness is concerned, only Mather and Johnson (2000) found that older age is associated with greater choice-supportive misremembering (in particular, source misattribution). Indeed, Queen and Hess (2010), Hess and Kotter-Grühn (2011), Hess et al. (2012) and Depping and Freund (2013) all observed that the memory of older adults was not significantly more choice-supportive than that of younger adults. Although age has mainly been looked at in relation to valence or overall choice-supportiveness, Hess and Kotter-Grühn (2011) introduced another dimension: morality vs. competence judgments. The participants in their first experiment were older and younger adults, rating target persons based on statements focusing on either morality or competence. The participants in one subgroup made an impression of the target persons and those in the other chose whom to spend a day with socially. Only in the older adult group was choice-supportiveness specific to the morality domain. Curiously, although different adult age groups have been investigated in several studies, research in children is lacking and it would represent an interesting avenue for future investigations.

The participants in three of the reviewed studies (Hess & Kotter-Grühn, 2011; Hess et al., 2012; Mather & Johnson, 2000) completed cognitive tests as part of the experiments. However, only Mather and Johnson (2000) discussed the correlations between the scores obtained there in older participants and the observed choice-supportiveness in memory. They assessed cognitive capacity with nine neuropsychological tests, and found significant correlations between memory choice-supportiveness and scores on tests requiring the kind of executive and reflective processing associated with the frontal lobes of the brain, but no significant correlations with tests of memory functions associated with the medial-temporal regions (only in their control condition). They also did not find correlations between overall memory accuracy and choice-supportive memory. In particular, participants with better performance in tests of frontal/executive functioning were *less* prone to choice-supportive memory.

Mather and Johnson (2000) set out to explore the influence of emotional/motivational factors on memory after decision making by comparing groups of participants assigned to three different review conditions: affective (think about how you felt about the options), factual (review the details of the options) and no review (filler task). The emotional focus in the affective condition increased the rate of choice-supportive memory in younger adults. This was the case despite the fact that the actual choice features were remembered equally well in the different review conditions. Interestingly, general memory capacity and even recognition accuracy in the specific scenario did not predict the level of choice-supportive misattribution.

1.2.6 Memory test

Given that “whether a person remembers an event depends on how memory is assessed” (Roediger & Gallo, 2001, p. 19), the method of testing memory is likely to have an impact on memory distortion. In the majority of the reviewed studies, memory of the options was tested through recognition. For instance, after choosing between two houses to purchase (“Red brick house” vs. “White house built of wood”), participants were asked to say whether “Safe neighborhood” was a feature belonging to the former or to the latter option or if was a new feature (never presented) (Mather & Johnson, 2000). Chen and Zhang (2003) and Mather et al. (2005), however, also included free recall (e.g., asking participants to recall all the attributes they could from each of the choice options). Unfortunately, Chen and Zhang (2003) did not mention whether any differences were found between the two assessment methods, and we have not been successful in obtaining more information about their experiment and findings. Mather et al. (2005) did not assess choice-supportive memory in their two free recall experiments. Depping and Freund (2013) used free recall and Svenson et al. (2009) cued recall. No choice-supportiveness was observed in the former study, while choice-supportive fact distortion was observed in the latter one.

To sum up, we cannot draw any strong conclusions about the influence of the type of memory test, as none of the papers specifically addressed this question. In particular, although choice-supportive memory has been observed repeatedly with recognition paradigms, it is not known whether the effect is reliable with free recall due to the scarcity of studies. In future research, it would be interesting to decipher whether recognition, cued and free recall yield differences in choice-supportive misremembering, also considering that free recall and cued recall are the more likely situations to occur in real life when someone is trying to remember the features of the options of a past choice in view of a related one.

A more specific issue related to the memory test concerns the fact that recognition tests for source attribution generally include both new and old features, where the old features are those that had been attributed to one option in the initial presentation and the new ones are the foils for the test. According to some scholars, assessing the extent to which old and new features are misattributed is not only useful to unveil choice-supportive misremembering, but it can also give some partial insight into when in the memory process the distortion is likely to have occurred. Benney and Henkel (2006), for example, found more choice-supportive memory for old than for new features. Both correctly and incorrectly, participants were more likely to attribute positive old features to the chosen option, but this was not the case for new features. Conversely, Henkel and Mather (2007) found similar choice-supportive misattribution for old and new features. As they pointed out, although it may be the case that participants are more attentive to the positive features that subsequently make them choose one option over the other, the fact that choice-supportive distortion was observed also for new features indicates that biased encoding alone may not explain the observed systematic memory distortion. Mather et al. (2003) found that positive old features were both correctly and incorrectly more likely to be attributed to the chosen option. Negative old features, on the other hand, were more likely to be attributed to the foregone option, although this effect was significantly smaller. Finally, positive new features were even more likely to be attributed to the chosen option than any of the old attributes, and negative new features were the ones most likely to be attributed to the foregone option. Similarly, Mather et al. (2000) found choice-supportive memory for old and new features, although it did not reach significance for new features in half of their scenarios. Again, the largest choice-supportiveness effect was found from positive features attributed to the chosen option rather than negative features attributed to the foregone option.

1.2.7 Other factors

Other factors could also affect misremembering after choice. For example, Queen and Hess (2010) and Hess et al. (2012) investigated the impact of deliberation (as opposed to intuition) during decision making on choice and on subsequent memory. Whereas Queen and Hess (2010) found no effect, Hess et al. (2012) observed more choice-supportive memory with no deliberation than with active deliberation, which was in line with their hypothesis that more attentive processing would decrease choice-supportive misremembering.

Svenson et al. (2009) found that memory distortion effects were stronger on conflicting attributes than on the attribute that turned out to be the most decisive. One of the hypotheses supported in their experiments was that there would be no consolidation of the attribute that each participant considered to be the most important. This provides some support for the notion that a higher degree of conflict on less important attributes would increase the memory distortion of the attributes. Chen and Zhang (2003), who focused on the differences in memory distortion between high and low conflict options, also found more choice-supportive memory where the options were more balanced in terms of attractiveness (high conflict) when testing the participants after a "long" delay (the precise length of which is unspecified).

Another factor that was looked at in one of the studies reviewed was how beliefs of what choice one has made affects subsequent memory (Henkel & Mather, 2007). Here, it was found that memory was biased in favour of the options the participants thought they had selected rather than their actual choices. The only difference compared to correctly remembered choices was that only somewhat, but not significantly, more negative items were attributed to the option they believe they had rejected. Not surprisingly, source accuracy was superior when the choice was correctly remembered. Similarly, Mather and Johnson (2000) discovered that, with increased delay, the believed choice became more likely to impact memory attributions than the actual choice. As the authors point out, this indicates that beliefs held at the time of retrieval is sufficient to create memory distortion, thus pointing to a crucial influence of the retrieval/test stage in the generation of choice-supportiveness.

1.3 Choice-supportive misremembering

1.3.1 Misattribution

The first type of memory distortion after decision making, misattribution, can be described as a type of choice-supportive misremembering where experimenters observe that participants misattribute attribute values to the wrong option when their memory is being tested after a delay. As mentioned previously, this is a narrower and thus more precise definition than previous ones (e.g., Johnson, Hashtroudi, & Lindsay, 1993; Schacter & Coyle, 1997). Misattribution is the most widely studied phenomenon in relation to memory distortion after choice. Much of the body of research on choice-blindness also investigates a kind of misattribution phenomenon of identifying a foregone option as the chosen one after a short delay (e.g., Pärnamets, Hall, & Johansson, 2015; Somerville & McGowan, 2016) as do other studies on the effect of bias on memory (Frost et al., 2015).

Several studies found choice-supportive misattribution (Benney & Henkel, 2006; Chen & Zhang, 2003; Henkel & Mather, 2007; Hess & Kotter-Grühn, 2011; Hess et al., 2012; Mather et al., 2000; Mather & Johnson, 2000; Mather et al., 2003; Queen & Hess, 2010), and none of the studies in this category that investigated choice-supportiveness failed to find this effect. From the reviewed studies, as we have already seen in the *Memory Test* section, it can also be concluded that the choice-supportive memory is more due to attributing positive features to the chosen option than to attributing negative items to the foregone option, although both of these phenomena are common.

Several processes may underlie misattribution. Biased encoding, errors in source attribution, and reconstructive remembering at the time of retrieval are the main ones proposed. As noted by Mather et al. (2003), attentional focus at encoding may provide a partial explanation, but their finding that new items are attributed in a choice-supportive manner points to the importance of the retrieval stage, as that is when source attribution takes place. When the source is not clearly remembered, the knowledge (or belief) of what choice one made may be used as an aid to infer the most likely source (Mather & Johnson, 2000). Indeed, Henkel and Mather (2007) found that the belief – at the time of retrieval – that one had made a particular choice, was sufficient to yield choice-supportive memory even when that belief was in fact incorrect.

Explanations focused on emotional and motivational factors point to the influence of emotional goals: the desire to feel that one has made the right choice and that the chosen option is superior to the foregone one may reduce regret and promote well-being (e.g., Kunda, 1990; Taylor & Brown, 1988). Mather et al. (2003) suggested that the belief and desire to have made the right decision provide a likely explanation for choice-supportiveness. Cognitive factors offer an alternative or complementary explanation. As the processing of stereotype inconsistent information has been found to be more cognitively demanding than that of stereotype consistent data (e.g., Henkel, Johnson, & De Leonardis, 1998; McIntyre & Craik, 1987), it may follow that any information inconsistent with the final choice may require more elaboration and cognitive effort. If such processing is rendered more difficult by age or cognitive capacity, there may be an increased reliance on feelings.

1.3.2 Fact distortion

As pointed out by Svenson et al. (2009), most research on memory distortion after decision making has focused on the subjective evaluation of the relevant facts rather than the recollection of the quantitative facts themselves. The focus of the three experiments covered in their paper and in three of the experiments in DeKay et al. (2014) was therefore the memory of the facts provided to the participants when asking them to make a choice between two options.

Similar to the studies in the *misattribution* category, both Svenson et al (2009) and DeKay et al. (2014) found systematic misremembering favouring the chosen option and downgrading the foregone option. However, DeKay et al (2014) looked at memory misremembering resulting from predecisional distortion of options based on whether they were leading or trailing alternatives early on in the decision process, whereas Svenson et al. (2009) were interested in the effect of choice on memory. Interestingly, all the experiments in the DeKay et al. (2014) paper and two out of three of those in the Svenson et al. (2009) paper found that most of this distortion stemmed from upgrading the leader or chosen alternative, and only one (Study 3, Svenson et al., 2009) that downgrading the foregone alternative contributed to most of the distortion. In Experiment 4 of the DeKay et al (2014) paper, downgrading the trailer did not even reach significance. The general trend in these six experiments is thus that bolstering the favoured option is the main contributor to this kind of memory distortion. However, the proposed mechanisms behind these effects can be considerably different and point to the importance of methodology when trying to discern underlying factors.

DeKay et al. (2014) found that participants' predecisional distortion of attributes correlated with their postdecision memory of them and cannot be attributed to response bias or any processes occurring after the choice. The suggested explanation is instead that new information is subjectively encoded as superior relative to its true value if it belongs to the currently leading option, and as inferior relative to its true value if it belongs to the trailer. This bias during encoding then would cause the memory distortion observed during the recall of facts. The authors also concluded that the errors appear to stem from biases in the mental representation of the facts rather than from the judged importance of the information. DeKay et al. (2014) argued, following the outcome of specific control analyses in their studies, that response biases and inferences made from one's choice are unlikely to explain choice-supportive memories of their participants. Thus, the authors allege that it is the initial mental representation of the information rather than any later processes that gives rise to the distortions in memory.

Svenson et al. (2009) on the other hand, argued that the systematic self-serving fact distortion that they observe in their three experiments is more likely to have arisen in the postdecision stage, as the decisions were made with the information externally available. Thus, at the moment the decision was made, the facts could not be misperceived. The observed memory distortions were predicted by the differentiation-consolidation theory (e.g., Svenson, 1992), according to which decision making is a process of differentiation between the alternatives before deciding and then of consolidation of the decision once made. Thus, the delay between the decision and the recall of that decision would allow the strengthening (consolidation) of the decision and the decision maker's confidence in it by means of increased choice-supportive memory. According to the differentiation-consolidation theory, fact distortion may occur either before or after a decision has been made and thus potentially both during encoding and during consolidation and it can be related both to cognitive factors (schema/gestalt-related processing) and to emotion-related factors (regret avoidance).

More studies investigating fact distortion and the time course of the observed effects in different scenarios and using a variety of methods will be useful to better understand when choice-supportive fact distortion takes place in different circumstances. It is also important to point out that fact distortion can be investigated only with free recall (and cued recall) and not with recognition, which represents the test that has been used in the great majority of studies on choice-supportive misremembering.

1.3.3 False memory

The third type of self-serving memory distortion proposed in our taxonomy is false memory; when attributes or facts not previously presented are 'remembered.' Most often, false memories have been studied as a consequence of misinformation from the experimenter (e.g., Ayers & Reder, 1998; Bernstein, Laney, Morris, & Loftus, 2005). The wider concept of false memory, however, has also been observed in studies where participants are asked to make a judgment after attentive consideration of evidence (e.g., Lindholm et al., 2014).

Studies offering evidence for choice-supportive false memories are reported by some of the papers fulfilling the inclusion criteria for this review and using source recognition when testing the memory of the options (e.g., Henkel & Mather, 2007; Mather & Johnson, 2000; Mara Mather et al., 2003). In those studies, the fact that some new features presented in the recognition test were recognized as old can be interpreted as indirect evidence of false memory, although other explanations are possible (e.g., the use of a more inference-based decision strategy for the 'new' items, perceived as less accessible).

None of the reviewed studies assessed false memory using free or cued recall. In particular, free recall tests will be highly informative in that they may provide less ambiguous and indirect information on the occurrence of a false memory than the just-mentioned source recognition studies. In future research, it would be useful to investigate the conditions needed for false memories to arise even without misinformation and when memory is assessed using free or cued recall (e.g., long delay). Moreover, considering that the memory literature has highlighted sizable individual differences in proneness to false memories (e.g., Winograd, Peluso, & Glover, 1998; Zhu et al., 2010), it would be interesting to consider the role of individual differences in choice-supportive false memories.

The papers reviewed do not discuss the specific mechanisms behind false memories directly, as none of them focused exclusively on this type of misremembering. Constructive or schema-based explanations (Loftus, 1995), Fuzzy-Trace Theory (Reyna & Brainerd, 1995), and the Source Monitoring Framework (Johnson et al., 1993) are three of the main theories attempting to explain the mechanisms behind false memory and they can be applied also in the context of choice-supportive false memories. Constructive or schema-based explanations assume that false memories originate from semantic integration and inferences that can change memory traces or simply produce competing and thus interfering traces (Loftus, Miller, & Burns, 1978). Fuzzy-Trace Theory stresses the distinction between verbatim and gist memory traces, where verbatim traces focus on precise details and gist traces on core meaning. These two types of traces arise in parallel, but verbatim traces are more susceptible to interference and the negative effects of increased delay rather than gist traces. Thus, false memories may arise when the gist affects remembering of verbatim information, or when verbatim memories from different sources are confused with one another. The Source Monitoring Framework, on the other hand, stipulates that false memories are caused by thoughts, images and feelings from one source being mistakenly attributed to another source.

In the context of our taxonomy false memories may consist in the production of an entirely new attribute with its values. This kind of phenomenon is more difficult to explain by making reference to wrong source attribution and easier to explain referring to constructive semantic processes or gist-based influences, assuming that the new attribute and their values are semantically consistent with the choice context and the overall attractiveness of choice options. However, choice-supportive false memories may be alternatively considered as failures of reality monitoring (i.e., the inability to discriminate between internal and external sources of information), although it would remain unexplained how these memories are initially formed. We will come back later to the theories of false memory in the general discussion on the explanations of the various types of misremembering in our taxonomy.

An understanding of the false memory phenomenon is important in the context of choice-supportive memory not only because it is one main type of misremembering, but also because the false memory literature shows that both actual events and falsely remembered events can affect our future attitudes and possibly our future decisions. For example, implanting false memories about loving asparagus the first time they were tried led participants to appreciate the food more and be willing to pay a higher sum for it (Laney et al., 2008), whereas false memories about becoming ill after eating a particular food (Bernstein & Loftus, 2009) or drinking a particular alcoholic beverage (Clifasefi, Bernstein, Mantonakis, & Loftus, 2013) diminished their liking of it, although consolidated food-related behavior seems difficult to change (Bernstein & Loftus, 2009). In line with these findings, Henkel and Mather (2007) found that memory was affected by the choice the participants thought they had made rather than the one they had actually made.

1.3.4 Selective forgetting

The final type of misremembering in our taxonomy is what we have labeled 'selective forgetting': when the negative features of the chosen option or the positive features of the foregone option are selectively forgotten. Mather et al. (2000) observed not only choice-supportive misattribution, but also choice-supportive recognition. That is, participants were more likely to recognize positive features of the selected option than positive features of the foregone option, thus showing selective forgetting of the latter ones. Choice-supportive recognition, however, was observed only for positive and not for negative features and not in all the scenarios tested. Thus, in some scenarios, "which option participants selected affected which positive items but not which negative items they recognized as old" (Mather et al., 2000, p. 136).

Depping and Freund (2013) primarily investigated selective forgetting (rather than misattribution or fact distortion). The main conclusion of their studies was that processing of decision-relevant information promotes a stronger focus on negative information in older adults and older adults remember more negative information in choice contexts. However, in their studies, Depping and Freund did not observe significant choice-supportive selective forgetting.

Other studies, not reviewed here because not specifically concerned with choice-supportive memory, suggest that making a choice may produce selective forgetting (or remembering). For instance, Biehal & Chakravarti (1983) contrasted memory for options after choice vs. directed learning of the same information. They observed that memory for chosen options had a similar level of accuracy as memory under directed learning, while accuracy of memory for rejected brands was poorer. The possible implication is that decision makers focus more on the chosen option and on the more choice-relevant information and this may have consequences for subsequent memory, both in terms of better remembering of the chosen option and, possibly, in terms of choice-supportive remembering. However, although there is some evidence that choice-supportive selective forgetting may take place, as we have seen, the evidence is very limited and more studies are needed.

For what concerns potential explanations, existing research, together with research in related topics like confirmation bias (Nickerson, 1998) and incidental and motivated forgetting (Anderson & Hanslmayr, 2014; Anderson & Huddleston, 2012; Bäuml, 2008), suggest that both biased encoding and biased retrieval processes may contribute to the phenomenon, possibly together with suppression of information not supportive of the chosen option and retrieval-based strengthening of supportive information. Interestingly, related research seems to suggest a more important role for encoding-related processes in this kind of distortion as compared, for instance, to more retrieval-based phenomena (like false memories). However, direct research on the processes underlying choice-supportive selective forgetting is lacking and new studies on this topic are needed.

1.4 General discussion and conclusion

1.4.1 Summary of the findings

In this review, we have presented a novel taxonomy of choice-supportive misremembering after decision making and reviewed papers where the participants make a deliberate choice between options described by multiple attributes and their memory of those attributes is then tested. Our taxonomy represents a theoretically and empirically derived classification of the main types of misremembering after choice: misattribution, fact distortion, false memory, and selective forgetting.

Misattribution is by far the most frequently investigated phenomenon and there is good evidence for it when source recognition tests are used. Indeed, the reviewed evidence seems robust and manifests itself primarily as biased attribution of positive features to the chosen option rather than negative items to the foregone option. Conversely, fact distortion has rarely been investigated, and merits further research, and so does selective forgetting (for which only weak evidence exists). Although some studies provided some evidence compatible with the existence of these two latter types of distortions, there is clearly not sufficient research to date to draw solid conclusions as to the extent of choice-supportive memory in these categories. Therefore, further studies are needed to clarify whether these phenomena are robust, especially when memory is assessed through free or cued recall. The evidence for choice-supportive false memories after decision making is also meager and obtained mainly with a recognition paradigm, which may complicate the interpretation of the findings due to potential alternative explanations.

1.4.2 Proposed explanations

Most of the papers where choice-supportive memory was observed do not delve deeply into the proposed mechanisms and explanations behind the phenomenon, but several theories can account for the various types of decision-related misremembering observed. The proposed explanations of the effects can be broadly classified in 'cognitive' vs. 'affective,' with some accounts making reference to both aspects. At the moment, the relative roles of cognition and emotion are not entirely clear. Neither have the specific processes behind choice-supportive misremembering been fully ascertained, even if some studies have provided preliminary evidence.

From a cognitive perspective, Festinger's cognitive dissonance theory (Festinger, 1957) generally predicts that healthy adults seek to avoid holding conflicting beliefs or values, and thus tend to distort them in a manner that reduces that dissonance. This would imply that after making a choice one's memory of the options would be distorted in a manner that would diminish any conflict and the choice would be remembered as more consistent (e.g., Brehm, 1956). The process of reducing conflict could be instrumental in reaching a decision, and continue once it has been made. The result would be choice-supportive memory. A cognitive account of choice-supportive misremembering can also be provided by the Fuzzy-Trace Theory (Reyna & Brainerd, 1995), suggesting that memory processes can produce verbatim or gist representations, with the former focusing on specific details and the latter on the core meaning of experiences. When a choice has to be made, gist is more important and better remembered than the precise details and the individual may therefore remember mainly that one alternative was superior enough to be chosen, and this general idea of superiority may then bias memory toward choice-supportiveness. Likewise, schema-driven or constructive processing (e.g., Loftus, 1995; Sulin & Dooling, 1974; see also Dooling & Christiaansen, 1977) would imply that memory would be distorted in agreement with the mental representation of the choice made (i.e., the chosen option is better than the alternative one and thus it was selected). Finally, the Source Monitoring Framework (Johnson, 2006; Johnson et al., 1993; Mitchell & Johnson, 2000; Mitchell & Johnson, 2009) would explain choice-supportive misremembering either in terms of confusion between different sources (options) for a retrieved item or in terms of a failure of discrimination between internal and external sources of information (depending on the type of misremembering).

Among these theories, source monitoring seems to be naturally and directly applicable to the misattribution category in our taxonomy (as a case of source attribution error), but it is less directly applicable to selective forgetting, false memory, and fact distortion. This does not mean that the theory cannot explain these effects, because they could be considered as the result of confusion between internal and external sources of information, but their explanation would require additional assumptions and specification. In particular, source monitoring needs additional major assumptions to cover selective forgetting. Moreover, the theory should also be able to explain how false memories are generated before being confused with the reality and how attribute values are distorted before being associated with real options, and why wrong attributions tend to boost the chosen option and demote the foregone one (e.g., perhaps due to the knowledge of one owns choice or related beliefs). Furthermore, bringing knowledge- or belief-related assumptions into the theory would blur the distinction between the Source Monitoring Framework and the constructive/schema-related theories. These latter theories, as well as Fuzzy-Trace Theory, have complementary strengths/weaknesses: they seem more able to explain choice-supportive false memory, fact distortion, and selective forgetting, due to postulated semantic/knowledge or gist-based influences on encoding and/or retrieval processes, and perhaps less directly able to explain choice-supportive misattribution. Neither can it be excluded that different mechanisms may explain different kinds of misremembering in out taxonomy. Additionally, it is also important to remember that other specific processes may even be involved in specific cases, like inhibition of non-supportive information or retrieval-based strengthening of supportive information in the case of selective forgetting/remembering (e.g., Bäuml, 2008).

From an affective perspective, memory may be choice-supportive as an implicit means to enhance positivity about oneself and one's decision making via emotion regulation (Mather & Carstensen, 2005). Indeed, socioemotional selectivity theory underlines the individual's adaptations to her or his life course, with the reduction in time horizons strengthening the motivation to preserve emotional balance (vs. knowledge-related goals), and leading to a greater focus on emotion regulation and positive aspects of life (e.g., Carstensen, 2006). These changes are thought to affect attention and memory processes in a way that promotes the maintenance of a positive emotional state also via choice-supportive misremembering. This would be in line with the notion of self-protecting memory in the field of autobiographical memories: the motivationally driven pursuit of a positive self-definition taking precedence over accuracy and truthfulness (see e.g., Sedikides, Green, & Pinter, 2004; see also Campbell & Sedikides, 1999;

Sedikides & Green, 2000; Tesser, 2001). An explanation referring both to cognitive and to emotional factors is provided by the differentiation-consolidation theory (Svenson, 2003). The theory holds that, once the differentiation process needed to reach a decision has been completed, "postdecision processes (called consolidation) work in support of the chosen alternative to maintain this alternative as the preferred gestalt separated from the non-chosen alternative, but also to protect the decision against poor outcomes, regrets, and so on" (p. 291). This suggests the intriguing possibility that multiple and diverse determinants underlie choice-supportive misremembering.

One of the major questions still open is therefore whether a higher degree of choice-supportive memory is better explained by higher degree of emotion regulation or whether it instead reflects more reliance on schema-driven, gist-based processing, or on error-prone source monitoring. Some of the evidence for the affective explanation of choice-supportive memory comes from studies comparing older and younger adults, starting from the assumption that older adults, due to their greater effort in maintaining a positive emotional balance due to age-related changes in high level goals (Carstensen, 2006; Mather & Carstensen, 2005), would show a greater degree of choice-supportive memory distortion than younger adults. Indeed, although a difference was found in one study (e.g., Mather & Johnson, 2000), as we have seen, the evidence is generally negative. In the study of Mather and Johnson (2000), the results of the 'affective review' condition in younger adults also point to the role of socio-emotional factors. However, the negative relation between control measures and choice-supportive distortion in older participants is not in agreement with the general statement that control abilities are needed to ensure emotion-regulation success (Mather & Knight, 2005; Mather & Carstensen, 2005), suggesting to the need for clarification of the role of cognitive control in different kinds of positivity biases. A possibility is that less effective active encoding and recollection processes, together with emotion-related factors, might contribute to older adults' stronger positivity bias for past choices (Mather & Johnson, 2000) – assuming that this age-related exacerbation of the bias exists – with the decline of executive control processes playing a significant role (Del Missier, Mäntylä, & de Bruin, 2012; Del Missier et al., 2015).

Another issue that would deserve more investigation is to elucidate more precisely the possible interplay between emotional and cognitive factors in determining choice-supportive misremembering and to provide more direct evidence for the proposed relations. While some approaches, like the socio-emotional one, seem to imply that affective and motivational drivers affect memory of choice options via cognitive mechanisms like those underlying biased source attribution (Mather & Johnson, 2000; Mather & Knight, 2005; Mather & Carstensen, 2005), there is no sufficient evidence, at the moment, to support empirically a more distal role of affect and a more proximal one of cognition. It may well be that cognition contributes to choice-supportive monitoring beyond emotion, as cognitive theories of false memory seem to suggest. And, as we have just discussed, more studies are also needed to better appraise the specific cognitive and emotional mechanisms involved and the time course of their potential interaction. Clearly, given the mixed results of the studies, research investigating more directly the paramount issue of the processes underlying the choice-supportive misremembering is needed, both to shed light on the respective contribution of cognitive and emotional factors and to clarify what kinds of cognitive (e.g., cognitive control, attention, episodic encoding and/or retrieval) and emotional processes (e.g., implicit or explicit emotion regulation, regret avoidance, goal setting) are involved.

1.4.3 Limitations and future directions

Our review did not cover all the factors that could potentially influence memory after choice. Given our necessarily restrictive eligibility criteria, we left out studies based on information provision after choice (e.g., hindsight bias and misinformation effects) and investigations based on the self-selection of information before choice. Another limitation is represented by the fact that the reviewed studies used a variety of methods and materials, which may have affected the specific results obtained in specific circumstances. For this reason, we included an analysis of potentially moderating factors, as a first step toward a systematic experimental appraisal of their role.

Our extensive search for published and unpublished studies on misremembering after a deliberate choice between options described by multiple attributes yielded a surprisingly low amount of papers, and pointed to several gaps in the literature. A fundamental question that remains to be answered is whether choice-supportive memory can be shown to be a robust phenomenon even in studies not focusing on misattribution and not testing only recognition memory. More research is also needed both on the temporal aspect of distortions (at encoding, during memory consolidation or retention, at retrieval), on the relative contribution and type of cognitive and socio-emotional processes involved, and on their interactions. This implies setting up studies specifically targeting the time-course of choice-related misremembering and their underlying processes, using both experimental and individual-difference approaches, eventually together with neuroimaging investigations capable of highlighting the cognitive and affective development of processing. It would also be interesting to explore choice-supportive memory in clinical populations (e.g., in patients with damage to the orbitofrontal cortex vs. the dorsolateral cortex vs. different areas in the temporal lobe, and in patients with autism spectrum disorder or alexithymia) to help unveiling the processes involved, and in children and adolescents to elucidate the developmental aspect.

Research on individual differences would also be useful to elucidate the relationships between individual differences in cognition, motivation, emotion and choice-supportive memory, as this could provide useful information about potential explanations of choice-supportive misremembering. For example, if individual differences in need for closure and rumination or regret were found to correlate with the degree of choice-supportiveness, this would lend support to the importance of motivational or emotional factors. Conversely, correlations between the degree of choice-supportiveness and the effectiveness of recollection measures would support a more cognitive account.

As a final issue, it would be useful to understand to what extent choice-supportive memory can lead to suboptimal decisions in repeated (or related/similar) future memory-based or mixed decisions (Chen & Zhang, 2003) and how it is connected to emotional balance, self-esteem and life satisfaction, in order to properly weigh the relative costs and benefits of choice-supportive misremembering. Just as it is important to assess the behavioral consequences of false memories (e.g., Bernstein et al., 2005; Laney et al., 2008), a better understanding of the behavioral influence of choice-supportive misremembering over time would be fruitful. Along this line of investigation, individual differences in proneness to different types of choice-supportive misremembering could also be examined in relation to personality variables to appraise when a normal and even adaptive degree of self-deception turns into a dangerous and delusional alteration of reality.

Chapter 2: Experiment 1

2.1 Introduction and aims

In our critical literature review, we found that the large majority of studies on choice-supportive misremembering used source recognition as the sole memory test, and, indeed, that the evidence in support of the phenomenon is weak for any other type of memory test. Predominantly, source misattribution was investigated and found to be significantly choice-supportive. For this reason, we suggested a taxonomy of the different types of misremembering choice information that could potentially be choice-supportive: misattribution, false memory, fact distortion and selective forgetting (see *Figure 1*). We then designed an experiment to test our taxonomy by investigating whether we would observe the four different types in a laboratory experiment. In this experiment, we also wished to characterize the memory of option information at different delays after the choice and with free and cued recall, since this was largely missing from the existing literature. Furthermore, we wanted to appraise the existence of choice-supportive memory in a standard choice context, with alignable items, participant-relevant scenarios, tabular presentation, and free followed by cued recall of information. This differed from most of the previous research that used mainly nonalignable items, non-tabular presentation and only source recognition memory tests. Our hope was to also gain insight into the temporality issue: whether any bias effects occur at the stage of encoding, consolidation or retrieval. Lastly, we wished to explore the influence of individual differences in cognition and motivation/personality to illuminate which may be the most influential in giving rise to choice-supportiveness effects.

