Interactions between spontaneous instantiations to the basic level and post-event suggestions

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Extensive research shows that post-event suggestions can distort the memory for a target event. In this study we examined the effect of such suggestions as they interact with the products of a spontaneous memory process: instantiation of abstract information to an intermediate level of abstractness, the basic level (Pansky & Koriat, 2004). Participants read a narrative containing items presented at the superordinate level (e.g., FRUIT), were exposed to suggestions that referred to these items at the basic level (e.g., APPLE), and were finally asked to recall the original items. We found that the tendency to instantiate spontaneously in the control (non-misleading) condition, particularly over time, increased following exposure to suggestions that were likely to coincide with those instantiations. Exposure to such suggestions, either immediately or following a 24-hour delay, reduced subsequent correct recall of the original items only if the suggested information coincided with the information one tends to instantiate spontaneously in a given context. Suggestibility, in this case, was particularly pronounced and phenomenologically compelling in terms of remember/know judgements. The findings are taken to imply that effects of post-event suggestions can be understood in terms of the constructive processes that set the stage for their occurrence.

Keywords: False memory; Misinformation effect; Suggestibility; Instantiation; Constructive memory.

On 18 July 2007 midtown Manhattan was shaken by a huge blast, which eventually turned out to be a steam pipe explosion (e.g., CNN, 2007). Given the recent wave of terror attacks, many of the eyewitnesses initially portrayed this explosion as a bomb (e.g., Fox News, 2007). Suppose that a group of eyewitnesses later shared their experiences of the event, with one eyewitness describing it as a bomb, and another eyewitness describing it as an earthquake. Which of these misleading accounts would be more likely to influence subsequent eyewitness reports of the event? What we aim to show in the present study is that the misinformation that a bomb exploded would be more likely to contaminate the eyewitness reports because it is consistent with the typical spontaneous interpretation of the explo-

sion, guided by the present context, expectations, and past experience.

The effects of context on the comprehension and encoding of information have been studied extensively in the domain of psycholinguistics. In particular, it has been shown that the meaning of a concept can be affected by the context in which it is presented (e.g., Anderson & Ortony, 1975; Roth & Shoben, 1983). Several previous findings imply that rememberers spontaneously instantiate abstract information that they encounter into more specific and concrete exemplars, based on their knowledge of the world and on the context (e.g., Anderson & McGaw, 1973; Anderson et al., 1976; Dubois & Denis, 1988; McKoon & Ratcliff, 1989). For example, McKoon and Ratcliff (1989) presented participants with sentences containing

contextually defined categories (e.g., "The young attorney wanted to make sure she had fresh juice for breakfast, so she bought and squeezed the FRUIT herself.") and found high false recognition rates for non-presented exemplars that were implied by the context (e.g., ORANGE), but not for non-presented exemplars that were less typical for the category in that context (e.g., GRAPEFRUIT). Although there was some debate in the literature regarding the pervasiveness of instantiation at encoding (e.g., Roth & Shoben, 1983; Whitney, 1986; Whitney & Kellas, 1984), there seems to be an agreement that it occurs quite frequently for contextually constrained categories (e.g., a FRUIT one squeezes for juice at breakfast) that have a most typical exemplar (e.g., McKoon & Ratcliff, 1989; O'Brien, Shank, Myers, & Rayner, 1988).

In a more recent study Pansky and Koriat (2004) have demonstrated, for both recall and recognition, instantiation to an intermediate hierarchical level known as the *basic level* (BL; see Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976). They presented participants with a narrative containing target items, each of which appeared at one of three hierarchical levels: superordinate (e.g., VEHICLE), basic level (e.g., CAR), or subordinate (e.g., SPORTS CAR). The results indicated that, irrespective of the original level at which an item was presented, participants tended to report it at the BL, exhibiting bidirectional hierarchical shifts towards the BL. Thus, whereas subordinate items showed loss of detail and an upward shift in abstractness, superordinate items underwent a downward shift in abstractness by which they were instantiated to more concrete exemplars that were consistent with the context, with these two opposing trends converging at the BL. This basic-level convergence effect (BLCE) was obtained at immediate testing, but was especially pronounced at delayed testing.

Assuming that instantiations to the BL occur at encoding (e.g., McKoon & Ratcliff, 1989; O'Brien et al., 1988), how can one explain the larger downward BLCE obtained with delay? One plausible account that is consistent with principles of fuzzy-trace theory (FTT; see Brainerd & Reyna, 2001, 2002) claims that an event item is encoded at multiple levels of abstraction in parallel. Thus, an instantiation to the BL, which is an exemplar of the category that is implied by the context, may be encoded in addition to the explicitly presented superordinate item (e.g., VEHICLE and CAR are encoded in parallel).

Due to the cognitive advantages of BL representations, such as achieving the optimal balance between specificity (i.e., informativeness) and distinctiveness (Murphy & Brownell, 1985; Rosch et al., 1976), they might become more accessible than the respective superordinate representations, particularly over time.

In the present study, we sought to examine the role of the spontaneous constructive process of instantiation in setting the stage for influences of external suggestions introduced after the event. The contaminating effect of such misleading post-event information (MPI) has been investigated extensively following the seminal study of Loftus, Miller, and Burns (1978). Numerous studies have shown that misleading suggestions introduced after an event can distort the memory for that event, in what is known as the *misinformation effect* (for reviews, see Pansky, Koriat, & Goldsmith, 2005; Zaragoza, Belli, & Payment, 2007). In a prototypical misinformation experiment participants who are exposed to an event are later presented with MPI that is either contradictory to event details (e.g., Loftus et al., 1978; Pansky & Tenenboim, 2011), provides additive information that was not part of the original event (e.g., Fiedler, Walther, Armbruster, Fay, & Naumann, 1996; Lindsay & Johnson, 1989), or both (e.g., Frost, 2000; Nemeth & Belli, 2006). Suggestibility is said to occur if the introduction of MPI increases the reporting of the suggested items on a subsequent memory test compared to a control condition in which MPI was not introduced.

