



Misinformation can influence memory for recently experienced, highly stressful events[☆]

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ARTICLE INFO

Available online 6 December 2012

Keywords:

False memory
Military
Cognition
Survival School
Eyewitness recall
Interrogation

ABSTRACT

A large body of research has demonstrated that exposure to misinformation can lead to distortions in human memory for genuinely experienced objects or people. The current study examined whether misinformation could affect memory for a recently experienced, personally relevant, highly stressful event. In the present study we assessed the impact of misinformation on memory in over 800 military personnel confined in the stressful, mock POW camp phase of Survival School training. Misinformation introduced after the negatively affected memory for the details of the event (such as the presence of glasses or weapons), and also affected the accuracy of identification of an aggressive interrogator. In some conditions more than half of the subjects exposed to a misleading photograph falsely identified a different individual as their interrogator after the interrogation was over. These findings demonstrate that memories for stressful events are highly vulnerable to modification by exposure to misinformation, even in individuals whose level of training and experience might be thought to render them relatively immune to such influences.

Published by Elsevier Ltd.

1. Introduction

Over the past three decades, a large body of research has provided strong evidence that human eyewitness memory is not fixed or indelible but rather is malleable and subject to substantial alteration over time (Cutler & Penrod, 1995). Although there are myriad reasons for such alterations, one particular etiology of memory distortion has been well studied and is referred to as the “misinformation effect”. The term refers to the errors in recalling the details of a past event made by individuals who were subsequently exposed to *false or erroneous* information about the event. The misinformation effect appears to operate largely outside a person’s awareness. That is, when people claim erroneously that they have seen the misinformation details, they seem to truly believe that they did (Loftus & Palmer, 1974; Scoboria, Mazzoni, & Kirsch, 2006).

In a typical ‘misinformation effect’ study, participants come to a laboratory setting where they witness a simulated event (e.g., a filmed

automobile accident and a staged crime). Sometime later, participants are exposed to false information that might be presented in the form of a suggestive questioning or erroneous details from another witness, among other sources. When subsequently asked to provide an accurate recollection about the original event, those participants who were exposed to misinformation frequently include the false information in their recollection.

The findings from misinformation studies demonstrate that exposure to misinformation can lead to distortions in memory for genuinely experienced objects or people – such as misremembering as ‘blue’ a getaway car that was actually green, or mis-recalling a man as having a mustache and curly hair when he was actually clean shaven with straight hair. Exposure to misinformation can lead people to recall seeing objects that did not appear or occur in the original event (i.e. broken glass, tape recorders, buildings or animals) (Nourkova, Bernstein, & Loftus, 2004). Studies dating back to the mid-1970s have consistently shown this. But more recently, researchers have shown that they can also persuade people to recall the existence of people or experiences that are completely fictitious (i.e. the experience of being lost in a mall) (Loftus & Pickrell, 1995). Using various forms of suggestion, researchers have led people to believe they have, in the distant past, been hospitalized, nearly drowned or attacked by a vicious animal or uncomfortably and repeatedly licked on the ear by a Disney character (Berkowitz, Laney, Morris, Garry, & Loftus, 2008; Heaps & Nash, 2001; Hyman, Husband, & Billings, 1995; Hyman & Pentland, 1996; Porter, Yuille, & Lehman, 1999).

[☆] The authors wish to thank the staff at the Survival School whose assistance greatly facilitated the completion of this project. Funding for this research was provided by the National Center for Post Traumatic Stress Disorder, VA New England VA Health Care Systems and by the US Government. The views expressed in this manuscript reflect those of the authors and do not represent those of the U.S. Government. All authors are free of financial ties or conflict of interest. All data analyses and manuscript preparation were performed by the authors and independently of funding entities.

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Based on the studies of false memory, researchers have proposed a sort-of recipe for how false memories are created in the mind of an individual. First, convincing the individual in whom one wishes to create a false memory that the “false event” is plausible; Second, leading said individual to believe the false event was personally experienced; Third, creating a false memory that is rich in detail through the use of false feedback or manipulations of information (Loftus, 2003).

For the most part the memory distortion studies have tended to focus on either impersonal events, or on personal ones that are chronologically distant. Although the data from such studies provide compelling evidence for a potential mechanism by which false memories for highly stressful events (child abuse, physical assaults, real crimes) might be produced, it remains to be shown that such suggestive techniques could affect memory for a recently experienced, personally relevant, highly stressful event. Such a demonstration might go a long way towards helping clinicians who work with adult victims of trauma to appreciate that the data from false memory studies may be relevant to their clinical work. Since the laboratory simulations do not involve the high degree of personal “threat” or “alarm” experienced during actual life threatening events – and presumably do not activate neurobiological systems in the same manner as realistic events (Morgan et al., 2004; Penrod, Fulero, & Cutler, 1995), they are easy to dismiss, especially by those who feel uncomfortable with their findings.

