Imagination or exposure causes imagination inflation

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To examine the effects of exposure to complex autobiographical events on imagination inflation, subjects performed a 3-stage procedure. First, they rated their confidence that a list of events had happened in their childhood. Second, subjects imagined and paraphrased complex fictitious events 0, 1, 3, or 5 times. Finally, they rated their confidence for the childhood events a second time. We found that subjects became more confident that the fictitious events really did happen in childhood, regardless of whether they were imagined or paraphrased. There was no repetition effect beyond that of a single exposure. Taken together with the results of other research, our data suggest that the greater processing fluency associated with the target events drives imagination inflation.

Imagination can change the way people think about their past. For example, Garry, Manning, Loftus, and Sherman (1996) gave subjects a life events inventory (LEI) asking them to rate their confidence that they had experienced a number of childhood events. Later, subjects imagined some events they had initially indicated probably did not happen and completed the LEI again. Garry et al. found that this one-time, brief imagination task increased subjects' confidence that they had experienced fictitious childhood events.

Goff and Roediger (1998) showed that more imagination produces more change. They examined the effect of repeated imaginings on imagination inflation for simple actions. Subjects imagined events such as "break the toothpick" anywhere from zero to five times. The more times they imagined performing the actions, the more likely subjects were to incorrectly claim they actually had performed them. Thomas and Loftus (2002) extended Goff and Roediger's work by examining the effect of multiple imaginings on familiar and bizarre simple actions. Some subjects imagined familiar actions such as "break the toothpick," and others imagined bizarre, atypical versions of that action, such as "sit on the toothpick." Like Goff and Roediger, Thomas and Loftus found a multiple imagination effect for both familiar and bizarre conditions: The more subjects imagined performing the action, the more they thought they really did perform it.

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Why do multiple imaginings have this effect on subjects' claims? One possibility is that when subjects imagine an event, they create perceptual detail about it; with each imagination, they create more perceptual detail. As a result, the imagined event becomes increasingly like memory for a genuine experience, and subjects become increasingly likely to confuse imagination and reality (Goff & Roediger, 1998; see also Henkel, Franklin, & Johnson, 2000).

However, recent research suggests that imagination is not needed for imagination inflation. This change in confidence without imagination has been demonstrated in an investigation of the revelation effect, which is the tendency for people to call an event "old" on a recognition test after being exposed to an intermediate task involving a similar event (Bornstein & Neely, 2001; Landau, 2001; Niewiadomski & Hockley, 2001; Watkins & Peynircioglu, 1990). In their experiment, Bernstein, Whittlesea, and Loftus (2002) gave subjects strategies to solve difficult anagrams in unconstrained event phrases such as "went to the *umoanitsn*" (*mountains*). This practice session created an expectation that anagrams are hard to solve. Later, subjects completed an LEI in which some question stems contained anagrams. For example, subjects were asked whether, in childhood, they "broke a *dwniwo* playing ball." Correctly unscrambled, the question asks about an event in which subjects "broke a window playing ball." Of course, these LEI anagrams are far more constrained, and subjects find them unexpectedly easier to solve than those in the training phase. However, subjects do not attribute their LEI unscrambling success to a decrease in difficulty; instead, they attribute the surprising sense of fluency to actual childhood experience. Bernstein et al. found that subjects were more confident about scrambled events than unscrambled events. They concluded that this greater confidence can be driven by a feeling of familiarity (Jacoby, Kelley, & Dywan, 1989; Johnston, Dark, & Jacoby, 1985; Whittlesea, 1993; Whittlesea & Leboe, 2000) caused by subjects' unexpected ease in making sense of the LEI items.

Bernstein et al.'s (2002) results suggest that generating perceptual details for an event is not necessary to increase confidence that it happened. Indeed, any task that increases familiarity for events has the potential to cause imagination inflation. One way to increase familiarity with events is by increasing exposure to them through imagination or some other cognitive task. Therefore, we wondered whether multiple imaginings and multiple exposures would cause the same kind of confidence increases.

