

Informational Social Influence Intensifies The Misinformation Effect When Applied To Immutable Item and Temporal Order Memory

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Abstract

The importance surrounding the fallibility of eyewitness testimony is evident from the literature (Loftus, 2005) and its unreliability is cited as a leading cause for wrongful convictions (The Innocence Project, 2017). The present study examined the misinformation effect linked to temporal order and immutable item memories from an episodic event. It also investigated whether informational social influence would intensify this effect. Fifty-two participants (33 women and 19 men) carried out the study using the misinformation paradigm's three-stage standard suggestibility procedure. Supporting the first hypothesis, participants exposed to informational social influence did yield to higher levels of misinformation. Indeed, in terms of immutable item memory, informational social influence was shown to be a causal factor in increasing the misinformation effect threefold. Congruent with the second hypothesis, participant's memory recognition accuracy did differ when information type was distorted. However, contrary to its prediction, participants demonstrated that temporal order memory was less susceptible to misinformation than that of immutable item memory. Findings are discussed in terms of their implications for real-life eyewitness testimonies and the accuracy of the criminal justice system's factual determinations.

Key Words:

Misinformation effect, memory, information type, informational social influence, eyewitness testimony

Individuals experience episodic events on a daily basis, and they rely upon cognitive processes such as memory, attention, and perception to recount these events after they have occurred (Hasselmo, 2012). This is true for eyewitness testimony which remains one of the most powerful and influential sources of legal evidence used to secure convictions (Loftus, 2013). Evidence shows that memories of episodic events are highly malleable and prone to fallibility, supporting the significant link between eyewitness testimony and wrongful convictions which The Innocence Project (2017) cites as being responsible

for 71% of the now 360 DNA exonerations caused by human error in eyewitness accounts.

Memories arising from episodic events cannot be comprehensively and accurately replayed like a tape recorder. This notion is supported by a plethora of evidence that demonstrates that memories do not reproduce everything that has been experienced as exact replicas of past events (Yapko, 1994; Lynn et al., 2015). Instead, memory is defined as being reconstructive with memory fragments being stitched together into plausible accounts based upon

familiar mental structures such as schemata. This concept dates back to and is supported by the historical and classical work on 'remembering' carried out by Bartlett (1932).

Bartlett's (1932) well-known 'War of the Ghosts' experiment was centered around an unfamiliar Chinook folk story. Bartlett found that participants replaced unfamiliar phrases such as 'something black came out of his mouth' with the more common phrase 'foamed at the mouth'. Or when 'canoes' were mentioned in the story, on recollection participants tended to substitute the word with 'boats' or 'paddling' with 'rowing'. Furthermore, Bartlett found that when recounting the folk story participants removed any of the mysterious connotations almost immediately and they then embarked on a gradual process of replacing unfamiliar details with more familiar ones (Bartlett, 1932; Parkin & Hunkin, 2001; Cook & Foresti, 2016). Based on this concept of 'effort after meaning', Bartlett explained these findings by suggesting that to guide remembering or to fill in memory gaps people often evoked a schema typical of the situational event based on pre-existing knowledge.

Whilst from a contemporary perspective, social factors may be a secondary consideration in memory research, Bartlett theorized that they played a principle role in the reconstructive process of remembering. Bartlett consistently used the active verb 'remembering' over 'memory' to imply that this is not a self-contained mental faculty as was historically purported by Ebbinghaus (1913). Instead, it is a daily activity involving a myriad of different processes (Wagoner, 2017). Certainly, Bartlett believed that these processes are inextricably linked to social context and prone to modification by social relations and influence (Bartlett, 1932; Wagoner, 2017; Holzhausen & McGlynn, 2001; Kiesler & Kiesler, 1969, cited in Polczyk, 2017). Whilst Bartlett's methodology was heavily criticized at the time for his failure to implement proper controls and stimulus uniformity, his influence remains pervasive and his concepts of schemata have been drawn upon extensively in subsequent memory research and successive published journals (Parkin & Hunkin, 2001; Wagoner, 2017).

Supported by Bartlett's earlier work, one of the most robust and prominent theories cited to explain the inaccuracies of eyewitness testimonies is the misinformation effect. Dating back a quarter of a century to the early 1970's, Elizabeth Loftus published a series of highly influential studies on eyewitness suggestibility which came to form the basis of the misinformation paradigm (Zaragoza et al., 2013). The misinformation effect is defined as the impairment of memory that arises after exposure to external, erroneous and misleading information, and is given as another causal reason for memory being rewritten retroactively (Loftus, 2005; Loftus, 2013).

There are many factors offered as causal reasons for why the misinformation effect occurs and why memories of an original event become reconstructed. These include reliance on pre-existing schemata, motivations, expectations, the methods used to retrieve the episodic memories, and decay arising from the time elapsed since its original formation (Bartlett, 1932; Yapko, 1994; Loftus & Palmer, 1974; Loftus, 1975; Loftus, 2005; Wagoner, 2017).