2.1.1 Hypotheses

We predicted that recall would worsen over time and that both omission errors (forgetting) and commission errors (distortions/false memories) would increase due to decreased accessibility of the presented information (Tulving & Pearlstone, 1966). Furthermore, we expected to find all four types of misremembering, with the most dramatic alteration - false memory - being the least common and most significantly affected by the passage of time (see e.g., Loftus, 2005). Regarding the hypotheses relating to individual differences, we predicted the following:

• Better episodic memory → less choice-supportive misremembering (as better episodic memory should act as a boundary against misremembering)

• Better inhibition → stronger effect (as more effective motivated forgetting - supported by inhibitory processes – may boost choice-supportive misremembering, see Anderson, Bjork, & Bjork, 2000)

• More need for closure → stronger effect (as premature closure of decisions may be associated with more shallow processing and encoding of decision stimuli, which might facilitate choice-supportive misremembering)

• More proneness to regret → stronger effect (as a stronger tendency to feel regret may lead to more choice-supportive misremembering in order to avoid regretting the choice made, see e.g., Bjälkebring, Västfjäll, Svenson, & Slovic, 2016; Svenson, 2003)

• More general rumination → weaker effect (as a stronger tendency to ruminate correlates with negative emotions: Thomsen, Yung Mehlsen, Christensen, & Zachariae, 2003, and may therefore increase choice-*opposing* misremembering)

• More depression → weaker effect (due to the phenomenon of 'depressive realism', see e.g., Gaddy & Ingram, 2014; Lyubomirsky & Ross, 1999; Storbeck & Clore, 2005; Wittekind et al., 2014)

• More anxiety → weaker effect (as anxious individuals may have a memory bias favouring threatening information, see e.g., Hertel & Brozovich, 2010; Mitte, 2008; Witthoft et al., 2016)

Lastly, we anticipated to find a tendency to distort memories in a choice-supportive direction mainly in the two longer delay groups (20 minutes and 2 days), with more choice-supportiveness with the longest delay, as memory research has documented more distortion with the passage of time, possibly due to the decay of memory traces or interference (Sulin & Dooling, 1974) and to the greater influence of schema-driven or reconstructive processes.

2.2 Method

2.2.1 Participants

We computed the sample size for a mixed Anova, with an a-priori power of .80 for a medium effect size on choice-supportiveness (f = .25), alpha = .05, considering the repeated measurements (scenarios). The overall number of participants needed was 78. We also computed the sample size for a paired t-test (two-tailed) with an a-priori power of .80 for a medium effect size on choice-supportiveness (dz = .50), alpha = .05. Considering the repeated measurements (scenarios), the number of participants needed was 34 per delay level. Therefore, we recruited approximately 50 participants for each delay level. In total, we recruited 155 undergraduates at the University of Trieste, Italy (F = 76%), aged 18-39 years (M = 20.32, SD = 2.32, median age = 20).

2.2.2 Design

A 3 x 5 mixed design was used, with the delay between choice and free recall manipulated between-subjects on three delay levels (2 minutes, 20 minutes, 2 days), and the scenario within subject on five levels.

2.2.3 Materials

The materials consisted of five scenarios with binary options in pre-tested student-relevant scenarios, and a battery of tests on individual differences. The choices were between pairs of rooms to rent, restaurants, entertainment bundles, gym packages, partners for a student project. Each option consisted of values on six attributes, common to the two options. Thus, the items were entirely alignable: only the value on each one differed between the options. Trade-offs were required, as Option A has more advantageous values on three attributes and Option B on the remaining three. The scales used for the different attributes were varied between purely numeric, stars, and verbal. Two scales of each type were used in each scenario. The tables with the two options presented side by side were presented simultaneously after a brief introduction to each scenario. The scenario order, right/left position of options and the order of the items were counter-balanced.

The battery of tests on individual differences consisted of:

Six tests measuring aspects of cognitive capacity

- Primary mental abilities (PMA) vocabulary (Thurstone & Thurstone, 1963)
- Episodic memory test (paired associates) (Del Missier, Visentini, & Mäntylä, 2015)
- Stroop test with manual response (Del Missier, Mäntylä, & de Bruin, 2012)
- Numeracy scale (Lipkus, Samsa, & Rimer, 2001)
- Applying Decision Rules (ADR) from the Adult Decision-Making Competence (A-DMC) scale (Bruine de Bruin, Parker, & Fischhoff, 2007)
- Socio-demographics questionnaire (age, gender, education)

Three affective tests

- Regret scale (Schwartz et al., 2002)
- Rumination scale (Trapnell & Campbell, 1999)
- STAI Y2 Trait Anxiety (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983)

One test on motivation

- Need for closure (Kruglanski, Webster, & Klem, 1993)

2.2.4 Procedure

The experiment was split into two separate sessions (or three, for the two day delay group). Before starting the experiment, participants received general information about the study and signed the informed consent form. They were then presented with the first scenario and asked to make their choice between the two options after attentive consideration of their features. They had two minutes (decided after a pretest) to do this for each choice, with the experimenters timing the procedure. The choice procedure was repeated for each scenario. After the delay associated with the between-subject condition (2 min, 20 min, or 2 days between the last choice and the first free recall), participants performed the surprise memory test, where free recall for each scenario was followed by cued recall for each scenario. In the 2- and 20-minute conditions, the delay between choices and memory tests was filled with unrelated tasks (as it was for 20 minutes after the choice phase of the 2-day delay condition). In the free recall tests, the participants were asked to write down as much specific information as they could remember about the values of the two options in three minutes (also decided after a pretest), being provided only with the options names. They were also asked to recall the choice made. In the cued recall, the attribute names were provided together with the option names and the participants were asked to fill in the values for each attribute and each option in two minutes, and to recall the choice they had made.

In the last session, the participants completed the battery of tests on individual differences.

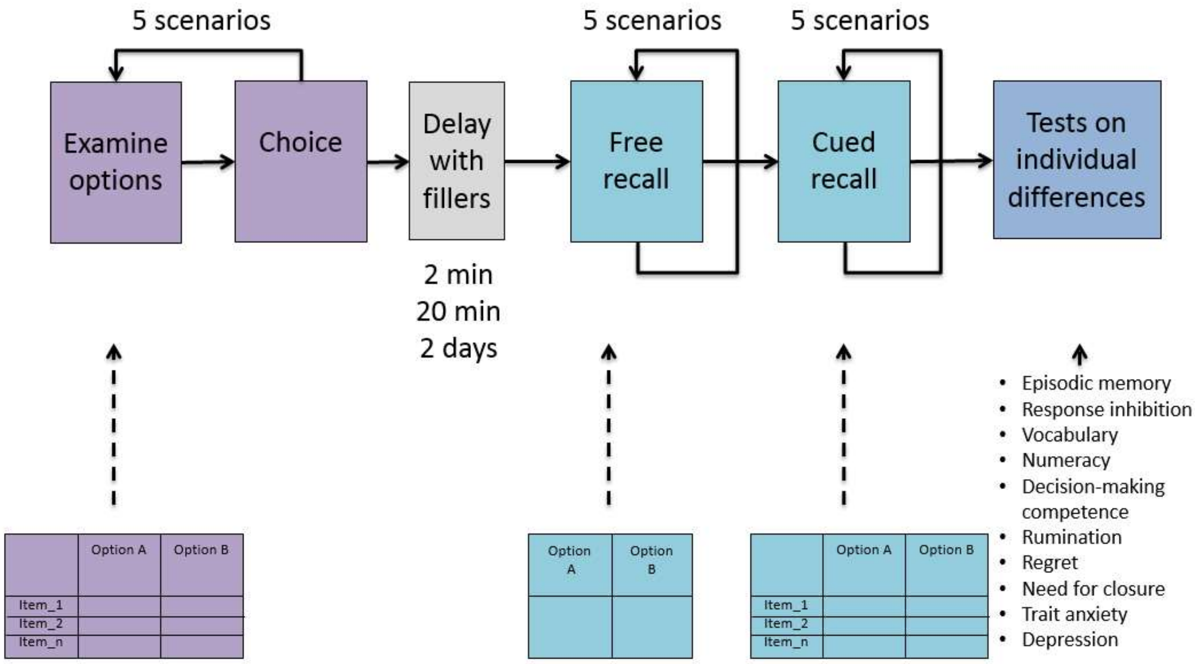

Figure 2: Experiment 1 procedure

After conclusion of the study, participants were debriefed and provided with full information about the study, which followed APA ethical guidelines and well as data protection and privacy standards.

2.2.5 Scoring procedures

Misremembering occurrences were categorized according to the taxonomy presented in Lind, Visentini, Mäntylä, & Del Missier (2017), constituting *Chapter 1* of this thesis. For an illustration of the taxonomy, see *Figure 1* (page 18 of this thesis). An error was classified as a misattribution when the item itself was correctly remembered, but it was attributed to the wrong option. For example, in the room scenario, if option A contained the item '300 euro' as the monthly rent and option B contained the item '250 euro' and the participants entered 250 euro as the monthly rent belonging to A, this was scored as a misattribution. If the misattribution made the chosen option better than it actually was (for instance by lowering the rent of the chosen room), it was scored as choice-supportive, whereas if the reverse happened, it was scored as nonsupportive.

If an item was remembered, but its value was distorted in a way that changed its attractiveness, for instance by lowering the chosen rent of room A from 300 to 150 euro, this counted as a fact distortion. Again, if the value distortion improved the chosen option, it was scored as choice-supportive, whereas if the reverse happened, it was scored as nonsupportive.

Selective forgetting implies selectively forgetting an attribute value. If the forgetting involved a value or an entire attribute that made the chosen option appear better than it actually was (for instance forgetting a rent value that was higher in the chosen vs. foregone option, or entirely forgetting such a rent attribute), it was considered as choice-supportive, and as nonsupportive if the reverse happened.

False memories are 'remembered' attributes that had never been presented. If the falsely recalled attribute favoured the chosen option, the false memory was scored as choice-supportive, whereas if it favoured the foregone option, it was scored as nonsupportive. For instance, falsely remembering that the chosen room was in a house that received high ratings on social media constitutes choice-supportive false memory, as no such attribute was presented in the room scenario. Importantly, to be considered as a false memory in a given scenario, a retrieved attribute had to have a different meaning from the presented ones. This was assessed by not considering as false memories mere synonyms of any of the presented attributes in the scenario under scrutiny.

Other types of misremembering, such as vague memories (e.g., 'I remember that room A had a higher rent than room B'), were scored in a separate category, but their overall frequency was low compared to the other types of misremembering. Therefore, they were not considered in the data analysis presented in the next sections.

An experienced and trained research assistant scored the responses of all participants. For the free recall, another trained independent rater scored 10% of the responses. Inter-rater reliability was over .60 (Cohen's kappa) for each scenario and the debated cases were resolved after a joint discussion.

2.3 Results

2.3.1 Descriptive statistics on choice shares and choice misremembering

Choice shares were as follows: *Student partner* (.34 vs. .66), *Room to rent* (.54 vs. .46), *Restaurant* (.55 vs. 45), *Entertainment bundle* (.35 vs. .65), and *Gym package* (.38 vs. .62). The proportion of participants misremembering their choice increased from 20 minutes to 2 days both in free and cued recall tests (Table 2.1 shows the findings per scenario and delay level in the free recall test). This shows a delayed form of choice blindness that could be worth investigating in future research, given that misremembering one's choice after a short delay (i.e., the more 'traditional' choice blindness phenomenon) was – in the present study - considerably rarer than doing so after a long delay. The cases in which participants misremembered their choices were excluded from the subsequent analyses on a scenario-by-scenario basis and test-by-test basis, and considered as missing data.

Table 2.1: *Proportion of participants misremembering their choice in free recall per delay level and scenario*

	SCENARIO				
DELAY	**PARTNER** **Prop. (95% CI)**	**ROOM** **Prop. (95% CI)**	**RESTAURANT** **Prop. (95% CI)**	**ENTMT. BUNDLE** **Prop. (95% CI)**	**GYM PACKAGE** **Prop. (95% CI)**
2 minutes (n = 52)	.00 (.000-.082)	.04 (.003-.137)	.04 (.003-.137)	.13 (.064-.256)	.06 (.014-.162)
20 minutes (n = 51)	.00 (.000-.082)	.06 (.014-.165)	.04 (.003-.140)	.06 (.014-.165)	.04 (.003-.140)
2 days (n = 52)	.12 (.050-.233)	.23 (.136 -.363)	.35 (.199-.443)	.19 (.106 - .321)	.31 (.198-.443)

2.3.2 Accuracy in recall tests

As shown in Table 2.2, accuracy was lower in free recall than in cued recall, reproducing a typical pattern in memory research. There were much more omission than commission errors in free recall, and the opposite pattern was apparent in cued recall. As expected, accuracy decreased with an increasing delay, in particular after 2 days, and both kinds of errors increased in free recall after 2 days. In cued recall, accuracy also decreased with time delay, especially after two days. Likewise, commission errors increased, but not omissions. Results seem to be consistent across scenarios, showing rather similar percentages of accurate responses and errors and largely similar trends.

Table 2.2: *Accuracy and errors (proportions) for the different memory tests and scenarios*

	PARTNER FOR STUDENT PROJECT					
	FREE RECALL			**CUED RECALL**		
DELAY (n = free, cued)	**Correct recall**	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**
2 minutes (n = 52, 52)	.516	.173	.311	.716	.280	.004
20 minutes (n = 51, 51)	.513	.181	.306	.663	.322	.015
2 days (n = 46, 44)	.279	.274	.447	.435	.554	.012

	ROOM					
	FREE RECALL			**CUED RECALL**		
DELAY (n = free, cued)	**Correct recall**	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**
2 minutes (n = 50, 50)	.672	.182	.147	.792	.200	.008
20 minutes (n = 48, 48)	.616	.194	.189	.720	.265	.015
2 days (n = 40, 42)	.306	.406	.288	.446	.542	.012

	RESTAURANT					
	FREE RECALL			CUED RECALL		
DELAY (n = free, cued)	**Correct recall**	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**
2 minutes (n = 50, 50)	.497	.293	.210	.587	.405	.008
20 minutes (n = 49, 50)	.473	.276	.252	.568	.400	.032
2 days (n = 34, 37)	.240	.353	.407	.440	.548	.012

	ENTERTAINMENT BUNDLE					
	FREE RECALL			CUED RECALL		
DELAY (n = free, cued)	**Correct recall**	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**
2 minutes (n = 45, 46)	.459	.231	.309	.540	.411	.050
20 minutes (n = 48, 47)	.368	.274	.358	.470	.462	.068
2 days (n = 42, 38)	.188	.333	.478	.327	.649	.024

	GYM PACKAGE					
	FREE RECALL			CUED RECALL		
DELAY (n = free, cued)	Correct recall	Commission errors	Omission errors	Correct recall	Commission errors	Omission errors
2 minutes (n = 49, 51)	.578	.180	.241	.673	.310	.018
20 minutes (n = 49, 50)	.520	.238	.241	.655	.326	.019
2 days (n = 36, 33)	.234	.398	.368	.298	.690	.012

2.3.3 ANOVAs on accuracy and errors

A series of 3 x 5 mixed ANOVAs was carried out on accuracy measures and commission/omission errors for the two memory tests and considering as factors:

1) Delay (2-minute, 20-minute, and 2-day) - between-subjects

2) Scenario (*Student partner*, *Room*, *Restaurant*, *Entertainment bundle*, *Gym package*) - within subjects

The 3 x 5 mixed ANOVA was repeated for the two different types of memory tests and the results will be presented accordingly. Missing data due to choice misremembering were treated with case wise exclusion (thus the means in the following analyses may differ from the means reported in Table 2.2, based on all the available cases for each scenario).

2.3.3.1 Free recall

For what concerns accuracy (proportion correct) in the free recall test, the ANOVA highlighted a main effect of delay ($F(2,95) = 19.791$, Mse = .105, $p<.001$, $\eta^2 = .29$), with better accuracy in the 2-minute and 20-minute delay vs. the 2-day delay condition ($M_{2min} = .57$, $M_{20min} = .51$, $M_{2day} = .28$). The 2-minute and the 2-day conditions differed significantly (HSD, $p <.001$) as well as the 20-minute and the 2-day conditions (HSD, $p <.001$), but not the 2-minute and the 20-minute conditions (HSD p = .176). The main effect of the scenario was also significant (F(4,380) = 16.054, Mse = .028, p<.001, $\eta^2 = .14$), with better accuracy in the *Room* scenario (HSD, all p <.001) and worse accuracy in the *Entertainment bundle* scenario (HSD, all p <.001), and all the other scenarios falling in between.

The ANOVA on the proportion of commission errors highlighted main effects of the delay (F(2,95) = 12.528, Mse = .021, p<.001, $\eta^2 = .21$), with fewer errors in the 2-minute and 20-minute delay vs. the 2-day delay condition ($M_{2min} = .202$, $M_{20min} = .227$, $M_{2day} = .354$), with the 2-minute and the 2-day conditions differing significantly (HSD, p <.001) as well as the 20-minute and the 2-day conditions (HSD, p <.01), but not the 2-minute and the 20-minute conditions (HSD p = .483). Here too, the main effect of the scenario was significant (F(4,380) = 7.682, Mse = .021, p<.001, $\eta^2 = .07$), with lower errors in the *Student partner* scenario (HSD, all at least p <.05, not different from *Room*) and *Room* scenario (HSD, all at least p <.05, not different from *Student partner* and *Gym package*).

The ANOVA on the proportion of omission errors highlighted main effects of delay (F(1,95) = 7.712, Mse = .061, p<.001, $\eta^2 = .14$), with fewer errors in the 2-minute and 20-minute delay vs. the 2-day delay condition ($M_{2min} = .233$, $M_{20min} = .226$, $M_{2day} = .371$), with the 2-minute and the 2-day conditions differing significantly (HSD, p <.01) as well as the 20-minute and the 2-day conditions (HSD, p <.05), but not the 2-minute and the 20-minute conditions (HSD p = .368). Again, the main effect of the scenario was significant (F(4,380) = 15.348, Mse = .020, p<.001, $\eta^2 = .14$), with lower errors in the *Room* scenario (HSD, all at least p <.05) and *Restaurant* scenario (HSD, all at least p <.05, not different from *Gym package* and worse than *Room*).

2.3.3.2 Cued recall

For what concerns accuracy (proportion correct) in the cued recall test, the ANOVA highlighted a main effect of delay (F(2,97) = 1.974, Mse = .09, p<.001, $\eta^2 = .31$), with better accuracy in the 2-minute and 20-minute delay vs. the 2-day delay condition ($M_{2min} = .662$, $M_{20min} = .615$, $M_{2day} = .389$). The 2-minute and the 2-day conditions differed significantly (HSD, p <.001) as well as the 20-minute and the 2-day conditions (HSD, p <.001), but not the 2-minute and the 20-minute conditions (HSD p = .253). The main effect of the scenario was significant (F(4,388) = 15.238, Mse = .031, p<.001, $\eta^2 = .14$), with better accuracy in the *Student partner* scenario (HSD, all p <.001, but not differing from *Room* and *Gym package*) and the *Room* scenario

(HSD, all $p < .001$, but not differing from *Student partner*) and worse accuracy in the *Entertainment bundle* scenario (HSD, all at least $p < .05$).

The ANOVA on the proportion of commission errors highlighted main effects of the delay ($F(2,97) = 23.829$, $Mse = .087$, $p < .001$, $\eta^2 = .33$), with fewer errors in the 2-minute and 20-minute delay vs. the 2-day delay condition ($M_{2min} = .321$, $M_{20min} = .355$, $M_{2day} = .596$), with the 2-minute and the 2-day conditions differing significantly (HSD, $p < .001$) as well as the 20-minute and the 2-day conditions (HSD, $p < .01$), but not the 2-minute and the 20-minute conditions (HSD $p = .468$). Once again, the main effect of the scenario was significant ($F(4,388) = 11.230$, $Mse = .029$, $p < .001$, $\eta^2 = .10$), with lower errors in the *Student partner* scenario (HSD, all at least $p < .05$, not different from *Room*) and *Room* scenarios (HSD, all at least $p < .01$, not different from *Student partner*). The ANOVA on the proportion of omission errors highlighted only the main effect of the scenario ($F(4,388) = 4.333$, $Mse = .004$, $p < .01$, $\eta^2 = .04$), with more omissions in the *Entertainment bundle* (HSD, all $p < .001$).

2.3.3.3 Differences between free and cued recall

A series of 2 x 3 x 5 mixed ANOVAs was carried out to show the differences between free and cued recall in accuracy, commission errors, and omission errors. For what concerns accuracy (proportion correct), the ANOVA highlighted a main effect of delay ($F(2,90) = 20.655$, $Mse = .176$, $p < .001$, $\eta^2 = .31$), with better accuracy in the 2-minute and 20-minute delay vs. the 2-day delay condition ($M_{2min} = .619$, $M_{20min} = .566$, $M_{2day} = .338$), with the 2-minute and the 2-day conditions differing significantly (HSD, $p < .001$) as well as the 20-minute and the 2-day conditions (HSD, $p < .001$), but not the 2-minute and the 20-minute conditions (HSD $p = .189$). The main effect of the test was also significant ($F(1,90) = 104.762$, $Mse = .018$, $p < .001$, $\eta^2 = .54$), with better accuracy in cued recall vs. free recall ($M_{cued} = .560$, $M_{free} = .455$) at any delay level (HSD, all $p < .001$; see also *Figure 2.1*). Again, the main effect of the scenario was significant ($F(4,360) = 17.634$, $Mse = .046$, $p < .001$, $\eta^2 = .16$), with better accuracy in the *Room* scenario (HSD, all $p < .001$) and worse accuracy in the *Entertainment bundle* scenario (HSD, all $p < .001$), and all the other scenarios falling in between.

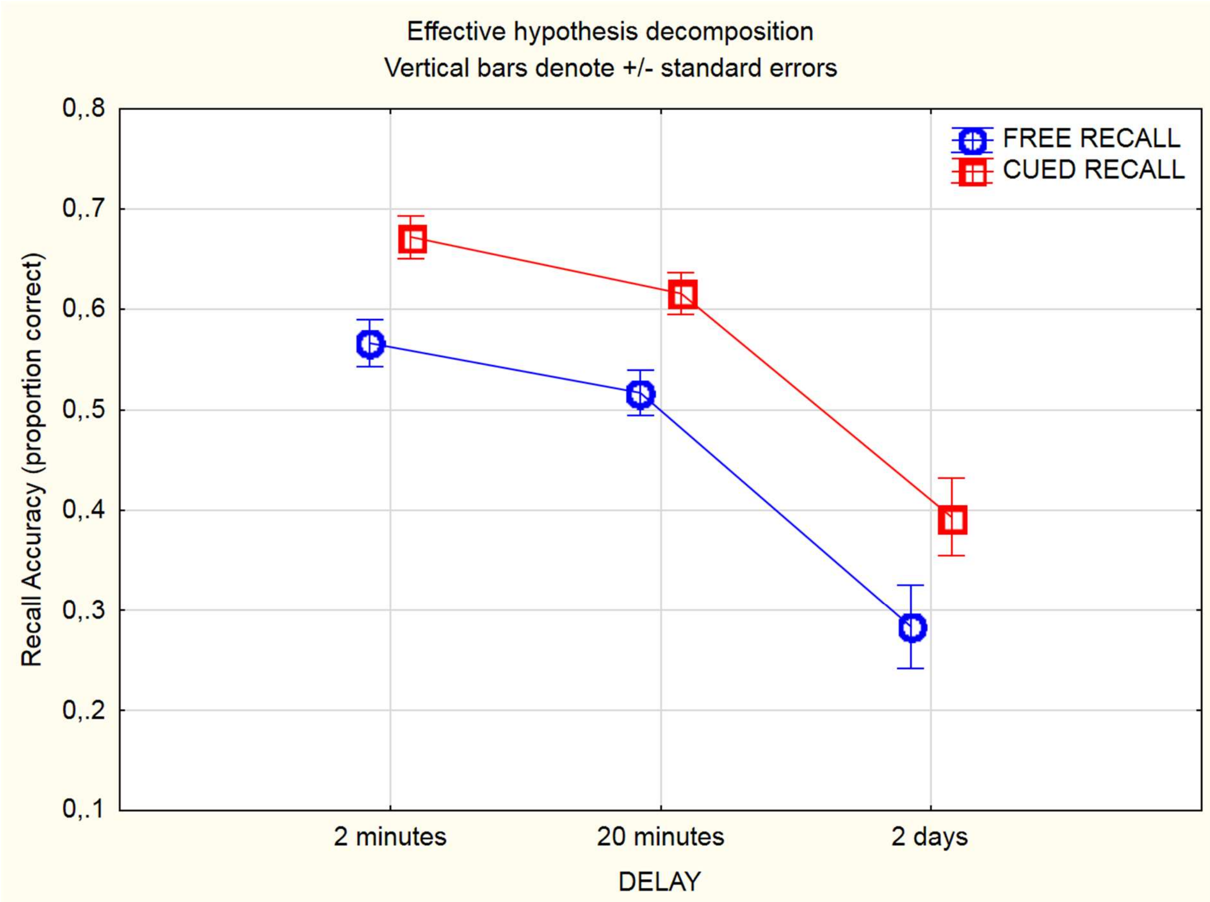

Figure 2.1: Main effects of the delay and of the test on accuracy of recall

The ANOVA on the proportion of commission errors showed a main effect of delay ($F(2,90) = 20.083$, Mse = .105, $p<.001$, $\eta^2 = .33$), with fewer errors in the 2-minute and 20-minute delay vs. the 2-day delay condition ($M_{2min} = .255$, $M_{20min} = .288$, $M_{2day} = .478$), with the 2-minute and the 2-day conditions differing significantly (HSD, $p <.001$) as well as the 20-minute and the 2-day conditions (HSD, $p <.001$), but not the 2-minute and the 20-minute conditions (HSD $p = .352$). The main effect of the test was also significant ($F(1,90) = 177.740$, Mse = .026, $p<.001$, $\eta^2 = .66$), with a lower proportion of commission errors in free recall vs. cued recall ($M_{free} = .257$, $M_{cued} = .423$) at any delay level (HSD, all $p < .001$). Delay and test interacted ($F(2,90) = 8.963$, Mse = .026, $p<.001$, $\eta^2 = .17$), with a larger difference in the proportion of commission errors in cued recall (vs. free recall) seen at the longer delay (2 days Δ: .25) vs. the other delays (2 minutes Δ: .11; 20 minutes Δ: .13), see also *Figure 2.2*. The main effect of the scenario was significant ($F(4,360) = 10.301$, Mse = .036, $p<.001$, $\eta^2 = .10$), with fewer errors in the *Student partner* (HSD, all $p <.001$, no difference with *Room* and *Gym package*) and *Room* scenarios

(HSD, all p <.001, no difference with *Student partner*). The effect of the scenario interacted with the test ($F(4,360) = 4.986$, $Mse = .014$, $p<.001$, $\eta^2 = .05$), so that the difference between cued and free recall in the proportion of commission errors was smaller in the *Room* scenario.

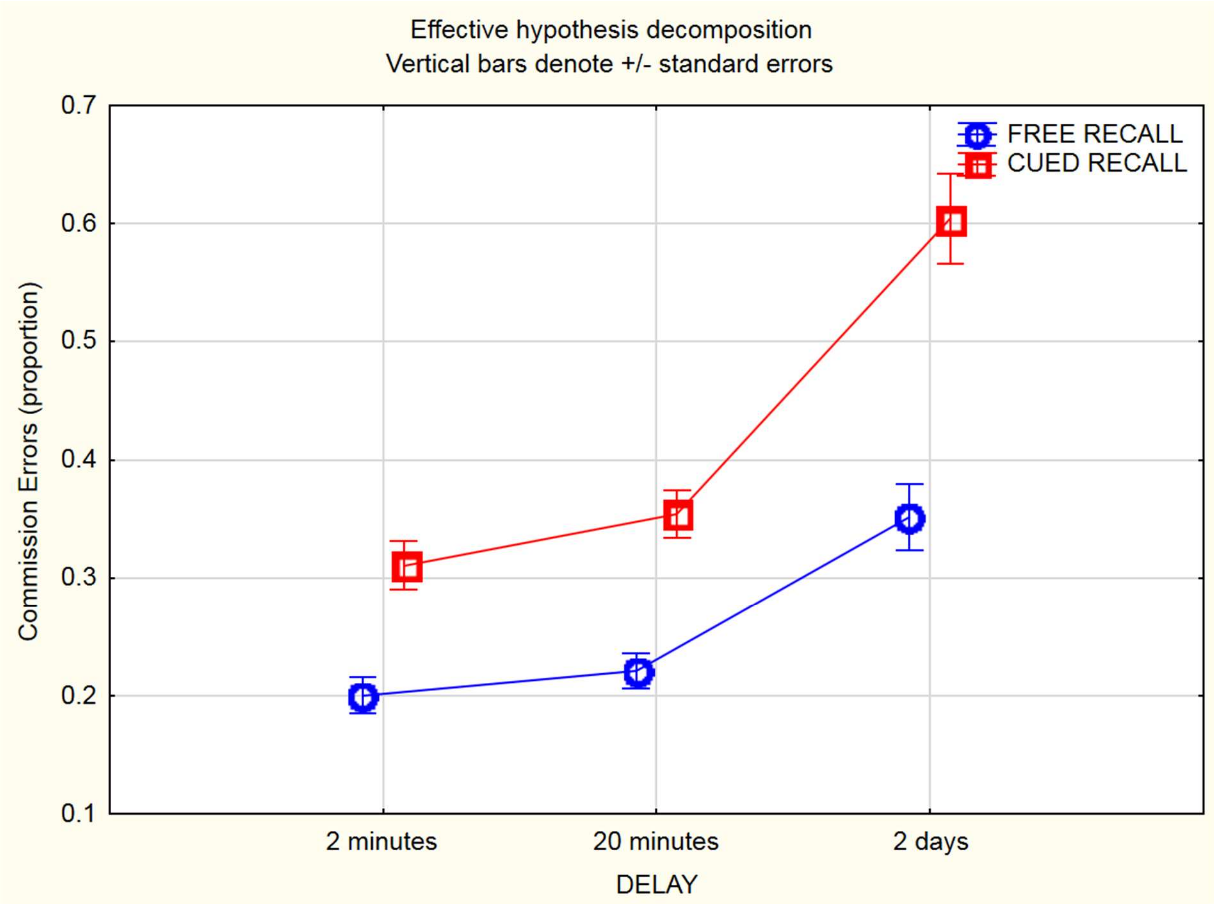

Figure 2.2: Interaction between delay and test on commission errors

The ANOVA on the proportion of omission errors highlighted the main effect of delay ($F(1,90) = 3.574$, $Mse = .046$, $p = .032$, $\eta^2 = .07$), with fewer errors in the 2-minute and 20-minute delay vs. the 2-day delay condition ($M_{2min} = .125$, $M_{20min} = .146$, $M_{2day} = .184$), but only the difference between 2-minute and 2-day being close to significance (HSD, $p = .091$). A main effect of the memory test was also detected ($F(1,90) = 480.770$, $Mse = .026$, $p<.001$, $\eta^2 = .84$), with much more omission errors in free recall vs. cued recall ($M_{free} = .287$, $M_{cued} = .016$). This effect was qualified by an interaction with the delay, showing a bigger difference in the 2-day condition than in the other conditions ($\Delta = .36$ vs. .21 and .24). Once again, the main effect of the scenario was significant ($F(4,360) = 13.678$, $Mse = .014$, $p<.001$, $\eta^2 = .13$), with fewer omissions in the

Room scenario (HSD, all at least $p < .05$) and more omissions in the *Entertainment bundle* scenario (HSD, all at least $p < .05$). As shown by a significant interaction between test and scenario ($F(4,360) = 10.166$, $Mse = .011$, $p < .001$, $\eta^2 = .10$), the difference between free and cued recall test in omission errors was smaller in the *Room* scenario and bigger in the *Entertainment bundle* scenario.