To address this issue, we asked our subjects to imagine some complex childhood events anywhere from zero to five times. We also exposed them to the idea of the events by asking them to write paraphrases about those same events. Paraphrasing is an activity in which people generate new

ways of conveying the same meaning. For example, subjects who read the sentence, "When I was young I broke a window with my hand" might paraphrase that information this way: "I smashed my hand through a window as a child."

Imagining versus paraphrasing

What should be the effect of paraphrasing on imagination inflation? Although paraphrasing and imagination share some underlying mechanisms, they also involve different processes (Paivio & Begg, 1971). For example, Koehler (1991) argued that when imagining a scenario, people must consider an alternative reality and act as though the merely hypothetical is true. By contrast, when paraphrasing a scenario, people do not need to consider an alternative reality. Instead, they need only to create a new sentence that expresses the same idea. We must consider the similarities and differences between paraphrasing and imagining in order to predict their effects on imagination inflation.

Similarities. First, let us consider the ways in which imagination and paraphrasing might involve similar processes. It is likely that both imagining and paraphrasing a sentence involves generating visual images, although in imagination images are the goal of the task, and in paraphrasing images are a byproduct of the task. Imagination necessarily produces images if subjects asked to imagine an event understand the common definition of *imagination,* which is "the act or power of forming a mental image of something not present to the senses or never before wholly perceived in reality" (Merriam-Webster Online Dictionary, 2003). It is also likely that paraphrasing generates mental images; for example, Durso and Johnson (1980) showed that people can spontaneously generate images while reading a short passage. Consequently, our subjects might also generate images: Reading text is a prerequisite to paraphrasing it. Therefore, if imagery production is the primary mechanism behind imagination inflation, then both paraphrasing and imagining should cause imagination inflation.

A second similarity between imagining and paraphrasing is that they both involve exposing subjects to the target events. As noted previously, exposing subjects to the fictitious events should make the processing of these events more fluent, and this fluency might be interpreted as a feeling of familiarity (Jacoby et al., 1989; Whittlesea, 1993; Whittlesea & Leboe, 2000). Consequently, subjects should attribute these familiar-feeling events to their childhoods and become more confident that they really happened. Thus, in line with what we hypothesized, if exposure to the events is the primary mechanism behind imagination inflation, then both paraphrasing and imagining should cause imagination inflation.

Taken together, both these overlapping features of paraphrasing and

imagination make the same prediction: The more imagination and paraphrasing work to promote image generation or the more imagination and paraphrasing expose subjects to the critical events, the more likely it is that they both will produce imagination inflation.

Differences. Next, let us consider the ways in which imagination and paraphrasing might be different processes. One difference between imagining and paraphrasing events might be the amount and type of imagery produced. Not only should imagination produce more visual images, but imagination might also contain details other than visual information, such as tactile and olfactory information (Sarbin, 1998). Much research has shown that imagined events contain a wide array of qualitative characteristics, including perceptual, sensory, olfactory, taste, and tactile details (Hashtroudi, Johnson, & Chrosniak, 1990; Johnson, Foley, Suengas, & Raye, 1988; Kahan, Mohsen, Tandez, & McDonald, 1999; McGinnis & Roberts, 1996). Therefore, this difference between paraphrasing and imagination leads us to predict that the more imagination works to enhance qualitative, nonvisual event characteristics, the more likely it is that only imagination will produce imagination inflation.

Multiple exposures

In addition to examining the issue of the type of exposure in imagination inflation, our secondary motive was to extend the "multiple imaginings" imagination inflation research (Goff & Roediger, 1998; Thomas & Loftus, 2002) to include the complex events that characterize the standard imagination inflation paradigm (Garry et al., 1996; Heaps & Nash, 1999; Horselenberg et al., 2000). Indeed, we can think of event complexity as lying on a continuum. At one end are the simple action events, such as "break the pencil" (Goff & Roediger, 1998; Thomas & Loftus, 2002). At the other end are the highly complex and detailed events from the false memory research, such as "spilled a bowl of punch on the parents of the bride at a wedding" (Hyman & Pentland, 1996; Loftus & Pickrell, 1995). Our complex events ("Being rescued from the water while swimming") lie somewhere between these two extremes. The effects of multiple exposures to complex events are unexamined in the literature; therefore, they are worthy of study in their own right.

