

# A REVIEW OF THE EFFECTS OF POST- EVENT INFORMATION ON THE MISINFORMATION PARADIGM

*Revisión de los efectos de la información post evento en el paradigma  
de la desinformación*

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## ABSTRACT

The main objective of this essay is to review the latest advances on the knowledge of the misinformation paradigm and the effect of post event information. Classical studies are revised and commented, which is used as a starting point for this actualisation. Special attention is given to Loftus' work, particularly to her classification of post event information in external and internal sources. With this differentiation the articles are chosen for the later review. External factors are found to have a more solid theoretical framework, while internal factors have some deficiencies when measured. This is commented during the essay, but also addressed directly on the Limitations section. External sources are subdivided on post event information transmitted by co-witnesses to the same event; forensic information provided, in the empiric situation, by the researchers, and by law enforcement agents on real life; by societal factors that shape the way in which subjects' process information and, finally, potentially protective factors.

**Key words:** misinformation, post-event information, witness testimony, witness memory, co-witness, forensic information.

## RESUMEN

El objetivo de este trabajo es revisar los avances más recientes sobre el conocimiento del efecto de desinformación y de la información post evento. Estudios clásicos son revisado y comentados, lo cual da lugar a esta actualización de contenidos. Especial atención se da al trabajo de Loftus, particularmente a su división de las fuentes de desinformación en fuentes externas e internas. Con esta diferenciación fueron elegidos los artículos para esta revisión. En ellos, los factores externos muestran una base teórica más clara y sólida, mientras que se puede ver en los internos algunos fallos en la conceptualización. Esto se comenta durante el trabajo, pero directamente en las Limitaciones. Las fuentes externas se subdividen en la información post evento transmitida por otros testigos del mismo evento; la información forense facilitada por los investigadores, o por agentes de la ley; por factores sociales que modifican la forma en la que procesamos la información, y, por último, en factores potencialmente protectores.

**Palabras clave:** desinformación, información post evento, testimonio de testigos, memoria de testigos, co-testigo, información forense.

## Introduction

The study of Memory has been around within the field of Cognitive Psychology for many years now. This particular field has its roots in the 20<sup>th</sup> century's studies about learning, schemes, maps and models, that scientists like Hull, Tolman, Ebbinghaus and Neisser conducted throughout the first half of this century. Later on, Atkinson and Shiffrin's multi-store theory (1968), in which they explained how memory is formed of different compartments, lead to the creation of a solid theoretical framework that is possible to be generalised on big variety of groups and situations.

These findings were rapidly being applied on other fields of Psychology, such as gerontology, pathology, human development, neurobiology, learning, (Baddeley, Eysenck & Anderson, 2020) and so on. Psychologists wanted to know how the groups remembered, and under which conditions their memory performance was better or worse. A great number of experiments were conducted, refining the knowledge about memory components and mechanisms, strengthening the previously proposed theory.

According to Atkinson and Shiffrin's findings, memory's compartments are specialised on different kinds of information. This information, which is available in the environment, first needs to be registered by the subject's senses, and, then, is stored in the short-term memory, that, then, leads to the long-term memory. Authors who reviewed this theory disagreed with Atkinson and Shiffrin in one aspect; they thought the memory flow is not unilineal, but it flows both ways (Baddeley, 2020). To explain how the information flowed from the short-term storage to the long-term storage, the theory of working memory proposed by Miller, Galanter and Pribram in 1960 was integrated into the multi-store theory (Baddeley & Hitch, 1974).

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But the information flow does not only include the encoding process, but also retrieval of the stored information (Baddeley, 2020). The process of retrieval is the one through which the subject brings back to the working memory the pieces of memory stored on the short-term memory or the long-term memory. Retrieval is closely related with forgetting. Ebbinghaus was a pioneer on the study of how humans forget, and the study of both memory and forgetfulness have grown hand in hand, but on this paper, I will focus more on the process of retrieval and which factors affects it.