An alternative and more contemporary theory posits that there is an inextricable link between the misinformation effect and difficulties with source monitoring. As an everyday memory function, source monitoring is prone to disruption with serious implications for event memory (Johnson et al., 1993). It is widely accepted that people find it notoriously difficult to remember where and when they have obtained information and to accurately differentiate sources of information retrospectively (Johnson et al., 1993; Crombag et al., 1996). Thus, cognitive errors in identifying the source of remembered information are thought to occur with frequency and these errors may originate at the various stages of encoding, retention, or at the time of retrieval (Johnson et al., 1993; Polczyk, 2017).

Social interactions may also yield framing effects which is a cognitive bias that arises from the meaning behind language and a derived logic that is produced through the use of positive and negative semantics in written and verbal form (Loftus et al., 1978). An example of this can be found in Loftus and Palmer's (1974) study into the interaction between language and memory which demonstrated that the use of language can alter and distort the memorial

representation of an event (Loftus, 1975). By presenting participants with different descriptions of the same event but varying the vividness of verbs, when measuring effects on memory Loftus and Palmer were able to demonstrate that the post-event question, 'About how fast were the cars going when they smashed into each other?' elicited higher estimates of speed than questions which used the verbs collided, bumped, or hit in place of smashed (Loftus and Palmer, 1974; Fausey & Boroditsky, 2011). Additionally, the participants who received the verb smashed showed a propensity to say 'yes' to the question, 'Did you see any broken glass', when in fact there was no broken glass in the event. This is compounded when heuristic and evaluative processes become flawed and confusion occurs over what was inferred or imagined as opposed to what actually happened (Johnson, 1988; Johnson, 1997). An example can be evidenced in a study referred to as 'crashing memories and the problem of source monitoring' carried out by Crombag et al. (1996). This study demonstrated the simplicity of making participants believe that they had witnessed an event from a fictitious film about a real-life disaster that they had not actually seen, but instead had only heard about from others. Consequently, when questioned, participants' memories of the event were based entirely on hearsay, inferences, and pre-existing schematic knowledge. The collective significance is that it demonstrates how social interactions and questions asked subsequent to an event can cause the reconstruction in one's memory of that event, and the ease in which the decision processes performed during remembering can be distorted to incorporate fiction as fact (Loftus and Palmer, 1974; Johnson et al., 1993).

Integrating a Cognitive Perspective with a Social Psychological Framework

Typically, explanations for why the misinformation effect occurs have relied upon and are usually formulated in terms of cognitive theories of memory (Polczyk, 2017). However, it is noteworthy that episodic events do not happen in a social vacuum, and that theories of the reconstructive nature of memory and source monitoring have some link to social psychology whether it be in terms of social interaction, social influence or social context. Certainly, one of the most significant characteristics

of the criminal justice system is that it is operationalized mostly through people: its agents, perpetrators, and witnesses. Consequently, it is a system reliant on combining malleable cognitive processes such as memory, attention, perception, recognition, and decision making, with social influence, emotion, and motivation. Indeed, the chances of eyewitness accounts of an episodic event not having been contaminated by external information arising from social influence is small (Yapko, 1994; Blank, 1998; Polczyk, 2017; Berkowitz & Frenda, 2018). Contextually this has momentous consequences because as Simon (2012) alludes, it means that criminal verdicts and convictions are no more reliable than the cognitive operations of the people involved in the process.

The importance of integrating social influence into research investigating cognitive processes is highlighted by research that has raised doubts regarding relying exclusively on memory failures alone to explain why people succumb to the misinformation effect. Blank's (1998) study investigating 'memory states and memory tasks' found that in 50% of cases where participants detected discrepancies between the original and post-event materials, participants still gave answers consistent with misinformation. These findings were reproduced in Polczyk's (2017) study whose primary aim was to replicate and extend the findings of Blank's work, showing that memory failure alone cannot explain why this irregularity occurred. The explanation given for this anomaly was embedded in informational social influence which is defined as the inclination for people to defer to those who appear more knowledgeable, or who are perceived to hold a higher credibility status such as experts and/or the police.

This can be supported by and links back to the historical experiments on conformity carried out by Asch (1951) where participants denied what they saw and instead conformed with the group giving obviously incorrect answers (Polczyk, 2017). However, a fundamental difference between conformity and misinformation frameworks is that in conformity experiments such as Asch's (1951) experiment, the pressure was exerted by a group of people. Whereas in experiments investigating the misinformation effect using the three-stage

standardized suggestibility procedure, the pressure is usually exerted by the experimenter through a narrative.

There is further evidence to support that the misinformation's standardized suggestibility procedure may evoke participants private acceptance of erroneous information if the information being imparted comes from an authoritative figure or someone perceived as an expert, otherwise referred to as the expertise effect (Holzhausen & McGlynn, 2001; Kiesler & Kiesler, 1969, cited in Polczyk, 2017; Echterhoff & Hirst, 2009). Studies investigating the power of social influence and memory conformity support that another person's perceived status and credibility if higher than oneself in terms of knowledge, mental acuity and confidence levels has the ability to significantly influence and alter the veridicality of another person's memory and can influence a much greater likelihood of misinformation acceptance (Horry et al., 2011; French et al., 2011; Allan & Gabbart, 2008). However, Williamson et al. (2013) argues that informational social influence that plays a role in the expertise effect is not pivotal in validating the veracity of our own memories, but rather affects how we process new information (including misinformation).