As pointed out by Belli (1989; see also Chandler, Gargano, & Holt, 2001; Loftus & Hoffman, 1989; McCloskey & Zaragoza, 1985; Pansky, Tenenboim, & Bar, 2011), suggestibility may reflect two possible influences of exposure to MPI with respect to the memory for the original event information. The first potential effect, involves *misinformation interference*, by which the MPI interferes with remembering the original target item, which could be achieved had no MPI been introduced. The other possible effect of MPI is *misinformation acceptance*, by which the MPI is simply accepted, usually because the original event item was not encoded in the first place or was forgotten by the time that the MPI was introduced. Thus, misinformation acceptance does not interfere with accessing the memory representation of the original event item, because there was no such accessible representation to begin with. In the present study we tested for misinformation interference in addition to testing

for suggestibility, which may reflect either misinformation interference, misinformation acceptance, or both.

The present study

The present study is based on the assumption that the effects of MPI can be understood in terms of the constructive memory processes against which they operate (see also Mazzoni, 2002). Consider instantiation to the BL. This constructive process is likely to occur when the target items are relatively abstract (e.g., FRUIT, JEWELLERY, FURNITURE) and contextually constrained, creating memory representations that are more informative and specific than the original items. In such cases MPI might have a stronger distorting effect if the suggested information is consistent with one's spontaneous instantiation of the original information. In accordance with the discrepancy detection principle (see Hall, Loftus, & Tousignant, 1984; Tousignant, Hall, & Loftus, 1986; see also Loftus, 2005) we propose that the suggested information is either accepted as consistent with the original event information or is rejected as discrepant, depending on the memory representation for the event information at the time the MPI is introduced. Due to the BLCE (Pansky & Koriat, 2004), the instantiation to the BL of the original superordinate item tends to be relatively accessible, particularly (but not only) when the MPI is introduced after a delay. If the MPI is consistent with that BL representation, this representation is likely to gain accessibility, resulting in suggestibility that is likely to be phenomenologically compelling (i.e., the falsely recalled event detail is experienced as having had occurred in the event). Furthermore, this increase in relative accessibility of the instantiated BL representation might also render it more accessible than the superordinate representation of the event item, resulting in misinformation interference. In contrast, when the MPI is inconsistent with the accessible BL representation of the event, it is likely to be rejected as discrepant, yielding no suggestibility and no misinformation interference.[1]

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[1]Note, though, that there are cases in which there is no accessible representation of the target event detail at the time the MPI is introduced (at any level of detail), which can result in suggestibility involving misinformation acceptance but not in misinformation interference (see Belli, 1989; McCloskey & Zaragoza, 1985).

Therefore, in the present study we focused on situations in which the original item was presented at the superordinate level, and compared the effects of suggested items that were either consistent or inconsistent with the postulated instantiations to the BL. In Experiment 1 we examined the influence of the type of suggested item and the timing of MPI introduction on the likelihood of recalling the suggested BL item instead of the original item. In Experiment 2 we examined how the phenomenology associated with false reports of the suggested items is also influenced by their likelihood to be instantiated spontaneously.

EXPERIMENT 1

The target event was a narrative containing 18 target items at the superordinate level (e.g., FRUIT). Based on preliminary testing we designed the experimental materials such that each target item, presented in a context, tended to elicit a highly probable instantiation to the BL. Following McKoon and Ratcliff (1989), we use the term *primary exemplar* to refer to this type of instantiation and the term *secondary exemplar* to refer to a less-probable (though plausible) instantiation of the target item.

After a retention interval of either 10 minutes or 24 hours the participants were presented with questions about the narrative, in which the target superordinate items were referred to either by the primary exemplar or by the secondary exemplar. We refer to such questions as *misleading* in the sense that they introduce information about the target item that extends beyond the original information, although this information is additive (cf., Frost, 2000; Lindsay & Johnson, 1989; Nemeth & Belli, 2006) rather than contradictory to the original information. Finally the participants were asked to recall the target items in response to specific questions.

As noted by Roediger, Jacoby, and McDermott (1996), a recall format (as used in the present study) allows a comparison between the control and the misleading conditions on two separate measures, without the two necessarily trading off against one another: (1) the proportion of correct recall of the event items, and (2) the proportion of false recall of the suggested items. Of course, at the level of the individual item, a trade-off necessarily occurs between reporting the target item and reporting the suggested item, because

participants are permitted to provide only one response to each question. However, at the aggregate level, because the participants have the option to respond with an item other than the target or suggested items, such a trade-off does not necessarily occur. Consequently the two measures do not always go hand in hand, and, in fact, our findings include cases in which they do not (see also Pansky et al., 2011; Roediger et al., 1996). Whereas the first comparison assesses misinformation interference, the second comparison assesses suggestibility.

Assuming that the primary exemplar is more likely than the secondary exemplar to coincide with the spontaneous instantiation of the target superordinate item, we predicted the following. First, a larger proportion of primary than of secondary exemplars will be reported in the control (non-misleading) condition. Second, this tendency is expected to be even more pronounced in the misleading condition. Consequently, primary-exemplar suggestions should yield stronger suggestibility than secondary-exemplar suggestions. Third, for both primary-exemplar and secondary-exemplar suggestions, we expected stronger suggestibility following a longer retention interval until the presentation of misinformation (and testing) due to forgetting over time of event details (see, e.g., Frost, Ingraham, & Wilson, 2002; Underwood & Pezdek, 1998). Fourth, due to stronger BLCE over time (Pansky & Koriat, 2004), we expected the proportion of primary exemplars recalled to increase over time, in both the control condition and the misleading condition. Finally, misinformation interference was expected only for primary exemplars, such that the correct recall of the target details would decline following primary-exemplar suggestions but not following secondary-exemplar suggestions.

Method

Participants. A total of 72 Hebrew-speaking undergraduates were randomly assigned to either the immediate-testing group, or to the delayed-testing group.