### **Information retrieval**

Retrieval is a complex process that interactants differently based on what kind of information is it trying to access, the conditions in which the information was firstly encoded, the actual conditions in which the subject is trying to remember, and how much time has passed since the encoding to the retrieval. These are only examples of factors that affects the process, but there are also particular events that may difficult the retrieval and modify the outcome (Baddeley, 2020).

Research has described two types of possible interferences when remembering: proactive interference and retroactive interference. These kinds of interference refer to how the subject's information interfere with the newly acquired information. In the first case, proactive interference is a product of the information already held by the subject at the moment of encoding the information that wants to be retrieved.

On the other hand, the retroactive interference happens due to the information that the subject acquires after the event that wants to retrieve has occurred, and the moment of the retrieval happens. The new information difficult the retrieval and can change how the subject remembers the event (Anderson, 2020). This specific kind of interference will be of great importance for the misinformation paradigm.

### **The appearance of witness memory and false memories**

During the decade of the 70s, along with the newly discovered characteristics of memory, researchers that had been focused on other topics started showing interest on how these findings could affect other fields of knowledge, and how would they interact.

Furthermore, classic articles that contained ideas that were not properly explained at the time regained relevance. Psychologists like Loftus or Baddeley favoured the blooming of the field with their experiments and researches, providing with a solid theoretical framework to work with.

As it was pointed out earlier in the essay, Loftus and her colleagues were not the first to talk about witness memory. An article by Dillard Gardner on 1933 was the first to recollect what was being said at the time about how witnesses remember the events they are questioned about. In the said article, Gardner writes about the factors that influence memory retrieval, and also during the encoding process. Characteristics such as perception and suggestibility are commented, and the personal differences between the subjects, such as physical difficulties (short sighting, colour blindness, etc) and the performance of the interviewer.

Gardner's findings were a starting point for psychologists that came after, and for experiments which objective was to scientifically prove assumptions and facts about memory and witness memory. In the following lines, this essay will focus on the retrospective interference and the sources that provoke it.

Before the scope of memory-related experiments reached the point at which they could be conducted outside of the laboratory, most experiments were conducted inside one, with the researchers as the main reference for the subjects. Psychologists started testing how did the subjects respond to the different actions they could perform. This was the case of

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Terry Daniel, who changed the way in which he tested how verbal labels changed the way in which his subjects remembered the stimuli they were supposed to (Daniel, 1972). Along with findings from his previous works, Daniel concluded that modifications in the way the stimulus is addressed can change the memory of it.

Daniel's contribution inspired one of the most important experiments in the history of witness memory and false memories; the Reconstruction of Automobile Destruction (Loftus & Palmer, 1974). In order to design this experiment, the team used both Gardner's and Daniel's findings about how subjects tend to misinterpret the speed of cars (Gardner, 1933) and how labelling influences memory (Daniel, 1972).

On the Automobile experiment, Loftus and Palmer showed a recording of a car crash to seven groups of students, whom were questioned about it right after the visualization. The difference between the groups was the way in which the question "About how fast were cars going when they hit each other?" was worded. The verb "hit" was substituted by other verbs such as "smashed", "collapsed" or "bumped into". Then, the differences on the responses were calculated, giving that the connotation of the verb changed the approximation to the car's speed.

Loftus' team observed that the greater difference was between "hit" and "smashed", so they repeated the experiment with larger groups for each verb. During this second run, subjects needed to be questioned again a week later after the showing of the recording, with a new question added: "Did you see any broken glass?". Although there was any glass on the original recording, some subjects claimed to have seen it. Most of them, from the group that had heard "About how fast were cars going when they smashed into each other?". The mean for the speed was also higher for the "smashed" group (Loftus & Palmer, 1974).

With these findings, the team proved that how the question made to require the information changed what was delivered by the subjects. Which not only apply to verbs, but also to articles, as was proved on a later experiment, similar to the Automobile Crash one, but changing the article used on the question from a definite article (“the”) to an indefinite one (“a”). Results showed that subjects were more prone to wrongly recognised the presence of an object if the question used a definite article (Loftus & Zanni, 1975).

