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Changing History: Doctored Photographs Affect Memory for Past Public Events[†]

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SUMMARY

We investigated how doctored photographs of past public events affect memory for those events. Italian participants viewed either original images or misleading digitally doctored images depicting the 1989 Tiananmen Square protest in Beijing and a 2003 protest in Rome against the war in Iraq, and they subsequently answered questions about those events. Viewing the doctored images affected the way participants remembered the events. Those who viewed the doctored photograph of the Beijing event estimated that a larger number of people participated in it. Those who viewed the doctored photograph of the Rome event rated the event as more violent and more negative, recalled more physical confrontation, damage to property, and injuries to demonstrators, and were less inclined to participate in future protests. Both younger and older adult participants were affected by the manipulation. Results indicate that doctored photographs of past public events can influence memory, attitudes and behavioural intentions. Copyright © 2007 John Wiley & Sons, Ltd.

'Whoever said the camera never lies was a liar'. So observed Russell Frank (2003, p. B11), Professor of Journalism Ethics at Penn State University, when he commented on a *Los Angeles Times* incident involving a doctored photograph from the Iraqi front. He went on to say 'Photographers have always arranged scenes and posed subjects. They also have been known to cut and paste one image onto another for comic or dramatic effect. Computers have just made it easier'. One of Frank's colleagues, Ken Light of the University of California, Berkeley, soon discovered that computer-manipulated photographs can strongly influence public opinion. During the 2004 U.S. presidential campaign, a photograph started circulating in support of allegations about Senator John Kerry's involvement in anti-American activities. The image, depicting the Democratic front-runner sharing a demonstration podium with Jane Fonda in the early 70s, quickly gained national prominence. Speculations about it continued until Light saw the picture and realised it was a paste-up job that started with a photograph he had personally taken more than 30 years before. The original had been taken from the website of Light's agency, merged with another image, equipped with a fake *Associated Press* (AP) logo, and finally distributed worldwide through the Internet (Light, 2004).

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[†]This paper is based in part on an Undergraduate Thesis submitted to the University of Padova under the supervision of the second author.

Apparently, the digital age provides sophisticated yet readily available means to deceive people and try to influence their opinion. But how efficient are these means? What are the effects on viewers of doctored materials that depict the past? And what is the impact on memory for the events being portrayed? The present study suggests that viewing doctored photographs might affect our attitudes, our intentions and even the way we remember past public events.

FALSE MEMORY CONSTRUCTION

Over 30 years of research on memory distortion demonstrate that remembering is not just a matter of retrieving the correct piece of information from a database, but rather involves a reconstructive process, through which the original memory can be continuously modified. Post-event misinformation can lead people to recall events differently from the way they actually occurred, or even to recall wholly false events that never occurred. For example, early studies showed that people who witness car accidents, and later receive misleading information about what they saw, will often incorrectly recall such details as the colour of a vehicle (Loftus, 1977) or the nature of a street sign (Loftus, Miller, & Burns, 1978).

In another study by Loftus and Pickrell (1995), participants were presented with a narrative describing a false event from their childhood allegedly recounted by a family member, and were encouraged to remember the event. By the end of the study, 25% of the participants claimed to fully or partially remember getting lost in a shopping mall, even though it had never happened to them. Further studies replicated and expanded upon these findings by leading participants to believe that they had experienced unusual or traumatic events, such as nearly drowning and ultimately being saved by a lifeguard (Heaps & Nash, 2001), and even highly implausible ones, such as witnessing demonic possession (Mazzoni, Loftus, & Kirsch, 2001).

Recent works have also investigated the hypothesis that memory distortion might have practical repercussions, such as affecting attitudes and behavioural intentions. Braun and Loftus (1998) employed the misinformation paradigm to modify participants' colour memory for the wrapper of a candy bar that they had previously tasted. They later introduced a fake Federal Drug Administration report, stating that wrappers of certain colours might be contaminated, and finally asked participants to rate on a number of dimensions the candy bar they had tasted. Their results suggest that both the subjective judgment and purchasing intention of potential customers can be affected by memory modification.

Another example of this line of research involves 'food avoidance' (Bernstein, Laney, Morris, & Loftus, 2005). Following a series of questionnaires and personalised false feedback, participants were convinced that they had felt sick in the past after eating either dill pickles or hard-boiled eggs. Asked to imagine themselves at a large barbecue and to indicate how likely they would be to eat different kinds of food, participants reported that they would be less prone to eat the specific kind of food for which they had been influenced.

DOCTORED PHOTOGRAPHS AS SUGGESTIVE POST-EVENT MISINFORMATION

As advanced technology becomes widely available, so do new forms of presenting post-event misinformation. In 2002, one research group (Wade, Garry, Read, & Lindsay,

2002) investigated the possibility of obtaining false childhood memories through exposure to doctored photographs. For each participant, a composite picture was digitally assembled depicting the participant taking a hot-air balloon ride with a family member. Participants viewed this doctored photograph portraying a fake event and three original photos portraying real events from their childhood. After a maximum of three interviews, 50% of the participants reported remembering all or part of the hot-air balloon event, sometimes embellishing their memory reports with additional sensory detail.

A subsequent study designed to directly compare different ways of presenting post-event misinformation (Garry & Wade, 2005) suggested that false images might not be as powerful as false narratives, but confirmed the overall effectiveness of digitally doctored photographs (once again, 50% of participants claimed to remember the mock event).

DOCTORED PHOTOGRAPHS IN THE MEDIA

False memory research involving doctored photographs has focused on childhood events. However, in everyday life it is much easier for people to encounter fake pictures of public events than to come across 'doctored photographs that depict them doing things they have never really done' (Wade et al., 2002, p. 602). In fact, over the past few years manipulated images inaccurately portraying public events have become alarmingly common in the media.