The present study was designed to assess whether human memory for recently experienced, personally relevant, high stress events would be altered by exposure to suggestive misinformation. We conducted the present study in U.S. military personnel enrolled in Survival School training. This on-going training offers a unique opportunity to study the impact of realistic stress on human neuro-physiology, cognition and eyewitness memory (Morgan, Doran, Steffian, Hazlett, & Southwick, 2006; Morgan et al., 2000, 2001, 2004). The realistic nature of the stress at Survival School, the presence of ground truth for the events, and relatively homogenous group of participant undergoing the training, made survival school an ideal setting for testing hypotheses about the real-world impact of misinformation for personally relevant, highly stressful events.

In this study, we hypothesized that:

- 1) Exposure to misinformation at an individual level would result in false memories related to specific stressful event (i.e. mock interrogation) that each participant experienced *individually* while at survival school;
- 2) Group exposure to misinformation would result in false memories about an event that participants experienced together as a group.

2. Methods

2.1. Participants

Participants in this study were 861 active duty military personnel recruited for participation in the study (649 male; 192 female). All participants were enrolled in U.S. Navy Survival School training. The mean age of participants was 26 (SD=5). As designated by their military branch, all were active duty navy or marine personnel.

3. Design and procedure

All participants were randomly assigned to one of four experimental groups (see Fig. 1). Participants in each group completed memory assessment questionnaires at the conclusion of Survival School training. The Control Group (N=158) consisted of participants who were NOT exposed to any misinformation during Survival School training and who were NOT exposed to any misinformation in the memory assessment questionnaire. Members of Misinfo-Questionnaire group (N=372) were exposed to post event misinformation embedded in

the memory questionnaire; Members of the Misinfo-Photo group (N=85) were exposed to photographic misinformation which was presented to them *during* the period of time they were in mock captivity; Members of the Misinfo-Video group (N=246) were exposed to a videotape concerning a specific event that participants all experienced – as a group – while in the mock POW camp. This last group was further divided into three sub-groups (N=81, 90 and 75) who were exposed to somewhat different versions of the misinformation-videotape. The three versions of the videos differed in whether, or to what degree they contained misinformation (see below for details). [Note: The large differences in the numbers between the groups reflected class size differences and enrollment differences per class during the data collection period of the study.]

3.1. The targeted events for memory assessment and misinformation

Although previous descriptions of the phases of Survival school are available (Morgan, Wang, et al., 2001; Morgan et al., 2000, 2004, 2006), the following brief description is provided to assist the reader in understanding the context of the study. Fig. 1 helps to illustrate the methodology. The Survival training begins with a didactic phase after which participants are given, in as highly realistic manner as possible, an experience of wilderness evasion, followed by a mock-captivity in a prisoner of war camp (POWC). The types of stressors experienced by participants are modeled from the experiences of actual military personnel who have been prisoners of war. Due to the classified nature of the course, a complete description of all components of the training is not possible, but suffice it to say the experience is highly stressful. The venue has been validated as a model for the study of acute stress in humans (Morgan, Hazlett, et al., 2001; Morgan, Wang, et al., 2001; Morgan et al., 2000, 2004, 2006). The portions of the training that were directly related to the focus of this study are described below.

3.2. Interrogation stress

Approximately 12 h after being placed in the POWC, participants experience, on an individual basis, a highly stressful interrogation. Due to the fact that interrogations are experienced individually and are conducted by a number of instructors, no individual student is knowledgeable about the identity of the interrogator who has interrogated another student. This results in students being unable to cue other students as to interrogator identity at the conclusion of the course when memory of this event is assessed.

Each student experiences interrogation while alone in a room with a survival school instructor who is not known to the student. During the interrogation, the room is illuminated and the students are able to see and hear the instructor. Throughout the interrogation the student is required to face the instructor and must maintain eye contact. In addition, the student must always adopt a height that is less than that of the instructor by bending or straightening his or her knees. Failure to comply with this rule results in physical punishment to the student by the interrogator. Thus, students must be attentive to the face and relative height of the instructor. During this phase, the interrogator asks questions and physically confronts the student if he or she does not appear to be answering the questions or complying with the interrogator's requests. The various types of physical confrontation have been made public by the US Congress during their inquiries into the relationship of SERE tactics and US Government activities at Guantanamo Bay, Cuba (Joint Personnel Recovery Association (JPRA) Memorandum for the Office of the Secretary of Defense Chief Counsel, 2002) and include facial slaps, abdominal punches, walling (slamming the student into the wall) and stress positions. Interrogations are approximately 30 min in duration.