Studies about this effect started being conducted on the 70s and 80s, receiving the name of “misinformation effect”. (Loftus & Hoffman, 1989). The amount of work being done during these years led to a theoretical framework that explains how information given after the occurrence of an event, the retroactive interference, actively modifies the details of it thus creating false memories. Years of research have led the scientific community to accept the fact that not only details inside of an event can be distorted, but entire memories can be false (Loftus & Pickrell, 1995).

### **Later years on the study of witness’ memory and advances on the misinformation effect study**

Once the amount of knowledge and evidence available about witnesses’ memory was enough, research started to produce more academic and compilation work about the topic, giving name to the effects discovered through the experiments and facilitating the spread of the knowledge. The misinformation effect gained attention from the scientific community, especially from experts on the applied cognitive sciences, like criminology and legal or forensic psychology.

Presence of errors in the witnesses memory during the recreation of their testimony stopped being blamed totally on forgetfulness and the effect of misinformation started being

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looked into, along with the sources of it, how and when in the process is it produced and the effect of personal characteristics.

Looking into how and when where the false memories created needs of the distinction between real memories that have been modified by distortions, false memories of events that did happen in the first place, and a third category that includes selective memories or failures during the retrieval of an authentic memory (Loftus & Davis, 2006). It has been proved that an untrue memory of abuse during childhood can be planted on someone's memory and believed as real, whereas such event never happened (Eysenck, 2020; Manzanero, 2010).

About sources, we have that it can be both external and internal to the subject, being the internal type a self-generated misinformation than interacts with both personal and situational characteristics, such as mood during the event and the retrieval or how many times the retrieval happened and how much time had passed since the encoding and the retrieval (Shaw, Bjork & Handal, 1995; Davis & Loftus, 2007).

On the other hand, external sources can come from the media, the testimony and collaboration with co-witnesses, and both the clinical and forensic procedures, including interviews and when taking statement and how they are administrated (Davis & Loftus, 2007). Some of the cited characteristics are, nowadays, still the object of observation for many psychologists.

Personal characteristics are the inner motive why misinformation has one effect or another in the subject's memory. Personality traits such as conformity (Davis & Loftus, 2007) or suggestibility (Gardner, 1933 +) shape whether the misinformation will become a part of the memory when accepted by the subject or if the subject would filter the information and recognise it as false. Then, other aspects of the self, such as biases (Loftus & Davis,

2006) or confidence (Davis & Loftus, 2007) can define the content that the modified memory will take after the post-event information has appeared.

Another important characteristic when remembering is the person's expectations. This means that, if the subject's schemes are challenged by the characteristics of the event, it would be more probable for the subject to remember the event in a way his or her personal schemes are met. For example, in the experiment conducted by Lindholm and Christianson in 1998, the students that were part of the test would recognise an immigrant as the author of a crime more easily than if the author was of their own ethnicity. These previous schemes are susceptible of interacting with the information provided by external sources.

### **Justification for the essay**

It is easy to see that the study of misinformation and its mechanisms has had a long research history along the years, and that has a great theoretical framework behind. Where it used to be a vague and undefined influence on other experiments, now it has its own category and place on nowadays science. But the whole comprehension of the misinformation effect is still to be reached.

In order to reach it, some questions are still being asked, such as; what kind of people is more susceptible of being a victim of misinformation, or when do the effect happens or has a greater influence, and the content of the altered memory (Loftus, 2005). Knowing this could facilitate the task of developing a way to prevent memories from being altered by the post-event information, and, so, helping the law enforcement optimise its processes in order to obtain true and reliable information from witnesses (Frenda, Nichols & Loftus, 2011).

Another question that has been asked during the later years is what happens to the original memory after it has been modified (Loftus, 2005). The debate about this topic is in two minds about the original memory not existing in the first place, and the subject filling in

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the space with the misinformation provided, and the opinion that the misinformation simply weakens the original information. When this happens, the subject might have a coexistence of both memories in their head, and, when asked about them, choose the one they believe to be true (Loftus, 2019).