Materials. A total of 18 superordinate target items (e.g., FRUIT) were embedded in a 636-word narrative written in Hebrew (see the Appendix for a translation). Each target item appeared in a separate sentence (e.g., "She quickly grabbed a FRUIT from the refrigerator, took a bite, and prepared to leave the house."). The post-event suggestions were presented via yes/no questions about the narrative that referred to the target items at the BL instead of the original superordinate level, in a presupposition format. The main focus of each question, which was underlined (see examples below), was not the suggested item. Therefore, the correct answer to each question could be either "yes" or "no".

Two types of misleading conditions were implemented. In the primary-exemplar condition each misleading question referred to the target item using the primary instantiation to the BL (e.g., APPLE) of the target superordinate item. The corresponding question in the secondary-exemplar condition referred, instead, to a less-probable BL instantiation (e.g., BANANA) of the target item, given the narrative context.[2] The 18 target items, presented in Table 1, were equally divided into one of three conditions: (1) misleading primary-exemplar condition, (2) misleading secondary-exemplar condition, and (3) control condition, in which the target items were not referred to at all.

TABLE 1
The target items and corresponding primary and secondary exemplars

Original item	Primary exemplar	Secondary exemplar
jewellery	ring	earring
clothing	shirt	knit
fruit	apple	banana
furniture	chair	couch
sweet	chocolate	gum
vegetable	carrot	cucumber
musical instrument	guitar	flute
pastry	cake	burekas*
kitchen utensil	pot	pan
dish	soup	roast
animal	dog	rabbit
aircraft	airplane	helicopter
vehicle	bus	taxi
toy	doll	ball
vessel	boat	raft
beverage	water	soda
reading material	book	article
writing utensil	pen	marker

*A type of popular puff pastry.

[2]Note that the particular contextual information that tends to lead to a primary-exemplar rather than to a secondary-exemplar instantiation was not mentioned in the misleading question, rendering the two types of suggested items equally plausible.

Each of the misleading questions was presented in one of two versions, one for which the correct answer was "yes" (e.g., "Was it mentioned that Yael had managed to brush her teeth before she took the apple/banana?", with either APPLE or BANANA serving as the suggested item, depending on the type of misleading condition), and one for which the correct answer was "no" (e.g., "Was it mentioned that Yael had managed to eat breakfast before she took the apple/banana?"). In order to obscure the suggestion manipulation, 12 filler questions that contained no suggestions and no reference to any target item were also presented, for a total of 24 yes/no questions. In a further attempt to make the suggestions relatively subtle, the participants were instructed to concentrate on the underlined information as the focus of each question (e.g., "Was it mentioned that Yael had managed to brush her teeth before she took the apple?"). The assignment of item to experimental condition and version (i.e., whether the correct answer was "yes" or "no") was counterbalanced across participants using a Latin Square Design. The questions were presented in the same pseudo-random order for all the participants, albeit in counterbalanced experimental conditions. The final memory test was identical for all of the participants and contained one cued-recall question for each target item (e.g., "What did Yael take with her instead of breakfast before she left the house?"). The order of the final questions corresponded to the order in which the items had appeared in the original narrative.

Procedure. The experiment consisted of two sessions. In the first session the participants read the narrative at their own pace and were informed that they would be asked to answer questions about it at a later stage. They then performed filler tasks for approximately 10 minutes (e.g., completing numerical series), followed by short tasks regarding the narrative (e.g., listing the character names).[3] The participants assigned to the immediate-testing condition then proceeded to the second session of the experiment, whereas

those assigned to the delayed-testing condition were released and returned 24 hours later.

In the second session the participants answered 24 yes/no questions, half of which contained suggestions. Finally, following 10 minutes of additional filler activities, the participants took the cued-recall test. This test was preceded by a warning that some of the earlier questions about the narrative may have contained inaccurate details. The participants were requested to answer the questions relying solely on the information presented in the original narrative, exactly as it was presented there, and to answer all the questions even if they had to guess.

Results and discussion

Two independent judges classified the responses on the final test as correct verbatim responses, primary exemplars, secondary exemplars, other exemplars at the BL, or other intrusions. The classifications made by these two judges were identical in 98% of the cases. A third judge determined the scoring of the controversial 2% of the responses. Table 2 presents the recall proportion of each response type in each experimental condition. Analyses of variance (ANOVAs) and planned comparisons (*t* tests) were used for statistical testing. All the analyses were significant at the $p < .05$ level, unless otherwise noted.

We first examine the results for the control condition in order to confirm that a BLCE occurred more often to the primary than to the secondary exemplars. An ANOVA was conducted on the proportion of primary and secondary exemplars recalled in the control condition, with retention interval (10 minutes, 24 hours) as a between-participants factor and type of exemplar (primary exemplar, secondary exemplar) as a within-participant factor.

As shown in Table 2, the participants were found to spontaneously instantiate to the primary exemplars significantly more often (.23) than to the secondary exemplars (.01), $F(1, 70) = 98.785$, $\eta_p^2 = .585$. We also found a main effect of retention interval, $F(1, 70) = 7.037$, $\eta_p^2 = .091$, with more instantiations at delayed testing (.15) than at immediate testing (.10). However, this effect was qualified by a significant two-way interaction between type of exemplar and retention interval, $F(1, 70) = 4.193$, $\eta_p^2 = .057$, with instantiations to the primary

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[3]These tasks were intended to give delayed-testing participants the impression that they had completed answering questions on the narrative in the first session, thus minimising the probability that they would utilise the retention interval between the two sessions to actively prepare for a memory test. These tasks did not relate to any of the target items (neither directly nor indirectly) and were performed by both experimental groups.