2.3.3.4 Summary

To summarize the results of the analyses on accuracy in free recall, it can be stated that participants were much less accurate and made both more commission and omission errors after a long delay (2 days), while there were no substantial differences at shorter delays (2 or 20 minutes). Some differences between the scenarios were apparent, with the *Room* and *Student partner* scenarios remembered better and the *Entertainment bundle* scenario remembered worse.

Also as expected, cued recall performance was better than free recall performance for accuracy, worse for commission errors (especially at the longer delay), and again better for omission errors. Scenario-related variation was similar to the one observed in free recall.

2.3.4 ANOVAs on misremembering occurrences

A series of 2 x 3 x 5 mixed ANOVAs was carried out on the number of misremembering occurrences per participant and considering as factors:

1) Choice-supportiveness (vs. non choice-supportiveness) - within-subjects

2) Delay (2-minute, 20-minute, and 2-day) - between-subjects

3) Scenario (*Student partner*, *Room*, *Restaurant*, *Entertainment bundle*, *Gym package*) - within subjects

This 2 x 3 x 5 mixed ANOVA was repeated for the four different kinds of misremembering and for the two different types of tests. Missing data were treated with case wise exclusion.

2.3.4.1 Free recall

The ANOVA on selective forgetting occurrences highlighted main effects of time delay and scenario[5]. Table 2.3 presents the significant effects. Post hoc tests showed an increase of selective forgetting after two days (vs. 2 minutes HSD $p = .007$ and vs. 20 minutes $p = .053$), and less forgetting in the *Room* scenario (HSD all $p < .05$ at least) with *Entertainment bundle* and *Student partner* showing the most forgetting (HSD all $p < .05$ at least) and not differing from each other.

Table 2.3: *Significant effects for selective forgetting in free recall*

Effect	F (df)	Mse	p	η^2	Means
Delay	F(2, 95) = 7.380	1.08	p = .001	.13	2 minutes = .698 20 minutes = .795 2 days = 1.100
Scenario	F(4, 380) = 14.822	.364	p < .001	.14	student partner = 1.005 room = .602 restaurant = .779 entmt. = 1.093 gym = .842

The ANOVA on misattributions in free recall did not show any significant effect, except for the scenario one ($F(4,380) = 2.821$, $Mse = .193$, $p = .025$, $\eta^2 = .03$), with significantly more misattribution in the *Restaurant* scenario vs. the others (HSD at least $p < .01$; $M = .364$ vs. .264 or lower)[6].

[5] Selective forgetting was analyzed at the attribute level, as single values were rarely forgotten (the median value of single value forgetting was zero for each scenario and the mean value close to zero).

[6] Misattribution was analyzed at the single misattribution level, as double switches of values between the options rarely happened (the median value of double switches was zero for each scenario and the mean value close to zero).

The ANOVA on false memories highlighted only the main effect of time delay ($F(2,95) = 6.859$, $Mse = .010$, $p = .002$, $\eta^2 = .13$), with the number of false memories increasing with time ($M_{2min} = .063$, $M_{20min} = .070$, $M_{2day} = .117$, HSD 2-min vs. 2-day $p = .013$).

The ANOVA on fact distortion highlighted the main effects of time delay and scenario and their interaction. Table 2.4 presents the significant effects. Post hoc tests showed a marginally significant increase of fact distortions after two days (vs. 2 minutes HSD $p = .063$), and overall fewer fact distortions in the *Student partner* scenario (HSD all $p < .05$ at least) but not differing from *Room*. The interaction shows a more marked increase in fact distortion in the *Room* scenario after 2 days than in the other conditions (but the HSD was only marginally significant $p = .096$).

Table 2.4: *Significant effects for fact distortion in free recall*

Effect	F (df)	Mse	p	η^2	Means
Delay	F(2, 95) = 4.170	1.524	p = .018	.08	2 minutes = .820 20 minutes = .852 2 days = 1.169
Scenario	F(4, 380) = 9.482	.812	p < .001	.09	student partner = .628 room = .852 restaurant = 1.257 entmt. = .998 gym = .999
Delay × scenario	F(8, 380) = 2.311	.812	p = .020	.05	2 min - partner = 0.659 2 min - room = 0.524 2 min - restaurant = 1.098 2 min – entmt. = 1.085

					2 min - gym = 0.732 20 min - partner = 0.534 20 min - room = 0.648 20 min - restaurant = 1.136 20 min – entmt. = 0.909 20 min - gym = 1.034 2 days - partner = 0.692 2 days - room = 1.385 2 days - restaurant = 1.538 2 days – entmt. = 1.000 2 days - gym = 1.231

Overall, choice-supportive misremembering in free recall was never detected, but misremembering was apparent (especially after 2 days) and, as predicted, increased over time (but misattribution did not). With the exception of false memories, scenario-related variation was observed for all types of misremembering.

2.3.4.2 Cued recall

For cued recall, an ANOVA was carried out on selective forgetting (at the attribute level) highlighting only the main effect of the scenario ($F(4, 388) = 4.526$, $Mse = .068$, $p = .001$, $\eta^2 = .04$), with significantly more forgetting in the *Entertainment bundle* vs. all the other scenarios (HSD all $p < .001$, $M = .16$ vs. .05 or lower).

In the case of misattribution (single value), the main effects of time delay and scenario and their interaction were significant. Table 2.5 presents the results. Misattributions increased significantly with delay, being more frequent after 2 days vs. after 2 minutes or 20 minutes (HSD $p = .010$ and $p = .031$, respectively). More misattributions were apparent in the

Restaurant scenario (HSD all p < .01 at least, but no difference from the *Entertainment bundle* scenario). The interaction qualified a marginally significant increase of misattributions at the 2-day delay vs. the 2-minute delay for the *Room* scenario (HSD p = .073).

Table 2.5: *Significant effects for misattribution in cued recall*

Effect	F (df)	Mse	p	η^2	Means
Delay	F(2, 97) = 6.834	.477	p = .002	.12	2 minutes = .383 20 minutes = .416 2 days = .629
Scenario	F(4, 388) = 4.405	.330	p = .002	.04	student partner = .514 room = .375 restaurant = .605 entmt. = .504 gym = .381
Delay × scenario	F(8, 388) = 1.975	.330	p = .048	.04	2 min – partner = 0.333 2 min - room = 0.262 2 min - restaurant = 0.619 2 min - entertainment = 0.452 2 min - gym = 0.250 20 min - partner = 0.352 20 min - room = 0.364 20 min - restaurant = 0.625 20 min – entmt. = 0.489

					20 min - gym = 0.250 2 days - partner = 0.857 2 days - room = 0.500 2 days - restaurant = 0.571 2 days – entmt. = 0.571 2 days - gym = 0.643

No analyses were carried out for false memories in cued recall, given that false memories were defined as remembering an attribute with a positive value that was never presented, and thus there is no chance to produce this type of misremembering when the real attributes are presented as cues like in cued recall of Experiment 1.

The ANOVA on fact distortion occurrences highlighted both the main effect of the delay ($F(2, 97) = 15.317$, $Mse = 2.707$, $p < .001$, $\eta^2 = .24$), and the main effect of the scenario ($F(4, 388) = 14.272$, $Mse = 1.162$, $p < .001$, $\eta^2 = .13$). Fact distortion increased with the delay ($M_{2min} = 1.262$, $M_{20min} = 1.330$, $M_{2day} = 2.121$, HSD 2-day vs. 2-min $p < .001$; HSD 2-day vs. 20-min $p < .001$). It was less frequent in the *Room* scenario and in the *Student partner* scenario, differing from all the other scenarios (HSD all at least $p < .01$ for the *Room* scenario and *Student partner* scenario, with the exception of the nonsignificant difference between *Student partner* and *Gym package*; M = 1.062 and M = 1.414 respectively vs. 1.759 or more).

Overall, choice-supportive misremembering in cued recall was never detected, but misremembering was apparent (especially after 2 days) and, as expected, increased over time (but selective forgetting did not), also showing scenario-related variation.

2.3.4.3 Differences between free and cued recall

A series of 2 x 2 x 3 x 5 mixed ANOVAs was carried out to show the differences between free and cued recall in each type of misremembering, with the independent factors being:

1) Choice-supportiveness (vs. non choice-supportiveness) - within-subjects

2) Memory test (free recall, cued recall) - within-subjects

2) Delay (2-minute, 20-minute, and 2-day) - between-subjects

3) Scenario (*Student partner*, *Room*, *Restaurant*, *Entertainment bundle*, *Gym package*) - within subjects

This 2 x 2 x 3 x 5 mixed ANOVA was repeated for the three different kinds of misremembering (false memories were not present by design in cued recall). Missing data due to choice misremembering were treated with case wise exclusion.

For what concerns selective forgetting (at the attribute level), main effects of condition, test, and scenario were detected. Moreover, significant interactions were shown between delay and test and between scenario and test. The effects are presented in Table 2.6. Selective forgetting increased with delay, but only the difference between 2 minutes and 2 days was marginally significant (HSD, $p = .098$). It was also detected more often in free recall vs. cued recall ($p < .001$), more often in the *Entertainment bundle* scenario (HSD at least $p < .05$) and less often in the *Room* scenario (HSD at least $p < .05$). The interaction between test and delay showed more selective forgetting in free vs. cued recall with this difference being more pronounced after 2 days (HSD all $p < .001$). The interaction between test and scenario showed more selective forgetting in free vs. cued recall with this difference being slightly more pronounced in the *Student partner* and *Entertainment bundle* scenarios (HSD all $p < .001$).

Table 2.6: *Significant effects for selective forgetting in free and cued recall*

Effect	F (df)	Mse	p	η^2	Means
Delay	F(2, 90) = 3.474	.809	p = .035	.07	2 minutes = .374 20 minutes = .437 2 days = .546
Test	F(1, 90) = 221.235	.466	p < .001	.84	free recall = .854 cued recall = .048
Scenario	F(4, 360) = 13.331	.242	p < .001	.13	student partner = .505 room = .314 restaurant = .403 entmt. = .604 gym = .436
Delay × test	F(2,90) = 9.189	.466	p < .001	.17	free recall - 2 minutes = .700 free recall - 20 min. = .786 free recall - 2 days = 1.083 cued recall - 2 minutes = .049 cued recall - 20 min. = .088 cued recall - 2 days = .008
Test × scenario	F(4, 360) = 9.770	.192	p < .001	.10	free recall - partner = 0.990 free recall - room = 0.604 free recall – rest. = 0.766 free recall - entmt. = 1.088

					free recall - gym = 0.834 cued recall - partner = 0.020 cued recall - room = 0.024 cued recall – rest. = 0.040 cued recall - entmt. = 0.120 cued recall n - gym = 0.037

The analysis on misattributions (at the value level), showed main effects of condition, test, and scenario, and a significant interaction between memory test and scenario. The effects are presented in Table 2.7. Misattribution increased with delay, with more misattributions after 2 days than after 20 minutes (HSD, $p = .037$) and 2 minutes (HSD, $p = .019$). It was also detected more often in cued recall vs. free recall ($p < .001$), and in the *Restaurant* scenarios vs. all the other scenarios (HSD at least $p < .01$). The interaction between test and scenario highlighted significantly more misattributions in cued recall vs. free recall (HSD, $p < .001$) with the exception of the *Room* and the *Gym package* scenarios (HSD, $p = .835$, $p = .267$).

Table 2.7: *Significant effects for misattribution in free and cued recall*

Effect	**F (df)**	**Mse**	**p**	**η^2**	**Means**
Delay	F(2, 90) = 6.128	.488	p = .003	.12	2 minutes = .299 20 minutes = .315 2 days = .475
Test	F(1, 90) = 72.423	.206	p < .001	.45	free recall = .258 cued recall = .468
Scenario	F(4, 360) = 4.592	.338	p = .001	.05	student partner = .350 room = .308 restaurant = .485 entmt. = .376 gym = .295
Test × scenario	F(4, 360) = 3.231	.172	p = .013	.03	free recall - partner = 0.201 free recall - room = 0.267 free recall – rest. = 0.361 free recall - entmt. = 0.242 free recall - gym = 0.220 cued recall - partner = 0.500 cued recall - room = 0.349 cued recall – rest. = 0.610 cued recall - entmt. = 0.511 cued recall n - gym = 0.371

Finally, the analysis of fact distortion highlighted significant main effects of delay, memory test, and scenario, and significant interactions between delay and test and between test and scenario. The effects are presented in Table 2.8. Fact distortion increased with delay, with significant differences between 2 days and 2 minutes (HSD, $p < .001$) and between 2 days and 20 minutes (HSD $p = .003$). Fact distortion was also detected more often in cued recall vs. free recall ($p < .001$), and less often in the *Room* and the *Student partner* scenarios (HSD all $p < .01$). The interaction between test and delay showed more fact distortion in cued vs. free recall with this difference being more pronounced after 2 days (HSD all $p < .001$). The interaction between test and scenario showed more fact distortion in cued vs. free recall with this difference being more pronounced in the *Entertainment bundle* and *Gym package* scenarios (HSD $p < .001$).

Table 2.8: *Significant effects for fact distortion in free and cued recall*

Effect	F (df)	Mse	p	η^2	Means
Delay	F(2, 90) = 11.729	2.980	p < .001	.21	2 minutes = 1.012 20 minutes = 1.077 2 days = 1.617
Test	F(1, 90) = 136.750	1.010	p < .001	.60	free recall = 0.916 cued recall = 1.554
Scenario	F(4, 360) = 11.756	1.379	p < .001	.11	student partner = 1.015 room = 0.934 restaurant = 1.487 entmt. = 1.382 gym = 1.357
Delay × test	F(2,90) = 7.879	1.010	p < .001	.15	free recall - 2 minutes = 0.803

					free recall - 20 min. = 0.829 free recall - 2 days = 1.117 cued recall - 2 min. = 1.221 cued recall - 20 min. = 1.326 cued recall - 2 days = 2.117
Test × scenario	F(4, 360) = 7.972	0.572	p < .001	.08	free recall - partner = 0.624 free recall - room = 0.820 free recall – rest. = 1.215 free recall - entmt. = 0.945 free recall - gym = 0.975 cued recall - partner = 1.406 cued recall - room = 1.048 cued recall – rest. = 1.760 cued recall - entmt. = 1.820 cued recall - gym = 1.738

Overall, choice-supportive misremembering was never detected in free or cued recall. Selective forgetting was more frequent in free recall vs. cued recall, while the opposite was true for misattribution and fact distortion. Misremembering increased over time, especially after 2 days. Scenario-related variation was always observed.

2.3.5 Detailed analysis of misremembering

2.3.5.1 Occurrence of the different kinds of misremembering in free recall

The occurrence of the four different kinds of misremembering in free recall was analyzed scenario per scenario. Missing data were excluded on a scenario per scenario basis. Consequently, the means in the following analyses may differ from the case wise-computed means reported in the ANOVAs.

Confidence intervals (95%) of the proportion of participants showing at least one occurrence of each specific misremembering type were computed, regardless of the choice-supportive nature of the misremembering. As Table 2.9 shows, all four types of misremembering in the taxonomy took place at least in one occurrence for a proportion of participants significantly different from zero. It is apparent that selective forgetting and fact distortion took place in at least one case for a large fraction of participants. A sizable fraction of participants also produced at least one misattribution, while false memories were less frequent but still apparent (the proportion was always greater than zero). False memories tended to increase with time delay, as predicted. The results are consistent across scenarios.

Table 2.9: *Occurrence of the four different kinds of misremembering in free recall in each choice scenario (proportion of cases showing at least one occurrence of each specific type)*

PARTNER FOR A STUDENT PROJECT								
	SELECTIVE FORGETTING		**MISATTRIBUTION**		**FALSE MEMORY**		**FACT DISTORTION**	
DELAY	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
2 min (n = 52)	.90	.79-.97	.35	.22-.49	.21	.11-.35	.67	.53-.80
20 min (n = 51)	.90	.79-.97	.29	.17-.44	.14	.06-.26	.63	.48-.76
2 days (n = 46)	1.0	.92-1.0	.50	.35-.65	.37	.23-.52	.76	.62-.86
Overall (n = 149)	.93	.88-.97	.38	.30-.47	.23	.16-.30	.68	.60-.75

ROOM SCENARIO								
	SELECTIVE FORGETTING		MISATTRIBUTION		FALSE MEMORY		FACT DISTORTION	
DELAY	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
2 min (n = 50)	.64	.49-.77	.62	.47-.75	.00	.00-.07	.66	.51-.79
20 min (n = 48)	.75	.60-.86	.50	.35-.65	.10	.03-.23	.60	.45-.74
2 days (n = 40)	.90	.76-.97	.60	.43-.75	.13	.04-.27	.93	.80-.98
Overall (n = 138)	.75	.67-.82	.57	.49-.66	.07	.04-.13	.72	.63-.79

RESTAURANT SCENARIO								
	SELECTIVE FORGETTING		MISATTRIBUTION		FALSE MEMORY		FACT DISTORTION	
DELAY	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
2 min (n = 50)	.86	.73-.94	.70	.55-.82	.14	.06-.27	.92	.81-.98
20 min (n = 49)	.90	.78-.97	.63	.48-.77	.10	.03-.22	.92	.80-.98
2 days (n = 34)	.97	.85-1.00	.59	.41-.75	.38	.22-.56	.88	.73-.97
Overall (n = 133)	.90	.84-.95	.65	.56-.73	.19	.13-.26	.91	.85-.95

ENTERTAINMENT BUNDLE								
	SELECTIVE FORGETTING		MISATTRIBUTION		FALSE MEMORY		FACT DISTORTION	
DELAY	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
2 min (n = 45)	.93	.82-.99	.36	.22-.51	.22	.11-.37	.89	.76-.96
20 min (n = 48)	.94	.83-.99	.52	.37-.67	.21	.10-.35	.85	.72-.94
2 days (n = 42)	1.0	.92-1.0	.43	.28-.59	.38	.24-.54	.79	.63-.90
Overall (n = 135)	.96	.92-.99	.44	.35-.53	.27	.19-.35	.84	.76-.89

GYM PACKAGE								
	SELECTIVE FORGETTING		MISATTRIBUTION		FALSE MEMORY		FACT DISTORTION	
DELAY	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
2 min (n = 49)	.94	.83-.99	.37	.23-.52	.02	.00-.11	.71	.57-.83
20 min (n = 49)	.84	.70-.93	.37	.23-.52	.14	.06-.27	.76	.61-.87
2 days (n = 36)	.97	.85-1.0	.58	.41-.74	.19	.08-.36	.83	.67-.94
Overall (n = 134)	.91	.85-.95	.43	.35-.52	.11	.06-.18	.76	.68-.83

The occurrence of the four different misremembering types in free recall was also analyzed via one-sample t-tests on the mean number of each specific misremembering type (against a zero mean). This analysis provided results converging with the ones obtained on the proportion of participants showing at least one occurrence of each specific misremembering type and the previous ANOVAs.

The findings are presented, scenario per scenario, in Table 2.10. They show that the mean number of the four different kinds of misremembering in free recall in each choice scenario is always greater than zero in one-tailed (directional) tests. The mean number of selective forgetting instances is greater than the mean number of fact distortion occurrences, which is in turn greater than the mean number of misattributions and false memories (low means in these cases). Misremembering tends to increase with time delay and, again, results are consistent across scenarios.

Table 2.10: *Mean number of the four different kinds of misremembering in free recall in each choice scenario (one-sample tests against a zero mean)*

PARTNER FOR A STUDENT PROJECT								
	SELECTIVE FORGETTING		**MISATTRIBUTION**		**FALSE MEMORY**		**FACT DISTORTION**	
DELAY	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**
2 min	3.731 2.097	12.830 (51) p < .001	0.462 0.727	4.581 (51) p < .001	0.231 0.469	3.546 (51) p < .001	1.269 1.157	7.913 (51) p < .001
20 min	3.667 2.169	12.070 (50) p < .001	0.510 0.946	3.849 (50) p < .001	0.137 0.348	2.820 (50) p < .001	1.078 1.036	7.432 (50) p < .001
2 days	5.370 2.471	14.739 (45) p < .001	0.804 1.046	5.215 (45) p < .001	0.500 0.782	4.338 (45) p < .001	1.511 1.236	8.069 (45) p < .001
Overall	4.215 2.358	21.815 (148) p < .001	0.584 0.916	7.780 (148) p < .001	0.282 0.570	6.032 (148) p < .001	1.268 1.148	13.480 (148) p < .001

ROOM SCENARIO								
	SELECTIVE FORGETTING		**MISATTRIBUTION**		**FALSE MEMORY**		**FACT DISTORTION**	
DELAY	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**
2 min	1.760 2.046	6.083 (49) p < .001	.980 1.020	6.794 (49) p < .001	0.000 0.000	--- (49) ---	1.160 1.201	6.828 (49) p < .001
20 min	2.271 1.783	8.822 (47) p < .001	0.771 0.951	5.617 (47) p < .001	0.104 0.309	2.338 (47) p = .012	1.271 1.250	7.042 (47) p < .001
2 days	3.450 2.218	9.837 (39) p < .001	1.050 1.108	5.992 (39) p < .001	0.150 0.427	2.223 (39) p < .001	2.500 1.553	10.184 (39) p < .001
Overall	2.428 2.113	13.495 (137) p < .001	0.928 1.023	10.655 (137) p < .001	0.080 0.297	3.148 (137) p = .001	1.587 1.443	12.915 (137) p < .001

RESTAURANT SCENARIO								
	SELECTIVE FORGETTING		**MISATTRIBUTION**		**FALSE MEMORY**		**FACT DISTORTION**	
DELAY	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**
2 min	2.520 1.752	10.168 (49) p < .001	1.100 0.974	7.985 (49) p < .001	0.014 0.351	2.824 (49) p = .003	2.260 1.651	9.677 (49) p < .001
20 min	3.020 1.797	11.766 (48) p < .001	0.918 0.886	11.766 (48) p < .001	0.122 0.389	2.203 (48) p = .016	2.224 1.462	10.654 (48) p < .001

2 days	4.882 2.384	11.942 (33) p < .001	1.000 1.101	5.296 (33) p < .001	0.412 0.557	4.311 (33) p < .001	2.441 1.862	7.646 (33) p < .001
Overall	3.308 2.154	17.714 (132) p < .001	1.008 0.973	11.941 (132) p < .001	0.203 0.440	5.325 (132) p < .001	2.293 1.632	16.205 (132) p < .001

ENTERTAINMENT BUNDLE								
	SELECTIVE FORGETTING		**MISATTRIBUTION**		**FALSE MEMORY**		**FACT DISTORTION**	
DELAY	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**
2 min	3.711 2.096	11.879 (44) p < .001	0.444 .659	4.524 (44) p < .001	0.222 0.420	3.546 (44) p < .001	2.133 1.424	10.051 (44) p < .001
20 min	4.292 2.509	11.850 (47) p < .001	0.896 1.115	5.564 (47) p < .001	0.208 0.410	3.517 (47) p < .001	1.813 1.214	10.341 (47) p < .001
2 days	5.738 2.642	14.077 (41) p < .001	0.738 1.014	4.719 (41) p < .001	0.429 0.590	4.705 (41) p < .001	2.024 1.732	7.573 (41) p < .001
Overall	4.548 2.547	20.746 (134) p < .001	0.696 0.964	8.392 p < .001	0.281 0.483	6.767 (134) p < .001	1.985 1.456	15.845 (134) p < .001

GYM PACKAGE								
	SELECTIVE FORGETTING		MISATTRIBUTION		FALSE MEMORY		FACT DISTORTION	
DELAY	**Mean SD**	**t-test (df) p one-tail**	**Mean SD**	**t-test (df) p one-tail**	**Mean SD**	**t-test (df) p one-tail**	**Mean SD**	**t-test (df) p one-tail**
2 min	2.898 1.874	10.827 (48) p < .001	0.510 0.767	4.656 (48) p < .001	0.020 0.143	1.000 (48) p = .161	1.571 1.369	8.033 (48) p < .001
20 min	2.898 1.960	10.347 (48) p < .001	0.510 0.767	4.656 (48) p < .001	0.163 0.426	2.685 (48) p = .005	1.980 1.574	8.802 (48) p < .001
2 days	4.417 2.500	10.600 (35) p < .001	1.167 1.363	5.137 (35) p < .001	0.194 0.401	2.907 (35) p = .003	2.472 1.682	8.821 (35) p < .001
Overall	3.306 2.181	17.549 (133) p < .001	0.687 0.999	7.952 (133) p < .001	0.119 0.348	3.974 (133) p < .001	1.963 1.563	14.538 (133) p < .001

2.3.5.2 Occurrence of the different kinds of misremembering in cued recall

The occurrence of the four different kinds of misremembering in cued recall was also analyzed scenario per scenario. The number of cases may differ between free and cued recall due to the fact that some participants may have forgotten the option they chose in a given scenario in the test made with free recall but not in the same test made with cued recall (or the reverse). As in the previous analyses, data from misremembered choices were excluded on a scenario per scenario basis. Confidence intervals (95%) of the proportion of participants showing at least one occurrence of each specific misremembering type were computed, regardless of the choice-supportive nature of the misremembering. As Table 2.11 shows, misattribution and fact distortion took place in at least one case in a large fraction of participants, while only a limited fraction of participants (albeit nonzero) exposed at least one case of selective forgetting, especially at the shorter delays. The results are consistent across scenarios.

Table 2.11: *Occurrence of the four different kinds of misremembering in cued recall in each choice scenario (proportion of cases showing at least one occurrence of each specific type)*

PARTNER FOR A STUDENT PROJECT						
	SELECTIVE FORGETTING		MISATTRIBUTION		FACT DISTORTION	
DELAY	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
2 min (n = 52)	.038	.011-.013	.577	.441-.701	.827	.703-.906
20 min (n = 51)	.058	.020-.156	.686	.550-.797	.824	.697-904
2 days (n = 44)	.205	.111-.345	.841	.706-.921	.909	.788-.964
Overall (n = 147)	.095	.058-.153	.694	.615-.763	.850	.784-.899

ROOM SCENARIO						
	SELECTIVE FORGETTING		MISATTRIBUTION		FACT DISTORTION	
DELAY	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
2 min (n = 50)	.040	.011-.135	.580	.442-.706	.660	.521-.77
20 min (n = 48)	.083	.033-.196	.750	.612-.851	.750	.612-.851
2 days (n = 42)	.190	.010-.333	.857	.721-.933	.952	.842-987
Overall (n = 140)	.100	.061-.161	.721	.642-789	.779	.703-.839

RESTAURANT SCENARIO						
	SELECTIVE FORGETTING		MISATTRIBUTION		FACT DISTORTION	
DELAY	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
2 min (n = 50)	.060	.021-.162	.820	.692-.902	.940	.838-.979
20 min (n = 50)	.180	.098-.308	.860	.738-.930	1	.929-1
2 days (n = 37)	.162	.076-.311	.784	.628-886	1	.906-1
Overall (n = 137)	.131	.085-.198	.825	.752-.879	.978	.938-.992

ENTERTAINMENT BUNDLE						
	SELECTIVE FORGETTING		MISATTRIBUTION		FACT DISTORTION	
DELAY	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
2 min (n = 46)	.174	.091-.307	.783	.644-.877	.957	.51-.988
20 min (n = 47)	.255	.152-.395	.809	.674-.896	.957	.857-.988
2 days (n = 38)	.211	.111-.363	.789	.637-.889	1	.908-1
Overall (n = 131)	.214	.152-.291	.794	.717-.854	.969	.924-.988

GYM PACKAGE						
	SELECTIVE FORGETTING		MISATTRIBUTION		FACT DISTORTION	
DELAY	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
2 min (n = 51)	.098	.041-.210	.608	.471-.730	.882	.766-.945
20 min (n = 50)	.120	.056-.238	.500	.366-.634	.880	.762-.944
2 days (n = 33)	.182	.086-.344	.758	.590-.872	1	.896-1
Overall (n = 134)	.127	.081-.194	.604	.520-.683	.910	.850-.948

The occurrence of the three different misremembering types in cued recall was also analyzed via one-sample t-tests on the mean number of each specific misremembering type (against a zero mean). This analysis provided results converging with the ones obtained on the proportion of participants showing at least one occurrence of each specific type of misremembering.

The findings are presented, scenario per scenario, in Table 2.12. They show that the mean number of the three different kinds of misremembering in cued recall in each choice scenario is almost always greater than zero in one-tailed (directional) tests. The exceptions occur in some scenarios for selective forgetting, mainly at the shortest delay (2 minutes). The mean number of fact distortion occurrences is greater than the mean number of misattributions, which is in turn greater than the mean number of selective forgetting instances (low means in this case). Fact distortions and misattributions tend to increase with delay. Results are consistent across scenarios.