In 2003, the *Los Angeles Times* published on its front page a dramatic photograph from the Iraqi front, taken by long time photojournalist Brian Walski. The image depicted a British soldier directing Iraqi civilians to take cover from Iraqi fire on the outskirts of Basra. One sharp viewer noticed that some of the people in the background seemed to appear twice, and decided to contact the paper's editors. Walski was reached by telephone in Iraq and admitted that 'he had used his computer to combine elements of two photographs, taken moments apart, in order to improve the composition' ('Editor's Note', 2003, p. A6). The photographer was fired and the *Los Angeles Times* published an editor's note to explain what had happened.

An analogous episode was reported by Garry and Gerrie in their review of false memory research involving photographs (Garry & Gerrie, 2005). In May 2004, the editor of Britain's *Daily Mirror* lost his job after publishing images of British soldiers torturing Iraqi prisoners—images that eventually turned out to be mere composites. More recently, *USA Today* published a close up picture of Secretary of State Condoleezza Rice on its website, a picture in which she appeared to have an extremely menacing, almost demonising stare. After numerous readers expressed their doubts about the veracity of the image, the editor decided to replace it with an adjusted version and claimed in a note that routine photo optimising processes had caused Rice's unnatural appearance ('Rice won't rule out U.S. troops in Iraq in 10 years', 2005).

DOCTORED PHOTOGRAPHS AND MEMORY FOR PUBLIC EVENTS

Impressed by the recent flurry of digital hoaxes appearing in the media, we wondered how the exposure to doctored photographs might affect viewers' memories for public events. Although no studies have examined this specific issue, interesting indications can be drawn from the rich literature involving true photographs.

For example, previous research suggests that associating images with written material facilitates the acquisition of information, affects the selective exposure behaviour of

readers (Knobloch, Hastall, Zillmann, & Callison, 2003; Zillmann, Knobloch, & Yu, 2001), and even influences their attitude towards social issues (Zillmann, Gibson, & Sargent, 1999). Another study was inspired by the common belief that photographs are important retrieval cues for the recollection of past events (Schacter, Koutstaal, Johnson, Gross, & Angell, 1997). Indeed, results showed that reviewing photos increases the likelihood of remembering details from previously presented material, but under certain conditions it also leads to the creation of false memories.

We already know that doctored pictures can effectively distort memory for childhood events. Could they have similar effects on the way people remember public events of the past? According to the *Source Monitoring Framework* (SMF; Johnson, Hashtroudi, & Lindsay, 1993), there is reason to believe so. This framework stresses the crucial cognitive function of attributing memories, knowledge and beliefs to a particular source, and views memory distortions as failures occurring during this process. For example, results from the typical eyewitness misinformation paradigm are explained in terms of an erroneous attribution of misleading post-event information to the event that was originally witnessed.

Source-monitoring decisions can be based on qualitative characteristics of memories (*heuristic* processing) or on more extended reasoning (*systematic* processing). The latter process may involve the search for relations and inconsistencies or the retrieval of supporting memories (Johnson et al., 1993). When making attributions about the origin of information, results from both heuristic and systematic processes can be integrated to produce a more accurate judgment. For example, to decide whether an autobiographic recollection is genuine or not we might consider how vivid it is (qualitative characteristic) but also how well it fits with our general knowledge (check for relations/inconsistencies).

Nevertheless, Wade et al. (2002) showed that misinformation presented through doctored photographs is sufficiently credible to pass this double check and tamper with childhood memories. Moreover, memories about past public events are likely to be less elaborate than personal recollections with respect to characteristics such as vividness and the type and amount of perceptual details. If these memories are less elaborate, then source-monitoring decisions should be less accurate for past public events than for personal experiences, and the memories should be more vulnerable to misinformation.

We hypothesised that showing participants a modified image of a past public event would lead them to commit a source-monitoring error and ultimately attribute the misleading information to the event itself. To test this hypothesis, we presented participants with doctored photographs of two events, one relatively old and the other more recent. The older event was the Tiananmen Square protest that took place in Beijing, China, in 1989. Participants who were too young to form a first-hand memory of this event at the time it took place were likely to know it only as history. The more recent event was the largest peace demonstration ever held in Italy, which took place in Rome on 15th February 2003, against the proposed war in Iraq. In this case, the event occurred the year before our study, thus all participants could remember it first hand. We chose protests and demonstrations as stimuli because these events often capture public interest.