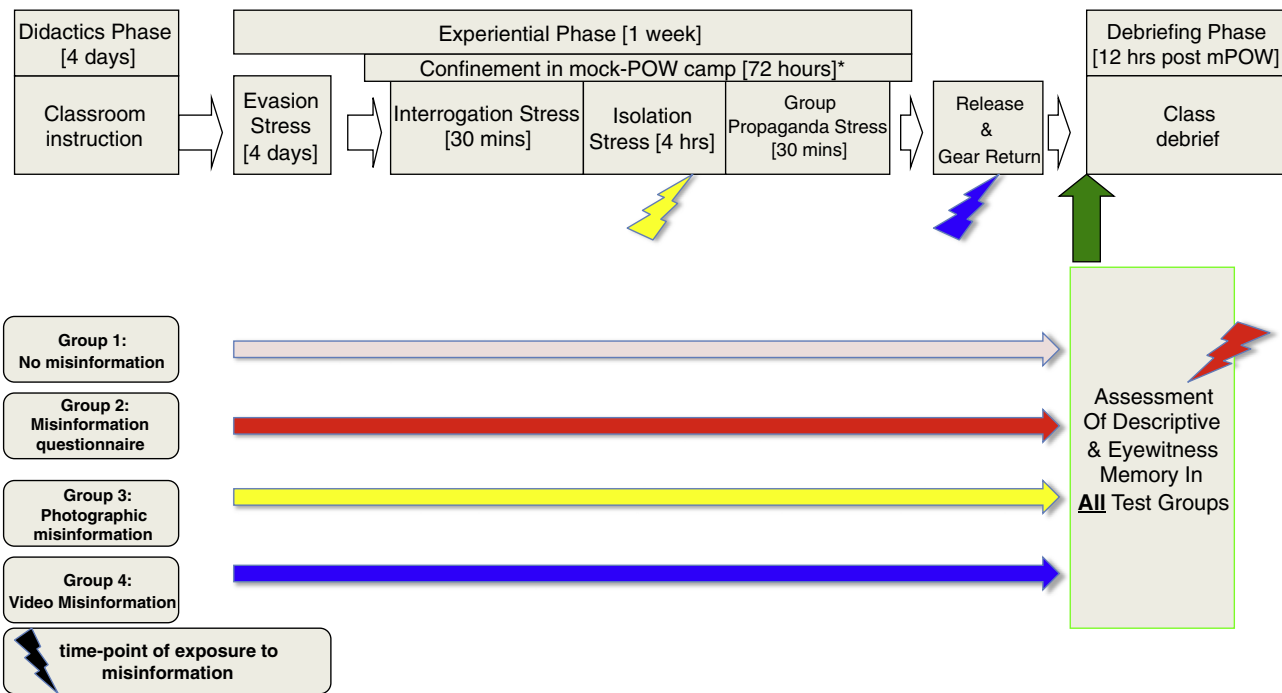


Fig. 1. Timeline of memory assessment and exposure to misinformation.

The interrogation stress experienced by participants at Survival School is intense and elicits profound alterations in psychological and neurobiological indices (Morgan, Wang, et al., 2001; Morgan et al., 2000). Norepinephrine and cortisol levels are elevated to a degree that is higher than that observed in many real world, threat-to-life events such as landing on an aircraft carrier at night for the first time or sky diving for the first time. In addition, gonadal hormone suppression is observed. Psychological symptoms of dissociation are also observed as are alterations in cognitive function as measured by standardized psychological testing (Rey Osterrieth Complex Figure [ROCF]) (Morgan, Hazlett, et al., 2001; Morgan et al., 2006).

Following interrogation stress exposure, all participants were exposed to the stress of isolation, as well as sleep and food deprivation for approximately the next 36 h. During this time, and after several hours of isolation stress, all participants were exposed as a group to an event in Survival School called the “Propaganda Speech.”

3.3. The propaganda speech

During this event all participants sat as a group on the floor of a building in the mock POW camp and listened to a “Commandant” of the camp give a lecture extolling the virtues of a non-US friendly political system. The event is provocative and designed to provide students in Survival School with a realistic experience as to how exposure to such events has led genuine US POWs in the past to provide useful propaganda to the enemy. The Propaganda Speech lasts approximately 30 min.

In the past we have not specifically evaluated the impact of this mock POW event on human physiology and hormone responses and, therefore, cannot comment specifically on the degree of stress experienced by participants during this event. We included this event in the current study so that we could assess memory for, and the impact of misinformation on, an event that participants experienced as a group.

Upon release from the POWC, all subjects were given access to food, clean clothing and the opportunity to collect their personal effects and gear. Following this memory testing occurred.