With prolific theoretical explanations of memory as a fragile, dynamic and temporary construction thought to be profoundly influenced and biased through contact with others (Loftus, 2005; Echterhoff & Hirst, 2009; Polczyk, 2017) it is important to give as much credence to interpersonal influences on cognition as it is to cognitive failures (Bartlett, 1932; Allan & Gabbart, 2008; Horry et al., 2011; Williamson et al., 2013). Therefore, a starting point for looking at alternative reasons other than memory failure, is to understand the mechanisms behind the misinformation effect by investigating to what degree informational social influence interacts with and intensifies this effect (Polczyk, 2017).

From the literature highlighted above, it is hypothesized that the misinformation effect will be stronger where participants are informed in the co witness statement of the credibility status of the co witness as opposed to not being informed (Hypothesis 1).

Information Type

A key part of the misinformation paradigm is centered around participants experiencing an original event. Any episodic event comprises a temporal structure–immutable item dichotomy, with both parts crucially important to eyewitness testimony and to criminal investigations (Han, 2017). In most cases where misleading post event information distorts eyewitnesses' original memories of an event, external hearsay information has been mixed with first-hand information. Any hearsay information may be implanted intentionally or unwittingly and can either be true or false. However, research suggests that if false, to be effectively implanted, the information must have a degree of prima facie plausibility (Bartlett, 1932; Loftus & Pickrell, 1995; Crombag et al., 1996; Loftus, 2005; Hart & Schooler, 2006). In other words, one can probably insert a non-existing black transit van into the memory of a witness of a bank robbery by asking the witness, 'Are you able to confirm which side of the road the black transit van used as a getaway vehicle was parked on'? Yet, by substituting 'horse and cart' for 'black transit van', in this question one would probably not succeed in inserting a non-existing horse and cart into a witness's memory. This is because it would not be logical for a bank robber to use a horse and cart as a getaway vehicle in light of common-sense inferences based on prior knowledge (Crombag et al., 1996).

However, when intending to elucidate the misinformation effect and the veridicality of memories, for example the degree to which one's internal evidence and representation of an episodic event accurately reflects the event itself as opposed to distorted information, it is crucial that both parts of the temporal structure–immutable item dichotomy are considered (Horry et al., 2011; Han, 2017). Yet, Han (2017) asserts that to date there have not been any studies directly comparing the misinformation effect on these two types of information. Instead, there has been a disproportionate amount of time spent investigating the strength of the misinformation effect on immutable item recall (Loftus, 2005; Han, 2017).

When focusing on temporal structure it is a truism that as an abstract concept, time is always there, omnipresent, with no specific receptor but

nevertheless embedded within us (Gozlan, 2013). Temporality is an integral part of our daily life with time perception being a subjective and relative experience understood to be affected by emotional states. For example, evidence suggests that fear distorts our internal sense of the passage of time (Droit-Volet et al., 2011; Droit-Volet, 2013). Any type of temporal distortion or illusion may have very real implications contextually. Additionally, evidence supports the view that any type of temporal structure is highly complex and more difficult than immutable item to recall (Han, 2017). Therefore it is ostensible that it is the fluidity and intricacies of time perception, together with time slice errors which refer to the recall of information from the wrong slice of time, for example the error that is made because people remember an event, but not the event that someone has asked them about (Hyman & Loftus 1998), that results in an inability to accurately decipher time durations and to remember when a singular event occurred amongst a series of events (Hyman & Loftus, 1998; Altmann, 2003). Furthermore, this rationale builds upon previous research which found that difficulties in temporal order memory were centered around age-related deficits and the difficulty that young children and older adults appear to have at integrating and recalling a series of 'what', 'where' and 'when' sequential information from an event (Newman et al., 2001; Friedman & Lyon, 2005).

Despite a voluminous amount of research having been conducted about temporal order memory and related variables which has concluded that temporal order memory is inferior to immutable item memory, so far only one published study carried out by Han (2017) has reported on the misinformation effect linked to temporal order memory. This study found that the misinformation effect could be produced by distorting temporal information post-event. However, the findings of Han's (2017) study are only informative to an extent due to flaws with its methodological design. When comparing the accuracy of participants memory of temporal and object items this was only carried out on non-target items. It is questionable as to why this approach was taken as opposed to the analysis being conducted on both non-target and target items. The study compared misled items and non-misled items separately, and then combined object misinformation

and temporal misinformation by looking at participant accuracy overall and without having looked at misled items versus non-misled items for each condition. The choice of using a paired t-test to compare object and temporal items to determine any effect of information type on accuracy can also be viewed as a flaw. This is because this type of statistical analysis lacks robustness, particularly given that multiple t-tests were carried out without the correction for multiple comparisons.

Additionally, there were a number of limits to the study's external validity: (i) the variation of the two-group design applied could be criticized for being overly simplistic. The participants in each condition were only subjected to one type of misinformation manipulation which lacks both psychological and mundane realism, (ii) only undergraduates were recruited, thus lacking in participant diversity and, (iii) the age-band of participants was circumscribed to young adults only. This constraint is surprising given that robust literature highlights age-related deficits in temporal order memory. Collectively, these limitations make the findings difficult to generalize to other populations and particularly those relevant to the Criminal Justice System.