For the *Beijing* event, we began with a famous photograph showing a lone student standing in front of a series of military tanks (see Figure 1a), part of which appeared on the cover of *Time* magazine on 19th June 1989. We doctored the photograph by adding crowds of people standing on the sidelines. Increasing the number of people in attendance is a common technique used by digital counterfeiters trying to amplify the importance of an event. However, participants in our study might notice the discrepancy, particularly if they had viewed the original image many times. But if they did not notice, would they be
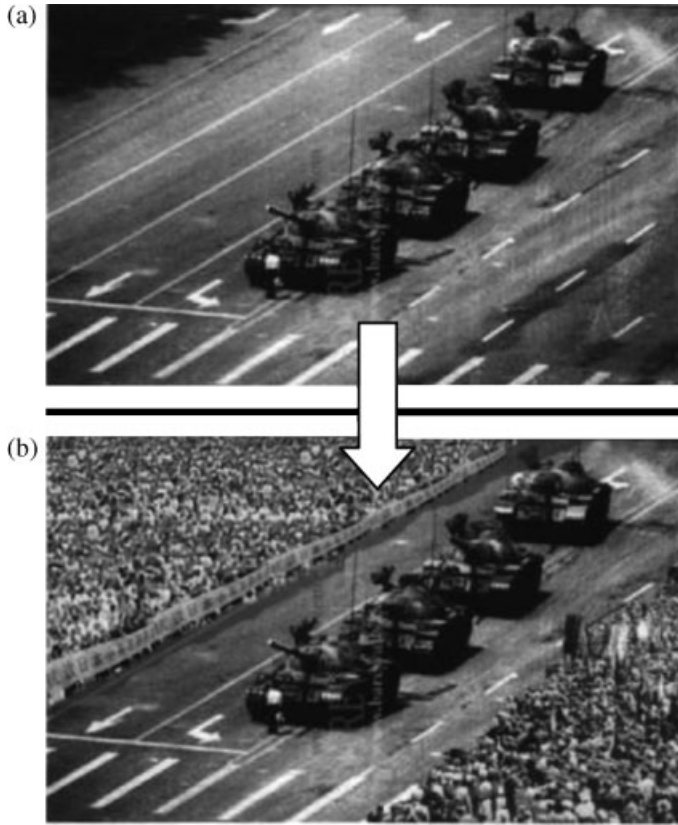
Figure 1. Original (a) and doctored (b) versions of the photograph for the Beijing event. Reproduced with permission of Stuart Franklin and Magnum Photos, Inc

influenced to remember the event differently from the way it actually occurred? Based on the evidence and the reasoning presented, we expected participants to remember the event as involving a larger number of people, and to rate the event as being more important.

For the *Rome* event, we doctored the image of the peaceful demonstration to convey an impression of violence. In this case, we expected viewers of the doctored photo to be more likely to recall violent episodes which never happened and to rate the event as being less peaceful and less positive overall.

In the first of two studies, we explored these issues involving college students as participants. In the second experiment, we tried to replicate our findings with older adults, and we also tested the additional hypothesis that viewing doctored photographs of a past public event could affect behavioural intentions.

EXPERIMENT 1

Method

Participants
A total of 187 participants (31 male and 156 female) took part in Experiment 1. They were undergraduates (92% Psychology, 8% other) enrolled either at the University of Padua or at
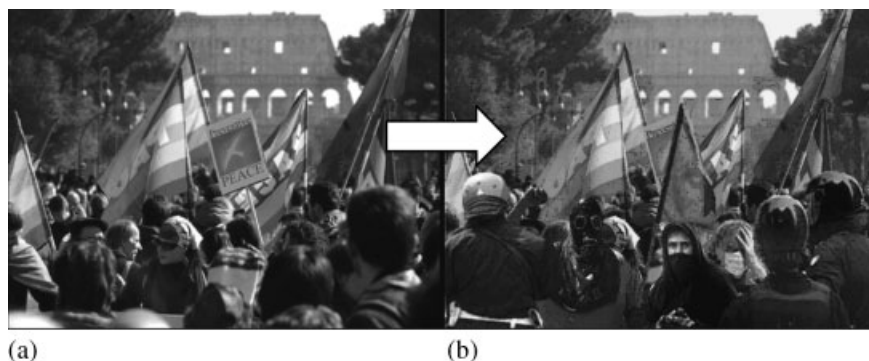
Figure 2. Original (a) and doctored (b) versions of the photograph for the Rome event. Original source unknown

the University of Udine, both located in northeastern Italy. The age range was 19–39 ($M = 22.3$, $SD = 3.2$). Participants did not receive any kind of compensation for their involvement.

Materials
As previously mentioned, to represent the Beijing event we chose the well-known image of a student standing in front of tanks in Tiananmen Square. The photograph of this incident, shown in Figure 1a, was taken by the British photographer Stuart Franklin, and won a World Press award. For the Rome event, we presented the photograph shown in Figure 2a depicting demonstrators marching in front of the Coliseum. The image was obtained from the Italian news website RAINEWS24.

A doctored version of each original photograph was created using *Microsoft Picture It! Photo 2001*. In the photograph corresponding to the Beijing event, a conspicuous crowd was added on both sides of the line of tanks (Figure 1b). In the photograph for the Rome event, police officers and aggressive-looking demonstrators were placed among the peaceful multitude[1] (Figure 2b).

Design
Each participant saw the photograph for the Beijing event and the photograph for the Rome event, each one either in its original or in its doctored version. Thus, participants viewed only one of four possible combinations: two original photos ($N = 48$); two doctored photos ($N = 44$); the doctored photo for the Beijing event and the original photo for the Rome event ($N = 43$); the original photo for the Beijing event and the doctored photo for the Rome event ($N = 52$). The order of presentation of the photographs was counterbalanced across participants.

Measures
Three sets of multiple-choice questions were developed: manipulation check questions, critical questions and attitude questions.

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[1]To ensure that the doctored photo for the *Rome* event conveyed an impression of violence, two distinct images of the demonstration were modified in different ways. We presented both images along with other photos to eight independent judges, and asked them to rate each image on a *peaceful–violent* scale. The version that was rated more *violent* was selected for the experiment.

Manipulation check questions were meant to ascertain whether our digitally doctored material was believable and to assess the participants' familiarity with the events. First, participants indicated whether they had already seen the photograph. In this case, three options were available: 'Yes', 'No', 'I'm not sure'. If the false images were plausible, then we expected the participants who viewed the doctored version of a photo to answer similarly to those who viewed its original version. A second question asked participants to rate how familiar they were with the event on a 7-point scale in which 1 = completely unfamiliar and 7 = completely familiar.