3.4. The assessment of memory (no misinformation)

As noted in Fig. 1, approximately 44 h after release from the mock POW camp (i.e. 36 h after exposure to Interrogation stress and approximately 20 h after exposure to the Propaganda Speech), participants in the No-Misinformation Control Group assembled in the classroom and completed a non-leading, proctored, questionnaire designed to assess memory for the events described above. All participants were told explicitly by the proctor that the focus of the questionnaire was the interrogation that each had experienced. In addition, they were reminded that if they were not sure of their memory they should indicate this on their form and not ‘guess’ when answering the questions. Each completed the questionnaire in silence; participants were not allowed to discuss with each other their responses. When each had completed the questionnaire, the participant put his/her head on their desk and waited quietly until the entire group had completed testing.

The initial section of the questionnaire asked participants to select descriptive characteristics of the interrogator who conducted their interrogation. These 11 descriptive categories were based on a consensus assessment derived from the Instructor Cadre at the Survival School (see Data analysis section) and were the following: Sex/Gender (*Male; Female*); Race (*Asian, African American, Caucasian, Hispanic*); Height (*Tall, Medium, Short*); Build (*Big, Average, Thin*); Hair Length (*Bald, Short Hair, Long Hair*); Hair Color (*Red, Brown, Blond, Gray, None*); Face Shape (*Round, Square, Oval, Long*); Facial Hair (*Clean Shaven, Mustache, Goatee, Beard*); Eye Color (*Blue, Brown, Green, Hazel*); Ear Appearance (*Ears Stick Out, Ears Flat to Head, Ears Normal*); and Teeth (*Straight, Crooked, Missing Teeth*). Participants were instructed to circle, within each category the word that best described their interrogator. They were instructed to write “I don’t know” if they did not remember.

After completing this section, participants moved to the second page to complete the second section of the questionnaire on which there were series of *open-ended* questions about emotionally neutral items for military personnel [i.e., glasses; telephone] and about items that would likely carry emotional valence for military personnel [i.e., military uniforms; weapons] (see Table 1). The open-ended nature of the questionnaire provided participants with the opportunity to endorse, deny the

Table 1
Assessing misinformation: non-leading and leading questions.

Questions regarding relatively neutral item	
Non leading: "Did your interrogator wear glasses? If so, what type?"	
Leading: "Did your interrogator remove his glasses before interrogating you? Please describe the glasses worn by your interrogator."	
Non leading: "Was there a telephone in the interrogation booth? If so, what color was it?"	
Leading: "Did your interrogator allow you to make a phone call? Describe the telephone in the interrogation room."	
<i>Questions regarding non neutral items</i>	
Non leading: "Please describe the uniform and rank of your interrogator." "If you do not remember, please indicate that you do not remember."	
Leading: "If your prisoner number was an odd number, please answer this question, if not please skip this one and answer the next question." Was the uniform worn by your interrogator green with red boards or blue with orange boards? [the alternate question gave the options of 'black with yellow boards or gray with green boards']	
Non leading: "Did your interrogator carry or have a weapon?" "If so, please describe it?"	
Leading: "When the interrogator wearing the weapon interrupted your interrogator [note: a fictitious event] and argued with him, what did they argue about?" "Describe the weapon worn by your interrogator."	

presence of the items and also, if endorsed, to describe them. Participants were also told that they could indicate a response of "I don't remember" or of "I don't know" when completing the questionnaire.

The third section of the questionnaire was given next. This section consisted of an 8 and 1/2 × 11 in. sheet of paper on which was printed a color photo-spread type Eyewitness array. This photo-spread was composed of nine "mug shot," photographs of former Survival School instructor/interrogators, each one two inch × two inch color.

Unlike the photo-spread used our previous studies of Eyewitness Accuracy (Morgan et al., 2004, 2007) this one was "target absent." This means the array DID NOT contain a photograph of any interrogator encountered by ANY participant. Participants were instructed to indicate whether his or her interrogator was depicted in the photo-spread by placing an 'X' on the [ONE] relevant photograph. All were explicitly told that their interrogator 'might not' be present in the array and that it was permissible to write "not present" or "I don't remember" on the photo array.¹ After responding to the photo spread each participant put his/her head down and waited quietly for the forms to be collected by the research team.

3.5. Misinformation conditions – assessment of memory

Participants in the Misinformation-Questionnaire Group received identical instructions to those described above for participants who were in the No-Misinformation Control group. In both, participants were asked to describe their interrogator by selecting descriptive adjectives. In the section that followed, the questionnaire given to participants in the Misinformation-Questionnaire group, differed from that given to the No-Misinformation Control Group in that it contained statements containing misinformation as well as leading questions (see Table 1; see Fig. 1). After completing this section participants in the Misinformation-questionnaire group made an eyewitness identification from a photo-spread.