Therefore, the present study will address these external limitations by (i) exposing each participant to both types of misinformation manipulation (temporal order and immutable items) simultaneously, (ii) by recruiting a more diverse selection of participants and, (iii) by increasing the age range of participants to include middle and old age. Thus, building upon initial findings whilst collectively improving upon all aspects of validity.

Whilst there is a lack of literature and evidence directly comparing information types on memory when linked to the misinformation effect, it is hypothesized that when information type is distorted there will be a difference in accuracy scores. It is predicted that temporal order recall will be less accurate than immutable item recall (Hypothesis 2).

Social Influence and the Type of Information

The existing literature suggest that cognitive processes activated in remembering are prone to fallibility and are tempered by social influence (Bartlett, 1932; Johnson et al., 1993; Loftus, 2005; Han, 2017; Polczyk, 2017). Findings from Han's

(2017) study into the misinformation effect and the types of misinformation demonstrated that misinformation has an effect on memory accuracy for both temporal order and immutable item information. The study's confidence analysis indicated that participants were less confident in their temporal order memory compared with immutable item memory when they were misinformed which supports the concepts of temporal recall being more complex (Newman et al., 2001; Friedman & Lyon, 2005; Han, 2017) and that decreased confidence levels may lead to a greater acceptance of misleading information (Horry et al., 2011). With these cumulative findings it will be interesting to establish whether there is any complex interaction between social influence and misinformation type on memory recognition accuracy. Exploring any such interaction would contribute to the literature by adding empirical data about the relationship between memory and social influence for each type of information.

Based on the literature, it is hypothesized that there will be an interaction effect between social influence and the type of information (for example, status disclosed and temporal order) (Hypothesis 3).

Summary of Hypotheses

Hypothesis 1: The misinformation effect will be stronger where participants are informed in the co witness statement of the credibility status of the co witness as opposed to not being informed.

Hypothesis 2: When information type is distorted there will be a difference in accuracy scores. It is predicted that temporal order recall will be less accurate than immutable item recall.

Hypothesis 3: There will be an interaction effect between social influence and the type of information (for example, status disclosed and temporal order).

Method

Design

A two-way mixed factorial experimental design was used in the present study. There were two independent variables: the first independent variable was a within-participant factor with two levels that pertained to the type of information an individual may be exposed to in an episodic event (i.e., the temporal order of the event and the immutable items

from the event). A within-participant factor was chosen because it was important for each participant to be exposed to both types of misinformation in order to make a direct comparison between information type on memory whilst at the same time reducing errors associated with individual differences. The second independent variable was a between-participant factor with two levels related to the social awareness of the co-witness's credibility status (i.e. they were either informed of the co-witness's credibility status or they were not given any information of this kind). Participants were randomly allocated to each condition of the second independent variable. The dependent variable was the measure of participant's accuracy scores in the two-alternative forced choice memory recognition test after their exposure to the post-event narrative containing erroneous information.

The design controls were: (1) standardized procedures incorporating the same instructions to all participants. (2) Randomized allocation to each level of the second independent variable to control for individual differences. (3) A minimal amount of deception was introduced as to what the experiment was about in order to reduce demand characteristics. (4) Questions in the two-alternative forced choice memory test targeting critical misled order and items were presented in random order. This was to try to minimize any susceptibility to sequence effects.

Participants

Based on empirical evidence suggesting that the ease and accuracy of temporal memory as opposed to immutable item memory varies across the lifespan (Newman et al., 2011; Altmann, 2003; Han, 2017), it was a focus of this study to recruit participants across all adult age bands. An opportunity sample of 52 adult participants were recruited (33 women, 63% and 19 men, 37%) from a pool of friends, family members, acquaintances, and psychology undergraduate students, who were made available through the Open University's Experimental Participation Website. The age of participants ranged from 18 to 90 years. 17 participants (33%) were in the 18-30 age group, 14 participants (27%) were in the 31 – 50 age group, 16 participants (31%) were in the 51 – 70 age group and 5 participants (9%) were in the 71 – 90 age group.

Care was taken to exclude anyone under the age of 18 years or anyone who was not fluent in reading and understanding English. None of the participants were either vision or hearing impaired. Participants were randomly assigned to one of two conditions: 26 participants (17 women, 65% and 9 men, 35%) were assigned to the condition that disclosed the credibility status of the co-witness and the other 26 participants (16 women, 62% and 10 men, 38%) were assigned to the condition where the credibility status of the co-witness was undisclosed. No payment or other incentives were offered to any of the participants. Participants were told they were taking part in an experiment examining perceptions of events and perceptual differences in individuals.

Materials

The Event

The stimuli used in this experiment consisted of a video extract of a mock-crime bank robbery developed by Weingarten (2013) of Second Sight Video & Multimedia. The video depicted a male suspect entering a bank during the course of a normal banking day. The male suspect, alongside other customers carried out normal banking behaviour before targeting one of the cashiers, threatening and coercing her into emptying her till drawer of money and handing over the money to him. After which the male suspect went to exit the bank with the money. The video was played with sound to increase the event's authenticity. The sound consisted of (i) continuous background music, (ii) an inner voice giving the male suspect instructions whilst he completed a note to the cashier (i.e. stating the notes (20's and 50's) that the cashier was to hand over so that no-one got hurt or had to die), (iii) the cashiers calling the customers over and asking how they could be of assistance) (iv) once the cashier had been handed the written instructions from the suspect, an alternative piece of music was used to build tension within the event just before the suspect told the cashier to hurry up in a threatening manner.