Critical questions addressed specific aspects of participants' memories for each event that we anticipated would be biased by the content of the doctored photographs. For the Beijing event, the focus of the critical questions was the number of demonstrators; for the Rome event, the focus was violent action. The critical questions for both events appear in Table 1.

Attitude questions were developed to test the hypothesis that the misleading doctored material could affect attitudes towards the events. Participants rated the importance of each event on a 7-point scale (1 = insignificant, 7 = important). They also rated how violent (1 = peaceful, 7 = violent), and how positive or negative (1 = positive, 7 = negative) the events were, according to their memory.

Procedure

Both the photographs and the questions were presented in a printed questionnaire that participants completed in large groups in classroom settings. No information about the experiment was given.

Participants were instructed to answer every question; if unsure about something, they were encouraged to express an opinion by selecting the option that looked more realistic according to their memory. There was no time limitation to complete the task.

On the first page of the questionnaire, participants saw both photographs (one for the Beijing event and one for the Rome event). They then answered the question 'Can you tell what major public event of the past 15 years is depicted in each of the following photos'? in a blank space next to each image.

On the next page, one of the two photographs (e.g. Beijing) appeared again, this time accompanied by a caption indicating the event and when it took place ('The following photograph depicts the 1989 Tiananmen Square protest in Beijing, China'). On this same page, participants also found the manipulation check questions and two short filler exercises. On the next page, participants were instructed to respond based on their

Table 1. Critical questions for the Beijing and Rome events

Event	Critical questions
Beijing	• How many people took part in this event? • How many people were around (within 10 m of) the tanks, when they entered the square? • How many people contributed to obstructing the tanks?
Rome	• Did any physical confrontation occur between the demonstrators and the law enforcement? • Was there any property damage? • How many people were injured? • How many people were killed?

memories of the event and not to look again at the earlier pages showing the photograph. They were then presented with the critical questions specific for that event and the attitude questions. Finally, a blank page was left for participants to add their comments or to point out aspects of the event that they had found particularly striking.

This sequence was then repeated for the second event (e.g. Rome, if the Beijing event appeared first): photograph with caption, manipulation check questions and filler exercises; critical and attitude questions; and a blank page for comments.

When participants completed the task, they remained seated until everyone finished, but their questionnaires were collected immediately. During the debriefing, participants saw both the original and the doctored version of each photograph, and the real purpose of the study was revealed.

Results and discussion

Since every participant was presented with only one version of each photograph, the data for each event were analysed separately. Thus, we independently compared one original ($N = 100$) and one doctored condition ($N = 87$) for the Beijing event, and one original ($N = 91$) and one doctored condition ($N = 96$) for the Rome event.

Manipulation check

For the Beijing event, 44% of the participants in the original condition claimed to have seen the photo before, 40% said they had not and 16% were not sure. Similarly, 45% of the participants in the doctored condition answered yes, 34% answered no and the remaining 21% were unsure. Thus, participants in the two conditions were equally likely to recognise the photograph for the Beijing event regardless of whether the version they saw had been modified or not. Ratings of familiarity with the Beijing event expressed on a 7-point scale (1 = completely unfamiliar, 7 = completely familiar) also did not differ between the two conditions, χ^2 (6, $N = 187$) = 8.03, $p > 0.05$.

For the Rome event, recognition of the photograph varied depending on the condition. We found that 45% of the participants in the original condition claimed to have seen the photo before, 35% said they had not, and the remaining 20% was unsure. On the other hand, only 24% of those in the doctored condition answered yes, 45% answered no, and 31% were not sure. Thus, the participants who viewed the original version were more likely to recognise the photo than those who saw the doctored version. Ratings of familiarity with this event also differed between the two conditions, χ^2 (6, $N = 186$) = 14.32, $p < 0.03$. This diversity is evident in the percentage of participants in each condition who selected familiarity ratings of 5, 6 or 7. These ratings of high familiarity were selected by 73.6% of the participants in the original condition, but by 51.6% in the doctored condition. Participants who were exposed to the doctored photograph of the Rome event were less likely to say that they were highly familiar with this particular event.

Apparently, our modification of the image for the Beijing event was credible, because participants' recognition rates were the same in the two conditions. Moreover, familiarity ratings in the two conditions were also similar, suggesting that viewing the modified photograph did not impair the participants' ability to recollect the Beijing event. On the other hand, acceptance of the doctored image for the Rome event was not as straightforward. Participants in the doctored condition were less likely to recognise the photograph, suggesting that maybe they realised that they were looking at a fabricated image. However, when we encouraged the participants to add their comments, none of

them doubted the veracity of the photograph. Instead, a few of them acknowledged a little confusion, stating that they had previously thought that there had not been any violent episode during the demonstration. Participants in the doctored condition may have experienced a discrepancy between the content of their memory and the content of the photograph, which could also account for the lower familiarity ratings they expressed.

Memory for the events

The three critical questions for the Beijing event required participants to select from numerical estimates (see Table 1). Those who were exposed to the doctored version of the photograph were expected to produce higher estimates. Figure 3 shows the answers to the question 'How many people took part in this event'? As we can see from Figure 3, there is a different trend of selection between the participants in the two conditions. For those in the doctored condition, there is a peak of selections corresponding to the fifth option ('1,000,000–3,000,000'), whereas the answers of the participants in the original condition are more evenly distributed. This difference is significant, χ^2 (5, $N = 174$) = 25.31, $p < 0.001$, $V = 0.38$, suggesting that participants who viewed the altered material were indeed more likely to produce higher estimates of the number of people that took part in the Beijing event.