The misinformation effect is also drawing the attention of other psychology fields, particularly of the neuropsychology. Studies focusing on the brain response to the misinformation using neuroimage is gaining popularity and showing promising results (Frenda et al., 2011).

However, the field that has the greater need of this knowledge is the legal one. Researchers agree that it could be a way to protect the witnesses from the effect of misinformation (Frenda et al., 2011) and that such a development would improve the efficiency and accuracy of the law processes (Loftus, 2019) and, therefore, facilitating the subjects experience with the legal system. For these reasons I reckon the interest on continuing the advances on the study of the misinformation effect.

### **Methodology**

In order to compose this essay, a literature search was made, using a variety of data bases for it. The ones chosen, particularly, were Scopus, PsycINFO and EBSCOhost, given the amount of publications available involving both cognitive psychology and its social applications. Most of the articles found were written in English, with the exception of a few written in Spanish. The ones that were published in any other language were discarded manually.

Searching consoles were similar in each data base, and so were the key words and connectors I selected; “misinformation” AND “post-event information” AND “witness memory”. With these instructions, the output were those articles talking about the topic of

interest. Each platform gave a different output, but some of the article were available in each platform, in which case it's counted in the first data base I consulted. On the other hand, the searches were limited to 2010 and onwards.

The following figure summarises the search:

Table 1  
*Search summary*

Database	Search commands used	Relevant articles found	Date of the search
EBSCOhost	Boolean/Phrase: witness AND misinformation AND post event information	3	24/3/2020
PsycINFO Proquest	(post event information) AND (misinformation) AND witness AND memory	65	22/03/2020
Scopus	TITLE-ABS-KEY (post- event AND misinformation AND witness AND memory)	16	23/3/2020

There weren't the only results the data bases gave, the selection was made manually, according to the following criteria:

- The articles had adults as a subject, not the elderly or children.
- The misinformation paradigm or the post-event information were the main topics of the articles, instead of a variable of another phenomenon.
- Within these phenomena, the articles looked into different variables that can affect and/or modify them.
- The articles conducted experimental situations.
- The neurological aspect of memory wasn't the main topic of the article.

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Any article that didn't follow the criteria, according to what the available abstract showed, was automatically discarded. The rest of them were downloaded for further examination.

The obstacles found during the phase of literature recompilation were different for each data base:

EBSCOhost: this platform has a lack of modern articles, and most of the articles found had children as subjects. On the other hand, some articles that didn't have an open access in other platforms were available at EBSCOhost.