Table 2.12: *Mean number of the four different kinds of misremembering in cued recall in each choice scenario (one-sample tests against a zero mean)*

PARTNER FOR A STUDENT PROJECT						
	SELECTIVE FORGETTING		**MISATTRIBUTION**		**FACT DISTORTION**	
DELAY	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**
2 min	0.192 1.138	1.218 (51) p = .115	0.885 1.041	6.126 (51) p < .001	2.423 1.742	10.033 (51) p < .001
20 min	0.157 0.674	1.661 (50) p = .052	1.431 1.300	7.863 (50) p < .001	2.314 1.679	9.840 (50) p < .001
2 days	0.795 1.837	2.872 (43) p = .003	1.841 1.569	7.782 (43) p < .001	3.341 1.842	12.031 (43) p < .001
Overall	0.361 1.298	3.368 (146) p < .001	1.361 1.355	12.178 (146) p < .001	2.660 1.796	17.955 (146) p < .001

ROOM SCENARIO						
	SELECTIVE FORGETTING		**MISATTRIBUTION**		**FACT DISTORTION**	
DELAY	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**
2 min	0.080 0.396	1.429 (49) p = .079	1.100 1.233	6.308 (49) p < .001	1.500 1.474	7.194 (49) p < .001
20 min	0.208 0.743	1.944 (47) p = .029	1.438 1.335	7.458 (47) p < .001	1.792 1.501	8.269 (47) p < .001
2 days	0.571 1.272	2.913 (41) p = .003	2.405 1.668	9.341 (41) p < .001	3.381 1.766	12.405 (41) p < .001
Overall	0.271 0.872	3.683 (139) p < .001	1.607 1.502	12.664 (139) p < .001	2.164 1.761	14.539 (139) p < .001

RESTAURANT SCENARIO						
	SELECTIVE FORGETTING		MISATTRIBUTION		FACT DISTORTION	
DELAY	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**
2 min	0.160 0.681	1.661 (49) p = .051	1.680 1.236	9.610 (49) p < .001	3.140 1.906	11.649 (49) p < .001
20 min	0.460 1.129	2.882 (49) p < .001	1.360 0.985	9.765 (49) p < .001	3.200 1.773	12.764 (49) p < .001
2 days	0.649 1.567	2.517 (36) p = .008	2.108 1.853	6.921 (36) p < .001	4.432 1.951	13.817 (36) p < .001
Overall	0.401 1.147	4.097 (136) p < .001	1.679 1.377	14.270 (136) p < .001	3.511 1.941	21.175 (136) p < .001

ENTERTAINMENT BUNDLE						
	SELECTIVE FORGETTING		**MISATTRIBUTION**		**FACT DISTORTION**	
DELAY	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**	**Mean** **SD**	**t-test (df)** **p one-tail**
2 min	0.543 1.295	2.847 (45) p = .004	1.435 1.223	7.957 (45) p < .001	3.543 1.810	13.278 (45) p < .001
20 min	0.809 1.702	3.256 (46) p = .001	1.809 1.555	7.972 (46) p < .001	3.277 1.753	12.812 (46) p < .001
2 days	0.526 1.109	2.927 (37) p = .003	1.553 1.501	6.375 (37) p < .001	4.184 1.768	14.585 (37) p < .001
Overall	0.634 1.404	5.164 (130) p < .001	1.603 1.429	12.842 (130) p < .001	3.634 1.803	23.071 (130) p < .001

GYM PACKAGE						
	SELECTIVE FORGETTING		MISATTRIBUTION		FACT DISTORTION	
DELAY	Mean SD	t-test (df) p one-tail	Mean SD	t-test (df) p one-tail	Mean SD	t-test (df) p one-tail
2 min	0.176 0.555	2.270 (50) p = .014	1.176 1.178	7.131 (50) p < .001	2.627 1.886	9.947 (50) p < .001
20 min	0.400 1.212	2.333 (49) p = .012	0.980 1.152	6.018 (49) p < .001	2.820 1.859	10.725 (49) p < .001
2 days	0.485 1.228	2.268 (32) p = .015	2.152 1.679	7.360 (32) p < .001	4.848 1.873	14.872 (32) p < .001
Overall	0.336 1.018	3.818 (133) p < .001	1.343 1.383	11.247 (133) p < .001	3.246 2.075	18.106 (133) p < .001

2.3.5.3 Choice-supportiveness

McNemar tests and paired t-test were used to test the hypothesis that the different types of distortions are choice-supportive (vs. non choice-supportive). The tests were carried out scenario per scenario on free recall and cued recall on the specific types of distortions that could be assessed with each kind of test (i.e., all four types in free recall, all but false memories in cued recall).

2.3.5.3.1 Choice-supportiveness in free recall

McNemar test were computed on the frequencies of participants showing at least one case of choice-supportiveness vs. at least one case of non-choice-supportiveness. Probabilities associated with the test were computed as one-tailed, given the defined directionality of the choice-supportiveness hypothesis. The robustness of the findings was assessed after Bonferroni correction for the number of the test at the scenario level (Bonferroni-corrected alpha levels for free recall is α = .05/4 = .013). Table 2.13 shows the results, highlighting choice-supportiveness in two cases and four tests running against the hypothesis. Only one of these tests resisted Bonferroni correction (against the hypothesis). Therefore, we can conclude that generally there is no difference and specifically there is no significant choice-supportive bias. Findings are consistent across scenarios.

Table 2.13: *McNemar tests for choice-supportiveness (CS) vs. non choice-supportiveness (NCS) in free recall on participants showing (vs. not showing) at least one case of each (Bonferroni-corrected alpha levels for free recall is α = .05/4 = .013)*

STUDENT PARTNER												
	SELECTIVE FORGETTING			**MISATTRIBUTION**			**FALSE MEMORY**			**FACT DISTORTION**		
DELAY	**Prop CS**	**Prop NCS**	**Mc Nemar p**	**Prop CS**	**Prop NCS**	**Mc Nemar p**	**Prop CS**	**Prop NCS**	**Mc Nemar p**	**Prop CS**	**Prop NCS**	**Mc Nemar p**
2 MIN	.79	.65	.09	.13	.17	.40	.15	.06	.12	.56	.50	.32
20 MIN	.69	.73	.41	.16	.18	.50	.10	.04	.23	.51	.41	.17
2 DAYS	.89	.76	.11	.26	.33	.32	.15	.26	.15	.57	.54	.50
Overall	.79	.71	.09	.18	.22	.22	.13	.11	.37	.54	.48	.13

ROOM												
	SELECTIVE FORGETTING			MISATTRIBUTION			FALSE MEMORY			FACT DISTORTION		
DELAY	**Prop CS**	**Prop NCS**	**Mc Nemar p**	**Prop CS**	**Prop NCS**	**Mc Nemar p**	**Prop CS**	**Prop NCS**	**Mc Nemar p**	**Prop CS**	**Prop NCS**	**Mc Nemar p**
2 MIN	.34	.42	.28	.20	.20	.50	.00	.00	.50	.52	.40	.13
20 MIN	.42	.52	.22	.21	.27	.32	.04	.06	.50	.50	.50	.50
2 DAYS	.58	.68	.19	.25	.43	.07	.05	.08	.50	.83	.78	.38
Overall	.43	.53	.07	.22	.29	.10	.03	.04	.38	.60	.54	.14

RESTAURANT												
	SELECTIVE FORGETTING			MISATTRIBUTION			FALSE MEMORY			FACT DISTORTION		
DELAY	**Prop CS**	**Prop NCS**	**Mc Nemar p**	**Prop CS**	**Prop NCS**	**Mc Nemar p**	**Prop CS**	**Prop NCS**	**Mc Nemar p**	**Prop CS**	**Prop NCS**	**Mc Nemar p**
2 MIN	.62	.48	.08	.38	.44	.35	.04	.10	.23	.64	.68	.43
20 MIN	.67	.59	.28	.37	.37	.50	.06	.06	.50	.78	.63	.10
2 DAYS	.82	.85	.50	**.41**	**.18**	**.02**	.18	.24	.39	.62	.76	.14
Overall	.69	.62	.09	.38	.35	.36	.08	.12	.20	.68	.68	.50

ENTERTAINMENT BUNDLE												
	SELECTIVE FORGETTING			**MISATTRIBUTION**			**FALSE MEMORY**			**FACT DISTORTION**		
DELAY	Prop CS	Prop NCS	Mc Nemar p	Prop CS	Prop NCS	Mc Nemar p	Prop CS	Prop NCS	Mc Nemar p	Prop CS	Prop NCS	Mc Nemar p
2 MIN	.71	.69	.50	.13	.18	.39	.11	.11	.50	.69	.73	.40
20 MIN	.67	.77	.19	**.10**	**.33**	**.02**	.13	.08	.38	**.77**	**.56**	**.02**
2 DAYS	.79	.83	.40	.14	.26	.15	.26	.14	.15	.60	.64	.40
Overall	.72	.76	.26	**.13**	**.26**	**.01**	.16	.11	.16	.69	.64	.24

GYM PACKAGE												
	SELECTIVE FORGETTING			**MISATTRIBUTION**			**FALSE MEMORY**			**FACT DISTORTION**		
DELAY	Prop CS	Prop NCS	Mc Nemar p	Prop CS	Prop NCS	Mc Nemar p	Prop CS	Prop NCS	Mc Nemar p	Prop CS	Prop NCS	Mc Nemar p
2 MIN	.53	.57	.44	.10	.18	.21	.00	.02	.50	.59	.55	.40
20 MIN	**.45**	**.67**	**.03**	.14	.16	.39	.08	.08	.50	.67	.67	.50
2 DAYS	.64	.81	.12	.25	.17	.28	.14	.06	.23	.72	.75	.50
Overall	**.53**	**.67**	**.03**	.16	.17	.37	.07	.05	.40	.66	.65	.50

Paired t-tests were also used to test the hypothesis that the different types of distortions are choice-supportive (vs. non choice-supportive), by comparing the mean number of choice-supportive distortions vs. non choice-supportive ones at the participant level. Also in this case, one-tailed probabilities were computed, given the directional prediction, and the robustness of the findings was assessed after Bonferroni correction for the number of the test at the scenario level. Table 2.14 shows the results, highlighting three significant differences in support of the choice-supportiveness hypothesis and five against it, but only four of them survived the Bonferroni correction (two for and two against the hypothesis). Therefore, there is no clear indication of choice-supportiveness overall, and no evidence of an overall difference between the conditions. Note that statistically significant values are highlighted in **bold type** in the following tables.

Table 2.14: *Paired t-tests of choice-supportiveness (CS) vs. non choice-supportiveness (NCS) in free recall (Bonferroni-corrected alpha levels for free recall is α = .05/4 = .013)*

STUDENT PARTNER												
	SELECTIVE FORGETTING			**MISATTRIBUTION**			**FALSE MEMORY**			**FACT DISTORTION**		
DELAY	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**
2 MIN	1.019 0.671	0.846 0.724	1.352 51 .091	0.135 0.345	0.173 0.382	-0.531 51 .149	0.137 0.430	0.058 0.235	1.629 51 .055	0.673 0.596	0.677 0.664	0.813 51 .209
20 MIN	0.882 0.739	0.941 0.705	-0.444 50 .329	0.176 0.434	0.176 0.385	0.00 50 .500	0.098 0.300	0.039 0.196	1.137 50 .130	0.569 0.510	0.608 0.703	0.518 50 .303
2 DAYS	1.457 0.836	1.196 0.859	1.521 45 .067	0.282 0.502	0.348 0.526	-0.621 45 .268	0.174 0.438	0.326 0.634	-1.360 45 .091	0.783 0.696	0.814 0.726	0.645 45 .261
Overall	1.107 0.781	0.987 0.771	1.456 148 .073	0.195 0.430	0.228 0.437	-0.698 148 .243	0.148 0.392	0.134 0.414	0.288 148 .387	0.671 0.702	0.597 0.697	1.129 148 .130

ROOM												
	SELECTIVE FORGETTING			MISATTRIBUTION			FALSE MEMORY			FACT DISTORTION		
DELAY	CS Mean SD	NCS Mean SD	Paired t-test df p	CS Mean SD	NCS Mean SD	Paired t-test df p	CS Mean SD	NCS Mean SD	Paired t-test df p	CS Mean SD	NCS Mean SD	Paired t-test df p
2 MIN	0.380 0.602	0.500 0.678	-1.098 49 .139	0.220 0.465	0.200 0.404	0.227 49 .411	0.00 0.00	0.00 0.00	--- 40 ---	0.640 0.722	0.520 0.735	1.030 49 .154
20 MIN	0.500 0.684	0.625 0.703	-0.814 47 .210	0.208 0.410	0.271 0.449	-0.771 47 .222	0.042 0.202	0.063 0.245	-0.443 47 .330	0.625 0.733	0.646 0.729	-0.191 47 .425
2 DAYS	0.825 0.844	0.900 0.744	-0.416 39 .340	0.275 0.506	0.475 0.599	-1.842 39 .037	0.050 0.221	0.100 0.379	-0.703 39 .243	1.350 0.921	1.150 0.864	1.433 39 .080
Overall	0.551 0.726	0.659 0.720	-1.294 137 .099	0.232 0.457	0.304 0.492	-1.365 137 .087	0.029 0.168	0.051 0.251	-0.831 137 .204	0.841 0.848	0.746 0.811	1.352 137 .081

RESTAURANT												
	SELECTIVE FORGETTING			**MISATTRIBUTION**			**FALSE MEMORY**			**FACT DISTORTION**		
DELAY	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**
2 MIN	0.680 0.587	0.580 0.673	0.778 49 .220	0.400 0.535	0.460 0.542	-0.535 49 .298	0.040 0.198	0.100 0.303	-1.137 49 .131	1.180 1.173	1.080 1.047	0.475 49 .318
20 MIN	0.857 0.736	0.633 0.566	1.596 48 .059	0.429 0.612	0.408 0.574	0.167 48 .434	0.061 0.242	0.061 0.242	0.000 48 .500	1.184 0.928	1.041 0.999	0.795 48 .215
2 DAYS	1.265 0.828	1.147 0.657	0.780 33 .221	**0.471** **0.615**	**0.176** **0.387**	**2.539** **33** **.008**	0.176 0.387	0.235 0.431	-0.572 33 .286	**1.000** **1.044**	**1.441** **1.284**	**-1.814** **33** **.040**
Overall	**0.895** **0.741**	**0.744** **0.670**	**1.874** **132** **.032**	0.429 0.581	0.368 0.529	0.872 132 .193	0.083 0.276	0.120 0.327	-1.043 132 .150	1.135 1.100	1.158 1.050	-0.186 132 .853

ENTERTAINMENT BUNDLE												
	SELECTIVE FORGETTING			**MISATTRIBUTION**			**FALSE MEMORY**			**FACT DISTORTION**		
DELAY	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**
2 MIN	1.000 0.853	0.844 0.706	0.894 44 .188	0.133 0.344	0.178 0.387	-0.573 44 .285	0.111 0.318	0.111 0.318	0.000 45 .500	1.067 0.956	0.918 0.864	1.570 134 .059
20 MIN	**0.875 0.815**	**1.271 0.893**	**-2.360 47 .011**	**0.125 0.393**	**0.354 0.526**	**-2.296 47 .013**	0.125 0.334	0.083 0.279	0.628 47 .266	1.067 1.009	1.067 0.837	0.000 44 .500
2 DAYS	1.286 0.944	1.548 0.942	-1.230 41 .113	0.143 0.354	0.310 0.563	-1.553 41 .064	0.286 0.508	0.143 0.354	1.432 41 .080	**1.146 0.850**	**0.667 0.663**	**3.599 47 .000**
Overall	1.044 0.880	1.215 0.893	-1.585 134 .057	**0.133 0.362**	**0.281 0.499**	**-2.686 134 .004**	0.170 0.397	0.111 0.315	1.301 134 .097	0.976 1.024	1.048 1.035	-0.416 41 .339

GYM PACKAGE												
	SELECTIVE FORGETTING			**MISATTRIBUTION**			**FALSE MEMORY**			**FACT DISTORTION**		
DELAY	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**
2 MIN	0.714 0.816	0.735 0.758	-0.133 48 .455	0.122 0.389	0.184 0.391	-0.724 48 .236	0.000 0.000	0.020 0.143	-1.000 48 .161	0.796 0.816	0.775 0.797	0.167 48 .434
20 MIN	**0.571** **0.736**	**0.878** **0.726**	**-1.977** **48** **.027**	0.143 0.353	0.163 0.373	-0.274 48 .392	0.082 0.277	0.082 0.277	0.000 48 .500	1.020 0.877	0.959 0.841	0.621 48 .268
2 DAYS	1.000 0.956	1.194 0.822	-0.909 35 .185	0.306 0.577	0.194 0.467	0.941 35 .176	0.138 0.350	0.055 0.232	1.138 35 .131	1.194 0.980	1.278 1.003	-0.475 35 .319
Overall	0.739 0.840	0.910 0.780	-1.649 133 .051	0.179 0.439	0.179 0.403	0.000 133 .500	0.067 0.251	0.052 0.223	0.533 133 .297	0.796	0.978 0.888	0.101 133 .459

2.3.5.3.2 Choice-supportiveness in cued recall

McNemar tests were computed on the frequencies of participants showing at least one case of choice-supportiveness vs. at least one case of non-choice-supportiveness. Probabilities associated with the test were computed as one-tailed, given the defined directionality of the choice-supportiveness hypothesis. The robustness of the findings was assessed after Bonferroni correction for the number of the test at the scenario level (Bonferroni-corrected alpha levels for free recall is α = .05/4 = .013). Table 2.15 shows the results, highlighting choice-supportiveness in only one case and three tests running against the hypothesis. Only one of these tests resisted Bonferroni correction. Thus, there is no difference overall and specifically there is no bias towards choice-supportiveness. Findings are consistent across scenarios.

Table 2.15: *McNemar tests for choice-supportiveness (CS) vs. non choice-supportiveness (NCS) in cued recall on participants showing (vs. not showing) at least one case of each (Bonferroni-corrected alpha levels for free recall is α = .05/4 = .013)*

STUDENT PARTNER									
	SELECTIVE FORGETTING			**MISATTRIBUTION**			**FACT DISTORTION**		
DELAY	**Prop CS**	**Prop NCS**	**McNemar p**	**Prop CS**	**Prop NCS**	**McNemar p**	**Prop CS**	**Prop NCS**	**McNemar p**
2 MIN	.019	.038	0,500	.308	.327	0,500	**.808**	**.673**	**0,023**
20 MIN	.039	.039	0,240	.353	.373	0,500	.725	.667	0,289
2 DAYS	.182	.114	0,124	.568	.455	0,202	.864	.841	0,500
Overall	.075	.061	0,341	.401	.381	0,402	.796	.721	0,027

ROOM									
	SELECTIVE FORGETTING			**MISATTRIBUTION**			**FACT DISTORTION**		
DELAY	**Prop CS**	**Prop NCS**	**McNemar p**	**Prop CS**	**Prop NCS**	**McNemar p**	**Prop CS**	**Prop NCS**	**McNemar p**
2 MIN	.020	.020	0,240	.220	.260	0,411	.580	.460	0,090
20 MIN	.063	.021	0,308	.250	.417	0,085	.583	.604	0,500
2 DAYS	.095	.143	0,341	.405	.476	0,345	.881	.810	0,252
Overall	.057	.057	0,386	.286	.379	0,077	.671	.614	0,128

RESTAURANT									
	SELECTIVE FORGETTING			MISATTRIBUTION			FACT DISTORTION		
DELAY	Prop CS	Prop NCS	McNemar p	Prop CS	Prop NCS	McNemar p	Prop CS	Prop NCS	McNemar p
2 MIN	.060	.020	0,240	.500	.600	0,202	.800	.800	0,395
20 MIN	.120	.080	0,362	.600	.540	0,350	.860	.880	0,500
2 DAYS	.135	.108	0,500	.568	.432	0,166	.838	.973	0,065
Overall	.102	.066	0,134	.555	.533	0,403	.832	.876	0,196

ENTERTAINMENT BUNDLE									
	SELECTIVE FORGETTING			MISATTRIBUTION			FACT DISTORTION		
DELAY	Prop CS	Prop NCS	McNemar p	Prop CS	Prop NCS	McNemar p	Prop CS	Prop NCS	McNemar p
2 MIN	.109	.065	0,362	.283	.413	0,188	.848	.891	0,362
20 MIN	.149	.170	0,362	.234	.489	0,350	.851	.851	0,500
2 DAYS	.079	.158	0,225	.316	.421	0,270	.921	.947	0,500
Overall	.115	.130	0,419	**.275**	**.443**	**0,012**	.870	.893	0,338

GYM PACKAGE									
	SELECTIVE FORGETTING			**MISATTRIBUTION**			**FACT DISTORTION**		
DELAY	**Prop CS**	**Prop NCS**	**McNemar p**	**Prop CS**	**Prop NCS**	**McNemar p**	**Prop CS**	**Prop NCS**	**McNemar p**
2 MIN	.039	.039	0,308	.275	.235	0,386	.765	.824	0,252
20 MIN	.100	.080	0,500	**.220**	**.240**	**0,022**	.840	.820	0,376
2 DAYS	.061	.121	0,341	**.364**	**.576**	**0,035**	1	.970	0,500
Overall	.067	.075	0,500	.276	.321	0,196	.851	.858	0,500

Paired t-tests were also used to test the hypothesis that the different types of distortions are choice-supportive (vs. non choice-supportive) in cued recall, by comparing the mean number of choice-supportive distortions vs. non choice-supportive ones at the participant level. Also in this case, one-tailed probabilities were computed, given the directional prediction, and the robustness of the findings was assessed after Bonferroni correction for the number of the test at the scenario level. Table 2.16 shows the results, highlighting two cases of choice-supportiveness in fact distortion and one case running against the hypothesis in misattribution, all resisting Bonferroni correction. Overall, the evidence is not sufficient to conclude that any general significant trend towards choice-supportiveness is apparent in cued recall.

Table 2.16: *Paired t-tests of choice-supportiveness (CS) vs. non choice-supportiveness (NCS) in cued recall (Bonferroni-corrected alpha levels for free recall is α = .05/4 = .013)*

STUDENT PARTNER									
	SELECTIVE FORGETTING			**MISATTRIBUTION**			**FACT DISTORTION**		
DELAY	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**
2 MIN	0.019 0.139	0.077 0.436	-1.352 51 .091	0.327 0.513	0.327 0.475	-0.000 51 .500	1.250 0.883	1.173 1.108	0.599 51 .276
20 MIN	0.039 0.196	0.039 0.196	-0.000 50 .500	0.372 0.528	0.431 0.608	-0.596 50 .277	1.216 0.986	1.098 1.025	0.759 50 .225
2 DAYS	0.227 0.522	0.159 0.479	1.138 43 .130	0.659 0.644	0.545 0.663	0.797 43 .215	**1.909** **1.235**	**1.432** **0.846**	**3.029** **43** **.002**
Overall	0.088 0.329	0.888 0.387	0.000 146 .500	0.442 0.574	0.428 0.585	0.212 146 .416	**1.435** **1.073**	**1.224** **0.999**	**2.470** **146** **.007**

ROOM									
	SELECTIVE FORGETTING			MISATTRIBUTION			FACT DISTORTION		
DELAY	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**	**CS Mean SD**	**NCS Mean SD**	**Paired t-test df p**
2 MIN	0.020 0.141	0.200 0.141	-0.000 49 .500	0.220 0.418	0.280 0.497	-0.622 49 .268	0.780 0.764	0.720 0.904	0.535 49 .297
20 MIN	0.083 0.347	0.021 0.144	1.137 47 .131	0.313 0.589	0.458 0.582	-1.188 47 .120	0.875 0.890	0.917 0.871	-0.313 47 .377
2 DAYS	0.119 0.395	0.167 0.437	-0.573 41 .285	0.452 0.593	0.524 0.594	-0.518 41 .304	1.786 1.094	1.595 1.170	0.870 41 .194
Overall	0.071 0.309	0.064 0.274	0.217 139 .414	0.321 0.540	0.414 0.562	-1.367 139 .087	1.114 1.011	1.050 1.041	0.722 139 .236

RESTAURANT									
	SELECTIVE FORGETTING			MISATTRIBUTION			FACT DISTORTION		
DELAY	CS Mean SD	NCS Mean SD	Paired t-test df p	CS Mean SD	NCS Mean SD	Paired t-test df p	CS Mean SD	NCS Mean SD	Paired t-test df p
2 MIN	0.060 0.240	0.020 0.141	1.429 49 .079	0.580 0.642	0.660 0.593	-0.663 49 .260	1.660 1.171	1.480 1.199	0.903 49 .185
20 MIN	0.120 0.328	0.100 0.364	0.330 49 .371	0.620 0.530	0.620 0.667	0.000 49 .500	1.720 1.213	1.480 0.909	1.409 49 .082
2 DAYS	0.216 0.630	0.108 0.315	1.071 36 .145	0.784 0.821	0.622 0.794	0.902 36 .186	1.919 1.362	2.514 1.170	-2.227 36 .016
Overall	0.124 0.410	0.073 0.288	1.405 136 .081	0.650 0.660	0.635 0.674	0.185 136 .426	1.752 1.235	1.759 1.179	-0.059 136 .476

ENTERTAINMENT BUNDLE									
	SELECTIVE FORGETTING			MISATTRIBUTION			FACT DISTORTION		
DELAY	CS Mean SD	NCS Mean SD	Paired t-test df p	CS Mean SD	NCS Mean SD	Paired t-test df p	CS Mean SD	NCS Mean SD	Paired t-test df p
2 MIN	0.174 0.529	0.087 0.354	0.892 45 .188	0.370 0.645	0.587 0.805	-1.201 45 .118	1.783 1.094	1.761 1.099	0.119 45 .453
20 MIN	0.170 0.433	0.234 0.598	-0.724 46 .236	0.319 0.629	0.681 0.810	-2.121 46 .019	1.702 1.178	1.574 1.037	0.643 46 .261
2 DAYS	0.105 0.338	0.158 0.370	-0.627 37 .267	0.421 0.683	0.553 0.795	-0.695 37 .245	2.132 1.298	2.053 0.985	0.329 37 .744
Overall	0.153 0.455	0.160 0.461	-0.145 130 .442	**0.366** **0.647**	**0.611** **0.800**	**-2.362** **130** **.010**	1.855 1.190	1.779 1.055	0.650 130 .258

GYM PACKAGE									
	SELECTIVE FORGETTING			MISATTRIBUTION			FACT DISTORTION		
DELAY	CS Mean SD	NCS Mean SD	Paired t-test df p	CS Mean SD	NCS Mean SD	Paired t-test df p	CS Mean SD	NCS Mean SD	Paired t-test df p
2 MIN	0.039 0.196	0.039 0.196	0.000 50 .500	0.274 0.451	0.235 0.428	0.573 50 .284	1.294 1.045	1.333 1.033	-0.321 50 .374
20 MIN	0.100 0.303	0.100 0.364	0.000 49 .500	0.260 0.527	0.280 0.536	-0.275 49 .392	1.380 0.966	1.440 1.013	-0.622 49 .268
2 DAYS	0.121 0.545	0.121 0.331	0.000 32 .500	0.515 0.755	0.788 0.781	-1.955 32 .029	2.485 1.176	2.364 1.055	0.571 32 .285
Overall	0.082 0.348	0.082 0.302	0.000 133 .500	0.328 0.572	0.388 0.612	-1.156 133 .125	1.619 1.155	1.627 1.108	-0.095 133 .462

2.3.6 Summary of findings on choice-supportiveness

Table 2.17 shows the overall picture of the results in relation to choice-supportiveness in the four different types of misremembering and the three types of memory tests.

Table 2.17: *Summary of choice-supportiveness in the four different types of misremembering and three types of memory tests*

TEST of CHOICE-SUPPORTIVENESS	SELECTIVE FORGETTING	MISATTRIBUTION	FALSE MEMORY	FACT DISTORTION
ANOVA free recall	No significant effect of CS	No significant effect of CS	No significant effect of CS	No significant effect of CS
ANOVA cued recall	No significant effect of CS	No significant effect of CS	NA	No significant effect of CS
McNemar test free recall	No CS overall trend	No CS overall trend	No CS overall trend	No CS overall trend
McNemar test cued recall	No CS overall trend	No CS overall trend	NA	No CS overall trend
Paired-t-test free recall	No CS overall trend	No CS overall trend	No CS overall trend	No CS overall trend
Paired-t-test cued recall	No CS overall trend	No CS overall trend	NA	No CS overall trend

The findings show no evidence for a general choice-supportiveness trend, but instead occasional McNemar or t-tests running for or against the hypotheses in a nonsystematic pattern (see above). This holds both for free and cued recall, and despite the clear and converging evidence for the existence of all the four types of misremembering hypothesized.

The sample size was computed for a mixed Anova, with an a-priori power of .80 for a medium effect size on choice-supportiveness (f = .25), alpha = .05. The overall number of participants needed was 78. We had also computed the sample size for a paired t-test (two-tailed) with an a-priori power of .80 for a medium effect size on choice-supportiveness (dz = .50), alpha = .05. Again, taking into account the repeated measures provided by the multiple scenarios, the number of participants needed was 34 per delay level. Thus, we recruited approximately 50 participants per condition.

However, in order to exclude the risk that choice-supportiveness went undetected due to low power of the single tests and missing data, we combined the probabilities of the overall (i.e., all the delays pooled) paired t-tests in free recall over the five scenarios using Fisher's method, and we did this separately for each kind of misremembering. Total sample size over the five scenarios in this case is n = 688, and the findings are summarized in Table 2.18. As shown in the table, there is no evidence of significant choice-supportiveness for any kind of distortion. The power for the combined sample size is 1 for a moderate effect size (.40) and .99 for a small effect size (.20) if computed as for a paired t-test on the total sample size. If the power is computed as for a meta-analysis with low heterogeneity (Valentine, Pigott, & Rothstein, 2010), it is 1 for a moderate effect size (.40), and .89 for a small effect size (.20).

Table 2.18: *Combined probabilities of the overall paired t-test for each kind of misremembering in free recall over the five scenarios, using the Fisher's method*

	Fisher's X^2	**df**	**Combined prob.**
SELECTIVE FORGETTING	12,549	10	0,250
MISATTRIBUTION	5,423	10	0,861
FALSE MEMORY	9,774	10	0,461
FACT DISTORTION	15,327	10	0,121

2.4 Discussion

In this experiment, we hoped to investigate the effects of delay and individual differences on memory choice-supportiveness. Due to the lack of a main choice-supportive effect, we were not able to do so, or to assess whether such distortions occur mainly at encoding, consolidation or retrieval. However, our findings nonetheless provided insight into the nature of memory errors after decision making, their potential origins, and the robustness of the choice-supportive memory phenomenon.