A similar result was obtained when participants were asked how many people found themselves in the vicinity of the tanks as the military broke into the occupied square. Compared to the participants in the original condition, those in the doctored condition were significantly more likely to select higher estimates, χ^2 (4, $N = 170$) = 30.07, $p < 0.001$, $V = 0.42$. Participants also estimated the number of people who contributed to obstructing the tanks, but in this case no difference in the response patterns was observed between the two conditions, χ^2 (4, $N = 168$) = 3.22, $p > 0.05$. This null result is not surprising because the two pictures both showed only one person blocking the tanks.

The critical questions for the Rome event focused on violence that in reality never happened during the peace demonstration. Participants were asked if any physical confrontation occurred between the demonstrators and the law enforcement, if any
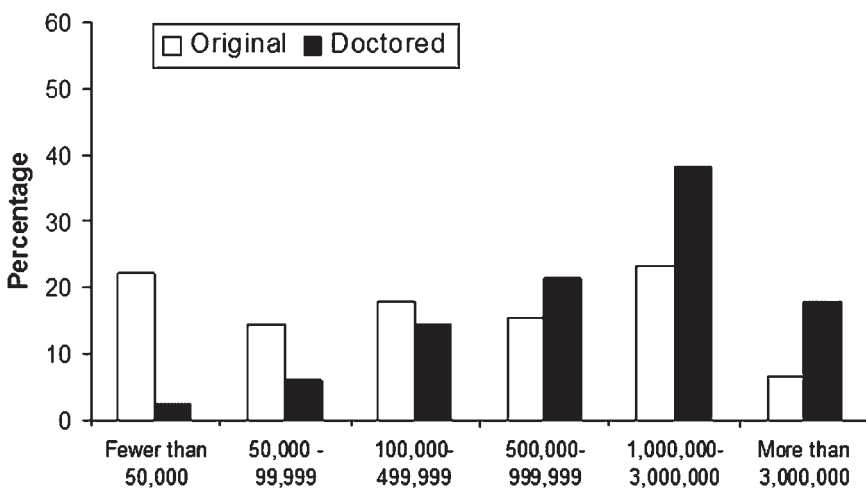

Figure 3. Histogram of numerical estimates of the number of people who took part in the Beijing event in Experiment 1

Table 2. Estimated frequency of violent episodes for the Rome Event in Experiment 1

	Confrontations		Damage		Injuries	
Version of the photograph	No	Yes	No	Yes	No	Yes
Original	64.8	35.2	61.6	38.4	66.3	33.7
Doctored	23.4	76.6	30.1	69.9	32.6	67.4
χ^2 (1)	31.65* ($N=182$)		17.9* ($N=179$)		20.18* ($N=178$)	

Note: The values represent the percentage of participants selecting each option.
*$p < 0.001$.

property was damaged and how many people were injured. They could choose among three response options: 'No, none', 'Yes, a few/minimal' and 'Yes, many/substantial'. Participants in the doctored condition were expected to indicate 'Yes' more often. The responses for the two conditions appear in Table 2; for each question, we first combined the data from the 'Yes, a few/minimal' and the 'Yes, many/substantial' options into a single 'Yes' category, and then compared the combined 'Yes' data with the data from the 'No, none' option.

The participants who were exposed to the altered version of the photograph were much more likely to respond 'Yes' to all three questions. For example, 34% of those who saw the original photograph claimed there were injuries, but 67% of those who saw the doctored photograph claimed injuries occurred. A medium to large effect ($\varphi = 0.42$) was found when they were asked about the physical confrontations, while a medium effect was found when we asked them about damage to properties ($\varphi = 0.32$) and injured people ($\varphi = 0.34$).

Participants also indicated how many people had been killed during the Rome event. Across conditions, 91% of the entire sample answered correctly that there had been no casualties. Compared to participants who saw the original photograph, however, those who saw the doctored photograph were almost seven times more likely to say that some people were killed during the demonstration (2.3% in the original condition vs. 15.7% in the doctored condition, a significant difference).

Attitudes towards the events
Table 3 presents the mean ratings for the two conditions in response to the attitude questions about both events. For the Beijing event, we expected participants in the doctored

Table 3. Mean ratings about the Beijing and Rome events in Experiment 1

	Ratings		
Photograph	1 = Insignificant 7 = Important	1 = Peaceful 7 = Violent	1 = Positive 7 = Negative
Beijing			
Original ($N=100$)	5.03 (1.61)	4.79 (1.69)	4.20 (1.93)
Doctored ($N=87$)	5.30 (1.36)	5.02 (1.50)	4.37 (1.80)
Rome			
Original ($N=91$)	5.39 (1.50)	1.78 (1.09)	1.80 (1.21)
Doctored ($N=96$)	5.29 (1.44)	2.94 (1.60)	2.96 (1.87)

Note: Standard deviations are in parentheses.

condition to produce higher ratings of importance, but results did not show a significant effect of the experimental manipulation, $t(177) = 1.19$, $p > 0.05$. Similarly, mean ratings on the peaceful–violent and positive–negative scales did not differ between the two conditions.

We expected participants to rate the Rome event more violent and more negative after viewing the doctored photo. Participants in both conditions indicated similar ratings of importance. As predicted, participants who viewed the doctored photo rated the event significantly more violent ($M = 2.94$) than those who viewed the original photo ($M = 1.78$), $t(181) = 5.7$, $p < 0.001$. Similarly, participants in the doctored condition rated the Rome event significantly more negative, $t(183) = 5.07$, $p < 0.001$.