Post-Event Materials

Two versions of a co-witness statement were created summarizing the video and which included the same erroneous misinformation on immutable items and

the temporal order of the events in the video. However, the fundamental difference in the post-event materials was that in the first version, the co-witness statement which took the form of a 'CCTV Footage Report', disclosed the co-witness's credibility status as a detective for the police force (Appendix 1a). Whereas in the second version of the co-witness statement which took the form of a general witness statement (Appendix 1b), no status information was given for the co-witness.

Memory Recognition Test

In a two-alternative forced choice memory recognition test a total of 6 temporal structure sequence statements and 6 immutable item statements depicted from the video were selected to be modified with misinformation in the memory test. Amongst these critical target statements there were 5 randomly placed filler statements. An example of the memory recognition test follows;

Example: The male suspect puts a bag on the counter __[1]__ passing the cashier the deposit slip with instructions on. The bag the male suspect gave to the cashier to put the money in was __ [2] __

[1] a. before b. after (temporal order information)

[2] a. blue b. grey (immutable item information)

Each type of information that was tested is listed in the manipulation table (Appendix 2).

Pilot

Pilot testing was carried out before the experiment went live from a pool of 5 family members, to ensure that the experiment ran smoothly, that there were no technical issues and no floor or ceiling effects. In addition, pilot testing was carried out to ensure that Qualtrics software was correctly recording the data and that the data was interpretable.

Procedure

Using their own computer and in their own time, participants were asked to access this experiment through an online link to Qualtrics.

In accordance with ethical standards, informed consent was obtained from all individual participants included in the study before they embarked on the first phase of the experiment.

Stage 1: the event. All participants were asked to watch a 1.29-minute extract of a video of a bank robbery. After watching the video participants were given a mathematical cognitive distractor task before the second phase began.

Stage 2: the post-event material. Participants were randomly assigned to one of two conditions where they were asked to read erroneous and misleading post-event material pertaining to the original event, in the form of a co-witness statement and in which they were either informed of the co-witness’s status or they were not dependent on their condition allocation. After reading the post-event material participants were given a further mathematical cognitive distractor task before the third phase began.

Stage 3: two-alternative forced choice memory recognition test. Regardless of the social awareness condition all participants completed the same two-alternative forced choice memory recognition test. Statements targeting critical sequences or immutable items were randomly assigned to positions 1, 2, 4, 5, 8, 11, 12, 13, 14, 15, 16 and 17 on the test.

At the end of the experiment participants were asked to read a debriefing sheet which informed participants of the real purpose of this study.

Results

A 2 (type of information; temporal order, immutable items) by 2 (social awareness; disclosed, undisclosed) mixed-design analysis of variance was performed to examine whether disclosing a co-witness’s credibility status would have more impact on memory recognition accuracy than not disclosing this information. As hypothesized, the between-subjects factor yielded a significant main effect with participants who were informed of the co-witness’s credibility status performing less effectively in the memory recognition accuracy test than those participants who were not informed of the co-witness’s credibility status ($F(1,50) = 17.86, p = .001, \eta^2 = .26$). The mean accuracy scores and standard deviations are presented in Table 1. Hypothesis 1 is supported.

Table 1. Means and standard deviations in memory recognition accuracy scores for status disclosed and status undisclosed in the two-alternative memory recognition test.

Table 1: Means and standard deviations in memory recognition accuracy scores for status disclosed and status undisclosed in the two-alternative memory recognition test.

Status Disclosed	Mean	SD	Status Undisclosed	Mean	SD
(N = 26)			(N = 26)		
Temporal Information	3.08	1.13	Temporal Information	3.81	1.02

Immutable Information	Item 2.15	1.49	Immutable Information	Item 3.65	1.50
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The within-subject factor exposed all participants to both types of misinformation, and the results demonstrated that memory recognition accuracy for temporal order and immutable item memory differed when the information type was distorted. However, contrary to prediction that temporal order recall will be less accurate than immutable item recall, the significant main effect ($F(1,50) = 4.79, p = .033, \eta^2 =$

$.087$) established that participants had increased memory accuracy scores for temporal order information than for immutable item information, showing that temporal order was more resistant to misinformation in the present study. The mean accuracy scores for information type are presented in Table 2. Hypothesis 2 is supported in part.

Table 2. Mean accuracy scores for information type.

	<i>Sum</i>	<i>Mean</i>	<i>SD</i>
Temporal Information Correct Responses (N = 52)	179	3.44	1.13
Immutable Item Information Correct Responses (N = 52)	151	2.90	1.66

The interaction effect between social influence and information type—was non-significant ($F(1,50) = 2.44, p = .12, \eta^2 = .047$). Social influence did not significantly impact the memory recognition accuracy scores for temporal or immutable misinformation items. Hypothesis 3 is rejected.