As expected, we found that the memory for option information worsened significantly over time. Correct recall after a 2- and a 20-minute delay was significantly better than after a 2-day delay. Likewise, we observed more commission and omission errors after 2 days in free recall than after a 20-minute or a 2-minute delay. This finding – albeit expected – adds to the available evidence with implications for memory-based and mixed choices. Any choice that is made or recalled after a rather long delay is likely to be affected by that passage of time due to forgetting and distortions of the information regarding the options. Previous research has shown that the overall evaluations of facts can both be retrieved and used separately from those facts and are, indeed, more durable in memory than the original facts themselves (e.g., Hastie & Park, 1986; Lynch, Jr., Marmorstein, & Weigold, 1988). Furthermore, Wirtz, Kruger, Scollon, & Diener (2003) found that the willingness to repeat a past enterprise is more dependent on the memory of the experience rather than on how it was perceived at the time. This was confirmed by Stragà, Del Missier, Marcatto, & Ferrante (2017), who also showed that two separate memory sources contribute in distinct manners to future intentions (see also Hastie & Park, 1986).

The recall problems were likely partly due to reduced accessibility at retrieval, as evidenced by the deterioration with time and the fact that there was an improvement when the attribute names were provided as cues. This provides a valuable hint for those trying to develop methods of decision support: attribute names could form the basis of an effective recall strategy. Perhaps it might even be useful to attempt to retrieve the choice attributes first and then their values, rather than simply trying to bring all remembered information of the options to mind. This, however, would need to be experimentally tested before determining its usefulness.

Considering that we found some forgetting and errors even after a short delay - and that some errors persisted even with attribute cues - recall problems could depend on encoding factors, as well. In this experiment, we did not include a recognition test and we can therefore not determine whether this was mainly an availability or accessibility issue. Nonetheless, considering that even the cued recall did not yield perfect scores after a short delay, our results indicate that some information may not have been successfully encoded. Possibly, this could be due to how this kind of decision is made: when the attributes are the same – only differing in the individual values of each one – it may be likely to trigger a strategy whereby the participant first decides which attributes are the most important, and then merely compares the values on those, weighing the attributes according to that importance ranking. The focus would be on which option has the most advantageous value on each important attribute rather than on each option considered as a whole, or on the precise values, which would then quickly be forgotten. Indeed, mere comparatives occurred in the free recall. For example, in some instances the participants wrote that the option was better or worse than the alternative on the remembered attributes rather than providing the actual values, despite explicit instructions to be precise.

It should also be mentioned that choice-supportive memory has previously been hypothesized to be more due to bias at retrieval than at encoding (e.g., Mather & Johnson, 2000; Mather et al., 2000). Likewise, other phenomena that share characteristics with it, such as wishful thinking effects (distorting memories to create source reliability - Gordon, Franklin, & Beck, 2005) and schema-based halo/devil effects (Cook, Marsh, & Hicks, 2003) have also been found to originate not in the encoding phase, but during retrieval of the information. Thus, imperfect encoding may in itself limit or prevent these kinds of effects.

The evidence from this experiment fully supported the new taxonomy of misremembering. Indeed, all four different types of misremembering were observed at all delay levels. As predicted, false memories were the least common, but in three of the five scenarios, they were present even after the shortest delay, and their occurrence increased with time. However, despite the high statistical power of the tests, we found no evidence of choice-supportive memory in this ecological standard choice context with alignable items, tabular presentation and free and cued recall. In this regard, our findings were similar to those of Depping & Freund (2013), indicating that it may be an overgeneralization to state that we remember chosen options as better than they were and not chosen ones as worse than they were. It appears justified to point out the need to determine when this effect is likely to occur and then acknowledge those boundaries. Clearly, the robustness of the phenomenon should be further appraised with memory tests other than source recognition of verbal unalignable features to reveal the origin and the conditions needed for the effect.

Chapter 3: Experiment 2

3.1 Introduction and aims

In our first experiment, we found no tendency of choice-supportive misremembering when using six short, alignable items describing each option in binary choice scenarios, and testing memory with free and cued recall. This provided further evidence that certain conditions are necessary for the effect to occur. In our next experiment, we therefore wanted to investigate which those conditions might be. Since the effect had been absent in earlier studies testing memory only with free recall, the methods used to test memory could be an influential factor. Alternatively - or additionally - the presentation format of the scenarios and options could play a crucial role. If memory choice-supportiveness stems from gist-based encoding, consolidation and retrieval of the information, facts that are not perceived as a coherent narrative may be processed in a way that protects from this bias. To test this hypothesis and investigate which conditions are needed for a choice-supportive misremembering effect, we designed an experiment with the option information presented in four different configurations.

3.1.1 Hypotheses

Our main hypothesis was based on the findings in our critical literature review (Lind, Visentini, Mäntylä, & Del Missier, 2017, *Chapter 1* of this thesis) and our first experiment: since many studies - including our own with short, alignable items - failed to find a choice-supportive tendency, it appears that certain conditions are needed for the effect. In turn, those conditions might induce schema- or gist-based processing, without which there would be no such tendency. If any choice-supportive memory effects are the result of having constructed a schema according to which the chosen option is not only distinct from the alternative in terms of the general idea of what that kind of option would include (e.g., when having chosen between a wilderness and a beach holiday, most people might be more likely to attribute the item 'crowded' to the beach version even if the item had been entirely forgotten), but also as being the preferred option. If the participant has chosen a specific option and then forgotten what it involved, she might still have a general idea of that option being better, merely based on the fact that she chose it. Consequently, she might be more inclined to attribute positive items to that option rather than to the foregone option. If this is an important reason behind choice-supportiveness observations, we hypothesized that a more 'narrative' presentation of the options would enhance choice-supportive misremembering.

Since our 'nonalignable' versions did not include corresponding items in the same dimensions in the two options, we hypothesized that they would make it more likely that the participant would form a general idea of each option and base their decision on the attractiveness of that general idea rather than compare item by item (Item 1 from A vs. Item 1 from B, Item 2 from A vs. Item 2 from B, etc.) and then choose the option that contained the largest amount of positive items (or the items that seemed most appealing, but ignoring any overarching general idea of the option). Likewise, we expected our 'narrative' versions (displaying the items of each option in blocks of text, with B underneath A) to produce more choice-supportiveness than our 'list' versions (displaying the items of the options in lists, with B to the right of A). Thus, we expected the most choice-supportiveness for the nonalignable version presented as a 'narrative'.

We also speculated that stronger effects would be seen in source recognition memory tests than in cued and free recall, with free recall yielding the least choice-supportive memory bias. The rationale behind this hypothesis was partly that our literature review showed strong support for choice-supportive memory from experiments where source recognition was used as the memory test, but insufficient evidence from free recall studies, and that our own first experiment – in which we used only free and cued recall memory tests – also did not yield any choice-supportiveness. Thus, we hypothesized that part of the gist or schema that remained in memory consisted of the general idea of superiority of the chosen option, and that it may have been strong enough to produce choice-supportive effects in recognition, but too weak to distort free recall. As suggested by the Source Monitoring Framework mentioned in *Chapter 1,* uncertain sources are subjected to a cue-based reconstruction at the time of retrieval. This implies that people generally attribute memories to the option for which it is most characteristic (Johnson et al., 1993). In addition to being in line (in this context) with both gist- and schema-based processing, this is similar to a *satisfying* search strategy (Simon, 1956) or *System I* thinking (Kahneman, 2011) requiring a minimum amount of effort. Both of these describe strategies whereby the first logical answer that comes to mind is accepted. In cases where the item is not particularly characteristic of either option, other heuristics may be used. Since they have chosen their preferred option, a rudimentary heuristic may be that the chosen option is the best.

If explained by a signal detection theory, there is no cost of answering that most of the positives belong to the chosen and the probability that they actually do should be higher than the reverse, since that option was chosen. In source recognition tests, participants normally has to tick whether the item belonged to the chosen, the nonchosen or none, whereas in free recall tests, the likelihood of participants guessing is lower. Finally, we expected to find all four types of choice-supportive memory manifestations: misattribution, false memory, fact distortion and selective forgetting, but that misattributions and false memories would be rare in free recall.

It is worth mentioning here that although we included diverse scenarios designed to represent high importance/positive valence, low importance/positive valence, high importance/negative valence and low importance/negative valence, we did not form any specific hypotheses regarding the differences in effect between the scenarios. Our literature review did not provide evidence of perceived importance or valence affecting choice-supportiveness, but we wanted to use diverse scenarios to cover as wide a range of choices as possible.

3.2 Method

3.2.1 Participants

We computed the sample size for a mixed Anova, with an a-priori power of .80 for a medium effect size on choice-supportiveness (f = .25), alpha = .05. Considering the repeated measurements (scenarios), the number of participants needed was 82 overall. Thus, we recruited a total of 100 participants, aged 19 – 45 years at the Department of Psychology at Stockholm University, Sweden, and online. 56 of the participants were undergraduate Psychology students compensated with course credits, and 44 were recruited online, compensated with a cinema ticket. Of those recruited online, 30 also completed the study online at home (or elsewhere) and the remaining 14 in the university laboratory. 55 of the Psychology students completed the study in the university laboratory and 1 at home. 4 of the Psychology students were excluded because of their age (above 45 years). Two additional Psychology students and one non-Psychology participant were excluded for not completing the study according to the instructions. This yielded a total of 50 Psychology undergraduate participants and 43 other participants. Out of these, one Psychology student and 26 others completed the survey outside the laboratory (e.g., at home). 5 participants (2 Psychology students, 3 others) failed to remember one of their choices. They were excluded only for the forgotten scenario. One participant completing from home only completed two scenarios due to an IT issue.

3.2.2 Design

The design was a 2 (alignability) x 2 (presentation format) x 4 (scenario) mixed design. Alignability and format were manipulated between-subjects and scenario within subjects by creating four different sets of materials, in which each choice scenario was presented as (1) alignable list, (2) nonalignable list, (3) alignable narrative, and (4) nonalignable narrative. All four scenarios were presented to each participant. The experiment involved three main phases: (1) presentation of each scenario and choice between the binary options, (2) fillers, and (3) free recall, then cued recall followed by a source recognition test for each scenario. The order of the scenarios was randomized for each participant, but presented in the same order in the first and the third stage.

3.2.3 Materials

The study was computer-based and run online using Qualtrics. As mentioned, the majority of the participants completed the survey in the laboratory at Stockholm University, Sweden. The survey was written in Swedish, but translated into English and therefore available in both languages. Four of the participants completed the survey in English and all others in Swedish. Four different scenarios were presented to the participants, who were asked to make binary choices for each one. The order of the scenarios was randomized and participants were randomized to complete one of the four versions of the survey, with each participant completing all four scenarios (except for the participant who was unable to access two of the scenarios). Each option contained 12 items, one out of which was identical for the two options. Any qualifiers (e.g., ‘somewhat’, ‘a bit’) were balanced between the two options and each option contained six positive and six negative items. The perceived valence had been tested in pilot studies and the present survey also included a section where the participants had to sort all items according to how positive/negative they felt they were.

We presented the four different scenarios and options in four different formats. These versions were alignable list, nonalignable list, alignable narrative and nonalignable narrative. ‘List’ and ‘narrative’ refer to how the options were presented: in a list with A on the right and B on the left with each item listed underneath each other, or in a manner that more resembles a narrative: A above B with the items presented in a block of text with each item separated from the next with a full stop. ‘Alignable’ refers to options containing items with a corresponding item on the same dimension in the other option (e.g., if A states ‘Expensive’, B might state ‘Cheap’). In the ‘nonalignable’ versions, on the other hand, for each item included, there was no corresponding item in the other option. For example, the first item in the *Glass* scenario in the alignable versions reads ‘Very economical’ for A and ‘Offer no economical option’ for B. In the nonalignable versions, the first item in B is unchanged, but the one in A reads ‘You have heard their glass is durable’. Please see the appendices for the English translation of the four versions of the scenarios.

The free recall test consisted of empty boxes where the participants were asked to enter as much information about each option as they could remember, and the cued recall tests listed four sentences from the options, with the numeric values left blank. Those were the only numeric values amongst the option items, and participants had to fill in those numbers in the cued recall test. Finally, the source recognition test included all the items describing the scenarios – except those tested in the cued recall – as well as 10 lures. Half of the lures were positive and half negative. One positive and one negative lure were designed to be consistent with the gist of each option (i.e., 4 out of 10 lures).

3.2.4 Procedure

Before the study, the participants were informed about the general procedure, but not that the study would include memory tests. They were told that they would make choices between different alternatives and the survey was referred to as ‘a preference survey’. Their participation was voluntary and they were informed that they could withdraw at any time. After signing the informed consent form, they completed the survey online – in the university laboratory or at home (see the *Participants* section for proportions of participants completing at home and in the laboratory). Those participating at home agreed to complete the survey undisturbed and without distractions, and all participants were given the opportunity to ask questions about the study before, during and after participation.

The surveys were divided into three sections: the encoding phase (reading the scenarios and options, and making the choices), the consolidation phase (fillers), and the retrieval phase (free recall, cued recall and source recognition). In the first section, the participants were given 2½ minutes to make each choice and were then automatically sent forward in the survey. After each choice, they were asked two quick questions: how important and how engaging the choice had felt. Once all the choices had been made and the two quick questions had been answered for each one, the participants reached the second section. The fillers – with questions about nutrition - lasted 10 minutes. After each separate part of the fillers, the participants were automatically sent forward. Thus, they were not able to spend more or less time than 10 minutes on the fillers. After that came the memory tests with free recall followed by cued recall and then recognition. The minimum delay between the presentation of the scenarios and options, and the free recall, was 22 minutes. For the scenarios that were not randomized to be presented first, the delay was longer, as the time of the previous memory tests added to the delay. For the free recall, the participants were first asked which option they had chosen. As mentioned, there were five occasions of a participant not remembering their choice correctly, and their memory tests were not scored for the scenario in question. The following text was displayed before each free recall test: 'Please think carefully and write down everything you remember about the features of your chosen [/the alternative (not chosen)] LUNCH RESTAURANT [/ SURGERY / GLASS REPAIR / HOLIDAY DESTINATION] option. Be as precise and specific as possible. You are automatically sent to the next page when time is up.' After two minutes, the subsequent page was displayed. For the cued recall part, which consisted of the four sentences from the scenarios with the numbers removed, the participants chose themselves when to move forward. The sentences had the name of the option from which it was taken in parenthesis and italics, e.g., 'Including ordering, being served takes on average [?] min. *(The Bluebell)*', and the missing number had to be completed in the space provided. In the recognition part, the participant had to tick whether the item belonged to their chosen option, the alternative (not chosen) option, both or was not presented at all. If more than one box was ticked for any other item than the item that formed part of both options, it was counted as a missing value. Once finished, the participant clicked to proceed to the next page.

The memory tests were followed by questions relating to ranking of the items and values to enable the scorer to judge whether any fact distortions of values presented were made in a choice-supportive direction (i.e., whether the participant felt that a higher/lower value for each number presented made the option more or less attractive), and to see whether item importance affected the rate of choice-supportiveness for each item.

After completion of the survey, which took approximately 1 hour and 10 minutes, all participants were thoroughly informed about the purpose of the study and were given either course credits (for the Psychology undergraduates) or a cinema ticket (for all others).

3.2.5 Scoring procedures

The memory errors and omissions were categorized according to the taxonomy presented in Lind et al. (2017), reproduced in *Chapter 1* of this thesis, and following the same guidelines as in Experiment 1. For an illustration of the taxonomy, see *Figure 1*, page 18 of this thesis.

An error was classified as a misattribution when the item itself was correctly remembered, but it was attributed to the wrong option. For example, if option A contained the item 'Near the beach' and the participant entered this as an item belonging to B, this was scored as a misattribution. If an item was remembered, but its value was distorted in a way that changed its attractiveness, this counted as a fact distortion. For example, the original sentence might have been that only four different meals were served in the restaurant, but it was remembered as six different meals. To judge whether a fact distortion was choice-supportive or not, we looked at a section in the survey where each participant had ranked the original sentence along with two more sentences, identical to the first except that one had a higher value and the other one a lower value. If the participant had ranked a higher value as more beneficial than a lower, the misremembering in the example would be choice-supportive if belonging to the chosen option (and choice-opposing if belonging to the alternative option).

False memories were any items 'remembered', but not presented in the original scenarios. The recognition test contained 10 lures for each scenario, and if any of these were attributed to one of the options, this was scored as a false memory (in line with earlier studies in the field, e.g., Mather, Knight, & McCaffrey, 2005). Using the same logic in the free recall, any items belonging to options in one of the other three scenarios presented were scored as false memories, but those that belonged to the other option in the same scenario was scored as misattributions. As in Experiment 1, where synonyms were remembered instead of the actual word(s) used, they were scored as correct answers.

Choice-supportive selective forgetting is when beneficial items from the nonchosen option and undesired items from the chosen option are forgotten rather than the other way around (which would constitute choice-opposing selective forgetting). An extreme case of choice-supportive selective forgetting in free recall would be if a participant remembers all the positive items describing their chosen option and all the negative items describing the foregone option, and none of the other items. The section where the participant had rated the valence of each item was used to determine whether an item was positive or negative. In the free recall, each positive item that was forgotten from the non-chosen option and each negative item that was forgotten from the chosen option counted as choice-supportively selectively forgotten. Forgetting of negative items from the non-chosen option and positive items from the chosen option was scored as non-choice-supportively selectively forgotten. In the cued recall, only entries completed with '0', 'don't know' or '?' counted as forgotten, and in the source recognition test, ticking the box 'not presented' for an item that had indeed been presented was interpreted as an instance of selective forgetting. The direction of the selective forgetting in the cued recall and source recognition was calculated in the same way as in the free recall.

The first author scored the responses of all participants in all tests, using a purpose-made template for the recognition test to avoid errors. For the free recall, an independent rater was trained and subsequently scored 10% of the responses.[7] Inter-rater reliability was .85 (Cohen's kappa) and the debated cases were resolved after a joint discussion.

3.3 Results

3.3.1 Descriptive statistics on choice shares, scenario evaluation and choice misremembering

Choice shares were reasonably balanced in all the scenarios, except the *Lunch* one. In the *Lunch* scenario the shares were .85 vs. .15, in the *Glass* scenario .29 vs. .71, in the *Holiday* scenario .57 vs. .43, and in the *Surgery* scenario .51 vs. .49.

[7] Sincere thanks to Anna-Maria Tuomiluoma for her contribution as independent rater.

The *Lunch* scenario received average ratings (on five-point scales) for what concerns difficulty of choice (2.656) and engagement (2.667). Only 2% of the initial sample (2 cases out of 96) misremembered the choice they made in this scenario. Similar figures were observed for the *Glass* scenario (difficulty = 2.758; engagement = 2.568; 3% misremembering of the initial sample - 3 cases out of 96). The *Holiday* scenario was perceived as slightly more involving (difficulty = 2.811; engagement = 2.842; 3% misremembering of the initial sample - 3 cases out of 96) as was the *Surgery* scenario (difficulty = 2.074; engagement = 2.947; 3% misremembering of the initial sample - 3 cases out of 96).

The few cases in which participants misremembered their choices as well as the cases in which they did not answer any question for a given scenario were excluded from the following analyses (on a scenario by scenario basis).

3.3.2 Accuracy in recall and recognition tests

As shown in Table 3.1, accuracy was lower in free recall than in recognition with cued recall falling in-between, reproducing a typical pattern in memory research. There were much more omission than commission errors in free recall (indeed a low percentage of commission errors). Generally, accuracy was rather low in free recall, but this is reasonable considering the delay between choice and recall and the interference from information belonging to other scenarios, as well as the large amount of information to be remembered. This may have been related more to retrieval processes than to encoding processes, given the high accuracy of recognition tests.

Results are consistent across scenarios, showing highly similar percentages of accurate responses and errors. The relatively low accuracy in free recall may have reduced the possibility to observe misremembering occurrences (other than selective forgetting) with this type of test and, as a consequence, choice-supportiveness. Therefore, the findings presented in the next paragraphs may need to be considered as conservative estimates (i.e., running against the choice-supportiveness hypotheses).

Table 3.1: *Accuracy and errors (proportions) for the different memory tests and scenarios*

LUNCH SCENARIO								
FREE RECALL (n = 93)			**CUED RECALL (n = 92)**			**RECOGNITION (n = 92)**		
Correct recall	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**
.269	.095	.636	.652	.329	.019	.836	.104	.060

GLASS SCENARIO								
FREE RECALL (n = 87)			**CUED RECALL (n = 85)**			**RECOGNITION (n = 87)**		
Correct recall	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**
.308	.050	.642	.621	.353	.026	.823	.126	.051

HOLIDAY SCENARIO								
FREE RECALL (n = 90)			**CUED RECALL (n = 90)**			**RECOGNITION (n = 90)**		
Correct recall	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**
.358	.047	.595	.522	.433	.044	.856	.082	.062

SURGERY SCENARIO								
FREE RECALL (n = 88)			**CUED RECALL (n = 88)**			**RECOGNITION (n = 88)**		
Correct recall	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**	**Correct recall**	**Commission errors**	**Omission errors**
.278	.059	.580	.557	.395	.048	.826	.127	.047

3.3.3 ANOVAs on accuracy and errors

A series of 2 x 2 x 4 mixed ANOVAs was carried out on accuracy measures and commission/omission errors for the various memory tests and considering as factors:

1) Alignability (alignable attributes/nonalignable attributes) - between-subjects

2) Format (narrative/list) - between-subjects

3) Scenario (*Lunch*, *Glass*, *Holiday*, *Surgery*) - within subjects

The 2 x 2 x 4 mixed ANOVA was repeated for the three different types of tests and the results will be presented accordingly. Missing data was treated with case wise exclusion due to a repeated measure variable (consequently, the means in the following analyses may slightly differ from the means reported in Table 3.1, based on all the available cases for each scenario).

3.3.3.1 Free recall

For what concerns accuracy (proportion correct) in the free recall test, the ANOVA highlighted a main effect of alignability ($F(1,77) = 4.118$, $Mse = .051$, $p = .046$, $\eta^2 = .05$), with slightly better accuracy in alignable conditions vs. nonalignable ones ($M_{align} = .33$, $M_{nonalign} = .28$). The main effect of the scenario was also significant ($F(3,231) = 15.637$, $Mse = .008$, $p < .001$, $\eta^2 = .17$), with recall accuracy in the *Holiday* scenario being slightly better than accuracy in the other scenarios (.36 vs. .31 or lower, HSD all $p < .001$). The main effect of the presentation format (narrative vs. list) and all the interactions were not significant.

The ANOVA on the proportion of commission errors highlighted main effects of alignability ($F(1,77) = 10.350$, $Mse = .004$, $p = .001$, $\eta^2 = .12$), with slightly more errors in the alignable conditions $M_{align} = .07$, $M_{nonalign} = .05$), and format ($F(1,77) = 4.540$, $Mse = .004$, $p = .036$, $\eta^2 = .06$), with slightly more errors in conditions with the list vs. the narrative format ($M_{list} = .07$ $M_{narrative} = .06$). Also the main effect of the scenario was significant ($F(3,231) = 19.703$, $Mse = .002$, $p<.001$, $\eta^2 = .20$), with the *Lunch* scenario being associated with more commission errors (.10 vs. .06 or lower, HSD all $p < .001$), as well as two interactions, the first between alignability and format ($F(1,77) = 6.487$, $Mse = .004$, $p = .013$, $\eta^2 = .08$) and the second between alignability and scenario ($F(3,231) = 11.572$, $Mse = .002$, $p < .001$, $\eta^2 = .13$). These interactions showed in particular slightly more commissions in alignable list format vs. the other conditions (.09 vs.

.06 or lower, HSD all $p < .01$ or lower), and more commissions in alignable conditions, especially in the *Lunch* scenario (.13 vs. .07 or lower, all $p < .001$).

The ANOVA on the proportion of omission errors highlighted main effects of alignability ($F(1,77) = 6.643$, $Mse = .064$, $p = .012$, $\eta^2 = .08$), with more forgetting in the nonalignable conditions $M_{align} = .57$, $M_{nonalign} = .64$), and format ($F(1,77,) = 5.047$, $Mse = .064$, $p = .027$, $\eta^2 = .06$), with more forgetting in conditions with the narrative format vs. the list format ($M_{list} = .58$ $M_{narrative} = .64$). The main effect of the scenario was also significant ($F(3,231) = 9.919$, $Mse = .009$, $p<.001$, $\eta^2 = .11$), with more omissions in *Lunch* and *Glass* scenarios vs. *Holiday* and *Surgery* ones (.62 and .64 vs. .59 and .57, respectively, HSD $p < .01$ and lower for *Surgery* vs. *Lunch*, *Surgery* vs. *Glass*, *Holiday* vs. *Glass*). No interaction was significant.

3.3.3.2 Cued recall

For what concerns accuracy (number of correct responses) in the cued recall test, the ANOVA highlighted a main effect of alignability ($F(1,75) = 4.480$, $Mse = 2.374$, $p = .038$, $\eta^2 = .06$), with slightly better accuracy in nonalignable conditions vs. alignable ones ($M_{align} = .2.139$, $M_{nonalign} = 2.506$). The main effect of the presentation format was nonsignificant while the main effect of the scenario was significant ($F(3,225) = 5.985$, $Mse = .785$, $p<.001$, $\eta^2 = .07$), with the *Lunch* and the *Glass* scenario showing more correct responses than the *Holiday* scenario (2.585 and 2.456 vs. 2.039, HSD $p <. 01$, $p < .05$). The ANOVA on the number of commission errors highlighted only the main effect of the scenario ($F(3,225) = 4.036$, $Mse = .801$, $p = .008$, $\eta^2 = .05$), with the *Lunch* scenario being associated with fewer commission errors than the *Holiday* one (1.326 vs. 1.799, $p = .010$). The ANOVA on the very small number of omission errors did not highlight significant effects.

3.3.3.3 Recognition

The ANOVA on the proportion of correct recognition (correct source attributions: hits and correct rejections) did not highlight a main effect of alignability, nor any significant interaction. However, both the main effect of the presentation format ($F(1,77,) = 4.416$, $Mse = .037$, $p = .039$, $\eta^2 = .05$) and the main effect of the scenario ($F(3,231) = 3.930$, $Mse = 0.006$, $p = .001$, $\eta^2 = .05$) were significant, with a slightly better performance in the list format conditions ($M_{list} = .860$, $M_{narrative} = .815$) and slight variations in accuracy across scenarios (with *Holiday* and

Lunch, .86. and .85, better than *Glass* and *Surgery*, .82 and .83, and *Holiday* and *Glass* differing at HSD test: $p = .014$).

The ANOVA on the proportion of commission errors in recognition (false alarms) showed only a significant main effect of the scenario ($F(3,231) = 3.600$, $Mse = 0.001$, $p = .014$, $\eta^2 = .04$) and one interaction between alignability and scenario ($F(3,231) = 7.436$, $Mse = 0.001$, $p = .001$, $\eta^2 = .09$), with more commission errors in the alignable vs. nonalignable conditions, in particular in *Lunch* scenario (HSD $p = .037$ for the *Lunch* scenario).

The ANOVA on the proportion of omission errors in recognition (misses) highlighted main effects of the presentation format ($F(1,77) = 5.829$, $Mse=.019$, $p = .018$, $\eta^2 = .07$), with slightly more forgetting in the narrative format ($M_{list} = .091$ $M_{narrative} = .128$) and of the scenario ($F(3,231) = 10.981$, $Mse = .004$, $p<.001$, $\eta^2 = .12$), with more omissions in the *Glass* and *Surgery* scenarios (vs. the others HSD p at least $< .05$), and a significant interaction between alignability and scenario ($F(3,231) = 3.252$, $Mse = .004$, $p = .022$, $\eta^2 = .04$) not resisting in post hoc tests.

3.3.3.4 Summary

To summarize the results of the analyses on accuracy in free recall, it can be stated that participants were slightly more accurate when information was presented in alignable formats, but they also made more commission errors when the information was alignable or presented in a list format, which appear to make items easier to encode and recall, but also more likely to be confused. Omission errors were higher in nonalignable and narrative formats, which possibly make information slightly harder to encode and remember. There was also some variation across scenarios, with the *Holiday* scenario remembered better and the *Lunch* scenario (the less balanced one) associated with lower recall. Possibly, less balance made the decision easier and as shown by Jacoby, Craik, & Begg (1979), memory tends to be better after difficult decisions. In cued recall, when the attributes were used as a cue, there was better recall in nonalignable conditions, possibly due to the lower confusability of items in these conditions vs. the alignable ones, and again scenario-related variation. In recognition, more accuracy and fewer omissions were observed with the list format, together with variation across scenarios, suggesting a possible influence of the presentation layout. Generally speaking, the effect sizes were small, thus showing that the manipulated variables had not a very strong effect on correct recall and errors, regardless of the test used.

3.3.4 ANOVAs on misremembering occurrences

A series of 2 x 2 x 2 x 4 mixed ANOVAs were carried out on the number of misremembering occurrences per participant and considering as factors:

1) choice-supportiveness (vs. non choice-supportiveness) - within-subjects
2) alignability - between-subjects
3) format (narrative/list) - between-subjects
4) scenario (*Lunch*, *Glass*, *Holiday*, *Surgery*) - within subjects

This 2 x 2 x 2 x 4 mixed ANOVA was repeated for the four different kinds of misremembering and for the three different types of tests. Missing data was treated with case wise exclusion due to a repeated measure variable

3.3.4.1 Free recall

The ANOVA on selective forgetting occurrences highlighted main effects of choice-supportiveness, alignability, presentation format, and scenario but no significant interactions. Table 3.2 presents the significant effects.

Table 3.2: *Significant effects for selective forgetting in free recall*

Effect	F (df)	Mse	p	η^2	Means
Choice-supportiveness	F(1, 77) = 23.713	3.52	p < .001	.23	CS = 7.196 NCS = 6.477
Alignability	F(1, 77) = 6.738	15.95	p = .011	.08	ALIGN = 6.428 NONAL = 7.245
Format	F(1, 77) = 5.074	15.95	p = .027	.06	LIST = 6.482 NARR = 7.191
Scenario	F(3, 231) = 4.469	3.35	p = .004	.05	LUNCH = 6.895 GLASS = 7.079 HOLIDAY = 6.491 SURGERY = 6.882

The ANOVA on misattributions showed only the main effect of alignability, and an interaction between choice-supportiveness and alignability, with choice-supportiveness in the nonalignable condition (HSD p = .049) but not in the alignable one (HSD p = .427). Table 3.3 reports the significant effects.