As noted in Fig. 1, participants in the Misinformation-Photo Group were exposed to misinformation in the form of a photograph prior to their release from the mock POW camp and approximately 1 h after they had been exposed to interrogation stress. The presentation of misinformation occurred while participants were confined in individual

¹ The target-negative nature of the array meant that only "Not Present" responses were coded as correct or 'true negative' responses. "I don't know" type responses were not coded as errors, but were recorded to reflect the lack of recall.

isolation cells. A member of the research team entered the isolation cell and handed the participant an 8 × 10 color, mug shot type photograph of a Caucasian male (later referred to in this paper as the 'Foil'). While holding the photograph, each was told to "look at this photograph" and while they viewed the photograph, each was asked the following questions by the research team member: "Did your interrogator give you anything to eat? Did your interrogator give you a blanket? Did your interrogator let you speak with any other prisoners?" After asking each of these questions, the research team member paused in order to let the participant answer the question. Once this was completed, the research team member took the photograph and left the isolation cell.

After release from the mock POW camp, participants in the Misinformation-Photo Group assembled in the classroom and completed a non-leading questionnaire that was identical to the questionnaire given to participants in the No-Misinformation Control Group. Following this, they viewed the eyewitness identification photo-spread shown to participants in the other groups. The inclusion of the 'Foil' in the array [i.e., the photograph to which participants in Group Three had been exposed while in isolation] made it possible to assess whether exposure to misinformation would lead to more false identifications of the Foil as the person who conducted their interrogation (relative to the other groups).

In order to assess the impact of misinformation delivered at the level of the group, participants in the Misinformation-Video Group were exposed – as a group – to misinformation in the form of a video prior to individually completing their memory questionnaires (Fig. 1). After watching the video as a group, participants in this group completed a non-leading questionnaire that differed from the non leading questionnaire used with other groups in the following way: Instead of presenting non-leading questions related to the interrogation event, the questionnaire included a non leading question related to the Propaganda Speech event: "Did the instructors carry or wear weapons during the Propaganda Speech? If so, please describe them."

In order to assess the impact of misinformation presented in the form of a videotape, we created three eight-minute videotapes about a group event from Survival School called the Propaganda Speech. During this event all participants sat as a group on the floor and listened to a speaker extolling the virtues of a non-US friendly political system. In each of the three versions, the video depicted the students being brought into the mock POW camp and then as they sat, as a group, listening to the propaganda speech. With the aid of Adobe Software, we altered two of the three videos so that they contained 'misinformation.' In each of the misinformation videos the survival school staff depicted during the Propaganda Speech wore automatic weapons and/or carried Rocket Propelled Grenade devices (RPGs). The two misinformation videotapes differed from each other in whether or not the instructors depicted in the videotape were familiar or unfamiliar to the participants.

Finally, all participants completed the self-report portion of the Clinician Administered Dissociative Symptom Scale (CADSS). The CADSS is a reliable, valid, self-report instrument designed to assess state symptoms of dissociation in response to a specified stressor (Bremner et al., 1998).

4. Data analysis

4.1. Initial descriptive section of questionnaire

The 11 descriptive categories were derived from a standard list of adjectives used in military debriefing assessments of eyewitness statements. The cadre of Survival School staff (N=20) were each given this initial descriptive section and asked to rate themselves and each of the nine interrogators to which the students would be exposed. For several of the categories (*Sex, Race, Build, Hair Length, Hair Color, Facial Hair, Eye Color, and Teeth*) there was 100% agreement among the staff. However, for three of the nine instructors, there was no agreement within the group of 20 staff members with

respect to the following categories (*Height, Ear Appearance and Face Shape*). These disagreements were resolved by group discussion.²

4.2. Second portion of the questionnaire

Responses to the open ended and leading questionnaires were manually reviewed and scored by two separate teams from our research group. This was done to permit a 'blind' assessment of the questionnaires, the eyewitness identification form and the questions related to the videotapes.

Responses of participants in the No-Misinformation Control Group were coded so as to indicate whether or not subjects responded to the question (0 = no response; 1 = response) and whether their answer was correct (0 = incorrect; 1 = correct; 2 = I don't know/I don't remember).

The responses of subjects in the Misinformation-Questionnaire Group, the Misinformation-Photo Group and the Misinformation-Video Group were similarly coded to indicate whether subjects responded to the misinformation and endorsed recalling such information, or whether they denied experiencing the suggested stimuli, or did not remember the information (0 = no endorsement; 1 = endorsed misinformation; 2 = I don't know/I don't remember). Chi-square analyses were used to examine whether the distributions of endorsements to questions were significantly greater in participants exposed to misinformation. Sign tests were used [for the Misinformation-Questionnaire Group] in order to assess whether there was a relationship between the endorsement of the different types of misinformation (neutral/non-neutral). General Linear Model Univariate Analyses of Variance were used to determine whether and to what degree endorsements of false information were significantly greater between the three comparison groups [Misinformation-Video Group].