Discussion

We investigated the misinformation effect focusing on two different types of information within an

episodic event: temporal order and immutable items. We were also specifically interested to determine whether informational social influence would intensify this effect. The results indicated that social influence did increase the misinformation effect in the status awareness condition supporting the first hypothesis and was consistent with extensive evidence arising from historic and current theories on informational social influence and conformity, and deference and private acceptance (Asch, 1951; Blank, 1998; Holzhausen & McGlynn, 2001; Kiesler

& Kiesler, 1969, cited in Polczyk, 2017; Polczyk, 2017). However, a subtle limitation of the present study which may affect how the results are interpreted, is that there was not a condition where there was no misinformation and therefore the baseline memorability of these events was not established. Though from the results it is likely, we cannot know conclusively that there was a misinformation effect at all in the status undisclosed condition. Furthermore, it was not possible to establish from the findings whether informational social influence was (i) so powerful that it caused participants to disregard their own memories in preference of conforming to someone they perceived as holding higher credibility, (ii) whether it was used as a validation process for information that had not been appropriately processed leading to lower confidence levels, or (iii) if it was simply relied upon for processing new information (misinformation) that had not been encoded from the original event (Horry et al., 2011; Williamson et al., 2013). Certainly, it is unlikely all participants would have drawn or relied upon the same connections uniformly. Nor would it be prudent to assume that informational social influence should be treated as a distinct pathway to memory validation. Rather, a broader perspective should be taken that also acknowledges heuristic processing and/or source attribution errors arising from a lack of visual acuity or to inattention whilst witnessing the event. Thus, considering a variety of processes that can all occur in the translation of our memory into a memory statement (Johnson et al., 1993; Johnson, 1988; Williamson, 2013).

The misinformation effect being intensified by informational social influence was most conspicuous when examining the answers participants had given to completing statement 17 in the memory recognition test. This statement was centered around a presupposed and plausible false piece of immutable item information that had been implanted into the co-witness statements and which suggested that the male suspect slammed a revolver down on the counter. In fact, in the original event it was the male suspect's hand that was slammed down on the counter. Similarly, to the issues surrounding leading questions, misinformation acceptance arising from presuppositions is significant as it is more likely to influence an eyewitness's later testimony (Loftus,

1975; Zaragoza et al., 2013). In the present study half of the participants randomly assigned to the status disclosed condition reported that they had seen the male suspect slam a 'revolver' down on the counter. This contrasted with only a minority of participants having succumbed to this misinformation in the randomly assigned condition where the co-witness's status was undisclosed. This discrepancy between the conditions was significant because it demonstrated that there was more at play other than chance, spontaneous error, framing effects, source monitoring issues, schema reconstruction and access to external information, all of which could have been applied across both conditions (Loftus, 2005; Zaragoza, 2013; Bartlett, 1932; Asch, 1951; Kiesler & Kiesler, 1969, cited in Polczyk, 2017; Loftus and Palmer, 1974; Johnson, 1997). Instead, findings demonstrated the misinformation effect being increased threefold in the 'status disclosed' condition. A plausible explanation might be that this incongruity and the heightened inaccuracy was evoked by informational social influence and enhanced by Allan and Gabbert's (2008) theoretical elucidation that people are more likely to be influenced when the receiver expects no deceptive intent from the person imparting the misinformation such as from police officers acting as agents of the criminal justice system.

From an applied perspective, this has important implications for the credibility placed on eyewitness testimony. It demonstrates that informational social influence can be causal and more powerful in influencing eyewitnesses to testify about aspects from an episodic event that they have never actually witnessed (Simon, 2012a). A plethora of compelling data demonstrates that the criminal investigatory process produces and relies upon evidence that is certain to contain unknown quantities of truth and error with an adjudicative process unable to distinguish between the two (Simon, 2012b). This type of fallibility runs the risk of the judicial process falling short of meeting acceptable levels of certitude from the testimonial evidence that the system so heavily relies upon. Furthermore, and more ominously, Simon (2012a) asserts that plausible falsely implanted memories of this nature, together with the additional influence that those in authority may have, increases the danger of agents of the criminal justice system being able to use erroneous

information to reinforce or fabricate their criminal investigations. Thus, increasing the risk of disseminating errors and unsound convictions.

The current study also supported the second hypothesis in part, that there would be a difference in memory recognition accuracy for temporal order and immutable item memory when distorting information type. However contrary to what was predicted, the results from the memory recognition test showed that after reading the post-event misinformation participants' temporal order memory was superior to immutable item memory. However, placing any credence in this finding may be premature and caution should be applied. This is for reasons that are two-fold. Firstly, the finding that temporal order memory when linked to the misinformation effect is less prone to error than immutable item memory is inconsistent with general evidence on temporal memory (Newman et al., 2001; Friedman & Lyon, 2005). Secondly, when examining the effect size which was not large, it may be inferred that the significant effect relating to the second hypothesis may have arisen from potential confounding variables. For example, it may be that stimuli used in the present study was too short (1m29s) in length to create higher levels of temporal order confusion. Indeed, in Han's (2017) study where temporal order memory was found to be inferior to immutable item memory for non-target items, a 6-minute film was used with the duration of cognitive processing being four times longer. Therefore, reconstructing the sequential order of events and accurately completing the temporal order statements in the memory recognition test may have been an easier task for participants in the present study. Furthermore, with only a brief time lapse of a couple of minutes between the stages it would have been unlikely for any memory decay and/or time slice errors to have occurred (Hyman & Loftus, 1998; Altmann, 2003) and this is another issue that could have affected the findings. Indeed, shorter retention times are bound to lead to a more accurate performance. This notion is supported by Simon (2012b) who reports the findings from a meta-analysis carried out by Deffenbacher et al., (2008) showing that memory begins to weaken soon after the time of encoding and decreases substantially after about one week.