Findings based on simple actions cannot necessarily predict what will happen when subjects repeatedly imagine complex events. Most life events are associated with a meaningful context of cause and effect, not simple actions with no consequences. Additionally, because these actions were so simple, it was possible to imagine them very quickly; indeed, Goff and Roediger's (1998) subjects imagined 20 actions, and Thomas and Loftus's (2002) subjects imagined 18 actions. By comparison, "complex

event" subjects typically imagine three or four events. Finally, "simple action" subjects actively try to ignore the imagined items, whereas "complex event" subjects are carefully controlled to prevent them from making a connection between the imagination session and the posttest confidence rating session.

In the experiment we present here, we first obtained data from subjects in which they indicated how confident they were that a number of childhood events had happened to them. One week later, we asked our subjects to imagine half of those complex, autobiographical events and to write paraphrases for the other half. Finally, one week after the exposure phase, we collected updated confidence data.

If we found that both imagination and paraphrasing caused imagination inflation, it would suggest that the similarities between the two processes cause this inflation. However, if we found that only imagination caused imagination inflation, it would suggest that the richer qualitative characteristics generated by imagination are necessary for imagination inflation.

EXPERIMENT

METHOD

Design

We used a 2 (imagination or paraphrasing) × 4 (number of repetitions) within-subject design. The dependent variable was the change in event confidence from pretest to posttest.

Subjects

Sixty-seven first-year psychology students at Victoria University of Wellington completed all three phases of the experiment, although 10 were excluded for failing a lie item (described later in this article). Participation was voluntary and was restricted to students who had lived in New Zealand since age 3 and for whom English was their first language. Each stage was run during normally scheduled laboratory times. Subjects were run in their intact lab groups, which ranged in size from 3 to 15.

Procedure

There were three phases to the experiment. In the first phase, subjects completed the LEI to report their confidence that various childhood events had or had not happened. The LEI consisted of a list of 19 childhood events, such as "broke a window with your hand." These items were modified from Garry et al. (1996) to accommodate New Zealand vernacular and culture. Subjects rated their confidence that they had experienced each event before age 10, using an eight-

point Likert scale, with anchors 1 (*definitely didn't happen*) to 8 (*definitely happened*). We included two lie items to detect subjects who completed the LEI items without actually paying attention to them: "Felt an earthquake" and "Played for the All Blacks [New Zealand's national rugby team]." Subjects' data were excluded from analysis if they gave these items a rating of anything other than 8 for the first and 1 for the second. Earthquakes are extremely common in New Zealand,[1] making it impossible for a person not to have felt one, and it is also impossible to make the All Blacks team as a child.

The second phase, the imagination and paraphrasing phase, took place two weeks later and was administered by a different experimenter. The experimenter told subjects that we were studying the relationship between imagination and thinking style. Subjects received a booklet, the front page of which contained brief instructions on how to imagine childhood events and how to paraphrase. They read the instructions and paraphrased an example sentence to make sure they understood how to paraphrase. The next page of the booklet contained a description of a critical event paraphrased from the LEI (e.g., "When I was young I broke a window with my hand") and instructions to imagine it happening in childhood. Each event description was followed, on the next page, by a question about the characteristics of the imagined event, drawn from a set of five (e.g., "Who was involved in your imagery? Describe them.") Finally, on the next page, subjects read another critical event, along with instructions to paraphrase it in as many ways as possible. For example, the sentence, "When I was young, I gave someone a haircut" appeared at the top of the page, followed by 10 rows of a table, labeled "Answer 1," "Answer 2," and so on.