5. Results

861 participants completed the initial section of the questionnaire (the description of the interrogator). [Note: one subject in Group Three did not provide a response on the eyewitness identification task and is removed from the denominator of this category.]

With respect to the Descriptive Categories, all 861 subjects correctly reported the Gender of their Interrogator. 836/861 (97%) of participants correctly described the Race of their interrogator, and 26 (3%) were mistaken. Of these 26 participants, 20 described their Caucasian interrogator as African American, two described their Caucasian interrogator as Asian and four described their Caucasian interrogator as Hispanic.

With respect to the categories of Height and Build, 621/861 (72%) and 474/861 (55%), respectively, correctly described their interrogator. Of the 240 erroneous descriptions within the category of Height, 194/240 (81%) were those in which the [Short] interrogator was described as "Tall;" the remaining represented those who labeled the [Medium] interrogator as "Tall." Of the 387 (45%) participants who erred within the category of "Build," 120 (31%) reflected a choice of "Medium" over the correct response "Thin" and 267 (69%) reflected the choice of "Big" over the correct response "Medium."

² With respect to two interrogators, three staff members could not decide whether or not the description of the category Height was best described as "Tall" or "Medium." For a third instructor, a fourth staff member was unsure as to whether or not the Face Shape for an interrogator was best described as "Oval" or "Long." In addition, this staff member was unsure as to whether the description of Ear Appearance for an interrogator was best described as "Flat to Head" or "Normal." To resolve these uncertainties, the staff engaged in a group discussion and came to a group consensus about which descriptor (or both) would be acceptable to them in a real world setting. In the end, the group consensus was that for category of Height, the term "Medium" would be the correct response for the two interrogators in question; with respect to the interrogator about whom there was disagreement about Face Shape and Ear Appearance, the group agreed to accept either "Oval" or "Long" and "Flat to Head" and "Normal" as correct responses, respectively for that particular interrogator.

When providing descriptions related to the head/face appearance of the interrogators, participants were incorrect in the majority of categories. Exceptions to this were noted for the categories of *Teeth* and *Hair Length* for which the majority of participants were correct. The types of errors committed were as follows: Hair Length (Of the 112 participants who erroneously endorsed hair length, 65 selected the attribute Long when the interrogator's hair was Short and 47 selected the attribute Short when the interrogator was Bald); Hair Color (Of the 490 participants who erred in hair color, 100 selected Red [the interrogator was Blond], 256 selected Brown [the interrogator was Gray] and 134 selected Gray [the interrogator was Brown]); Facial Shape (Of the 499 participants who provided erroneous responses, 218 selected Round [the interrogator was Square], 41 selected Round [the interrogator was Long] 19 selected Square [the interrogator was Oval], and 221 selected Long [the interrogator was Round]); Facial Hair (Of the 517 participants who erred, 192 selected Clean Shaven [the interrogator had a Mustache], 158 selected Beard [the interrogator was Clean Shaven], 117 selected Goatee [the instructor was Clean Shaven], 11 selected Mustache [the instructor was Clean Shaven] and 39 selected Beard [the interrogator had a Mustache]); Teeth (Of the 344 participants who erred, all selected Crooked [the interrogator's teeth were Straight]); Eye Color (Of the 542 who erred on this item, 83 selected Green [the interrogator's eyes were Blue], 248 selected Brown [the interrogator's eyes were Blue], 192 selected Hazel [the interrogator's eyes were Green] and 19 selected Blue [the interrogator's eyes were Brown]); Ears (Of the 637 participants who erred on this item, 324 selected Normal [the interrogator's ears Stuck Out], and 313 selected Normal [the interrogator's ears were Flat to Head]).

As shown in Table 2, compared to those who were not exposed to misinformation, participants who were exposed to misinformation were more likely to endorse false memories for their experience at Survival School. As noted below, these differences in endorsement were statistically significant.

5.1. Misinformation questionnaire condition (group two)

As noted in Table 2, exposure to misinformation increased false memory for both neutral and non neutral items. [Neutral items: Glasses: no misinformation, 4/158 (2.5%); misinformation, 74/372 (20%); Chi-square = 2.6; df = 1, p < 0.001; Telephone: no misinformation, 16/158 (10%); misinformation: 365/372 (98%); Chi-square = 4.2; df = 1, p < 0.001. Non neutral items: Military Uniform: No misinformation, 35/158 (22%); Misinformation, 316/372 (85%); Chi-square = 1.9; df = 1; p < 0.001. Weapons: No misinformation, 5/158 (3%); Misinformation, 100/372 (27%); Chi-square = 3.9; df = 1; p < 0.001.]