Limitations

One limitation of the present study is the participants' lack of familiarity with the Beijing event. Even though we expected lower familiarity ratings in comparison with the Rome event, we did not anticipate that 66 of the 187 total participants (35%) would report that they were 'completely unfamiliar' with the 1989 Tiananmen Square protest. This result is a potential threat to the validity of our findings. Participants were instructed to answer the critical and attitude questions according to their memory, but how could they comply with this instruction if they did not know or remember the event at all? Perhaps they simply gave fabricated answers.

One way to overcome this limitation is to analyse the Beijing event data without considering the responses of the participants who stated that they were completely unfamiliar with the event. If we disregard those data, we are still left with a total of 121 participants, 59 in the original and 62 in the doctored condition. Interestingly, results obtained with this subset are very similar to those obtained when the entire pool of participants is considered. Significant effects were found when participants were asked 'How many people took part in this event'? $\chi^2 (5, N = 117) = 15.44$, $p < 0.01$, and 'How many people were around (within 10 m of) the tanks, when they entered the square'? $\chi^2 (4, N = 114) = 15.43$, $p < 0.01$. No difference between the two conditions was found for estimates of the number of people who obstructed the tanks. Responses were also similar for the three attitude questions.

Another limitation is that we do not know whether the participants responded on the basis of a modified memory or simply based their answers on the photograph they were shown. For example, we know that participants who viewed the doctored photo of the Rome event reported that it was violent although there should not have been any violent episodes in their previous memory of the event. However, the answers to our multiple-choice questions do not clarify whether the participants actually incorporated these pieces of misleading information in their memory of the event. The comments written on the final page of the questionnaire seem to suggest that, at least in some cases, they did. Many participants remarked about violent conflicts between the demonstrators and the law enforcement in their comments. A few of them talked about injuries, and a couple of participants even mentioned the death of one or more demonstrators. One participant wrote:

> I do not remember very much about this event. All I remember were the conflicts with the police, and the fact that the demonstrators caused some damage to the city. I think that this should have not happened, for it to be a real peace demonstration.

This comment is particularly striking because the participant expresses her bewilderment about the irony of a 'violent peace demonstration', but that is not a strong enough hint for her to reject the misleading visual suggestion.

These issues prompted our interest in replicating the study with an older sample of people (who would probably be more familiar with the Beijing event), and in employing more direct instructions about disregarding the photographs when answering the questions.

One final consideration also suggested a new hypothesis. Provided that the exposure to a doctored photograph could influence people's memory and attitude for a past public event, could it also affect people's behavioural intentions? In other words, if the manipulation led our participants to rate an event more violent and more negative, would they also be less likely to say they would participate in a similar event in the future? This reasoning inspired the design of Experiment 2.

EXPERIMENT 2

Method

Participants
A total of 112 participants (35 male, 73 female, 4 did not specify their gender) took part in Experiment 2. They were enrolled at the *Università della Terza Età 'Paolo Naliato'* in Udine, Italy, and their age range was 50–84 ($M = 64.9$, $SD = 7.7$). About 56% of the participants were retired, 20% were still working and the remaining 24% did not indicate their occupation. Participants did not receive any kind of compensation for their involvement.

Materials
The same photographs from Experiment 1 were used as stimulus material for Experiment 2.

Design
As in Experiment 1, each participant in Experiment 2 saw the photograph for the Beijing event and the photograph for the Rome event, each one either in its original or in its doctored version. Thus, participants viewed only one of four possible combinations: two original photos ($N = 28$); two doctored photos ($N = 27$); the doctored photo for the Beijing event and the original photo for the Rome event ($N = 28$); the original photo for the Beijing event and the doctored photo for the Rome event ($N = 29$). The order of presentation of the photographs was counterbalanced across participants.

Measures
Manipulation check questions, critical questions and attitude questions were all the same as in Experiment 1. To test the hypothesis that the exposure to a doctored photograph of a past public event could affect people's behavioural intentions, one question was added for the Rome event. Participants rated how likely they would be to take part in a similar demonstration on a 7-point scale (1 = completely unlikely, 7 = completely likely).
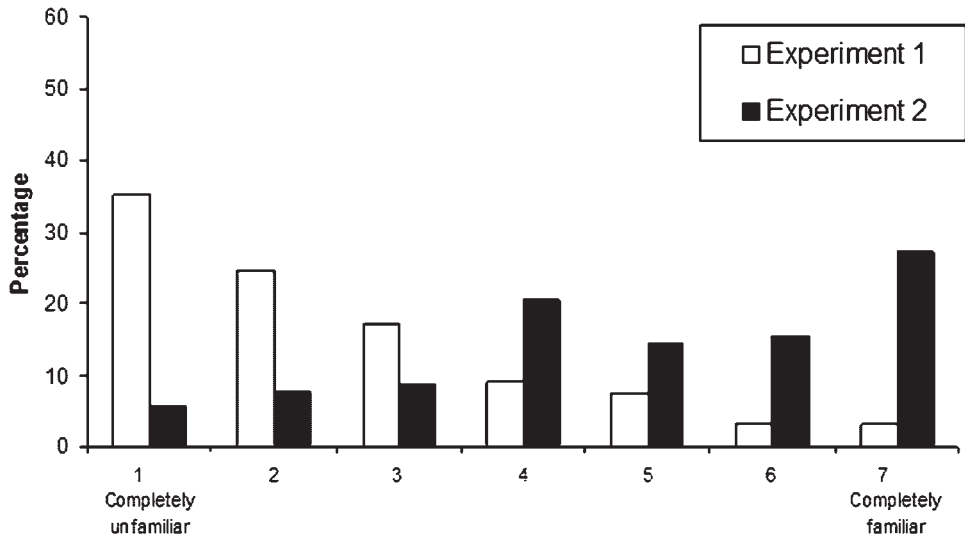
Figure 4. Histogram of ratings of familiarity for the Beijing event in Experiments 1 and 2

Procedure
Experiment 2 followed the same procedure as did Experiment 1. Only the directions on how to answer the critical and the attitude questions were different. Instead of simply asking participants to respond based on their memory of the event, the instruction read: 'Please disregard the previous photograph and answer the following questions only on the basis of your memory of the event'[2].