In all, each subject encountered six critical events drawn from a possible eight. We grouped events into four pairs (1a and 1b, 2a and 2b, etc.). Events and processing instructions were counterbalanced such that for each pair, half of the subjects imagined item a and paraphrased item b, and the other half imagined item b and paraphrased item a. For each subject, one of the four pairs was presented once, one three times, one five times, and one not at all; this presentation ordering was also counterbalanced across subjects. No event was ever presented twice consecutively: Events to which subjects were exposed multiple times were presented with a lag of at least one event. For example, subjects who were exposed to Event A five times, Event B three times, Event C one time, and Event D zero times would have seen these events in the following order: A, B, A, B, A, C, A, B, A. Finally, within each booklet, no one question followed a given event more than once. Questions were assigned to events in a counterbalanced fashion so that no particular questions were associated with any particular number of repetitions. For imagined events, subjects imagined for 1 min and answered the imagery content questions for 30 s. For each paraphrased event, they reported as many paraphrasings as they could in 1 min and 30 s.

One week later, in the third session, subjects completed the LEI again with the experimenter from the first session. They were told the readministration was to determine test–retest reliability. We used this cover story because introductory psychology students learn about test–retest reliability, and such an instruction would encourage students to produce the same response as they did on the first LEI.

RESULTS AND DISCUSSION

To make sure subjects invested time and effort at each paraphrasing opportunity, we counted the number of sentences they wrote. Each time they were asked to paraphrase an event, subjects wrote a similar number of statements regardless of how many times they had paraphrased the event before. For events paraphrased once, subjects wrote an average of 4.40 sentences, $SD = 0.97$, range = 3–6; for events paraphrased three times, subjects wrote an average of 4.13 sentences each time, $SD = 1.01$, range = 2–7; and for events paraphrased five times, subjects wrote an average of 4.18 sentences each time $SD = 1.04$, range = 2–6. To illustrate what subjects' paraphrased sentences were like, one subject paraphrased the sentence, "When I was young, I won a toy at the fair" in the following ways: "At the fair I won a toy; A toy was won by me when I was young at the fair; I was young when I went to the fair and won a toy; At a fair in my youth I won a toy; I won a toy when I was young and went to a fair; When I went to a fair I won a toy."

The major question in this experiment was whether repeated exposure to an event would make people more confident that it happened in their past. If so, we also wanted to know whether imagination and paraphrasing produced similar results. To answer these questions, we first plotted the mean pretest and posttest confidence scores for each level of repetition for both imagined and paraphrased events, as shown in Figure 1. Note that there were no pretest differences, $F < 1$.

In both panels of Figure 1, the bottom line shows mean pretest confidence, and the top line shows mean posttest confidence. Figure 1 shows that when subjects did not imagine or paraphrase events (at zero repetitions), their confidence remained unchanged. However, when subjects imagined or paraphrased events, their confidence was greater than when

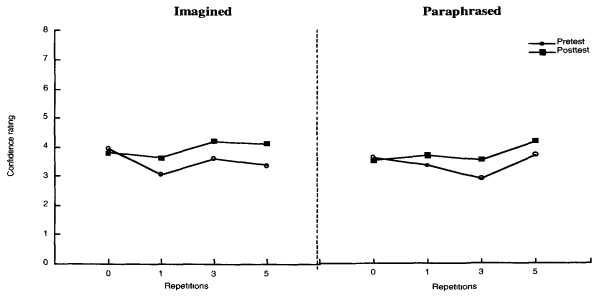

Figure 1. Mean pretest and posttest confidence ratings according to the number of times the event was imagined or paraphrased

they did not. A 2 (pretest or posttest) × 2 (imagined or paraphrased) × 4 (zero, one, three, or five repetitions) within-subject ANOVA showed that there was no interaction between type of exposure and number of repetitions, $F < 1$. Regardless of whether subjects imagined or paraphrased the events, confidence increased by the same amount; there was also no effect for type of exposure, $F < 1$. However, the greater the number of repetitions, the greater subjects' increase in confidence, $F(3, 56) = 2.98$, $p = .03$. Further analyses revealed that this repetition effect was driven by the confidence increase from zero to one repetition. Once subjects had been exposed to the event, the number of exposures did not matter: When the analysis was restricted to one, three, or five repetitions, there was no repetition effect, $F < 1$. Overall, our results show that imagination inflation occurred when subjects encountered an event once, but they did not become more confident with repeated encounters. The means by which they encountered the event—whether by imagining it or paraphrasing it—did not matter.