5.2. Misinformation-photo condition (group three)

As noted in Table 2, exposure to misinformation in the form of a photograph (Fig. 2) resulted in a significant increase in false positive eyewitness identifications: No misinformation, Eyewitness Identification False Positive endorsement rate: 84/158 (53%); Misinformation, Eyewitness Identification False Positive rate: 77/85 (91%); Chi-square = 4.5; df = 1; p < 0.001.

In addition, the majority of individuals exposed to the misinformation about the identity of the interrogator selected the false information (i.e., the "Foil") when performing the eyewitness identification task: No misinformation, Foil selection: 13/84 (15%); Misinformation, Foil selection: 65/77 (84%); Chi-square = 7.6; df = 1; p < 0.001.

5.3. Misinformation-videotape condition (group four)

Impact of misinformation on the endorsement of weapons present during the Propaganda Speech. [No misinformation, familiar staff in video: 4/75 (5%); Misinformation, unfamiliar staff in video: 10/90

Table 2
Impact of misinformation on memory for events.

Misinformation given at the individual level		
Questionnaire:	No misinf N (%)	Misinf. N (%)
Neutral items		
Glasses	4/158 (2.5%)	74/372 (20%)*
Telephone	16/158 (10%)	365/372 (98%)*
Non neutral items		
Uniform	35/158 (22%)	316/372 (85%)*
Weapon	5/158 (3%)	100/372 (27%)*
Photograph		
False Pos. (FP) Eyewitness ID	84/158 (53%)	77/85 (91%)*
Foil selection among FP IDs	13/84 (15%)	65/77 (84%)*
Misinformation given at a group level via videotape		
		N (%)
Endorsement of weapons in group event (no misinformation) (5%)		4/75 (5%)
Endorsement of weapons in group event (misinformation and unfamiliar staff)		10/90 (11%)
Endorsement of weapons in group event (misinformation and familiar staff) (51%)*		41/81 (51%)*

* Significant at a level of $p < 0.001$.

(11%); Misinformation, familiar staff in video: 42/81 (51%); Chi-square = 5.9; $df = 2$; $p < 0.001$. General Linear Model Univariate Analysis of Variance using endorsements as the dependent variable and Group as the independent variable (i.e., the 'between subject' factor) indicated that there was a significant between-subjects effect ($F(1,2) = 38$; $p < 0.001$). As shown in Table 2, post-hoc comparisons (Tukey) indicated that this effect was due to the fact that endorsement rates {0 = no endorsement; 1 = endorsement} for weapons were significantly higher *only* in group exposed to the misinformation video containing familiar staff members [mean difference group 3 (Misinformation with familiar staff) and groups 1 (No misinformation, familiar staff) and 2 (Misinformation, unfamiliar staff) = .465; $p < 0.001$].

With respect to dissociation scores, no differences in stress-induced dissociation symptoms were observed between the four groups: No-Misinfo Control Group, CADSS mean score: 18.8 (SD = 14); Misinfo-Questionnaire Group: 17.5 (SD = 13); Misinfo-Photo Group: 19.4 (SD = 12); Misinfo-Video Group: 18.1 (15). No significant relationships were observed between dissociation scores and vulnerability to misinformation.

6. Discussion

The present data confirm our previously published data showing that human memory for realistic, recently experienced stressful events is subject to substantial error. In addition, however, the present data confirm that memories for stressful events are also highly vulnerable to modification by exposure to misinformation. Indeed,

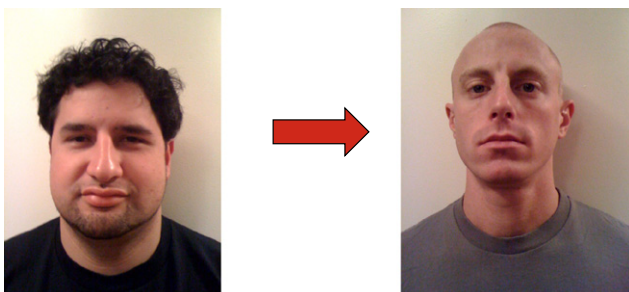


Fig. 2. Misinformation photograph.

with very little effort we were able to create false memories in a population of military personnel who are trained to resist propaganda and misinformation. The endorsement rates in this study raise the possibility that, until now, professionals have underestimated the impact of misinformation. To wit, false memory endorsements about non-trivial items (i.e., weapons) were observed in *at least* 27% of participants. Even higher endorsement rates, upwards of 80% of participants, occurred with respect to misinformation about uniforms or human faces. That we were able to alter memory for such non-trivial events in military personnel trained to resist propaganda and exploitation techniques extends the applicability of false memory research to a wider population than heretofore examined, and suggests that these observations should be taken seriously by professionals who work with victims of traumatic stress and who interact with the criminal justice system. Given the myriad ways in which real world victims of stressful events may be exposed to misinformation (through the media, police interviews, talking to attorneys or friends, etc.), it is possible that the present data under-represent the true risk of, and prevalence of, false memories.