TABLE 2
Experiment 1: Recall proportions of target items and of various types of intrusions as a function of retention interval and misinformation condition

Retention interval	Misinformation condition	Response type				
		Target item	Primary exemplar	Secondary exemplar	Other BL exemplar	Other intrusion
10 minutes	Control	.56 (.22)	.18 (.15)	.01 (.04)	.06 (.11)	.19 (.16)
	Misleading-primary exemplar	.43 (.24)	.37 (.19)	.02 (.05)	.06 (.11)	.12 (.15)
	Misleading-secondary exemplar	.52 (.24)	.19 (.17)	.11 (.14)	.06 (.11)	.12 (.11)
24 hours	Control	.27 (.19)	.28 (.21)	.02 (.06)	.08 (.13)	.35 (.23)
	Misleading-primary exemplar	.18 (.19)	.65 (.23)	.02 (.06)	.06 (.12)	.09 (.14)
	Misleading-secondary exemplar	.28 (.23)	.22 (.15)	.28 (.20)	.07 (.12)	.15 (.17)
Total	Control	.41 (.25)	.23 (.18)	.01 (.05)	.07 (.12)	.28 (.21)
	Misleading-primary exemplar	.31 (.25)	.51 (.25)	.02 (.06)	.06 (.11)	.10 (.15)
	Misleading-secondary exemplar	.40 (.26)	.21 (.16)	.19 (.20)	.06 (.11)	.14 (.14)

Standard deviations appear in parentheses.

exemplars increasing (by .10) with retention interval, $t(70) = 2.418$, $d = .580$, but not instantiations to the secondary exemplars, $t(70) = 0.845$, *ns*, $d = .196$. Thus, even in the face of no suggestion, the participants were found to instantiate spontaneously to the primary exemplars, especially over time, demonstrating a BLCE to these exemplars.

Suggestibility. In order to assess suggestibility—the difference between the misleading and control conditions in the proportion of falsely recalled suggested items—we added the data of the misleading condition to the previously reported ANOVA, with misinformation condition (control, misleading) as an additional within-participant factor. Indeed, a higher proportion of suggested items was recalled in the misleading condition (.35) than in the control condition (.12), resulting in a significant suggestibility effect across the two misleading conditions, $F(1, 70) = 110.741$, $\eta_p^2 = .613$. In general, primary exemplars (.37) were erroneously recalled more often than secondary exemplars (.10), $F(1, 70) = 209.211$, $\eta_p^2 = .749$. However, as expected, this trend was more pronounced in the misleading than in the control condition, with a significant interaction between misinformation condition and type of exemplar, $F(1, 70) = 7.750$, $\eta_p^2 = .100$, yielding greater suggestibility for primary exemplars (.27) than for secondary exemplars (.18).

We now turn to examine the effects of retention interval on suggestibility. As expected, suggestibility was greater when the introduction of

MPI (and final test) was delayed (.31) than when it was immediate (.15), $F(1, 70) = 16.401$, $\eta_p^2 = .190$. As shown in Figure 1, in both control and misleading conditions the proportion of primary exemplars that were erroneously recalled increased to a larger extent with retention interval than the proportion of secondary exemplars, with a significant interaction between type of exemplar and retention interval, $F(1, 70) = 7.167$, $\eta_p^2 = .093$. That is, a parallel effect of retention interval to the one reported earlier for the control condition was found in the misleading condition: The proportion of suggested primary exemplars that were recalled increased with retention interval (by .32) to a larger extent than the proportion of suggested secondary exemplars recalled (by .18), with a significant interaction between type of exemplar and retention interval, $F(1, 70) = 3.825$, $\eta_p^2 = .052$. The three-way interaction between type of exemplar, misleading condition, and retention interval was not significant, $F < 1$, confirming that the larger effect of retention interval on the erroneous recall of primary compared to secondary exemplars was comparable for the control and the misleading conditions.

Misinformation interference. To what extent did the introduction of each type of MPI reduce the tendency to correctly recall the target items, yielding misinformation interference? The proportion of correctly recalled target items in the control condition averaged .41. In comparison, the proportion of correctly recalled target items was significantly lower in the misleading
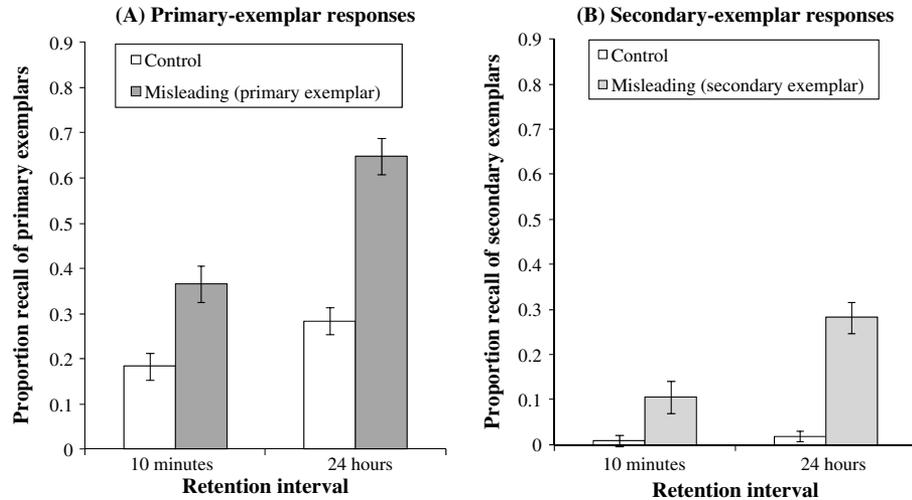
(A) Primary-exemplar responses

(B) Secondary-exemplar responses

Figure 1. Mean proportion of primary-exemplar responses (panel A) and secondary-exemplar responses (panel B) by retention interval (10 minutes vs 24 hours) and misinformation condition (control vs misleading), Experiment 1. Error bars indicate 1 SEM.

primary-exemplar condition (.31), $F(1, 70) = 12.841$, $\eta_p^2 = .155$, but not in the misleading secondary-exemplar condition (.40), $F < 1$. Thus, as predicted, significant misinformation interference was found following the suggestion of a primary exemplar but not following the suggestion of a secondary exemplar. A main effect of retention interval was also found, $F(1, 70) = 47.836$, $\eta_p^2 = .406$, with a lower proportion of correct recall of target items following a longer retention interval. As shown in Figure 2, this applied to both control and misleading conditions, with a non-significant interaction between retention interval and misinformation condition, $F < 1$.