Additionally, and unavoidably it should be borne in mind when interpreting these findings that due to ethical constraints the present study lacked a degree of psychological realism. Participants engaged in the three-stage standard suggestibility procedure would not have felt fear, an emotion likely to be present whilst witnessing a crime and a feeling widely recognized for interfering with time perception and the processing of temporal order structure (Droit-Volet et al., 2011). So, it is possible in the present study that participants were unnaturally able to capture temporal information more accurately and thus giving the impression that temporal memory may be superior to immutable item memory.

However, it is also possible, as endorsed by the results of the present study, that temporal order memory is less vulnerable to the misinformation effect than immutable item memory. In response to the inference made by Han (2017) that memorizing temporal order may be more difficult than memorizing immutable items from an event, such a conclusion should be viewed with caution. This is because of the study's methodological design flaws and limitations of external validity. Additionally, in Han's (2017) study, comparing memory accuracy for both information types was not the main focus of the study. Rather, the essence was simply to examine whether the misinformation effect could be produced by temporal misinformation.

Therefore, to either validate or falsify the significant main effects of the present study's second hypothesis, more research using the misinformation's three-stage standardized suggestibility procedure linked to temporal order and immutable item recall is needed. Any future research should address the potential confounding variables identified in the present study. Moreover, to increase aspects of mundane realism, further research might consider modifying the third stage/test phase to free recall of the original event. This would have the advantage of being more cognitively challenging and more representative of real-world situations. Additionally, it removes the element of chance when selecting answers to two-alternative forced choice memory recognition tests and instead would allow for a direct comparison of how temporal and immutable item misinformation not only supplements eyewitness memories but also whether,

and to what degree, they would transform them retrospectively (Loftus et al, 1978; Zaragoza et al., 2013).

From an applied perspective, exploring the misinformation effect linked to information type, and understanding the mechanisms behind temporal order when linked to this effect is of continued importance to the judicial system. In legal processes such as criminal investigations and trials significant credence is based upon timelines given by witnesses and/or victims. Therefore, any inaccuracies in temporal order recall may have the potential of increasing the likelihood of eyewitnesses erroneously reconstructing events. This carries significant implications for criminal investigations and may take the form of spurious acquittals or innocent people being accused of and incarcerated for crimes that they did not commit, as well as risking the likelihood of crimes remaining unsolved (Altmann, 2003; Han, 2017; The Innocence Project, 2017).

The findings indicating that there was no difference in status disclosed and status undisclosed on temporal order and immutable item memory, may have been affected by potential confounding variables and a causal factor for the lack of any interaction effect. Alternatively, it may be that the concept of social influence and temporal order as abstract variables and immutable items as a concrete variable were too different for an interaction effect to occur. However, even though no interaction was found in this study, this needs to be further researched.

Conclusion

To conclude, the recognized ease of reconstructing events due to memory's malleability has very real-world implications for the criminal justice system. There is considerable evidence to suggest that eyewitnesses are prone to produce testimonies that contain substantial errors due to pre-existing schemata, memory's reconstructive nature, framing effects, source monitoring issues and external information. A significant achievement of this study was the ability to demonstrate that informational social influence intensifies the misinformation effect when linked to temporal order and immutable item

memory. The obvious relevance and ramifications to the criminal justice system whose processes and verdicts are only as good as the evidence on which it relies upon, makes it understandable why psychological research should continue to investigate and inform on the frailty of eyewitness testimony.

Acknowledgements

I owe a debt of thanks to my Co-Author, Dr Axelle Philippon, who has given me unwavering support throughout my undergraduate studies and in all aspects of my research. I would also like to thank everyone, from colleagues, family and friends who participated in my research, and to all the dedicated staff within The Open University's Faculty of Psychology and Counselling Department.

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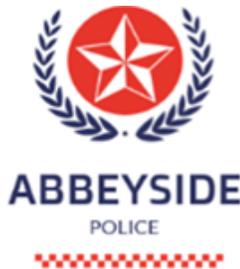
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Appendix 1a – Co-Witness Statement – Status Disclosed



Operation Crypton Date: 28th January 2019

My name is Detective George Russell. I am a senior police officer in Abbeyside police and the designated CCTV reporting officer. One piece of CCTV footage ("Exhibit GR1") has been identified, retrieved and seized from Northern Waterford Bank, Castle Street, Abbeyside, in relation to Operation Crypton, between the time parameters of 19.00 hours on Monday, 21st January 2019 to 17.00 hours on Friday, 25th January 2019.

From the video footage viewed, there was nothing untoward until 14.15 hours on Friday, 25th January, when a Caucasian male suspect, gauged to be in his early thirties enters the bank. For the benefit of this statement, I will now fully describe the male suspect; he is approximately 5'9 in height, wearing a black cap without any logos on the front, mirrored sunglasses, a grey long-sleeved muff hoodie with white drawstrings and a lighter grey fabric inside the hood, beige chinos with external pockets on both sides and black boating shoes.