Our results suggest that imagination inflation is driven by the overlapping components of paraphrasing and imagination: visual imagery or exposure. Taken together with Bernstein et al.'s (2002) results, they indicate that merely exposing subjects to the event—in their case by having them solve an anagram, or in our case by having them paraphrase a statement—can be enough to inflate confidence that the experiences were real. Additionally, our results provide the first demonstration of imagination inflation without subjects receiving an explicit instruction to imagine the target events.

However, our results do not show the same pattern as previous work showing that with repeated imaginings, subjects are more likely to claim that they had performed a simple action they had not (Goff & Roediger, 1998; Thomas & Loftus, 2002). This different pattern of results may result from the differences in the complexity of the target events and the interaction of those differences with both fluency and information about cognitive processes.

We know that source confusions, as described in the source monitoring framework (SMF; Johnson, Hashtroudi, & Lindsay, 1993), occur when an internally generated event is judged as fluent, perceptually similar to a real experience, and consistent with expectations. Note that not all of these features must be true for a source confusion to occur. A false event can be perceptually similar to a real experience, inconsistent with expectations, and still incorrectly judged as a real event (Wade, Garry, Read, & Lindsay, 2002). Similarly, as an event becomes more fluent, the SMF suggests that people may confuse that fluency for a genuine experience in the absence of an obvious alternative source of that fluency, such as imagining or paraphrasing.[2]

Consider now the results from the "simple action events" research. Goff and Roediger (1998) and Thomas and Loftus's (2002) subjects should have found it easy to imagine simple action events. As a result, they should have had weak information about the cognitive operations involved in creating those simple event details (Finke, Johnson, & Shyi, 1988; Johnson, Raye, Foley, & Foley, 1981), which would promote the confusion between imagined simple events and actual simple events. By contrast, our subjects should have found it more difficult to imagine or paraphrase the complex events. As a result, they might have created more information about the cognitive processes involved in generating details about those events. The same pattern, then, should extend to the effects of repeatedly imagining simple and complex events. Repeatedly imagining simple events should have increased fluency without increasing information about cognitive operations as much as repeatedly imagining complex events. Because information about cognitive operations is information about the source of the fluency, such an outcome would lead to more imagination inflation for repeatedly imagined simple events than for repeatedly imagined complex events. Future research should compare directly the effects of event complexity—perhaps with increasingly complex versions of the same event—and multiple imaginations.

Taken together, these studies suggest that although inducing subjects to generate perceptual (but false) details that they later confuse with a genuine experience may be one route to imagination inflation, it is not the only one. Another route to inflated confidence might be that imagining and paraphrasing a sentence both give subjects practice with the idea of the event. Later, when subjects read a target phrase on the LEI, they process the information more easily. Put another way, imagining and paraphrasing may cause some overall change in fluency, or the ease with which the event comes to mind (Whittlesea, 1993; Whittlesea & Leboe, 2000). Whittlesea and colleagues suggested that when people judge whether they have had a particular experience, they use a rule based on fluency: Increasing exposure causes increasing fluency, which in turn increases familiarity. The trap for subjects is that familiarity arises from exposure in general, not just exposure from a specific source. The increased familiarity increases the likelihood that subjects believe targeted events were real experiences. In a fluency account of imagination inflation, exposure to an event should increase its fluency—and subsequently its familiarity—which may cause subjects to become more confident that target events really happened.

There are theoretical and practical implications of these findings. On the theoretical side, our results suggest that imagination inflation can be caused by the type of processing that occurs during more normal thought as well as directed imagination. Additionally, we can think of imagination

and paraphrasing as overlapping processes, and either can cause inflation. As a result, imagination inflation might be better thought of as fluency inflation[3] in that any process that increases the fluency of an event can increase confidence for it. On the practical side, our results suggest that simply putting a fictitious experience into new words may cause people to become more confident that the fictitious experience was real.

Notes

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1. There are about 14,000 earthquakes in New Zealand each year, and approximately 100–150 of these are felt during people's everyday activities (Institute of Geological & Nuclear Sciences Limited, 2003).
2. We thank Marcia Johnson for this helpful line of thinking.
3. Thanks to Roddy Roediger for suggesting this name.

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