Table 3.3: *Significant effects for misattributions in free recall*

Effect	F (df)	Mse	p	η^2	Means
Alignability	F(1, 77) = 4.530	.057	p = .036	.06	ALIGN = 0.013 NONAL = 0.053
Choice-supportiveness × alignability	F(1, 77) = 8.956	.021	p = .004	.10	ALIGN CS = 0.000 ALIGN NCS = 0.026 NONAL CS = 0.074 NONAL NCS = 0.031

The ANOVA on false memories highlighted the main effect of choice-supportiveness, and a three-way interaction between choice-supportiveness, alignability, and scenario, with choice-supportiveness being significant in the *Surgery* scenario in the nonalignable conditions (HSD p = .007), and in the *Glass* scenario in the alignable conditions (HSD p < .001), but choice-supportiveness also being generally more apparent in nonalignable vs. alignable conditions. Table 3.4 presents the significant effects.

Table 3.4: *Significant effects for false memories in free recall*

Effect	F (df)	Mse	p	η^2	Means
Choice-supportiveness	F(1, 77) = 28.870	.564	p < .001	.27	CS = 0.547 NCS = 0.229
Choice-supportiveness × alignability × scenario	F(3, 231) = 5.043	.485	p = .002	.06	ALIGN LUNCH CS = 0.229 ALIGN LUNCH NCS = 0.274 ALIGN GLASS CS = 0.797 ALIGN GLASS NCS = 0.098 ALIGN HOLIDAY CS = 0.644 ALIGN HOLIDAY NCS = 0.314 ALIGN SURGERY CS = 0.246 ALIGN SURGERY NCS = 0.229 NONAL LUNCH CS = 0.499 NONAL LUNCH NCS = 0.117 NONAL GLASS CS = 0.536 NONAL GLASS NCS = 0.354 NONAL HOLIDAY CS = 0.597 NONAL HOLIDAY NCS = 0.226 NONAL SURGERY CS = 0.830 NONAL SURGERY NCS = 0.222

The ANOVA on fact distortions showed significant main effects of alignability, format, scenario, and three significant interactions: between alignability and format, between alignability and scenario, and between choice-supportiveness and scenario. The last interaction showed very slight and nonsignificant choice-supportiveness in the *Holiday* and *Glass* scenarios, some more choice-supportiveness in the *Surgery* scenario (HSD p = .004), and nonsignificant non-supportiveness in the *Lunch* scenario Table 3.5 reports the findings.

Table 3.5: *Significant effects for fact distortions in free recall*

Effect	F (df)	Mse	p	η^2	Means
Alignability	F(1, 77) = 8.510	.920	p = .005	.10	ALIGN = .822 NONAL = .602
Format	F(1, 77) = 4.911	.920	p = .030	.06	LIST = .796 NARR = .628
Scenario	F(3, 231) = 19.161	.590	p < .001	.20	LUNCH = 1.077 GLASS = .538 HOLIDAY = .496 SURGERY = .736
Alignability × format	F(1, 77) = 7.053	.920	p = .010	.13	ALIGN LIST = 1.006 ALIGN NARR = .638 NONAL LIST = .585 NONAL NARR = .618
Alignability × scenario	F(3, 231) = 11.517	.590	p < .001	.13	ALIGN LUNCH = 1.470 ALIGN GLASS = .604 ALIGN HOLIDAY = .574 ALIGN SURGERY = .639 NONAL LUNCH = .683 NONAL GLASS = .472 NONAL HOLIDAY = .574 NONAL SURGERY = .639
Choice-supportiveness × scenario	F(3, 231) = 5.924	.632	p < .001	.07	LUNCH CS = 0.942 LUNCH NCS = 1.212 GLASS CS = 0.601 GLASS NCS = 0.475

					HOLIDAY CS = 0.547 HOLIDAY NCS = 0.445 SURGERY CS = 0.974 SURGERY NCS = 0.499

Overall, choice-supportive distortions in free recall are seen in selective forgetting and false memory as main effects. Not so in misattributions (very few occurrences) and in fact distortion. Choice-supportive misattributions (vs. non supportive ones) are apparent in nonalignable conditions only, in line with a significant interaction. For fact distortion, there is variation in choice-supportiveness related to the scenario, again qualifying a significant interaction.

3.3.4.2 Cued recall

For cued recall an ANOVA was carried out on fact distortions highlighting main effects of the scenario ($F(3, 231) = 3.303$, $Mse = .401$, $p = .021$, $\eta^2 = .04$) a two-way interaction between scenario and format ($F(3, 231) = 3.175$, $Mse = .401$, $p = .025$, $\eta^2 = .04$) a three-way interaction between scenario, alignability, and format ($F(3, 231) = 3.226$, $Mse = .401$, $p = .023$, $\eta^2 = .04$) and a four-way interaction involving all the factors (($F(3, 231) = 2.852$, , $Mse = .647$, $p = .038$, $\eta^2=.04$). Only the four-way interaction involved choice-supportiveness, showing no easily interpretable pattern.

3.3.4.3 Recognition

For recognition three ANOVAs were carried out on selective forgetting occurrences, misattributions, and false memories. In addition, another ANOVA was carried out on the asymmetry score used in previous studies to assess choice-supportiveness (Mather, Shafir, & Johnson, 2000). This was computed as follows:

Asymmetry score = (number of positive attributes remembered as associated to the chosen option + number of negative attributes remembered as associated to the foregone option) -

(number of negative attributes remembered as associated to the chosen option + number of positive attributes remembered as associated to the foregone option)

Thus, if the index is positive there is attribution-related choice-supportiveness, if it is negative non supportiveness or choice-opposition (with a balance point of zero). It should be noted that our asymmetry score differs from that used by Mather and colleagues in that we only included presented items. The ten lures were excluded to turn this into a clean misattribution test without false memories influencing the score.

The ANOVA on selective forgetting showed significant main effects of the presentation format and scenario, and two interactions, the first involving choice-supportiveness and alignability, and the second choice-supportiveness and presentation format. The first interaction highlights more choice-supportive selective forgetting in alignable conditions vs. nonalignable conditions (differences not resisting HSD tests), and the second more choice-supportive selective forgetting with a narrative vs. list presentation format (differences not resisting HSD test). The effects are presented in Table 3.6.

Table 3.6: *Significant effects for selective forgetting in recognition*

Effect	F (df)	Mse	p	η^2	Means
Format	F(1, 77) = 5.912	2.592	p = .017	.07	LIST = 0.702 NARR = 1.010
Scenario	F(3, 231) = 5.370	1.027	p = .001	.06	LUNCH = 0.720 GLASS = 1.073 HOLIDAY = 0.686 SURGERY = 0.945
Choice-supportiveness × alignability	F(1, 77) = 4.812	.853	p = .031	.06	ALIGN CS = .994 ALIGN NCS = .796 NONAL CS = .756 NONAL NCS = .877
Choice-supportiveness × format	F(1, 77) = 4.387	.853	p = .040	.05	LIST CS = .645 LIST NCS = .762 NARRATIVE CS = 1.105 NARRATIVE NCS = 0.914

The ANOVA on misattributions highlighted main effects of choice-supportiveness, alignability, and scenario, plus a two-way significant interaction between choice-supportiveness and scenario. The interaction shows significant choice-supportive misattributions in the *Glass* and marginally in the *Surgery* scenarios (HSD, p = .022 and p = .068, respectively). Table 3.7 summarizes the findings related to the significant effects.

Table 3.7: *Significant effects for misattribution in recognition*

Effect	F (df)	Mse	p	η^2	Means
Choice-supportiveness	F(1, 77) = 4.719	0.734	p = .033	.06	CS = .751 NCS = .605
Alignability	F(1, 77) = 6.751	2.695	p = .011	.08	ALIGN = .510 NONAL = .846
Scenario	F(3, 231) = 6.473	0.794	p < .001	.08	LUNCH = .694 GLASS = .727 HOLIDAY = .433 SURGERY = .859
Choice-supportiveness × scenario	F(3, 231) = 6.476	0.694	p < .001	.08	LUNCH CS = 0.548 LUNCH NCS = 0.840 GLASS CS = 0.937 GLASS NCS = 0.518 HOLIDAY CS = 0.465 HOLIDAY NCS = 0.401 SURGERY CS = 1.056 SURGERY NCS = 0.661

The ANOVA on false memories showed main effects of choice-supportiveness and scenario, plus a two-way significant interaction between choice-supportiveness and scenario, and another between scenario and alignability. The first interaction highlights significant choice-supportive false memories especially in the *Glass* scenario (HSD, p = .006). Table 3.8 presents the findings related to the significant effects.

Table 3.8: *Significant effects for false memory in recognition*

Effect	F (df)	Mse	p	η^2	Means
Choice-supportiveness	F(1, 77) = 6.449	0.873	p = .013	.08	CS = .839 NCS = .653
Scenario	F(3, 231) = 3.600	0.499	p = .014	.04	LUNCH = .737 GLASS = .709 HOLIDAY = .893 SURGERY = .645
Choice-supportiveness × scenario	F(3, 231) = 2.942	.702	p = .034	.04	LUNCH CS = 0.703 LUNCH NCS = 0.771 GLASS CS = 0.948 GLASS NCS = 0.470 HOLIDAY CS = 0.958 HOLIDAY NCS = 0.829 SURGERY CS = 0.749 SURGERY NCS = 0.540
Alignability × scenario	F(3, 231) = 7.436	.499	p < .001	.09	ALIGN LUNCH = 1.002 NONAL LUNCH = 0.664 ALIGN GLASS = 1.017 NONAL GLASS = 0.593 ALIGN HOLIDAY = 0.472 NONAL HOLIDAY = 0.755 ALIGN SURGERY = 0.770 NONAL SURGERY = 0.696

The ANOVA carried out on the asymmetry score in recognition showed only a significant effect of the scenario ($F(3, 231) = 6.274$, $Mse = 11.075$, $p < .001$, $\eta^2 = .07$), with a positive value in the *Glass* scenario (1.275) and *Surgery* scenario (1.279) and 95%CIs not including zero for *Glass* (.522-1.028) and for *Surgery* (.529-2.028).

3.3.5 Detailed analysis of misremembering

3.3.5.1 Occurrence of the different kinds of misremembering in free recall

The occurrence of the four different kinds of misremembering in free recall was analyzed scenario per scenario (as in experiment 1). Missing data was excluded on a variable per variable basis (so the means in the following analyses may slightly differ from the case wise-computed means reported in the ANOVAs).

As in experiment 1, 95% confidence intervals of the proportion of participants showing at least one occurrence of each specific misremembering type were computed, regardless of the choice-supportive nature of the misremembering. As Table 3.9 shows, all four types of misremembering in the taxonomy took place at least in one occurrence in a proportion of participants significantly different from zero. It is apparent that selective forgetting and fact distortion took place in at least one case in a big fraction of participants, a sizable fraction of participants also produced at least one false memory, while only a small proportion of participants misattributed values (although the proportion was greater than zero). The results are very consistent across scenarios.

Table 3.9: *Occurrence of the four different kinds of misremembering in free recall in each choice scenario (proportion of cases showing at least one occurrence of each specific type)*

LUNCH SCENARIO (n = 93)							
SELECTIVE FORGETTING		**MISATTRIBUTION**		**FALSE MEMORY**		**FACT DISTORTION**	
Prop.	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
1	.961 to 1	**.065**	.024 to .135	**.430**	.328 to .537	**.882**	.798 to .939

GLASS SCENARIO (n = 87)							
SELECTIVE FORGETTING		**MISATTRIBUTION**		**FALSE MEMORY**		**FACT DISTORTION**	
Prop.	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
1	.958 to 1	**.046**	.013 to .114	**.540**	.430 to .648	**.747**	.642 to .834

HOLIDAY SCENARIO (n = 90)							
SELECTIVE FORGETTING		**MISATTRIBUTION**		**FALSE MEMORY**		**FACT DISTORTION**	
Prop.	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
1	.959 to 1	**.033**	.007 to .094	**.500**	.393 to .607	**.700**	.594 to .792

SURGERY SCENARIO (n = 88)							
SELECTIVE FORGETTING		**MISATTRIBUTION**		**FALSE MEMORY**		**FACT DISTORTION**	
Prop.	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**	**Prop.**	**95%CI**
.989	.938 to .999	**.057**	.019 to .128	**.523**	.413 to .630	**.693**	.586 to.787

The occurrence of the four different misremembering types was also analyzed via one-tailed t-tests on the mean number of each specific misremembering type (against a zero mean). This analysis provided results converging with the ones obtained with the one carried out on the proportion of participants showing at least one occurrence of each specific misremembering type.

The findings are presented, scenario per scenario, in Table 3.10. They show that the mean number of the four different kinds of misremembering in free recall in each choice scenario is always greater than zero in one-tailed (directional) tests. The mean number of selective forgetting instances is greater than the mean number of fact distortions occurrences, which is in turn greater than the mean number of false memories and misattributions (low means in these cases, in particular for misattributions). Again, results are very consistent across scenarios.

Table 3.10: *Mean number of the four different kinds of misremembering in free recall in each choice scenario (one-sample tests against a zero mean)*

LUNCH SCENARIO (n = 93)			
	Mean	**SD**	**t-test (one-tailed t-test)**
SELECTIVE FORGETTING	14	3.867	**t (92) = 34.913, p < .001**
MISATTRIBUTION	.086	.38	**t (92) = 2.182, p = .016**
FALSE MEMORIES	.656	1.005	**t (92) = 6.295, p <.001**
FACT DISTORTION	2.086	1.62	**t (92) = 12.418, p <.001**

GLASS SCENARIO (n = 87)			
	Mean	**SD**	**t-test (one-tailed t-test)**
SELECTIVE FORGETTING	14.126	3.361	**t (86) = 39.202, p < .001**
MISATTRIBUTION	.057	.279	**t (86) = 1.906, p = .030**
FALSE MEMORIES	.931	1.118	**t (86) = 7.767, p < .001**
FACT DISTORTION	1.069	.912	**t (86) = 10.933, p < .001**

HOLIDAY SCENARIO (n = 90)			
	Mean	**SD**	**t-test (one-tailed t-test)**
SELECTIVE FORGETTING	13.089	3.594	**t (89) = 34.550, p < .001**
MISATTRIBUTION	.033	.181	**t (89) = 1.730, p = .044**
FALSE MEMORIES	.933	1.169	**t (89) = 7.572, p < .001**
FACT DISTORTION	1.022	.948	**t (89) = 10.227, p < .001**

SURGERY SCENARIO (n = 88)			
	Mean	**SD**	**t-test (one-tailed t-test)**
SELECTIVE FORGETTING	13.773	3.423	**t (87) = 37.745, p < .001**
MISATTRIBUTION	.057	.233	**t (87) = 2.295, p = .012**
FALSE MEMORIES	.784	1.139	**t (87) = 6.457, p < .001**
FACT DISTORTION	1.375	1.316	**t (87) = 9.801, p < .001**

3.3.5.2 Choice-supportiveness

McNemar tests and paired t-test were used to test the hypothesis that the different types of distortions are choice-supportive (vs. non choice-supportive). The tests were carried out scenario per scenario on free recall, cued recall, and recognition on the specific types of distortions that could be assessed with each kind of test (i.e., all four types in free recall, fact distortion in cued recall, and all types except fact distortion in recognition).

3.3.5.2.1 Choice-supportiveness in free recall

McNemar test were computed on the frequencies of participants showing/not showing at least one case of choice-supportiveness and showing/not showing at least one case of non-choice-supportiveness. Probabilities associated with the test were computed as one-tailed, given the defined directionality of the choice-supportiveness hypothesis. The robustness of the findings was assessed after Bonferroni correction for the number of the test at the scenario level (Bonferroni-corrected alpha levels for free recall is α = .05/4 = .013). Table 3.11 shows the results, highlighting choice-supportiveness in six cases out of 16 tests in free recall (37%) and not a single significant difference in the opposite direction. Consistent and robust effects corroborating the choice-supportiveness hypothesis are apparent for false memory.

Table 3.11: *McNemar tests for choice-supportiveness (CS) vs. non choice-supportiveness (NCS) in free recall on participants showing (vs. not showing) at least one case of each*

LUNCH SCENARIO						
	CS Y **NCS Y**	**CS Y** **NCS N**	**CS N** **NCS Y**	**CS N** **NCS N**	**McNemar p**	**Resisting Bonferroni correction (α = .013)**
SELECTIVE FORGETTING	92	0	1	0	$\chi^2(1) = 0.000$, p = .50	-
MISATTRIBUTION	1	4	1	87	χ^2 (1) = 0.800, p = .186	-
FALSE MEMORY	4	26	10	53	**χ^2 (1) = 6,250, p = .006**	YES
FACT DISTORTION	39	19	24	11	$\chi^2(1) = 0,372$, p = .271	-

GLASS SCENARIO						
	CS Y **NCS Y**	**CS Y** **NCS N**	**CS N** **NCS Y**	**CS N** **NCS N**	**McNemar p**	**Resisting Bonferroni correction (α = .013)**
SELECTIVE FORGETTING	87	0	0	0	cannot be computed	-
MISATTRIBUTION	0	2	2	83	$\chi^2(1) = 0.25$, p = .308	-
FALSE MEMORY	11	27	9	40	**$\chi^2(1) = 8.028$, p = .002**	YES
FACT DISTORTION	14	27	24	22	$\chi^2(1) = 0.078$, p = .389	-

HOLIDAY SCENARIO						
	CS Y NCS Y	**CS Y NCS N**	**CS N NCS Y**	**CS N NCS N**	**McNemar p**	**Resisting Bonferroni correction (α =.013)**
SELECTIVE FORGETTING	90	0	0	0	cannot be computed	-
MISATTRIBUTION	0	2	1	87	$\chi^2(1) = 0{,}000$, $p = .5$	-
FALSE MEMORY	7	28	10	45	**$\chi^2(1) = 7{,}605$, $p = .003$**	YES
FACT DISTORTION	12	32	19	27	**$\chi^2(1) = 2{,}824$, $p = .046$**	NO

SURGERY SCENARIO						
	CS Y NCS Y	**CS Y NCS N**	**CS N NCS Y**	**CS N NCS N**	**McNemar p**	**Resisting Bonferroni correction (α = .013)**
SELECTIVE FORGETTING	88	0	0	0	cannot be computed	-
MISATTRIBUTION	0	2	3	83	$\chi^2(1) = 0{,}000$, $p = .5$	-
FALSE MEMORY	6	27	14	41	**$\chi^2(1) = 3{,}512$, $p = .030$**	NO
FACT DISTORTION	20	30	11	27	**$\chi^2(1) = 7{,}902$, $p = .002$**	YES

Paired t-tests were also used to test the hypothesis that the different types of distortions are choice-supportive (vs. non choice-supportive), by comparing the mean number of choice-supportive distortions vs. non choice-supportive ones at the participant level. Also in this case, one-tailed probabilities were computed, given the directional prediction, and the robustness of the findings was assessed after Bonferroni correction for the number of the test at the scenario level.

Table 3.12 shows the results, highlighting choice-supportiveness in eight cases out of 16 tests (50%) in free recall and a single significant difference in the opposite direction (not resisting Bonferroni correction). Consistent and robust effects are apparent for selective forgetting and false memory. The Hedges' g effect sizes, computed only for the effects resisting Bonferroni correction, are also indicated in Table 3.12. The mean overall effect size is g = .425 (medium size effect).

Table 3.12: *Paired t-tests of choice-supportiveness (CS) vs. non choice-supportiveness (NCS) in free recall. Hedges' g effect size is indicated in the last column.*

LUNCH SCENARIO						
	Mean CS	**SD CS**	**Mean NCS**	**SD NCS**	**Paired t-test**	**Resisting Bonferroni correction (α = .013)**
SELECTIVE FORGETTING	7,516	2,229	6,484	2,150	**t(92) = 4,842, p = .000**	YES (g = .467)
MISATTRIBUTION	0,065	0,288	0,022	0,146	t(92) = 1,648, p = .051	-
FALSE MEMORY	0,462	0,802	0,194	0,516	**t(92) = 2,885, p = .003**	YES (g = .394)
FACT DISTORTION	0,925	0,924	1,161	1,135	**t(92) = 1,770, p = .040**	NO

GLASS SCENARIO						
	Mean CS	**SD CS**	**Mean NCS**	**SD NCS**	**Paired t-test**	**Resisting Bonferroni correction (α = .013)**
SELECTIVE FORGETTING	7,437	2,208	6,655	1,952	**t(86) = 3,039, p = .001**	YES (g = .372)
MISATTRIBUTION	0,023	0,151	0,034	0,239	t(86)= 0,376, p = .354	-
FALSE MEMORY	0,655	0,900	0,276	0,543	**t(86) = 3,613, p <.001**	YES (g = .506)
FACT DISTORTION	0,586	0,724	0,483	0,588	t(86) = 1,013, p = .157	-

HOLIDAY SCENARIO						
	Mean CS	**SD CS**	**Mean NCS**	**SD NCS**	**Paired t-test**	**Resisting Bonferroni correction (α = .013)**
SELECTIVE FORGETTING	6,689	2,201	6,400	2,098	t(89) = 1,160, p = .124	-
MISATTRIBUTION	0,022	0,148	0,011	0,105	t(89) = 0,575 , p = .283	-
FALSE MEMORY	0,633	0,965	0,300	0,694	**t(89) = 2,616, p = .005**	YES (g = .393)
FACT DISTORTION	0,578	0,670	0,444	0,736	t(89) = 1,215, p = .113	-

SURGERY SCENARIO						
	Mean CS	**SD CS**	**Mean NCS**	**SD NCS**	**Paired t-test**	**Resisting Bonferroni correction (α = .013)**
SELECTIVE FORGETTING	7,307	2,404	6,602	2,076	**t(87) = 2,028, p = .023**	NO
MISATTRIBUTION	0,023	0,150	0,034	0,183	t(87) = 0,445 , p = .328	-
FALSE MEMORY	0,534	0,970	0,261	0,514	**t(87) = 2,417, p = .009**	YES (g = .349)
FACT DISTORTION	0,932	1,059	0,477	0,742	**t(87) = 3,438, p < .001**	YES (g = .496)

3.3.5.2.2 Choice-supportiveness in cued recall

For what concerns cued recall, choice-supportiveness in fact distortion was detected with the McNemar (one-tailed) test in the *Glass* scenario (Chi(1) = 4.558, p = .016) and in the *Holiday* scenario (Chi(1) = 4.558, p = .048), but not in the *Lunch* and *Surgery* scenario (p > .05).

Paired t-tests detected a significant effect in the expected direction for the *Glass* scenario (t(86) = 2.507, p = .014) but one in the opposite direction in the *Lunch* scenario (t(92) = 2.100 , p = .019), while the other two tests were nonsignificant (p > .05). Overall there seems to be some indication of choice-supportiveness even in cued recall and for fact distortion, but much less consistent than the evidence coming from free recall.

3.3.5.2.3 Choice-supportiveness in recognition

The recognition test allowed the appraisal of all the types of choice-supportiveness with the exception of fact distortion. Table 3.13 summarizes the findings of McNemar tests for what concerns recognition. Again, one-tailed probabilities were computed, given the directional prediction, and the robustness of the findings was assessed after Bonferroni correction for the number of the test at the scenario level. There is little evidence of choice-supportiveness in the recognition data as analyzed with McNemar, with the exception of the *Glass* scenario (misattribution and false memory).

Table 3.13: *McNemar tests to test choice-supportiveness (CS) vs. non choice-supportiveness (NCS) in recognition on participants showing (vs. not showing) at least one case of each*

LUNCH SCENARIO						
	CS Y NCS Y	**CS Y NCS N**	**CS N NCS Y**	**CS N NCS N**	**McNemar p**	**Resisting Bonferroni correction (α = .017)**
SELECTIVE FORGETTING	27	13	23	30	$\chi^2(1) = 2.250$, p = .067	-
MISATTRIBUTION	19	9	26	39	**$\chi^2(1) = 7.314$, p = .004**	YES
FALSE MEMORY	32	11	16	34	$\chi^2(1) = 0.593$, p = .220	-

GLASS SCENARIO						
	CS Y NCS Y	**CS Y NCS N**	**CS N NCS Y**	**CS N NCS N**	**McNemar p**	**Resisting Bonferroni correction (α = .017)**
SELECTIVE FORGETTING	40	14	17	16	$\chi^2(1) = 0.129$, p = .359	-
MISATTRIBUTION	19	25	13	30	**$\chi^2(1) = 3.184$, p = .037**	NO
FALSE MEMORY	15	30	13	29	**$\chi^2(1) = 5.953$, p = .007**	YES

HOLIDAY SCENARIO						
	CS Y **NCS Y**	**CS Y** **NCS N**	**CS N** **NCS Y**	**CS N** **NCS N**	**McNemar p**	**Resisting Bonferroni correction ($\alpha = .017$)**
SELECTIVE FORGETTING	22	17	19	32	$\chi^2(1) = 0.028$, $p = .434$	-
MISATTRIBUTION	12	14	13	51	$\chi^2(1) = 0{,}000$, $p = .5$	-
FALSE MEMORY	22	17	19	32	$\chi^2(1) = 0.028$, $p = .434$	-

SURGERY SCENARIO						
	CS Y **NCS Y**	**CS Y** **NCS N**	**CS N** **NCS Y**	**CS N** **NCS N**	**McNemar p**	**Resisting Bonferroni correction ($\alpha = .017$)**
SELECTIVE FORGETTING	34	12	18	24	$\chi^2(1) = 0.833$, $p = .181$	-
MISATTRIBUTION	32	18	12	26	$\chi^2(1) = 0.833$, $p = .181$	-
FALSE MEMORY	34	12	18	24	$\chi^2(1) = 0.833$, $p = .181$	-

However, paired t-tests on recognition data offer a more encouraging picture, due to their greater sensitivity. The results of the analysis are reported in Table 3.14.

Table 3.14: *Paired t-tests to test choice-supportiveness (CS) vs. non choice-supportiveness (NCS) in recognition. Hedges' g effect size is indicated in the last column*

LUNCH SCENARIO						
	Mean CS	**SD CS**	**Mean NCS**	**SD NCS**	**Paired t-test**	**Resisting Bonferroni correction (α = .017)**
SELECTIVE FORGETTING	0.753	1.204	0.839	0.992	t(92) = 0.651, p = .258	-
MISATTRIBUTION	0.527	1.017	0.806	1.154	**t(92) = 1.968, p = .026**	NO
FALSE MEMORY	0.806	1.125	0.871	1.135	t(92) = 0.528, p = .300	-

GLASS SCENARIO						
	Mean CS	**SD CS**	**Mean NCS**	**SD NCS**	**Paired t-test**	**Resisting Bonferroni correction (α = .017)**
SELECTIVE FORGETTING	1.092	1.263	1.034	1.028	t(86) = 0.402. p = .344	-
MISATTRIBUTION	0.885	1.176	0.517	0.805	**t(86) = 2.926, p = .002**	YES (g = .362)
FALSE MEMORY	0.943	1.165	0.494	0.847	**t(86) = 3.259, p = .001**	YES (g = .437)

HOLIDAY SCENARIO						
	Mean CS	**SD CS**	**Mean NCS**	**SD NCS**	**Paired t-test**	**Resisting Bonferroni correction (α = .017)**
SELECTIVE FORGETTING	0.733	1.003	0.700	0.893	t(89) = 0.265, p = .396	-
MISATTRIBUTION	0.467	0.851	0.400	0.747	t(89) = 0.705, p = .241	-
FALSE MEMORY	0.911	1.056	0.822	0.856	t(89) = 0.651, p = .259	-

SURGERY SCENARIO						
	Mean CS	**SD CS**	**Mean NCS**	**SD NCS**	**Paired t-test**	**Resisting Bonferroni correction (α = .017)**
SELECTIVE FORGETTING	0.909	1.161	0.909	0.930	t(87) = 0.000, p = .5	-
MISATTRIBUTION	1.045	1.203	0.705	0.873	**t(87) = 2.618, p = .005**	YES (g = .321)
FALSE MEMORY	0.761	0.983	0.557	0.786	**t(87) = 1.736, p = .043**	NO

These recognition findings show evidence of choice-supportiveness in particular in the *Glass* and *Surgery* scenario, and in particular for misattribution and false memories. The mean effect size for the test resisting Bonferroni correction is g = .373, highlighting a medium/small effect not much different from the one obtained in free recall tests.

For what concern the *Glass* and the *Surgery* scenarios, we also computed the asymmetry score to assess choice-supportiveness via the analysis of the attribution of values to the options (see section *3.4.3*). For the *Glass* scenario, the mean value of the index across participants is 1.069 (SD = 3.430, n = 87), which is significantly greater than zero according to a one-sample t-test (t(86) = 2.907, p = .002). The same holds for the *Surgery* scenario: the mean value is 1.136 (SD = 3.309, n = 88), which is significantly greater than zero according to a one-sample t-test (t(87) = 3.220, p = .001). This analysis confirms the evidence for choice-supportive misattribution in two of the scenarios we employed and the source recognition test, while this is not the case for the remaining two scenarios.

3.3.6 Summary of findings on choice-supportiveness

Table 3.15 shows the overall picture of the results in relation to choice-supportiveness in the four different types of misremembering and the three types of memory tests.