We found that misinformation, when presented at a group level, was effective at creating false memories in a large number of participants. Consistent with previous reports suggesting that misinformation is more readily accepted by a person when the misinformation is paired with someone who is trusted or who is familiar to that person, the impact of the videotape based misinformation was significantly enhanced when we included the faces of instructors who were known to the students watching the videotape. In all three versions of the videotape we included a snippet that showed the participants' own faces. Although this may have influenced endorsement rates somewhat, this seems not likely to have been a major factor leading to the endorsement of the false information in that the greatest number of endorsements occurred when we paired familiar staff faces with the misinformation about weapons. Thus, it may be that misinformation is more likely to be accepted when presented in association with persons perceived, by the recipients, to be in positions of authority.

With respect to eyewitness identifications, we observed that approximately 50% of participants, when presented a target-absent eyewitness array and asked to identify their interrogator, gave false positive identifications. This surprisingly high false positive rate is very similar to that observed in our previous eyewitness identification study (Morgan et al., 2004).

Unlike our previous studies in which we only asked participants to perform an eyewitness face identification task, in this study we also asked participants to describe their interrogator by selecting adjectives that might accurately characterize that person. Taken together, the majority of participants were *correct* when describing characteristics about their interrogator that one might observe from a distance (i.e. race, gender, height, build). Yet, the majority of participants were *incorrect* when describing other characteristics that might be more discriminating in nature (i.e., one's facial hair, eye color, or shape of face). The etiology of this finding is not known. Similarly, we observed that when making errors in describing the build or height of their interrogator, participants erred in describing the interrogator as larger and as taller than was the case rather than describing them as smaller or shorter. At present the etiology of this is not known.

With respect to the descriptive memory data in this study, keep in mind that the reported percentage of correct responses may actually *over-represent* eyewitness accuracy. These percentages have not been corrected for guessing. For example, when selecting from the category *hair color*, participants were able to choose their answer from five options. This means participants who were just guessing had a one in five chance of being correct on this category simply by guessing. We freely acknowledge that the method of asking participants to select adjectives in order to describe their interrogator has limitations. Time constraints prevented us from being able to assess a free-recall, open

narrative type memory in participants. Future research with Survival School participants might profitably use open-ended, free recall procedures.

The observation that memory for recent events can be altered by misinformation has a number of implications for a number of professionals. First, physicians and psychotherapists who may work with victims of trauma and who may engage in associated legal advocacy or forensic work (i.e., Evaluations for Asylum; Forensic criminal evaluations; Debriefings) would be well advised to videotape their evaluations and to take great care to use non-leading, open ended information gathering interviewing techniques.

Although videotaping evaluations may not prevent the alteration of memory for traumatic events, it may provide an objective means by which the source of such false memories can be identified. Given the present data it is reasonable to believe that the social status of physicians and therapists may significantly facilitate – albeit unintentionally – the acceptance of misinformation and alter memories on the part of victims.

Law enforcement professionals would do well to take great care in both interviewing methods as well as the degree to which interviewees are exposed to information that might alter their memory. Based on the current study, one might anticipate that the use of leading questions, exposing witnesses to photographs or statements may significantly alter subsequent recollections. In the interest of not contaminating evidence (or of documenting how inconsistencies in witness recollections may have come about) it may be prudent to videotape all interviews and to also control the level of exposure witnesses may have to photographs, comments, or other information related to a past experience. Further, and although we would not disagree with the current police practice of assessing eyewitness memory as soon after the events of interest as possible, we believe it prudent to hold to the view that event memory for events that have “just occurred” are also vulnerable to misinformation.

There were a number of limitations in the present study. First, the time constraints of the training environment and limited access to participants prevent us from conducting a debriefing to explore whether the alterations in reported memory represent altered ‘beliefs’ or altered ‘remembering’. In addition, we were not able to assess the impact of the various types of misinformation in each participant; this meant we were not able to test whether vulnerability to one type of misinformation would indicate that a person was more likely to be vulnerable to another type of misinformation. This issue awaits further study. In addition, all participants at Survival School experienced significant food and sleep deprivation during their time in the mock POW camp environment. These stressors may have influenced the accuracy of memory recall or vulnerability to misinformation. This said, given the uniform application of sleep and food deprivation across participants, these factors are not a likely explanation of the differences in memory recall between subjects. Finally, the rates of false memory endorsements in these military participants may not reflect those of the general population due to the relative homogeneity of the sample. This said, given that these mili-

tary personnel represent individuals who are specially trained to resist exploitation and propaganda efforts, it seems unlikely that they are more susceptible than general civilians. This too, however awaits future testing in studies that include both civilian and military participants.

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