The male suspect walks purposefully across the bank to stand in the queue, before changing his mind and walking over to the table with the deposit slips. He looks around the bank towards the cashiers before taking a deposit slip and filling it out. It is evident from the video footage that the suspect is right handed as it is his right hand that he uses to write on the deposit slip. Once the suspect has finished, he is seen to usher a Latino customer in front of him, before joining the queue and waiting to be served by one of two cashiers who were both serving other customers. At this point there is a large wall clock confirming the time as 14.20 hours.

The brunette cashier finishes serving a customer and gestures over the Latino customer. The blonde cashier finishes serving a customer and beckons over the male suspect. The male suspect passes the cashier the deposit slip with instructions on, before placing a blue bag on the counter. The male suspect appears to be threatening the cashier as she reads the instructions. Initially the cashier smiles but then the smile fades and is replaced with a look of alarm. The suspect leans forward in a menacing manner, he pushes the blue bag on the counter towards the cashier and slams his revolver down on the counter in frustration. The frightened cashier takes the blue bag and is seen to bend down to an open till drawer. The cashier collects the bank notes from the front left compartment of the drawer which she then proceeds to put into the blue bag. The male suspect snatches the bag with his right hand, turns and walks at a fast pace towards the exit of the bank.

Thereafter, there was no further evidential value in the video footage.

Reporting Officer: George Russell
Detective George Russell

Date: 28th January 2019

Appendix 1b – Co-Witness Statement Undisclosed

WITNESS STATEMENT

Criminal Procedure Rules, t 32.1; Criminal Justice Act 1973, r. 4; Magistrates' Courts Act 1982, s.3B

Statement of: John Phillips

URN: 3456 7291 6790 XSA

Age if under 18: Over 18 (if over 18 insert 'over 18')

Occupation: Not entered

This statement (consisting of 01 page signed by me) is true to the best of my knowledge and belief and I make it knowing that, if it is tendered in evidence, I shall be liable to prosecution if I have wilfully stated in it anything which I know to be false, or do not believe to be true.

Signature: *Jane Phillips* (witness)

Date: 28th January 2019

I am providing this statement in relation to the bank robbery that took place at Northern Waterford Bank, Castle Street, Abbeyside, on Friday 25th January 2019, at approximately 14.15pm. I am confident of the time because my mother always comes to look after the children between 13.30 and 15.00 on Fridays.

I was sitting in the little glass office to the left as you walk into the bank, when a Caucasian male suspect, in his early thirties enters the bank. I can fully describe the male suspect; he was approximately 5'9 in height, wearing a black cap without any logos on the front, mirrored sunglasses, a grey long-sleeved muff hoodie with white drawstrings and a lighter grey fabric inside the hood, beige chinos with external pockets on both sides and black boating shoes.

The male suspect walked purposefully across the bank to stand in the queue, before he changed his mind and walked over to the table with the deposit slips. He looked around the bank towards the cashiers before taking a deposit slip and filling it out. I remember that the suspect was right handed as it was his right hand that he used to write on the deposit slip. Once the suspect had finished, he ushered a Latino customer in front of him, before joining the queue and waiting to be served by one of two cashiers who were both serving other customers. At this point, I remember a large wall clock confirming the time was 14.20.

The brunette cashier finished serving a customer and gestured over the Latino customer. The blonde cashier finished serving a customer and beckoned over the male suspect. The male suspect passed the cashier the deposit slip with instructions on, before he placed a blue bag on the counter. The male suspect appeared to be threatening the cashier as she read the instructions. Initially the cashier smiled but then the smile faded and was replaced with a look of alarm. The suspect leaned forward in a menacing manner, he pushed the blue bag on the counter towards the cashier and slammed his revolver down on the counter in frustration. The frightened cashier took the blue bag and was seen to bend down behind the counter. I think the cashier was collecting bank notes, which she then proceeded to put into the blue bag. The male suspect snatched the bag with his right hand, turned and walked at a fast pace towards the exit of the bank.

Appendix 2 – Manipulation Table

Item No.	Temporal Information		Immutable Item Information	
	Original	Misled	Original	Misled
1	Walks across the bank to the table with the deposit slips; goes over to stand in the queue	Walks across the bank to stand in the queue; goes over to the table with the deposit slips	Blue cap with logo on the front	Black cap without logo on the front
2	Starts filling out a deposit slip; looks around the bank towards the cashiers	Looks around the bank towards the cashiers; fills out a deposit slip	Dark sunglasses	Mirrored sunglasses
3	Waits in the queue; ushers a customer in front of him	Ushers a Latino customer in front of him; goes to wait in the queue	Clock on the wall states 13.53	Clock on the wall states 14.20
4	Puts a bag on the counter; passes the cashier the deposit slip with instructions	Passes the cashier the deposit slip with instructions; puts a bag on the counter	Grey bag	Blue bag
5	Cashier reads the instructions on the deposit slip; cashier is threatened	Cashier is threatened; cashier reads the instructions on the deposit slip	Grey muff hoodie with grey drawstrings	Grey muff hoodie with white drawstrings
6	Slams the counter; leans forward and pushes the bag towards the cashier in a menacing manner	Leans forward in a menacing manner and pushes the bag towards the cashier; slams the counter	Hand	Revolver