Table 3.15: *Summary of choice-supportiveness in the four different types of misremembering and three types of memory tests*

TEST of CHOICE-SUPPORTIVENESS	**SELECTIVE FORGETTING**	**MISATTRIBUTION**	**FALSE MEMORY**	**FACT DISTORTION**
ANOVA free recall	main effect $p < .001$ $\eta^2 = .23$	interaction with alignability $p = .004$ $\eta^2 = .10$	main effect $p < .001$ $\eta^2 = .27$ interaction with alignability and scenario $p = .002$ $\eta^2 = .06$	interaction with scenario $p < .001$ $\eta^2 = .07$
ANOVA cued recall	NA	NA	NA	No clear pattern in a four-way interaction
ANOVA recognition		main effect $p = .033$ $\eta^2 = .06$	main effect $p = .013$ $\eta^2 = .08$	NA

	interaction with alignability $p = .031$ $\eta^2 = .06$ interaction with format $p = .040$ $\eta^2 = .05$	interaction with scenario $p < .001$ $\eta^2 = .08$ Asymmetry score significant for 2 scenarios	interaction with scenario $p = .034$ $\eta^2 = .04$	
McNemar test free recall	NO	NO	In 3 scenarios	In 1 scenario
McNemar test cued recall	NA	NA	NA	In 2 scenarios
McNemar test recognition	NO	1 scenario choice-opposing	In 1 scenario	NA
Paired-t-test free recall	In 2 scenarios	NO	In 4 scenarios	In 1 scenario
Paired-t-test cued recall	NA	NA	NA	In 1 scenario (1 choice-opposing)
Paired-t-test recognition	NO	In 2 scenarios	In 2 scenarios	NA

The findings show stronger choice-supportiveness for false memory in free recall tests (with evidence for it in recognition, as well). Good evidence of choice-supportiveness is also seen for selective forgetting in free recall, but not so in recognition. However, the assessment of selective forgetting from the source recognition test used in Experiment 2 is not directly comparable to that from free recall tests, as an item will only count as forgotten if the participant ticks the box ‘not presented’ for it. Weak memory traces are therefore more likely to give rise to other types of errors (or, indeed, no error at all) in source recognition tests than in free recall, where the only evidence of them may be seen as selective forgetting. There is also good evidence of choice-supportiveness in misattribution in recognition tests, but only in half of the scenarios. Weak evidence for choice-supportive fact distortion, mainly related to one scenario. In free recall, choice-supportiveness for misattribution and false memories is observed mainly in nonalignable conditions.

The sample size had been computed for a mixed Anova, with an a-priori power of .80 for a medium effect size on choice-supportiveness (f = .25), alpha = .05. Taking into account the repeated measurements provided by the multiple scenarios, the number of participants needed was 82 overall. Consequently, 100 participants were recruited for this study.

3.4 Discussion

Contrary to our first experiment, we found choice-supportiveness in all conditions and all types of memory tests. For a discussion of the possible reasons for the differences in findings between our two experiments, please see the *Overall conclusion and discussion*. In the present section, I will focus on Experiment 2 and choice-supportiveness. The results not relating to choice-supportiveness have been briefly discussed in the *Results* section above.

Our hypotheses for this experiment could be divided into an overall hypothesis, i.e., that schema- or gist-based processing are the main causes of choice-supportive misremembering, and three sub-hypotheses. According to the latter, unalignable and narrative versions would yield the most choice-supportiveness (with the combination unalignable narrative at the top), the effect would be the strongest in recognition, then cued recall and the weakest in free recall, and we would find all four types of memory distortions described in our taxonomy. Starting off with the sub-hypotheses and leaving the overall hypothesis aside for the time being, it is clear that our results did not fully support all three.

3.4.1 Alignability and presentation format

Although alignability and presentation format had effects on memory accuracy and the relative proportions of commission and omission errors, they did not have a significant effect on choice-supportiveness overall. This can be compared to the results in an earlier study (Hess et al., 2012), where alignability was found to affect choice-supportiveness. An important difference between that study and ours is that they used both alignable and unalignable items within the same options (in common with Mather et al., 2005, who did not investigate choice-supportiveness) rather than in separate conditions. Whereas their study highlights the effects of mixed alignability, ours assesses potential processing differences in two divergent choice situations. Our prediction of finding more choice-supportiveness in the unalignable and narrative versions was based on the expectation that gist-based processing would be more evident in these conditions. An increased reliance on gist should increase choice-supportiveness, but if alignability and presentation format have no effect on the type of processing used, it does not necessarily affect choice-supportiveness either.

However, the fact that misattributions and false memories were choice-supportive mainly in the unalignable conditions in free recall may point to an influence of the choice on the gist perceived. This may only have been strong enough to be detected when coupled with the comparably stronger gist traces that the unalignable options provide. At any rate, the effects of alignability on choice-supportiveness were not large, and were only found for misattributions and false memories, while presentation format had no discernible effect on any type of distortion. This in itself provides an important contribution to the knowledge in the field, as our literature review highlighted an uncertainty as to whether alignability affects choice-supportiveness. Whereas earlier research had not assessed the potential importance of differences in alignability and presentation format in the design of the studies, we can now conclude that this is not likely to be the decisive factor determining the presence or absence of choice-supportiveness.

3.4.2 Type of memory test

We expected to find the most choice-supportiveness in the source recognition memory test, less in cued recall and even less or none in free recall. Clearly, it is not possible to directly compare the results from the three different tests, as cued recall and recognition are inherently cognitively less demanding than free recall for the participants in this kind of study, and also inevitably dependent on the types and amounts of lures and cues. In addition, the cued recall in this experiment could only measure fact distortion, and it was limited to testing 4 of the 23 unique items describing the options in each scenario. Admittedly, it is therefore in isolation not a sufficiently sensitive test of choice-supportiveness, and perhaps as a consequence it also generally failed to detect choice-supportiveness.

Despite these inherent limitations, we tried to discern whether the free recall and recognition tests produced different degrees of choice-supportiveness by comparing the mean effect sizes for the these two memory tests (see the tables reporting Hedges' g in the preceeding results), and the findings showed similar effects. Thus, it appears likely that the stimuli rather than the type of memory test is the determining factor. This also indicates that the effect observed in earlier source recognition experiments was not due to participants using the heuristic 'any positive item is more likely to belong to my chosen option than to the one I did not choose' when guessing in cases where their memory traces were weak.

Instead, it appears more likely that the scenarios and options we used in this experiment were complex and verbose enough to trigger gist-based processing in all our versions. After all, the contents differed only between the alignable and nonalignable versions (not between list and narrative versions), and the length of the descriptive text was similar in all four conditions.

Clearly, by using both free recall and source recognition tests with the same stimuli and in the same experiment, we have elucidated a question we were left with after reviewing the relevant literature: is choice-supportive memory dependent on the use of other memory tests than free recall? It now appears that the answer to that question is 'no'.

3.4.3 Types of distortions

In this second experiment, we again found support for the new taxonomy in that all four types of memory distortions were observed. Not surprisingly, selective forgetting was the most common type in free recall. Both selective forgetting and false memories were shown to be choice-supportive, whereas no such effect was seen for misattribution and fact distortion in the free recall.

Misattributions were rare, which could be explained by a high reliance on gist memory. If the choice is made after differentiating the two options in terms of gist, the latter provides a scaffolding that facilitates source attribution of the individual items. This could also explain why the choice-supportiveness of the misattributions was not significant overall: other factors, such as salience, familiarity and how closely each item conforms to the general gist of the option, might have provided stronger clues during retrieval than whether they were chosen or not.

The absence of an effect for fact distortion could be explained by the fact that this type of distortion mainly occurs for details (i.e., specific numbers) that will not form part of the gist memory traces. Admittedly, qualifiers also gave rise to some fact distortions and in these cases, the errors were in some cases likely to be due to inaccurate gist traces rather than a forgetting of specific details. For example, leaving out a qualifier in the free recall test counted as a fact distortion, the direction of which depended on whether the item became more or less positive without the qualifier. Although even the qualifiers may have felt like unimportant details, there were also cases where a qualifier was distorted significantly, entirely changing the valence of the individual item. However, due to their infrequency, these could not have had a discernible impact on the general choice-supportiveness of fact distortions.

In the present experiment, selective forgetting and false memories were choice-supportive overall. However, selective forgetting did not yield a main effect in the recognition test and, in common with misattribution and false memory, was not tested in the cued recall. It should be noted that in the free recall, all items that are not brought to mind and listed within the limited time frame count as forgotten. Thus, considering the finite patience and ability of each participant to fully focus on remembering as much as possible for each of the eight options in the time given, it may result in only the most salient items being mentioned. It could therefore increase the likelihood that the participant starts by listing the items that were most decisive for the choice. In addition, gist-processing may contribute by adding a component to the mentally constructed schema for each option, namely whether it was the preferred or rejected alternative. That would then further increase the likelihood of choice-supportive recall. Whether the effect for selective forgetting would persist if participants had unlimited time that they were motivated to spend on retrieving as much as they possibly could about the options remains unclear and open for exploration in further research.

That false memory was choice-supportive points to the importance of gist memory traces and that the choice made forms an integral part of them. Numerous previous studies have showed that false memories tend to be schematic (e.g., Miller & Gazzaniga, 1998; Neuschatz, Lampinen, Preston, Hawkins, & Toglia, 2002; Webb & Dennis, 2018), but whether the choice one has made becomes integrated with that general essence has been considerably less clear. The options used in this experiment were designed to enable the participants to construct distinct schemata for each one. That the false memories arising out of those schemata were choice-supportive regardless of which of the two options the individual participant had chosen provides strong evidence that gist processing is what gives rise to the phenomenon. In earlier studies, choice-supportive false alarms were found. Our source recognition test also yielded this result, but, more importantly, so did our free recall task. Clearly, free recall is the 'purest' memory assessment in that no hints are given and there is less of an incentive to guess than in source recognition tests. Likewise, in the absence of external attempts to manipulate memory after the encoding phase, false memory is the 'purest' type of memory distortion: it is entirely generated by the mind of the participant when elaborating the material.

Thus, with regard to the main hypothesis, the evidence for gist memory traces being at the root of choice-supportive misremembering is convincing despite all conditions yielding similar effects. The fact that the tendency was found with these rich and complex scenarios – and in particular the frequency and clear choice-supportive direction of the false memories, coupled with the minimal effect on fact distortions – are in line with the tenets of Fuzzy-Trace Theory, briefly mentioned in *Chapter 1*. To reiterate, this theory suggests that gist memory traces and verbatim memory traces are stored separately and in parallel. When being exposed to a coherent story - or information that is sufficiently rich and contextual to enable a mental construction of a narrative – gist memory traces prevail. Specific details (such as precise numbers), on the other hand, necessitate verbatim processes for effective encoding and retrieval. As mentioned, gist traces are known to give rise to schema-consistent false memories, whereas fact distortions generally demonstrate a failure of the verbatim processes. If choice-supportiveness is caused by gist and not verbatim processes, it would therefore follow that the effect should be stronger for distortion types relying on the former. Selective forgetting is not as clearly a direct effect of relying on gist traces as false memory, although it may indicate an indirect influence. If part of the gist of the chosen option is that it must be superior simply based on the fact that it was selected after consideration of all the items, this could facilitate retrieval of the items that support this view. Likewise, these mechanisms could explain choice-supportive misattribution in recognition tests, in particular for items that had not been presented, but that were not schema-inconsistent.

An obvious limitation of this experiment is that our conditions failed to trigger divergent processing mechanisms. Instead, all conditions had similar effects and we therefore had to analyze the types of distortions in light of the prevailing memory theories, and compare the stimuli to those of previous studies in order to decipher the implications of our findings. Without altering the contents of the option descriptions and thereby introducing confounding factors, it would be difficult to construct such scenarios within the same experiment. Possibly, it might be sufficient to use similar option descriptions to those in our first experiment and compare them with lists where each option is described with sentences and verbal description replace all numbers, but the options would also need to be unalignable. New and additional information is needed to construct unalignable options, and it could therefore not be excluded that any effects found in such an experiment would be due to the increased cognitive load and differences in the included items. Thus, four conditions would still be needed and the adjustments made might be insufficient for an effect.

Despite this shortcoming, our findings have illuminated the conditions necessary for choice-supportive misremembering to occur and paved the way for further research into the side-effects of a memory system that strives for coherence and thrive on story-telling.

Chapter 4: Overall discussion and conclusion

In our critical literature review, we found seemingly conflicting evidence of the strength of the choice-supportive misremembering phenomenon, and we therefore conducted two experiments to clarify the situation. The first one revealed an absence of choice-supportiveness with a typical design used in studies on decision making, whereas the effect was present in all conditions in our second experiment. This shows that some condition crucial for the effect to occur was present in our second experiment but not in our first. I will therefore proceed to discuss some of the differences between our two experiments.

4.1 Comparison between Experiments 1 and 2

4.1.1 Type of memory test

4.1.1.1 Free recall and recognition

Prior to analyzing the results in our second experiment, we hypothesized that source recognition tests may be more likely to detect choice-supportiveness than free recall test. Our literature review indicated that the support for the phenomenon was weak from free recall studies and we found no choice-supportiveness in our own free and cued recall study. As discussed previously, signal detection theory could explain why source recognition tests may be more sensitive to discerning the effect, as could SMF (see *Chapter 3, Hypotheses*). However, comparing the effect sizes of the choice-supportiveness observed in free recall and source recognition in our second study revealed a medium and similar effect for the two tests. As mentioned, the two tests could not be directly and reliably compared, but if there is a difference in sensitivity, our experiment did not detect it.

4.1.1.2 Cued recall

The cued recall tests in our first experiment did not show any choice-supportive tendency and those in our second gave inconsistent results but no clear choice-supportiveness. Although it could be argued that the fact that the values tested with cued recall in our experiments were not also tested with recognition might explain the difference in choice-supportiveness between free and cued recall in our second experiment (as there is more evidence for the phenomenon from recognition studies), our cued recall bore similarities to recognition tests. For each item containing a numeric value, the full sentence was provided in the cued recall test, and the participant was only asked to state the missing value. An earlier study (Svenson et al., 2009) that used cued recall as the memory test did find significant choice-supportiveness. Their cued recall test was similar to that used in our second experiment in the sense that only the value was asked for in the memory test, but different in that Visual Analogue Scales (VAS) were used when presenting the values as well as in the memory test in Svenson et al. (2009), whereas we asked our participants to complete the sentences by entering the missing numbers. This could constitute a fundamental difference, as VAS may shift the focus from verbatim to gist. Indeed, VAS are normally used to measure subjective phenomena, and their completion tends to be perceived as more intuitive than writing down exact numbers (or other descriptions) exactly because they avoid the constraint of direct quantitative terms (Wewers & Lowe, 1990). By offering a continuum, they may induce the participant to access their general idea of the option and specific item rather than trying to bring to mind the exact missing values. In other words, by using VAS, Svenson et al. (2009) (and Svenson, Gonzalez, Memon, & Lindholm, 2018) may have impeded the kind of verbatim processing that could prevent choice-supportive bias. Clearly, this is a hypothesis that remains to be tested in more experiments before we can draw any definite conclusions.

It is important to mention that the sensitivity of the cued recall might have been low in our second experiment, as we only tested recall of four items per scenario (or, in other words, two per option). The total number of different items was 23, i.e., 12 items per option, with the two options having one item in common. In other words, the cued recall tested approximately 17% of the items. In our first experiment, however, we tested cued recall for all 12 values, i.e., 100% of the items. In that experiment, we had six different parameters, but the value for each was what differed between the options. Thus, the total amount to be remembered was considerably smaller in our first experiment, but we tested all of them compared to a small proportion in our second experiment. This makes it difficult to compare the results of the two experiments, but if we compare our first experiment with Svenson et al., (2009), we see that it was similar both in terms of amount to be remembered and the design of the cued recall test – except that we did not use VAS. This may have contributed to the fact that we observed no choice-supportive bias whereas Svenson and colleagues did. The design in our first study could be said to encourage a comparison of the values item by item, focusing on the numbers, whereas it could be that the experiment conducted by Svenson and colleagues – by not including precise numbers - encouraged a comparison of each option as a whole against the other option as a whole rather than item by item (i.e., the items of A compared with each corresponding item of B, and then choosing the option that 'mathematically' turned out to be the best when weighing in the importance of each item). Again, this is a hypothesis that remains to be tested, for example by conducting an experiment where half of the participants use VAS and the other half precise numbers (both in the scenario and option presentation and in the cued recall test).

4.1.2 Types of distortions

Comparing our two experiments, there are less misattributions and many more false memories in our second study. The lower degree of comparability in the alignable versions in Experiment 2 compared to those in Experiment 1 most likely contributes to the lower proportions of misattributions in our second study. If the parameters are kept constant with only the values changing (or if the items are direct opposites of one another), the memory load is lower overall, but it may make misremembering of which value belonged to which option more likely. Although any degree of alignability can help in retrieval of the corresponding item for the other option, if the value is stored in memory along with the parameter, correct source attribution may be facilitated when the entire items differ. Furthermore, weak or non-existent gist traces would also make it more difficult to remember which item belonged to which option.

Likewise, the higher frequency of false memories in our second study could be a results of a larger degree of gist processing in that second study. Indeed, previous research has found that understanding the gist promotes false memories for schematically related information (e.g., Miller & Gazzaniga, 1998; Webb & Dennis, 2018). This may be a similar mechanism to that found in the Deese-Roediger-McDermott (DRM) paradigm (Deese, 1959; Roediger & McDermott, 1995), where a non-presented item strongly related to the studied items is frequently falsely recalled. As suggested by Underwood (1965), an implicit associative response (IAR) - which can be explained as an unintentional activation of words similar in meaning - may be triggered. In the free recall tests in our studies, we counted synonyms as correct and they did therefore not count towards the false memories, but automatic associations consistent with the gist of each option provide a likely explanation for the higher rate of false memories in our second study compared with our first. For a discussion of these findings in relation to descriptive memory distortion theories, please see the next section of this thesis (*Memory distortion theories*).

4.1.3 Type of stimuli

The main difference between our experiments – other than the use of three different memory tests in the second and only two in the first – was in the degree of the complexity, verbosity and alignability of the scenarios. The descriptions of the options in our first study were brief and directly comparable between the two options. Although two of the versions used in our second study were also meant to be alignable, it was clear that the degree of alignability was not as high as in the first experiment even in those versions. The items in the first study were largely 'numeric', as the difference between each set of two options was the score (expressed as numbers, stars or verbally) on the included parameters. This kind of set-up encourages a comparison item by item, across options, and the scores on each parameter (relative to the corresponding item in the other option) have to be used to make the choice.

In our second study, we hoped to make our alignable versions similar to the stimuli in our first experiment, but in order to investigate the effect of alignability, we could not remove details from these versions while keeping them in the non-alignable versions. Likewise, our narrative versions could not contain more information than our list versions. The options were also presented with descriptive sentences rather than scores on parameters. As a consequence, all versions in Experiment 2 turned out to be more complex and verbose than those in our first experiment. It may be the case that the scenarios and options used in Experiment 2 were too complex to enable the participants to make their choice without first forming an overall idea of what each option involved. For that, we may have needed shorter and fewer items, and our alignable versions would have needed a higher degree of commensurability. Indeed, the terms 'alignable' and 'commensurable' can capture a wide range of comparability. In some cases, the parameters are the same and only a specific value differs between the two options (as in our first experiment and Svenson et al., 2009), and in others, the terms refer to items that merely share the same dimension (as in Hess et al., 2012). In our second experiment, the degree of alignability varied somewhat within the alignable options although it was similar across the scenarios. Potentially, this could influence the type of processing used to reach the decision and then retrieve the information in the memory test., which brings us back to Fuzzy-Trace Theory and other memory distortion accounts already briefly discussed in *Chapter 1*.

4.2 Memory distortion theories

Although the types of memory distortions in our taxonomy have been investigated in scientific experiments and much literature has focused on their various manifestations (see e.g., Schacter, 1999; Schacter, Guerin, & St Jacques, 2011), the theories on their origins are as scattered as the studies on the different types of distortions. Few of them are designed to explain choice-supportive memory specifically, even fewer on the general phenomenon rather than a specific type. We briefly discussed some of these theories in *Chapter 1*, and I will now return to them as well as introduce additional ones to discuss our empirical findings in their light.

At the basis of most of these descriptive theories lies the reconstructive nature of memory, stressed already by Bartlett (1932), who observed that "[i]n all ordinary instances [the individual] has an over-mastering tendency simply to get a general impression of the whole; and, on the basis of this, he[/she] constructs the probable detail" (p. 5). He used the word 'schema' – previously used by Immanuel Kant in philosophy, Jean Piaget in psychology and Henry Head in neurology[8], amongst others – to refer to "an active organisation of past reactions, or of past experiences, which must always be supposed to be operating in any well-adapted organic response. That is, whenever there is any order or regularity of behaviour, a particular response is possible only because it is related to other similar responses which have been serially organised, yet which operate, not simply as individual members coming one after another, but as a unitary mass" (p. 3). In other words, when we interpret events, we relate them to elements of our past experiences, activating schemata that can fill in the gaps to provide coherence and a full picture even when details may be lacking. Since Bartlett's treatise, much has been written on schema-based effects on memory (see Alba & Hasher, 1983, for a review, and Hirt, Lynn, Payne, Krackow, & McCrea, 1999, for a review focusing on their influence on false memories specifically) and numerous experiments have shown that inferences and interpretations often serve to complement incomplete recollection. For example, Dunning & Sherman (1997) observed that a sentence like "The rock star was upset about the amount of alcohol served at the party" was falsely remembered as "The rock star was upset that so little

[8] See e.g., Kant (1998), Piaget (1936) and Head (1920).

alcohol was served at the party", whereas changing the subject to a nun instead lead to it being falsely remembered as "The nun was upset that so much alcohol was served at the party". From these observations and general principles of memory, several theories have emerged that attempt to elucidate how false memories, misattributions and other types of distortions arise.

4.2.1 Constructive Memory Framework (CMF)

In *Chapter 1*, we mentioned schema-driven and constructive processing theories that have been presented to explain the origin of memory distortions. One such account is the Constructive Memory Framework (CMF) proposed by Schacter, Norman, & Koutstaal (1998). In common with most – if not all – descriptive memory distortion theories, the CMF has its roots in the account of Bartlett (1932), who wrote that "if we consider evidence rather than supposition, memory appears to be far more decisively an affair of construction rather than one of mere reproduction" (pp. 204–205). At encoding, it emphasizes on the process of connecting features of an event to create a coherent trace while ensuring that this trace is sufficiently distinct for it to be separated from other similar events. At retrieval, it points to the process of constructing a description of the event that is sufficiently focused to identify the correct episode and distinguish it from others. After retrieval follow further monitoring and verification. Both perceptual and conceptual features of a past experience aid in this process of pattern completion.

This process requires certain conditions in order to yield accurate results. If the various elements of an event are inappropriately connected at encoding, source memory errors of the kind described by the Source Monitoring Framework can ensue. The different episodes must also be kept apart in memory to avoid gist-based distortions that originate in the overlap between similar experiences depicted by the Fuzzy-Trace Theory.

4.2.2 Source-Monitoring Framework (SMF)

The Source-Monitoring Framework stipulate that source attributions are decision processes that can be made between external sources (e.g., did I hear it on the radio or did I see it on TV?), internal sources (e.g., did I actually do it or just imagine doing it?) or external and internal sources (e.g., did my friend or I come up with this idea?). Rather than forming an integral part of the memory itself, the source of the memory trace is inferred from its contents and nature.

An example given by Lindsay (2008) is that “a mental event with the characteristics of a memory is likely to be attributed to memory” (p. 325). Thus, in contrast with other theories, this framework stresses misattributions of sensory details rather than the feeling of global familiarity. Contrary to Fuzzy-Trace Theory, it also presupposes that subsystems interact and are not independent from each other.

A premise in SMF is that the more diverse the sources are from each other, the easier source monitoring becomes. Indeed, we found more misattributions in our first experiment, where the options were described using scores on the same parameters, than in our second, where more detailed descriptions were provided for each option, and where differentiation between the two was facilitated. Likewise, the difference in choice-supportiveness between the two experiments could be explained by the chosen option being remembered as superior, and that positive items therefore feel more characteristic of that alternative. It would follow that negative items would then also feel more typical of the rejected option.

It is also in line with the predictions of the SMF that the richer context would dictate a higher probability of false memories in our second experiment compared with our first. For example, Lindsay, Hagen, Read, Wade, & Garry (2004) found that showing participants a class photo from the year of an invented incidence significantly affected the likelihood of false memory: 66% of those who saw the photo compared with 23% of those who did not see it were judged to believe that the event had occurred.

4.2.3 Differentiation Consolidation account (Diff Con)

Diff Con, briefly discussed in *Chapter 1*, suggests that decision making involves a holistic assessment of the alternatives, then a restructuring and an application of heuristics to arrive at or even create a sufficiently superior alternative to reach a decision. After the choice has been made, consolidation processes take over that serve to maintain superior mental representations of the chosen alternative and to protect from regret. However, immediately after making the final choice, the decision maker may experience cognitive dissonance or regret, as the opportunity to choose and the positive aspects of the rejected alternative are now lost, while the negative aspects of the chosen option remain. Post-consolidation processes – similar to those in the pre-decision differentiation phase - then take over to protect from a poor outcome. These processes also involve adapting the situation to render it as favourable as possible to the chosen alternative, and to further restructure the mental representation to its advantage. Thus, post-decision consolidation is an underlying cause of habits and even confirmation bias.

In the context of memory after choice, Diff Con would predict that the chosen option would be remembered in a favourable light and the rejected or non-chosen alternative as worse than it first appeared – at least after the initial period of (possible) cognitive dissonance. As discussed earlier, Festinger's cognitive dissonance theory predicts that healthy adults distort conflicting values and beliefs to reduce the experienced dissonance. In relation to memory choice-supportiveness, this could imply increasing the remembered attractiveness of the chosen option and/or reducing that of the non-chosen option.

In common with Fuzzy-Trace Theory, schema-driven and constructive processing theories (e.g., Constructive Memory Framework), Diff Con presupposes that the decision arises out of mental (gist or schema) representations of the alternatives that are sufficiently distinct to allow them to be judged in terms of desirability. A strength of this theory in this context is that it clearly predicts that with time, the chosen alternative will – in the memory of the decision maker - become increasingly beneficial and the non-chosen option will decrease in attractiveness. However, it does not as clearly define the specific conditions needed for the effect, or when cognitive dissonance will be part of the process and when consolidation will take place without affective motivation.

In our experiments, options that were sufficiently different to enable a choice to be made, but perhaps no distinctive gist to be discerned, did not yield choice-supportive memory. Thus, merely having selected an option and thereby decided that it was the best out of the two, did not trigger the consolidation processes that give rise to choice-supportive memory. Choosing between more complex and verbose options, however, did. Unless the added information made the choices appear more important, it seems likely that the difference would lie either in engagement with the task (which could be heightened with more details) or in the richer and more differentiated mental representations of the two alternatives that those added details made possible. Diff Con does predict that a higher degree of perceived importance will strengthen the effect, but not specifically that sufficiently clear and distinct mental representations are necessary conditions for the phenomenon.

4.2.4 Fuzzy-Trace Theory (FTT)

To reiterate, FTT is a dual-process model according to which both gist and verbatim memory traces are formed and stored in parallel. The gist is the overarching meaning of the situation, whereas verbatim traces are shallow but precise details. Gist traces last longer and give rise to intuitions, whereas verbatim traces are quickly forgotten. The nature of the task at hand dictates which traces are the most important for its accurate completion. Successful solution of reasoning problems relies on gist-memory abilities whereas verbatim memory abilities are more important to respond accurately on memory tests for meaningless word tests, for example.

Contrasting our two experiments with one another, our first study appears likely to induce verbatim processing, as the option descriptions were short, with identical parameters where only the score on each one differed between the two options. This renders it difficult to form a general idea of each option, especially since they were designed and tested to be balanced. As discussed earlier, the complexity, verbosity and lack of complete alignability in our second study likely induced gist-based processing in all conditions.

Our second experiment alone did not provide an answer to the question of whether gist-based processing increases choice-supportiveness (which was our main hypothesis), but by comparing the outcome between our two experiments - rather than that of the different versions in our second experiment – it offers an indication that it does. Indeed, FTT appears compatible with the finding that presentation format can influence which processing style will prevail. Short, alignable and numeric descriptions that encourage item by item comparison rather than one of the gist of the two options should cause increased reliance on verbatim traces, whereas longer, more detailed descriptions that cannot easily be compared with corresponding items in the other option should result in a gist processing preference. If part of the gist is that the chosen option is better than the non-chosen one, more choice-supportive misremembering in our second experiment than in our first would follow.

As the combined results of our experiments – in conjunction with the evidence from previous studies – provide a strong indication that gist processing tend to induce choice-supportive misremembering whereas verbatim processing does not, it follows that these two systems are likely to work independently rather than together. This is also in accordance with the Fuzzy-Trace Theory and appears to contradict accounts (such as SMF) that suggest system interaction.

4.3 Practical consequences of our findings

Knowing when and why individuals tend to remember the information in a choice-supportive manner is useful both to prevent detrimental consequences of this bias and – in other situations - to be able to harness the positive aspects of adaptive memory. As pointed out by Gordon et al. (2005), misattribution of information to experts (when the true source lacked any such credibility), could lead to life-threatening consequences if it results in a cancer patient pursuing a bogus miracle cure. On the other hand, diagnoses made by professionals also risk being influenced by prior cases and decisions rather than being based on an unbiased observation of the patient's symptoms. Likewise, choice-supportive misremembering can serve to uphold addictions by maintaining the belief sets that support addiction (see Viscusi, 1992).

Decision making from memory can be likened to a game of telephone, in which the original information is whispered from person to person, but with the added component that the last person in line has to make a choice based on it. Schema-based distortions may occur on the way (see Allport & Postman, 1947, but also Treadway & McCloskey, 1987), implying that the final decision is in fact based on inaccurate information. An increased awareness of the tendency to remember information in a choice-supportive manner and when this is likely to occur should lead to less reliance on the infallibility of memory. In turn, this should make us revisit the original information when possible rather than assuming that we remember it accurately.

Furthermore, an understanding of these effects may promote tolerance for divergent and seemingly irrational choices made by others and thus prevent the kind of polarization and acrimony that can otherwise easily ensue. It also indicates when we should question our own memory and thereby promote better informed choices. In addition, such knowledge can help us make more accurate predictions about our own and others' future choices, and can be used to nudge people in the direction of healthier ones. If we know that people will remember their chosen alternative as even more superior than it was and easily misremember non-presented items consistent with the gist of that option as actually belonging to it, an effort could be made to make healthy items fit that description.

4.4 Limitations and future directions

4.4.1 Boundaries of the topic discussed

In *Chapter 1*, we specified the eligibility criteria for the critical literature review: only studies in which participants were presented with at least two options with multiple features and asked to make a deliberate preferential choice between the options after reviewing their features (i.e., only studies on choice, not judgment, and not a mere quick decision as is common in studies on choice blindness). No additional information was to be given between the presentation of the options and the memory test (i.e., we are excluding misinformation and hindsight effects) and the participants should not themselves select which information to access. Furthermore, the memory test should be of the information provided in the encoding phase (i.e., not merely which of the options was chosen) and not focusing on the effects of prior information. Clearly, this excluded large bodies of literature, but was necessary to enable an isolation of the choice-supportive effect. Naturally, the two empirical studies conducted as part of this project satisfy these criteria, and our conclusions are limited to these kind of situations.