To summarise, the results of Experiment 1 support the predictions. First, we found the expected BLCE to the primary exemplar, with significantly more spontaneous instantiations to the primary exemplars than to the secondary exemplars in the control condition, particularly over time. Second, this trend was enhanced when primary-exemplar vs secondary-exemplar suggestions were introduced, yielding greater suggestibility for primary than for secondary exemplars. Third, lengthening the retention interval until the introduction of MPI (and the final test) yielded greater suggestibility for both types of misleading items. However, the proportion of suggested primary-exemplars that were recalled was more affected by retention interval than the proportion of suggested secondary-exemplars recalled. Finally, memory for the original event items was also differentially affected by the two types of misleading suggestions: Introducing a

primary-exemplar suggestion, either immediately or following a delay, yielded misinformation interference whereas introducing a secondary-exemplar suggestion did not.

EXPERIMENT 2

In Experiment 1 we found that primary-exemplar suggestions were more likely to be falsely recalled than secondary-exemplar suggestions. In Experiment 2 we examined whether the false recall of these two types of misleading suggestions also differed in terms of its subjective quality. Because
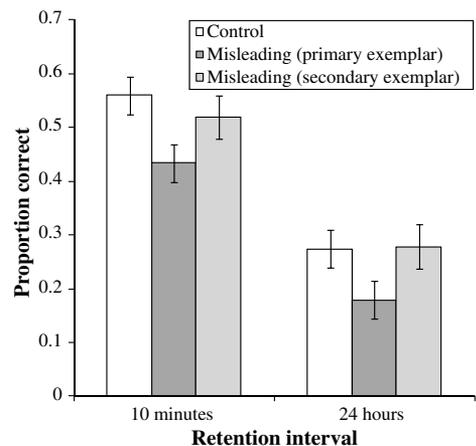

Figure 2. Mean proportion of correct recall of superordinate target items in the control, misleading primary-exemplar, and misleading secondary-exemplar conditions by retention interval (10 minutes vs 24 hours), Experiment 1. Error bars indicate 1 SEM.

primary-exemplar suggestions were more likely than secondary-exemplars to be consistent with the spontaneous instantiations of the target superordinate items, we expected their recall to be accompanied by a stronger phenomenological experience of remembrance from the original event.

To examine the subjective experience of remembering, we applied Tulving's (1985) *remember/know* procedure (for reviews, see Gardiner & Java, 1993; Rajaram & Roediger, 1997) following the recall of each test item. In this procedure, a "remember" judgement for a reported item, whether accurate or inaccurate, is thought to reflect a subjective experience of remembering the occurance of that item in the original event. In contrast, a "know" judgement reflects knowledge that it was part of the event, without actually remembering its exact occurrence.

Previous studies have shown that misled responses are often associated with "remember" responses, indicating that they can be subjectively experienced as event memories (e.g., Frost, 2000; Roediger et al., 1996), particularly when the MPI is additive rather than contradictory (Frost, 2000). Therefore, in Experiment 2 we expected that the recall of both primary-exemplar and secondary-exemplar suggestions would be quite frequently judged as "remembered" from the original event, because both of them were plausible and entailed additive (as opposed to contradictory) information. However, more importantly, we predicted that recalling suggested primary exemplars would be more often associated with "remember" judgements than recalling suggested secondary exemplars, because a suggested primary exemplar is more likely to coincide with the information most people tend to instantiate following the presentation of the target information in its original context. Using contradictory misinformation, Pérez-Mata and Diges (2007) showed that misleading suggestions were both more likely to be recognised and more likely to be judged as "remembered" (rather than "known") if the misleading suggestions were congruent with the original target scene than if they were incongruent. Although both types of misleading suggestions in their study were plausible (i.e., could have appeared in the target scene), the congruent suggestions referred to details that were found to yield high false recognition rates in a preliminary study entailing no misinformation, whereas the incongruent suggestions referred to details that were found to yield low false recogni-

tion rates. In similar vein we aimed to show that the suggested primary exemplars in our study not only yield greater suggestibility than the secondary exemplars, but are also more likely to be associated with a compelling subjective experience of having been present in the original event.

The basic methodology in Experiment 2 was the same as in Experiment 1, with two modifications: (1) At test, the participants were requested to provide a remember/know/guess judgement after providing a response (see Gardiner, Ramponi, & Richardson-Klavehn, 1998, for this variation of the methodology). (2) Based on the results of Experiment 1, in this experiment we used only the delayed condition, which, in comparison to the immediate condition, was found to generate sufficient cases of suggestibility to allow a breakdown of suggested responses according to phenomenological judgements.

Method

Participants. A total of 36 Hebrew-speaking undergraduates participated in the experiment.

Materials and procedure. The materials and procedure were the same as in Experiment 1 except for the following changes: (1) The interval between the two sessions was fixed at 24 hours for all the participants, and (2) The remember/know/guess procedure was applied after each question in the final cued-recall test. For each item that the participants provided, they were asked to indicate whether they *remember* its specific occurrence in the narrative, *know* that it occurred but cannot recall the exact episode, or are merely *guessing*. The instructions followed those that were used by Roediger et al. (1996).

Results and discussion

Examination of the data in the control condition revealed that, as in Experiment 1, spontaneous instantiation to the primary exemplars was more frequent (.24) than instantiation to the secondary exemplars (.03), $t(35) = 7.213$, $d = 1.20$.