Results and discussion

As in Experiment 1, the data for each event were analysed separately. Thus, we independently compared one original ($N = 57$) and one doctored condition ($N = 55$) for the Beijing event and one original ($N = 56$) and one doctored condition ($N = 56$) for the Rome event.

Manipulation check
For the Beijing event, 63% of the participants in Experiment 2 indicated that they had seen the photograph before. The responses of participants in the two conditions were similar, χ^2 $(2, N = 112) = 0.06$, and much higher than in Experiment 1. These results suggest that our participants were likely to recognise the photograph of the Beijing event, regardless of whether they viewed the original or the doctored version.

Ratings of familiarity with the Beijing event were crucial to Experiment 2, because we wanted to test our hypotheses with participants who were more familiar with this event compared to those in Experiment 1. As Figure 4 shows, 57% of the entire sample rated their familiarity with the event between 5 and 7, whereas in Experiment 1 only 14% of the

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[2]Minor changes to the questionnaire were made so that the task would not be too demanding for the older participants. The photographs featured in Experiment 2 were about ¼ larger than those that were used in Experiment 1, and we eliminated one of the filler questions.

participants did so. The older participants of Experiment 2 were indeed more likely to express familiarity with the Beijing event.

For the Rome event, 40% of the entire sample claimed to have seen the photograph before, and the distributions of the answers in the two conditions were very similar, χ^2 (2, $N = 112$) $= 2.84$, $p > 0.05$. Ratings of familiarity also did not differ significantly between the two conditions, χ^2 (6, $N = 107$) $= 7.64$, $p > 0.05$, suggesting that the exposure to the doctored photo did not impair the participants' familiarity with the Rome event.

Apparently, participants in Experiment 2 found both doctored photographs plausible, since image recognition rates and familiarity ratings were similar in the two conditions.

Memory for the events

For the Beijing event, the experimental manipulation affected the estimates of the number of people who took part in the protest, χ^2 (5, $N = 99$) $= 19.28$, $p < 0.01$, $V = 0.44$. As Figure 5 shows, the majority of participants in the doctored condition selected either the fifth or the sixth option, whereas those in the original condition distributed their answers more evenly. As we hypothesised, participants who viewed the doctored photograph of the Beijing event produced significantly higher estimates than did participants who viewed the original photograph. We expected to observe a similar effect on the estimate of the number of people in the vicinity of the tanks, but the two groups did not differ, χ^2 (4, $N = 95$) $= 4.00$, $p > 0.05$. There was also no significant difference in the estimated number of demonstrators who obstructed the tanks, χ^2 (4, $N = 92$) $= 3.48$, $p > 0.05$.

For the Rome event, participants answered the critical questions differently depending on the version of the photograph they had viewed. Participants who saw the doctored image were more likely to indicate that the peace demonstration featured physical confrontations, χ^2 (1, $N = 107$) $= 14.24$, $p < 0.001$, $\varphi = 0.36$, damage to properties, χ^2 (1, $N = 100$) $= 7.61$, $p < 0.01$, $\varphi = 0.28$ and injured people, χ^2 (1, $N = 99$) $= 6.37$, $p < 0.03$, $\varphi = 0.25$. Moreover, when asked how many people had died during the Rome event, participants in the doctored
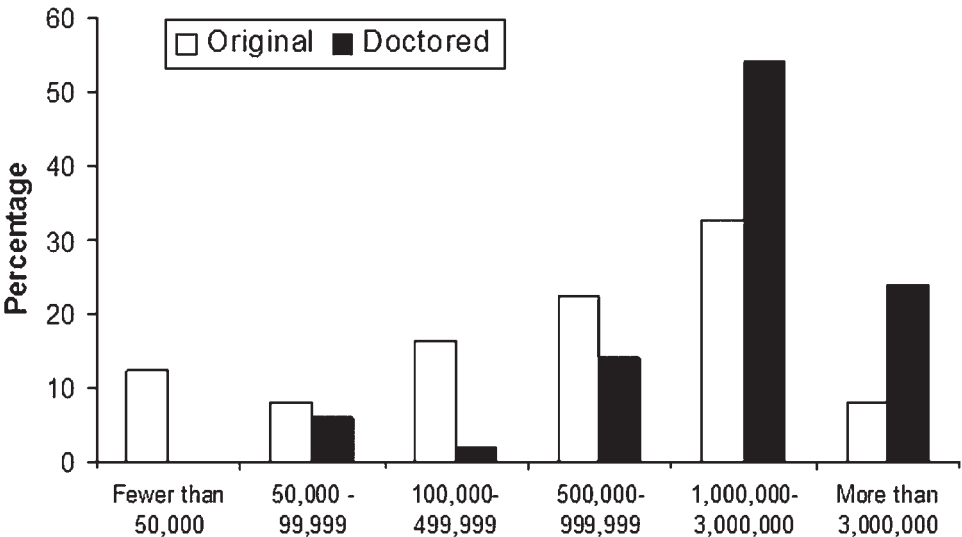

Figure 5. Histogram of numerical estimates of the number of people who took part in the Beijing event in Experiment 2

Table 4. Mean ratings about the Beijing and Rome events in Experiment 2

Photograph	Ratings			
	1 = Insignificant 7 = Important	1 = Peaceful 7 = Violent	1 = Positive 7 = Negative	1 = Unlikely 7 = Likely
Beijing				
Original ($N = 57$)	5.83 (1.57)	5.92 (1.83)	3.60 (2.44)	
Doctored ($N = 55$)	6.04 (1.51)	5.71 (1.87)	3.90 (2.49)	
Rome				
Original ($N = 56$)	4.78 (2.02)	2.09 (1.48)	2.85 (2.24)	2.62 (2.09)
Doctored ($N = 56$)	4.60 (2.15)	3.38 (1.99)	3.75 (2.21)	1.93 (1.82)

Note: Standard deviations are in parentheses.

condition were four times more likely to answer that there had been one or more casualties (3.9 vs. 15.6%, a significant difference).