4.4.2 Study population

The study population represents another limit of our empirical studies as well as of most experiments included in our review. Although almost half of the participants in our second experiment were not Psychology students, the population can be considered rather homogenous and excludes children, teenagers under the age of 19 and adults above age 45. Considering that FTT predicts that young children use a larger proportion of verbatim processing than adults, it would be illuminating to perform a memory choice-supportiveness study on preschoolers. If they exhibit less choice-supportiveness than adults, it would provide further support for the role of gist-based processing in giving rise to these kind of distortions. Likewise, studies on individuals with autism – appearing to rely more on verbatim processing than gist-processing (see e.g., Koldewyn, Jiang, Weigelt, & Kanwisher, 2013; Miller, Odegard, & Allen, 2014) - could offer valuable insight both into the phenomenon of choice-supportive memory and the autism spectrum disorders.

4.4.3 Memory tests

Although our empirical studies indicated that the type of memory test is not a crucial factor for the effect, it is important to point out that only one (DeKay et al., 2014) of the studies in our literature review and neither of our own experiments used any other memory tests than source recognition, free recall and cued recall. That study did not focus on choice-supportive misremembering, which has not yet been tested in a standard recognition paradigm. Likewise, the cued recall tests in the available literature do not cover the range of possible ways to administer such tests. To further test the robustness of the phenomenon, more types of memory tests could be used.

4.4.4 Study design

As previously discussed, our second experiment was designed to test whether different presentation formats would affect choice-supportiveness by inducing gist vs. verbatim processing. Not wanting to change the information contained in the option descriptions between the list and narrative versions (which would have introduced confounding factors), we did not succeed in inducing different types of processing within the same experiment. We therefore had to look at the differences between our two experiments (and those reviewed in *Chapter 1*) to deduce the origins of the effect.

Another limitation of our experiments and all of those reviewed is that they all involved binary choices. Our inclusion criteria for the literature review did not actually specify that only such studies could be included, but no experiment with a larger choice set qualified. For this reason, we used only binary choices in our own empirical studies. However, it has been argued that more options require more effort to make a decision and that the decision maker therefore becomes more vested in the outcome (Payne, Bettman, & Johnson, 1992). This may augment the need to differentiate the chosen option from those rejected and thereby produce more choice-supportiveness in accordance with the Diff Con theory. Alternatively, it may make the memory traces sufficiently strong to resist even schema-consistent intrusions. As cognitive load has been found to induce a switch to a similarity-based decision strategy (e.g., Hoffmann, von Helversen, & Rieskamp, 2013), it would be interesting to explore the impact of the size of the choice set on choice-supportive misremembering.

It is also worth mentioning that only our first experiment included different levels of delay. Since the conditions in that study did not yield choice-supportive memory, we were unable to assess what influence delay may have on the studied phenomenon. In accordance with the Differentiation Consolidation account, increased delay may reinforce the differentiation between the meaning and attractiveness of the two options. This in turn could lead to stronger effects with longer delays. Future experiments with the kind of design most likely to induce choice-supportive misremembering effects could reveal whether this is actually the case.

Most importantly – and as already discussed in *Section 4.1* of this thesis – our two experiments differ in many respects, thus preventing any strong conclusions from being drawn from them. However, they pave the way for future experiments based on new and more specific hypotheses. Since they suggest that the critical conditions are related to the type of stimuli (that need to be sufficiently complex) and to option-based (rather than attribute-based) processing leading to a gist-based mental representation of the options, manipulating the complexity and presentation of the information could provide more conclusive evidence as to the validity of our conclusions. As mentioned in *Section 4.4.2*, studying the phenomenon in children and individuals with autism could also provide further insight into the implications of Fuzzy-Trace Theory as well as into choice-supportive misremembering. Since FTT predicts that children rely more on verbatim memory traces than adults, preschoolers should exhibit less choice-supportiveness than adults and older children. Likewise, less of this bias should be seen in adults with autism than in other adults.

Thus, our literature review and experiments have illuminated which conditions are needed for the effect, in addition to paving the way for future explorations of how to further advance the knowledge to enable more precise predictions of when and to what extent choice-supportive misremembering will occur.

4.5 Conclusion

In *Chapter 1*, we proposed a new taxonomy to categorize the possible manifestations of choice-supportive misremembering. According to that, choice-supportive misremembering can be divided into four types: misattribution, false memory, fact distortion and selective forgetting. We then reviewed the relevant literature and found that the effect is robust when testing memory with source recognition and investigating misattributions, but considerably weaker with other memory tests and for the remaining types of distortions. Studies that used free recall did not yield the effect and only one study using cued recall had been conducted. Thus, our literature review provided the foundation for a deeper analysis of the phenomenon by revealing gaps in the knowledge, and our taxonomy a new tool to use when filling those gaps.

We then conducted an empirical study, described in *Chapter 2*, where we investigated the effects of different delay levels, tested the taxonomy, and appraised the existence of choice-supportive memory in an ecologically valid and standard choice context, using free and cued recall as memory tests. The study provided support for our taxonomy in that all four types of memory distortions were observed, but there was no tendency to remember the options in a choice-supportive manner, despite a high statistical power to detect any such effect. This finding was in line with previous studies using free recall, but conflicting with the paper that tested cued recall.

However, in our second study – reported in *Chapter 3* - where we tested memory with free recall, cued recall and source recognition, we found choice-supportiveness with all three types of tests. This is an important contribution to the knowledge in the field, as it shows that the effect may be more dependent on the type of stimuli rather than the type of memory test. By comparing the design of our experiments as well as by analyzing the detailed findings in light of the main theories proposed to explain misremembering effects, I then discussed the implications of our results and how they clarify the conditions needed for the effect to occur.

The typical scenario in studies on decision making involves two options and their scores or values on specific attributes. The participant is then asked to evaluate the options and choose their preferred one. This setting is conducive of an item by item comparison, and a second stage where the scores on the highest valued attributes determine the final choice. Most studies on choice-supportive misremembering, however, contain verbal descriptions of each option on parameters that differ between the two. Commonly, numeric values are absent or limited, and a comparison item by item would not yield a well-founded decision. Instead, the decision-making process becomes more complex, involving an overall evaluation of each option and then a comparison of the results of that analysis. The extraction of meaning can thus be said to reach a higher level (i.e., that of the option as a whole rather than the individual item) and an understanding of the gist of each option becomes crucial for an adequate decision.

Fuzzy-Trace Theory suggests that memory and reasoning are based on dual verbatim (detailed information, such as specific numbers) and gist (general overall meaning) processes giving rise to distinct memory traces. Correct recall may be based on readout from verbatim memory or a reconstruction from gist memory (Reyna, Corbin, Weldon, & Brainerd, 2016). The former is literal, whereas the latter is substantive. The kind of design traditionally used in studies on decision making favours verbatim processing whereas choice-supportive memory findings are predominantly based on settings where gist memory processes are more appropriate.

The prevailing type of processing not only dictates the method used to reach the decision, but also what is likely to be recalled – both in terms of accurate and distorted memories. Where the gist of an option has not been the decisive factor in reaching a decision, that gist is unlikely to exert a significant influence on recall. The details may not always be correctly remembered, but meaning-consistent misremembering will be less prevalent. When compelled to guess in the absence of reliable memory traces, an individual may still use the knowledge of which choice they made to infer that any positive item is more likely to belong to that option than to the alternative, but this is likely to be limited to cases of pure guessing.

On the other hand, where an individual has made a decision by comparing the gist of two (or more) options, memories may be more vivid and durable due to the richer context, but also more prone to distortions that are compatible with that extracted meaning. The factors that influenced the choice are more susceptible to amplification, whereby the positive items of the chosen option are remembered as even more positive and the negative items of the non-chosen option are remembered as even more negative. In addition, false memories that are consistent with the gist and evaluation of the options become more likely.

Our literature review and first experiment revealed that choice-supportive memory as a phenomenon may not be as robust as previously thought and indeed be the result of an overgeneralization. As shown by the 'replication crisis', it is important not to draw wider conclusions than the study designs permit and to continue testing hypotheses until we can be certain that any results are not due to confounding factors.

Our second experiment and the application of memory theories to our findings clarified the boundaries of the phenomenon as well as illuminated the probable causes. Not only does this help us predict when the effect is likely to be observed, but it also provides insight into what can be done to avoid or induce it to promote better choices – both in situations where the accuracy of that information is crucial, and when choices-supportiveness actually leads to a preferable outcome.

Lastly, this project accentuates the importance of interdisciplinary research. Although studies on decision making in the fields of economics and political science have used designs that may – at first sight - not appear significantly disparate from those in most experiments on choice-supportive misremembering conducted in the field of psychology, a closer analysis reveals that the different paradigms produce considerably divergent effects - both on the processing and the subsequent recall of the information.

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Appendices

- 1 Choice scenarios used in Experiment 1
- 2 Choice scenarios used in Experiment 2
    - 2a Nonalignable narrative version
    - 2b Nonalignable list version
    - 2c Alignable narrative version
    - 2d Alignable list version

1 Choice scenarios used in Experiment 1

STUDENT PARTNER

Immagina che tu debba scegliere un/una compagno/a di corso per svolgere un progetto di laboratorio collaborativo che verrà valutato dall'insegnante e che contribuirà alla tua valutazione finale.

Dopo un'estrazione casuale, hai la possibilità di scegliere tra due colleghi/e (NERI e BIANCHI), le cui caratteristiche sono riassunte nella tabella presentata qui sotto. Anche se nessuna delle due persone corrisponde esattamente alla persona con cui vorresti lavorare, ti chiediamo comunque di indicare il/la compagno/a che preferisci.

Tieni presente che, nelle descrizioni qui sotto, i valori possono essere presentati anche utilizzando una valutazione che va da una stella (* = valore molto scarso) a cinque stelle (* * * * * = valore molto buono).

	COMPAGNO/A NERI	COMPAGNO/A BIANCHI
Affidabilità	molto buona	buona
Disponibilità tempo	3 ore al giorno	5 ore al giorno
Organizzazione	* * *	* *
Cortesia	intermedia	buona
Motivazione	* *	* * *
% progetti con valutazione positiva	80%	75%

ROOM TO BE RENTED

Immagina che tu debba scegliere <u>una stanza da prendere in affitto</u>. Dopo una ricerca, hai selezionato due possibili stanze tra cui scegliere (AZALEA e NINFEA), le cui caratteristiche sono riassunte nella tabella presentata qui sotto. Anche se nessuna delle stanze corrisponde esattamente alla stanza nella quale vorresti alloggiare, ti chiediamo comunque di indicare quella che preferisci.

Tieni presente che, nelle descrizioni qui sotto, i valori possono essere presentati anche utilizzando una valutazione che va da una stella (* = valore molto scarso) a cinque stelle (* * * * * = valore molto buono).

	STANZA AZALEA	**STANZA NINFEA**
Prezzo affitto mensile	300 euro	250 euro
Silenziosità	buona	intermedia
Distanza università	* *	* * *
Ampiezza	20 m^2	15 m^2
Luminosità	* * *	* *
Arredamento	buono	molto buono

RESTAURANT

Immagina di aver invitato a cena un/una amico/a. Hai selezionato due possibili ristoranti tra cui scegliere (RAVIOLO e AGNOLOTTO), le cui caratteristiche sono riassunte nella tabella presentata qui sotto. Anche se nessuno dei due ristoranti corrisponde esattamente al locale che vorresti trovare, ti chiediamo comunque di indicare quello che preferisci.

Tieni presente che, nelle descrizioni qui sotto, i valori possono essere presentati anche utilizzando una valutazione che va da una stella (* = valore molto scarso) a cinque stelle (* * * * * = valore molto buono).

	RISTORANTE RAVIOLO	**RISTORANTE AGNOLOTTO**
Prezzo medio (persona)	35 euro	24 euro
Qualità cibo e ingredienti	* * * * *	* * * *
Rapidità servizio	intermedio	rapido
Atmosfera del locale	* * *	* * * *
Piatti principali sul menù	15 piatti	8 piatti
Valutazioni clienti sui social	molto buone	buone

ENTERTAINMENT BUNDLE

Immagina che ti siano stati proposti due <u>pacchetti promozionali</u> comprendenti dei <u>biglietti da utilizzare per andare a vedere film e spettacoli teatrali</u> (ORSO e GROLLA). Le caratteristiche dei due pacchetti sono riassunte nella tabella presentata qui sotto. Anche se nessuno dei due pacchetti corrisponde esattamente all'offerta che vorresti acquistare, ti chiediamo comunque di indicare quello che preferisci.

Tieni presente che, nelle descrizioni qui sotto, i valori possono essere presentati anche utilizzando una valutazione che va da una stella (* = valore molto scarso) a cinque stelle (* * * * * = valore molto buono).

	PACCHETTO ORSO	**PACCHETTO GROLLA**
Numero spettacoli compresi nel pacchetto	24 spettacoli	18 spettacoli
Numero sale aderenti	numerose	scarse
Qualità media spettacoli (valutazione critici)	* * *	* * * *
Costo per spettacolo	2,5 euro	3,5 euro
Acustica media sale	buona	molto buona
Confort medio sale	* *	* * * *

GYM PACKAGE

Immagina di avere la necessità di tenerti in forma, e di avere deciso di andare in palestra. <u>I tuoi amici frequentano soprattutto due palestre (FIT e SHAPE) e tu hai deciso di andare in una delle due</u>. Le caratteristiche delle due palestre sono riassunte nella tabella presentata qui sotto. Anche se nessuna delle due palestre corrisponde esattamente alla palestra che vorresti frequentare, ti chiediamo comunque di indicare quella che preferisci.

Tieni presente che, nelle descrizioni qui sotto, i valori possono essere presentati anche utilizzando una valutazione che va da una stella (* = valore molto scarso) a cinque stelle (* * * * * = valore molto buono).

	PALESTRA FIT	**PALESTRA SHAPE**
Prezzo abbonamento mensile	35 euro	25 euro
Qualità del luogo	buona	molto buona
Qualità e varietà attrezzi	* * *	* *
Costo accesso iniziale	3 euro	5 euro
Qualità allenatori	molto buona	buona
Flessibilità orari	* *	* * *

2 Choice scenarios used in Experiment 2

2a Nonalignable narrative version

LUNCH RESTAURANTS

Background:

Imagine that you are a university student working on a stimulating assignment together with a friend. You are actually really enjoying yourselves and even though it is still early in the day, you have already made great progress. You decide to book a table at a restaurant for lunch and are choosing between two restaurants, both of which you have tried and enjoyed many times before.

Options:

The Anemone

Relaxed ambiance. Ingredient list not available. Last time, 14 min waiting time to order. Tasty coffee. Licensed to serve alcohol. Welcoming staff. Tables close together. Bread has slight taste of yeast. Dingy bathroom. Average lunch cost is 62 SEK. Comfortable seating. Dishes cannot be adapted to client's preferences.

The Bluebell

Portion size not flexible. Recently renovated. Offer 8 different desserts. Dingy bathroom. Don't play music you like. Tasteful modern interior. Fresh ingredients. Accept Swish. Slight smell of detergent. Max stay is 35 min. On a busy road. Food beautifully presented.

GLASS

Background:

Imagine that your kitchen window broke a few days ago when a large bird flew into it. It is the middle of the winter and you have fixed it temporarily with cardboard, but there is still a bit of a cold draft coming in. Although you don't feel that repairing it is particularly urgent, you have gathered some information about a few glaziers and are now deciding between your two preferred alternatives.

Options:

All Glass

You have heard their glass is durable. Uninformative website. Glazier on holiday for next 13 days. Approachable office staff. Youth sports sponsor. Long tradition of making glass. Not technologically advanced. High staff turnover. Advance payment only. Company located 1.5 km away. Offer advice free of charge. There are no online reviews.

Best Glass

Offer no economical option. Tidy up after themselves. Employees have at least 9 years' experience. Advance payment only. Don't provide time of day of arrival. Can also renovate the frame. Safety glass available. Company is popular nationwide. Their putty takes long to dry. Costs 7% more than the average. Cannot take order by phone. All employees carry certification ID.

HOLIDAY DESTINATIONS

Background:

Imagine that you are planning a holiday with good friends to celebrate your graduation. You have discussed the alternatives for several months and now that there is one month left before your planned date of departure, you are deciding between the two that everyone likes. Although everyone likes both options, half of your friends would prefer the first option and the other half the second. Thus, your friends have asked you to decide where to go, as you have all agreed to book the trip tomorrow.

Options:

Airival

Warm climate. Humid air. Beach is 5 km from hotel. Comfortable hotel room. Low crime level. Hotel has swimming pool. Many beach vendors. Booking is nonrefundable. Weather unpredictable. Choice of 6 different water sports. Allows you to pack light. Noisy at night.

Binair

Far to closest food shop. Opportunity to explore wilderness. Lodging costs 73 SEK/night. Weather unpredictable. Plane trip is long. Cozy evenings with friends. Rich animal life. Locals speak English. Public transportation lacking. Same 4 dishes to choose between every day. No cultural attractions. Scenic nature.

SURGERY METHODS

Background:

While recovering from an unusually persistent bad cough, you start feeling a discomfort when you are walking that you have never felt before. Your doctor tells you that the coughing has caused serious internal injury that will not heal by itself or with medication: you will need an operation. It turns out that the condition is quite common among older adults, but rare among people your own age. After several consultations, extensive searching on the internet, contact with specialists, and reading of the relevant scientific literature, you feel that you have to choose one of two surgery options.

Options:

Dr Anderson

No need to avoid strenuous physical exercise after the recovery period. Requires short daily training program for rest of life. Treatment first used 3 years ago. Study results are positive. Health care institution invests ethically. Visible scarring is minimal. Loan needed to afford surgery. You barely grasp the science behind the method. Soreness during recovery period. May return to physical activity after 12 days. Surgeon has solid clinical research background. Can only be performed in the USA.

Dr Benson

Causes impaired feeling in the skin around the navel. Your GP recommends it. Acquaintance who had the surgery 18 weeks ago is satisfied. Soreness during recovery period. You have to take time off. Short term success guaranteed. Positive personal experience of the hospital. Meal provided after the surgery. Repeat surgery often unsuccessful. Long-term failure rate is 11%. You're not as involved in treatment discussions as you'd like. Minimal waiting time.

2b Nonalignable list version

LUNCH RESTAURANTS

Background:

Imagine that you are a university student working on a stimulating assignment together with a friend. You are actually really enjoying yourselves and even though it is still early in the day, you have already made great progress. You decide to book a table at a restaurant for lunch and are choosing between two restaurants, both of which you have tried and enjoyed many times before.

Options:

The Anemone	***The Bluebell***
Relaxed ambiance	Portion size not flexible
Ingredient list not available	Recently renovated
Last time, 14 min waiting time to order	Offer 8 different desserts
Tasty coffee	Dingy bathroom
Licensed to serve alcohol	Don't play music you like
Welcoming staff	Tasteful modern interior
Tables close together	Fresh ingredients
Bread has slight taste of yeast	Accept Swish
Dingy bathroom	Slight smell of detergent
Average lunch cost is 62 SEK	Max stay is 35 min
Comfortable seating	On a busy road
Dishes cannot be adapted to client's preferences	Food beautifully presented

GLASS

Background:

Imagine that your kitchen window broke a few days ago when a large bird flew into it. It is the middle of the winter and you have fixed it temporarily with cardboard, but there is still a bit of a cold draft coming in. Although you don't feel that repairing it is particularly urgent, you have gathered some information about a few glaziers and are now deciding between your two preferred alternatives.

Options:

All Glass	***Best Glass***
You have heard their glass is durable	Offer no economical option
Uninformative website	Tidy up after themselves
Glazier on holiday for next 13 days	Employees have at least 9 years' experience
Approachable office staff	Advance payment only
Youth sports sponsor	Don't provide time of day of arrival
Long tradition of making glass	Can also renovate the frame
Not technologically advanced	Safety glass available
High staff turnover	Company is popular nationwide
Advance payment only	Their putty takes long to dry
Company located 1.5 km away	Costs 7% more than the average
Offer advice free of charge	Cannot take order by phone
There are no online reviews	All employees carry certification ID

HOLIDAY DESTINATIONS

Background:

Imagine that you are planning a holiday with good friends to celebrate your graduation. You have discussed the alternatives for several months and now that there is one month left before your planned date of departure, you are deciding between the two that everyone likes. Although everyone likes both options, half of your friends would prefer the first option and the other half the second. Thus, your friends have asked you to decide where to go, as you have all agreed to book the trip tomorrow.

Options:

Airival	***Binair***
Warm climate	Far to closest food shop
Humid air	Opportunity to explore wilderness
Beach is 5 km from hotel	Lodging costs 73 SEK/night
Comfortable hotel room	Weather unpredictable
Low crime level	Plane trip is long
Hotel has swimming pool	Cozy evenings with friends
Many beach vendors	Rich animal life
Booking is nonrefundable	Locals speak English
Weather unpredictable	Public transportation lacking
Choice of 6 different water sports	Same 4 dishes to choose between every day
Allows you to pack light	No cultural attractions
Noisy at night	Scenic nature

SURGERY METHODS

Background:

While recovering from an unusually persistent bad cough, you start feeling a discomfort when you are walking that you have never felt before. Your doctor tells you that the coughing has caused serious internal injury that will not heal by itself or with medication: you will need an operation. It turns out that the condition is quite common among older adults, but rare among people your own age. After several consultations, extensive searching on the internet, contact with specialists, and reading of the relevant scientific literature, you feel that you have to choose one of two surgery options.

Options:

Dr Anderson	***Dr Benson***
No need to avoid strenuous physical exercise after the recovery period	Causes impaired feeling in the skin around the navel
Requires short daily training program for rest of life	Your GP recommends it
Treatment first used 3 years ago	Acquaintance who had the surgery 18 weeks ago is satisfied
Study results are positive	Soreness during recovery period
Health care institution invests ethically	You have to take time off
Visible scarring is minimal	Short term success guaranteed
Loan needed to afford surgery	Positive personal experience of the hospital
You barely grasp the science behind the method	Meal provided after the surgery
Soreness during recovery period	Repeat surgery often unsuccessful
May return to physical activity after 12 days	Long-term failure rate is 11%
Surgeon has solid clinical research background	You're not as involved in treatment discussions as you'd like
Can only be performed in the USA	Minimal waiting time

2c Alignable narrative version

LUNCH RESTAURANTS

Background:

Imagine that you are a university student working on a stimulating assignment together with a friend. You are actually really enjoying yourselves and even though it is still early in the day, you have already made great progress. You decide to book a table at a restaurant for lunch and are choosing between two restaurants, both of which you have tried and enjoyed many times before.

Options:

The Anemone

Relaxed ambiance. Looks a bit run down from the exterior. Last time, 14 min waiting time to order. They play music you like. Agreeable odor. Pleasant traditional decor. Watery coffee. Bread has slight taste of yeast. Dingy bathroom. Average lunch cost is 62 SEK. Located in a beautiful park. Few dishes.

The Bluebell

Pace somewhat rushed. Recently renovated. Including ordering, being served takes on average 7 minutes. Shrill music. A bit of smell of detergent. Tasteful modern interior. Tasty coffee. Several types of bread included. Dingy bathroom. Costs 9% more than the average in the area. On a busy road. Wide range of dishes.

GLASS

Background:

Imagine that your kitchen window broke a few days ago when a large bird flew into it. It is the middle of the winter and you have fixed it temporarily with cardboard, but there is still a bit of a cold draft coming in. Although you don't feel that repairing it is particularly urgent, you have gathered some information about a few glaziers and are now deciding between your two preferred alternatives.

Options:

All Glass

Very economical. Uninformative website. Glazier on holiday for next 8 days. Approachable office staff. Provide gadgets for their customers. Friends have recommended the company. You need to clean up afterwards. Employee rights not protected. Advance payment only. Company located 1.3 km away. Flexible booking. Once installed, no official guarantee.

Best Glass

Offer no economical option. Company is technologically advanced. Can come within 6 hours on workdays. Contact only through web forms. Don't give out freebies. Positive online reviews. They keep tidy. Their workers are members of a trade union. Advance payment only. Their closest office is 27 km from your home. Cannot take order by phone. Extended warranty.

HOLIDAY DESTINATIONS

Background:

Imagine that you are planning a holiday with good friends to celebrate your graduation. You have discussed the alternatives for several months and now that there is one month left before your planned date of departure, you are deciding between the two that everyone likes. Although everyone likes both options, half of your friends would prefer the first option and the other half the second. Thus, your friends have asked you to decide where to go, as you have all agreed to book the trip tomorrow.

Options:

Airival

Beach nearby. May be crowded. Accommodation costs 680 SEK/night/person. Comfortable hotel room. Easily accessible destination. Good nightlife. Humid air. Booking is nonrefundable. Weather unpredictable. Hotel restaurant has 13 different dishes. Allows you to pack light. Charter destination.

Binair

Far from any beach. Opportunity to explore wilderness. Lodging costs 96 SEK/night. Only basic amenities. Plane trip is long. Cozy evenings with friends. Clean air. Free cancellation. Weather unpredictable. Same 4 dishes to choose between every day. Requires careful packing. Unique location.

SURGERY METHODS

Background:

While recovering from an unusually persistent bad cough, you start feeling a discomfort when you are walking that you have never felt before. Your doctor tells you that the coughing has caused serious internal injury that will not heal by itself or with medication: you will need an operation. It turns out that the condition is quite common among older adults, but rare among people your own age. After several consultations, extensive searching on the internet, contact with specialists, and reading of the relevant scientific literature, you feel that you have to choose one of two surgery options.

Options:

Dr Anderson

No need to avoid any type of physical exercise after the recovery period. Requires short daily training program for rest of life. Treatment first used 3 years ago. Study results are positive. Health care institution invests ethically. This far, treatment has never failed. Loan needed to afford surgery. You have to bring your own lunch. Soreness during recovery period. May return to physical activity after 12 days. The information provided is excellent. Can only be performed in the USA.

Dr Benson

Even after the recovery period, jumping and running should be avoided to prevent relapse. No maintenance program needs to be followed. Has been standard treatment for this problem for the past 11 years. Some researchers have criticized this method. Hospital known to underpay their nurses. Short term success guaranteed. Cost covered by insurance. Meal provided after the surgery. Soreness during recovery period. During recovery period of 23 days, minimal lifting and walking. You would like to be more involved in treatment discussions. Carried out in your local hospital.

2d Alignable list version

LUNCH RESTAURANTS

Background:

Imagine that you are a university student working on a stimulating assignment together with a friend. You are actually really enjoying yourselves and even though it is still early in the day, you have already made great progress. You decide to book a table at a restaurant for lunch and are choosing between two restaurants, both of which you have tried and enjoyed many times before.

Options:

The Anemone	***The Bluebell***
Relaxed ambiance	**Pace somewhat rushed**
Looks a bit run down from the exterior	**Recently renovated**
Last time, 14 min waiting time to order	**Including ordering, being served takes on average 7 minutes**
They play music you like	**Shrill music**
Agreeable odor	**A bit of a smell of detergent**
Pleasant traditional decor	**Tasteful modern interior**
Watery coffee	**Tasty coffee**
Bread has slight taste of yeast	**Several types of bread included**
Dingy bathroom	**Dingy bathroom**
Average lunch cost is 62 SEK	**Costs 9% more than the average in the area**
Located in a beautiful park	**On a busy road**
Few dishes	**Wide range of dishes**

GLASS

Background:

Imagine that your kitchen window broke a few days ago when a large bird flew into it. It is the middle of the winter and you have fixed it temporarily with cardboard, but there is still a bit of a cold draft coming in. Although you don't feel that repairing it is particularly urgent, you have gathered some information about a few glaziers and are now deciding between your two preferred alternatives.

Options:

All Glass ***Best Glass***

Very economical	Offer no economical option
Uninformative website	Company is technologically advanced
Glazier on holiday for next 8 days	Can come within 6 hours on workdays
Approachable office staff	Contact only through web forms
Provide gadgets for their customers	Don't give out freebies
Friends have recommended the company	Positive online reviews
You need to clean up afterwards	They keep tidy
Employee rights not protected	The workers are members of a trade union
Advance payment only	Advance payment only
Company located 1.3 km away	Their closest office is 27 km from your home
Flexible booking	Cannot take order by phone
Once installed, no official guarantee	Extended warranty

HOLIDAY DESTINATIONS

Background:

Imagine that you are planning a holiday with good friends to celebrate your graduation. You have discussed the alternatives for several months and now that there is one month left before your planned date of departure, you are deciding between the two that everyone likes. Although everyone likes both options, half of your friends would prefer the first option and the other half the second. Thus, your friends have asked you to decide where to go, as you have all agreed to book the trip tomorrow.

Options:

Airival	***Binair***
Beach nearby	Far from any beach
May be crowded	Opportunity to explore wilderness
Accommodation costs 680 SEK/night/person	Lodging costs 96 SEK/night
Comfortable hotel room	Only basic amenities
Easily accessible destination	Plane trip is long
Good nightlife	Cozy evenings with friends
Humid air	Clean air
Booking is nonrefundable	Free cancellation
Weather unpredictable	Weather unpredictable
Hotel restaurant has 13 different dishes	Same 4 dishes to choose between every day
Allows you to pack light	Requires careful packing
Charter destination	Unique location

SURGERY METHODS

Background:

While recovering from an unusually persistent bad cough, you start feeling a discomfort when you are walking that you have never felt before. Your doctor tells you that the coughing has caused serious internal injury that will not heal by itself or with medication: you will need an operation. It turns out that the condition is quite common among older adults, but rare among people your own age. After several consultations, extensive searching on the internet, contact with specialists, and reading of the relevant scientific literature, you feel that you have to choose one of two surgery options.

Options:

Dr Anderson	*Dr Benson*
No need to avoid any type of physical exercise after the recovery period	Even after the recovery period, jumping and running should be avoided to prevent relapse
Requires short daily training program for rest of life	No maintenance program needs to be followed
Treatment first used 3 years ago	Has been standard treatment for this problem for the past 11 years
Study results are positive	Some researchers have criticized this method
Health care institution invests ethically	Hospital known to underpay their nurses
This far, treatment has never failed	Short term success guaranteed
Loan needed to afford surgery	Cost covered by insurance
You have to bring your own lunch	Meal provided after the surgery
Soreness during recovery period	Soreness during recovery period
May return to physical activity after 12 days	During recovery period of 23 days, minimal lifting and walking
The information provided is excellent	You would like to be more involved in treatment discussions
Can only be performed in the USA	Carried out in your local hospital