Suggestibility. Also replicating the findings of Experiment 1, a higher proportion of suggested items was recalled in the misleading conditions (.52) than in the control conditions (.13), resulting in a significant suggestibility effect (.39), $F(1,$

35) $= 235.064$, $\eta_p^2 = .870$. A main effect was found here as well for type of exemplar, with a higher proportion of primary exemplars (.45) erroneously recalled than secondary exemplars (.19), regardless of misinformation condition, $F(1, 70) = 123.723$, $\eta_p^2 = .779$. Finally, as in Experiment 1, suggestibility was greater for primary exemplars (.45) than for secondary exemplars (.32), $F(1, 35) = 6.076$, $\eta_p^2 = .148$.[4]

Remember/know/guess judgements. In order to test the hypothesis that recalled primary-exemplar suggestions are more phenomenologically compelling than recalled secondary-exemplar suggestions, we first compared the absolute proportions of remember/know/guess judgements associated with these two types of responses. As expected, the interaction between type of misleading exemplar and type of phenomenological judgement was significant, $F(2, 70) = 12.828$, $\eta_p^2 = .268$. As shown in Figure 3 (panel A), although recalled primary-exemplar and secondary-exemplar suggestions were associated with comparable proportions of "know" (.16 and .13, respectively), $t(35) = 0.888$, *ns*, $d = .15$, and "guess" judgements (.09 and .07, respectively), $t(35) = .838$, *ns*, $d = .14$, primary exemplar responses were associated with a higher proportion of 'remember' judgements (.43) than secondary exemplar responses (.16), $t(35) = 5.977$, $d = 1.00$. Thus, not only were rememberers more likely to recall primary-exemplar suggestions than secondary-exemplar suggestions, the difference between the two conditions consisted entirely of "remember" responses. It should also be noted that only a small proportion of responses (less than 10%) were classified by the participants as guesses, and that this proportion was comparable in the two misleading conditions.

In order to correct for the different levels of suggestibility in the primary-exemplar and secondary-exemplar conditions, a second analysis of remember/know/guess judgements compared the probability for each type of judgement, conditional

on the recall of the suggested information (i.e., given that the participant recalled the suggested primary or secondary exemplar). As shown in Figure 3 (panel B), the conditional probability for a "remember" judgement was significantly higher for a recalled primary-exemplar suggestion (.62) than for a recalled secondary-exemplar suggestion (.45), $t(34) = 2.054$, $d = .35$. In contrast, the conditional probability for a "know" judgement was lower in the primary-exemplar condition (.25) than in the secondary-exemplar condition (.35), $t(35) = 1.582$, $d = .27$ (one-tailed). Finally, the conditional probability for a "guess" judgement did not differ significantly between the two conditions (.13 and .20, respectively), $t(35) = 1.238$, *ns*, $d = .21$. Thus, whereas approximately 2/3 of the recalled primary-exemplar suggestions were associated with a subjective experience of "remembering", less than half of the recalled secondary-exemplar suggestions were associated with a subjective experience of "remembering", indicating that the former were experienced as more phenomenologically compelling than the latter. Nonetheless, the proportion of "remembered" responses for both types of suggested responses was substantial, replicating previous findings for plausible additive misinformation and delayed memory testing (see Frost, 2000, Exp. 2).

GENERAL DISCUSSION

In two experiments we found evidence for a BLCE: Superordinate items were spontaneously instantiated to the BL, predominantly to BL terms that were especially likely to be inferred from the narrative context (i.e., primary exemplars). The introduction of post-event suggestions reduced the correct recall of the target items (i.e., produced misinformation interference) only if the suggested information was a primary exemplar, and not if it was a secondary exemplar. In addition, suggestibility was more pronounced for the primary than for the secondary exemplars. Furthermore, the additional cases of suggestibility that were found in the primary-exemplar condition compared to the secondary-exemplar condition, were associated with "remember" (rather than "know" or "guess") judgements, suggesting that they were more likely to be subjectively experienced as genuine event items. The proportion of "remember" judgements was larger among the recalled primary-exemplar suggestions than among the recalled secondary-exemplar

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[4]Although not the focus of Experiment 2, it should be noted that the results of Experiment 1 with regard to misinformation interference were also replicated in Experiment 2. Compared to the proportion of correct target items recalled in the control condition (.26), a lower proportion was recalled in the primary-exemplar condition (.18), $F(1, 35) = 6.435$, $\eta_p^2 = .155$, but a comparable proportion was recalled in the secondary-exemplar condition (.25), $F < 1$, demonstrating misinformation interference following primary-exemplar but not secondary-exemplar suggestions.
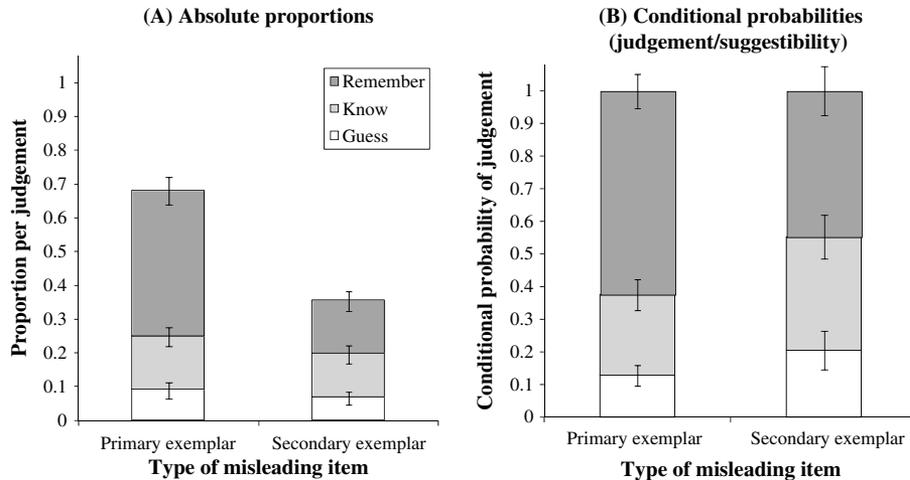
Figure 3. Absolute mean proportions (panel A) and conditional probabilities (given that one recalled the suggested information, panel B) for remember/know/guess judgements by type of misleading item (primary vs secondary exemplar), Experiment 2. Error bars indicate 1 SEM.

suggestions (see Pérez-Mata & Diges, 2007, for related findings). Finally, erroneous recall of the primary exemplars, both spontaneously (in the contol condition) and as a result of suggestion (in the misleading condition), increased with retention interval to a larger extent than erroneous recall of the secondary exemplars.