Attitudes towards the events

Table 4 presents the mean ratings for the two conditions in response to the attitude questions about both events. As we observed in Experiment 1, the ratings expressed by participants in Experiment 2 about the Beijing event did not differ significantly depending on the condition.

For the Rome event, importance ratings were also similar between the two groups, $t < 1$. According to our expectations, however, the experimental manipulation affected the participants' evaluation when they rated the violence of the event, $t (103) = 3.94$, $p < 0.001$, and its negativity, $t (105) = 2.38$, $p < 0.05$. As in Experiment 1, participants in the doctored condition indicated that the Rome event was more violent and more negative.

In Experiment 2, we also asked participants how likely they were to take part in a demonstration similar to the 2003 peace rally. In comparison with participants who saw the original photograph, we expected those who saw the doctored photograph to express less likelihood to participate. Participants' mean ratings appear in the bottom half of Table 4. Indeed, participants in the doctored condition ($M = 1.93$) gave significantly lower ratings compared to participants in the original condition ($M = 2.62$), $t (108) = 2.15$, $p < 0.05$.

GENERAL DISCUSSION

In the two studies, we investigated the effects of exposure to misleading doctored photographs of past public events. One major result was that viewing modified images affected not only the way people remember past public events, but also their attitudes and behavioural intentions. For the Beijing event, participants who viewed the doctored photo estimated that a larger number of people took part in the protest. For the Rome event, participants who viewed the altered material were more likely to report that the demonstration featured more physical confrontations, damage to property, injured people and even casualties. Those same participants also rated the Rome event more violent and more negative, and they reported being less likely to participate in similar demonstrations in the future. The effect was similar for younger and older adults, regardless of whether the specific events were recent enough to be remembered first hand.

To our knowledge, this is the first study to investigate the effects of digitally altered images on memory for past public events. Previous research involving this kind of post-event misinformation has focused mainly on personal autobiographical memory. Although our results suggest that memory for past public events is malleable, just as is personal autobiographical memory, we cannot say whether one is more or less malleable than the other due to numerous differences in the design and procedure employed in the respective studies. Because we were investigating past public events, we did not have to rely on pre- and post-test scores, nor did we have to recruit relatives of the participants as confederates. Moreover, we selected a non-invasive procedure (a questionnaire) so that participants did not have to engage in demanding memory enhancement activities, such as guided imagery or context reinstatement.

As mentioned earlier, however, such a non-invasive procedure does not allow us to determine the extent to which the observed effect is due to actual memory impairment or to a mere acceptance of the post-event misinformation. This debate has accompanied the study of the misinformation effect since its beginning (e.g. Belli, 1989), but today there seems to be a consensus among researchers that in most cases both memory-based and situational factors are responsible for the observed effects (Ayers & Reder, 1998).

Wade et al. (2002) developed an argument based on the SMF (Johnson et al., 1993) that can account for our results. They suggest that altered images do not simply provide visual details that participants include in their reports. Instead, the seeming authenticity of a fake photograph makes it less likely that participants will reject the misleading suggestion, and it prompts them 'to search their memory for event-consistent information' (Wade et al., 2002, p. 602).

We know that participants in our study found the modified images plausible and did not suspect that the material had been altered. We also know that participants who viewed doctored photos included false details in their comments that did not explicitly appear in the photographs (for the Rome event: conflicts, damages, injuries and casualties). The apparent authenticity of our doctored images may have led participants to engage in the reconstructive process of remembering and to retrieve bits of information that were consistent with the misleading suggestion. According to the SMF, the misattribution of this information to the event is ultimately responsible for the observed effect.

Clearly, this kind of speculation needs further testing. Ayers and Reder (1998) identified overall memory for the original information and delay before test as key factors that determine how much of the misinformation effect is due to memory impairment. In future research, we could examine the role of memory impairment by including a pre-test assessment of each participant's memory for the specific event and a delayed test session to investigate whether the effect lasts over time.

Beyond these theoretical issues, our findings pose some practical concerns. The Kerry–Fonda incident prompted us to ask whether doctored photographs of past public events can be used to manipulate public opinion. According to the results of our study, anybody intending to deceive people and affect their opinion by circulating such material would have a good chance of being successful. Even more alarming is the recent flurry of modified images appearing in the media. If viewing false pictures during the retrieval stage affects our recollection of well-known events, what happens when we are exposed to misleading material as we first learn about a new event? Certainly, more specific research on prospective rather than retrospective memory is needed to properly address this question. Nonetheless, the results obtained so far suggest a consideration. Television, newspapers and magazines often constitute the primary channel through which we learn

about public events of the past and the present, and they are generally trusted as reliable sources. When such media employ digitally doctored photographs, they may have a stronger effect than merely influencing our opinion; by tampering with our malleable memory, they may ultimately change the way we recall history.

ACKNOWLEDGEMENTS

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