The present study was motivated by a perspective that focuses on the effects of MPI as MPI interacts with the products of spontaneous constructive processes (see also Mazzoni, 2002). The constructive memory process that was examined in the present study was instantiation, a process that has been previously shown to yield false recall and false recognition even without external suggestion (e.g., McKoon & Ratcliff, 1989; Pansky & Koriat, 2004). This process was assumed to set the stage for particularly pronounced effects of MPI that was consistent with the products of such spontaneous instantiation, as indeed we found. According to this perspective, when one is presented with a superordinate item in the context of an event, one tends to spontaneously instantiate a BL term that is consistent with that context (e.g., Pansky & Koriat, 2004). This instantiation is then encoded and stored (e.g., McKoon & Ratcliff, 1989) in parallel to the encoded superordinate term (see Brainerd & Reyna, 2002). Due to the cognitive advantages of the BL (see Murphy & Brownell, 1985; Rosch et al., 1976), these instantiated representations may become highly accessible, particularly over time (see also Pansky & Koriat, 2004). Indeed, we found spontaneous instantiations to the primary exemplars in the

control condition of Experiment 1, which became more frequent with retention interval, in parallel to the decline in memory for the original superordinate items.

What happens when one encounters MPI that is an instantiation of the target item? In accordance with the discrepancy detection principle (see Hall et al., 1984; Tousignant et al., 1986; see also Loftus, 2005), we propose that the suggested information is either accepted as consistent with the original event information or is rejected as discrepant, depending on the current state of the memory representation for the original information. Thus, if one remembers the original item only at the superordinate level, as it was presented, the MPI will be detected as discrepant and will be rejected, resulting neither in suggestibility nor in misinformation interference. In contrast, if one remembers nothing about the original item (either because it was not encoded in the first place or because it was forgotten), the MPI will be accepted, resulting in suggestibility that involves misinformation acceptance rather than misinformation interference (because there was no original memory to impair; see McCloskey & Zaragoza, 1985). In this case the suggested information that is reported is likely to be accompanied by a "know" rather than "remember" judgement.

However, in addition to these two cases there are also cases in which, in parallel to the original superordinate item, its instantiation to the BL is relatively accessible, particularly (but not only) when the MPI is introduced after a delay.

A post-event suggestion that is consistent with this representation may enhance its relative accessibility compared to that of the original superordinate representation, thus increasing the likelihood that the BL term will be the preferred response on the final test (see also Reyna & Titcomb, 1997). This enhanced accessibility of the BL instantiation is likely to result in misinformation interference and in phenomenologically compelling suggestibility, with the suggested item experienced as a genuine memory from the original event (i.e., judged as ''remembered''). In contrast, when the MPI is inconsistent with the accessible BL representation of the event it is likely to be rejected via discrepancy detection, yielding no suggestibility and no misinformation interference. It is in this situation that primary-exemplar and secondary-exemplar suggestions produce differential effects, because, as indicated by the results of the control condition in our study, a primary-exemplar suggestion is more likely to coincide with one's spontaneous instantiation of the target item than a secondary-exemplar suggestion.

Thus, the comparable proportions of suggested primary-exemplar responses and suggested secondary-exemplar responses that were accompanied by ''know'' judgements can be attributed to situations of misinformation acceptance. The additional cases of suggestibility found in the primary-exemplar condition (beyond those that were found in the secondary-exemplar condition), which were accompanied by phenomenological judgements of ''remember'', can be attributed to cases in which the primary-exemplar suggestions coincided with one's spontaneous instantiations.

The present findings can also be explained by the source-monitoring framework (SMF; Johnson, Hashtroudi, & Lindsay, 1993), which has been successful in accounting for misinformation effects. According to SMF, suggestibility in general can result from an error in source monitoring by which a suggested item is misattributed to the original event (e.g., Johnson et al., 1993; Lindsay & Johnson, 1989). Such source-monitoring errors are especially likely to occur if the sources of the original event and post-event suggestions are not highly discriminable (see Lindsay, 1990, 1994, 2008; Mitchell & Johnson, 2000). From this perspective, the stronger suggestibility found in the present study following primary-exemplar than following secondary-exemplar suggestions, as well as the greater likelihood of the primary-exemplar suggestions to be ''remembered'' from

the original event, can be readily explained by the higher semantic overlap between the primary-exemplar suggestions and the target information (in its context). This semantic overlap rendered them more difficult to be discriminated from the event information in comparison to the secondary-exemplar suggestions. The finding of misinformation interference only in the primary-exemplar condition can also be explained by SMF if the stronger (and more phenomenologically compelling) suggestibility in this condition reduces the likelihood that an additional memory search will be conducted once the recalled suggested detail is misidentified as an event detail (see Lindsay, 1990).

Conclusions and implications

The present study demonstrates a novel type of post-event suggestion that was shown to influence the subsequent recollection of the event details. In contrast to most misinformation studies that introduced misleading suggestions containing contradictory details, the post-event suggestions in this study did not contradict the event information but rather entailed inferences that went beyond the information that was explicitly provided. In this sense, the paradigm we used is more similar to that used in studies that introduced additive suggestions of items that were not part of the original event but fit with its general theme (e.g., Lindsay & Johnson, 1989).

To conclude, the findings indicate that suggested information that is more specific or informative than the original abstract information can yield pronounced and compelling suggestibility and reduce the tendency to correctly recall the original information, if the suggested information is consistent with the information one tends to instantiate spontaneously from the event. Importantly, the tendency to instantiate spontaneously that was found in the control (non-misleading) condition, particularly over time, increased following exposure to misleading suggestions that were likely to coincide with those instantiations.

In terms of theoretical implications, we believe that our findings highlight the importance of focusing on the relationship between the suggested information and the memory representation of the original information at the time the suggestion is introduced (following spontaneous memory processes), rather than on the degree of

correspondence between the suggested information and the original information per se (see also Belli, 1988; Pansky et al., 2011). More generally, the present findings demonstrate that examining the effects of post-event suggestions as they interact with the products of spontaneous constructive processes that set the stage for their occurrence can promote the understanding of such effects.

What are the empirical contributions of our study? Some of our findings constitute replications of earlier findings. Thus, the results obtained in the control condition replicate previous findings that demonstrated the spontaneous instantiation of abstract terms to more concrete terms that are implied by the context (e.g., Anderson et al., 1976; McKoon & Ratcliff, 1989), particularly over time (Pansky & Koriat, 2004). We also replicated the findings that suggestions that are more congruent with the context of the original event yield greater and more compelling suggestibility than suggestions that are less congruent with that context (e.g., Pérez-Mata & Diges, 2007). However, the main empirical contribution of the present study pertains to the effect of post-event suggestions that are likely to coincide with one's spontaneous instantiation, particularly when they are introduced after a delay. Indeed, the extent of suggestibility that we found following such suggestions was substantial: In our delayed condition, 65% of the suggested primary exemplars were recalled, most of which (62%) were claimed to be explicitly remembered from the event. Furthermore, these suggestions were found to impair the correct recall of the original event item, exhibiting misinformation interference.

These findings have practical implications for situations in which abstract items are read or heard (e.g., via discourse or radio) in context, and for eyewitness situations in which the viewing conditions are less than optimal. In such eyewitness situations one cannot observe exactly what a particular item is, and is therefore induced to infer (or instantiate) what it is likely to be. Consider that an instantiation is a type of inference, and although it is often an adaptive process, the particular exemplar that comes to mind when encountering an abstract item in context is not necessarily correct (as in the New York pipe explosion example we presented in the introduction). In these cases such instantiations constitute false memories. The present findings indicate that receiving misinformation that is consistent with these spontaneous false memories

can result in particularly high levels of false recall accompanied by a strong feeling of remembrance.

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APPENDIX: THE EVENT NARRATIVE (WITH TARGET ITEMS HIGHLIGHTED IN BOLD)

It was a Tuesday morning and Yael was having a bad day. She was in a hurry because she had an early morning doctor's appointment. When she washed her hands, the running water made the **jewellery** that her husband had bought her, slip into the wet sink. Yael panicked, but fortunately she managed to save the situation at the last moment. After washing her face, she went back into the bedroom. The mess in the room made it difficult for her to find the **clothing** she had chosen the earlier day to match her face tone and her new pants. Due to the delay, she didn't have time to eat breakfast. She quickly grabbed a **fruit** from the refrigerator, took a bite, and prepared to leave the house. On her way to the door, she almost ran into the **furniture** that she had been nagging her husband to fix for the past week. Yael thought to herself that, as always, she had to take responsibility for everything, otherwise nothing would be done.

Suddenly the phone rang. It was her daughter Ronny, calling from her grandmother's house. As usual, Ronny had many complaints. She was angry that Yael hadn't reminded her to take the **sweet** that Dad had bought her at the airport. Ronny had a hard time falling asleep at Grandma's. The mattress was too hard, the pillow was not big enough and the blanket had an odd smell. Additionally, every morning when Ronny gets up, Grandma performs the same ritual. She takes a **vegetable**, peels it, grates it on a grater, and adds it to the salad she had prepared earlier. After Grandma insisted on cutting her nails, Ronny couldn't practice playing her **musical instrument** properly, and she was afraid that her teacher would be upset. Yael understood the general message: Ronny wanted to come home.

Grandmother Rachel also wanted to talk to Yael and tell her in great detail about the new and delicious **pastry** she prepared following a cooking show she had seen, and thought it could be appropriate for Ronny's birthday party. Additionally, she asked Yael to come and take the **kitchenware** she had bought her as a holiday gift with a special discount, and would free up some of her storage space. She was sure that one day she would turn Yael into a proper cook. Yael apologized and explained that she had to leave immediately, since she had a doctor's appointment and said she would call her when she returned home to set a time for her to come. She left the apartment and quickly ran down the stairs. From one of the other apartments, she could smell a **dish** that reminded her of the cold winter days in her childhood when she was sick and her mother used to cook it for her.

On her way to the station, Yael passed by a public park, where she used to swing Ronny when she was an infant. In that garden she noticed a freckled girl playing with an **animal** and petting its head. Yael got tired a bit so she set down on a bench in a place that was vacant. A light breeze was blowing, causing leaves and dust fly in the air. A soldier looking tired and exhausted sat down next to her. Suddenly a strong noise was heard, and the soldier looked up and noticed an **aircraft** in the sky. Yael thought to herself that judging by the smile on his face, he probably wanted to become a pilot. Yael continued walking. On her way, she met the neighbor from upstairs and they exchanged a few polite words with each other. By the post office, she noticed a large group of elderly women stepping out of a **vehicle** on the other side of the street, when one of them slipped and fell on the sidewalk.

After a long walk, Yael got to the clinic. She went up to the second floor and walked into the doctor's waiting room. Most of the people were sitting quietly in the waiting room, but some were impatient, wandering back and forth in the crowded room. The queue was beginning to progress a bit when a mother and a little girl in a dress were asked to enter to the doctor's office. Yael noticed that the girl left the **toy,** with which she was playing earlier, on one of the chairs.

Various merit certificates were hanging on one of the walls in the waiting room. Amongst them stood out one picture, in which the doctor's family was standing close together near a **vessel**, with life jackets on. The waiting room was very crowded and the air conditioning stopped working. Yael gazed at the doctor's secretary, and she smiled and offered her a **drink** to ease her thirst. Yael remembered that she forgot the **reading material**

she had borrowed from a friend and had planned to bring with her this morning. After a few minutes she got bored. She looked for something to do to pass the time. She searched her purse and found a **writing utensil**. At that moment, the secretary signaled Yael to enter the doctor's office. Yael entered the room and was surprised to find out that her family doctor was ill, and that in the room sat a young and unfamiliar doctor. Yael thought to herself that today in particular, she was not looking forward to unpredictable changes.