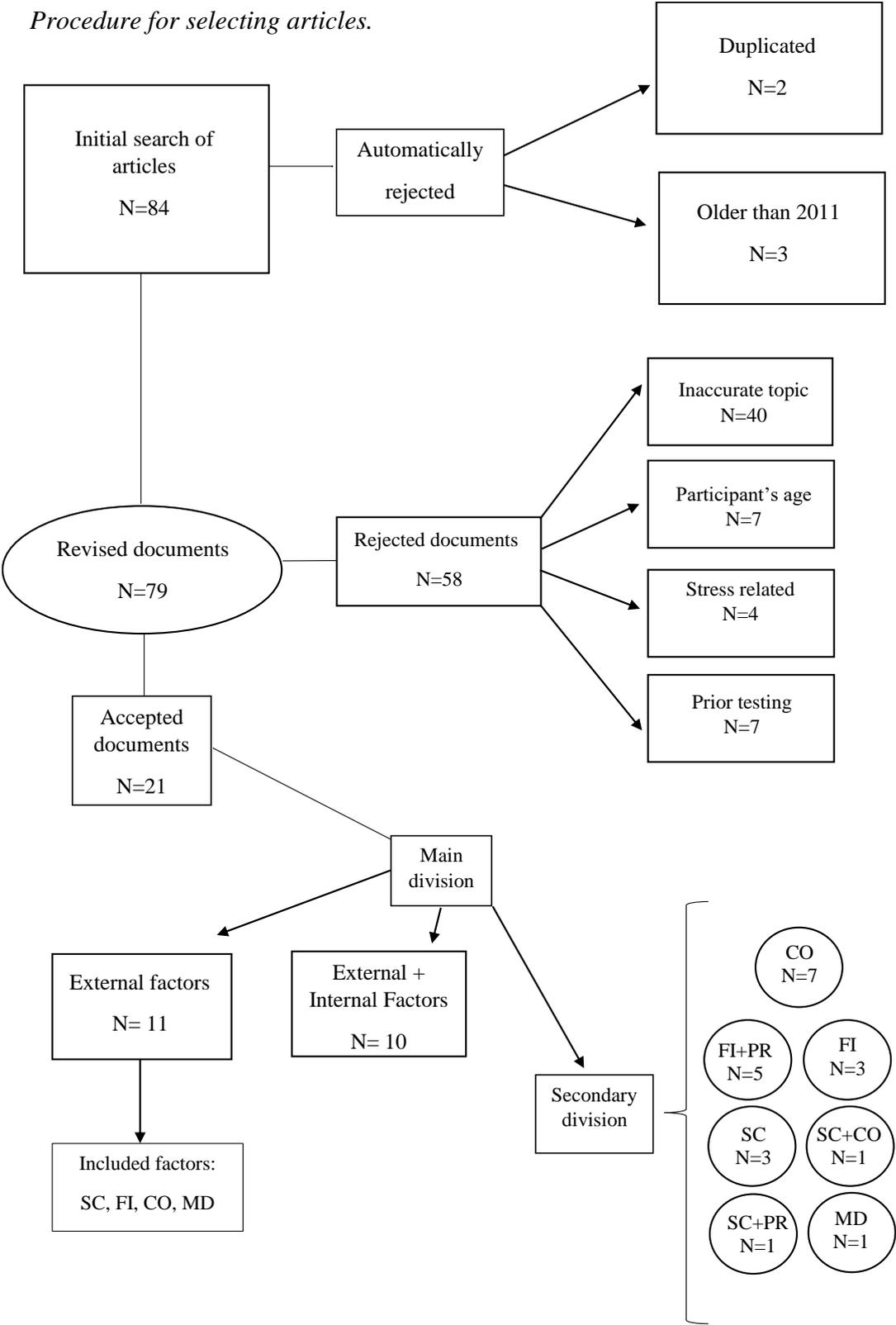
PsycINFO Proquest: five separate data bases were used at this platform: APA PsycArticles®, APA PsycBooks®, APA PsycInfo®, the Criminology Collection and the Psychology Database. Publications that weren't either articles or book chapters were discarded, and still the number was superior to 800. Many of the articles were duplicated and, after the 150 articles, there were only articles related to memory, with no mention of witnesses.

Scopus: There were fewer articles on this platform, but many of them didn't have an open access. Some of them were found later on PsycINFO.

After revising the 84 articles originally selected, the number of final articles chosen for the revision was 21. This was the strategy followed to filter the articles:

Figure 1.

*Procedure for selecting articles.*



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Given the particularities of the topic reviewed in this article, I saw convenient to organise the papers used on a double division. First, there were articles that treated solely the effect of some external factors on the misinformation effect, while others included insights about related internal factors and/or the interaction between both external and internal factors. The decision to use this distinction was based on the article by Davies and Loftus on 2007, where these two types of sources to misinformation were described.

However, this division was not the only one when selecting which essay should be considered for the review. Another characteristic was whether the article proposed, directly or not, a way to prevent the misinformation effect. On the other hand, certain differences appeared when revising documents that described the external sources for misinformation, thus I established a further illustrative distinction between them; Forensic information, Co-Witnesses, Societal/Cultural and Media related. This distinction can be observed in Figure 1 under the initials of each category.

Figure 2.

*Distribution over time of the articles selected.*



On Figure 2, we can observe a year distribution of the articles selected. One of the first steps when filtering, was to reject those whose publication date was older than 2011, which were 3, and were identified by mistake. After that, more modern articles were preferred over the older ones, when the topic and/or experiment was similar. Consequently, most articles date from 2013 to 2019.

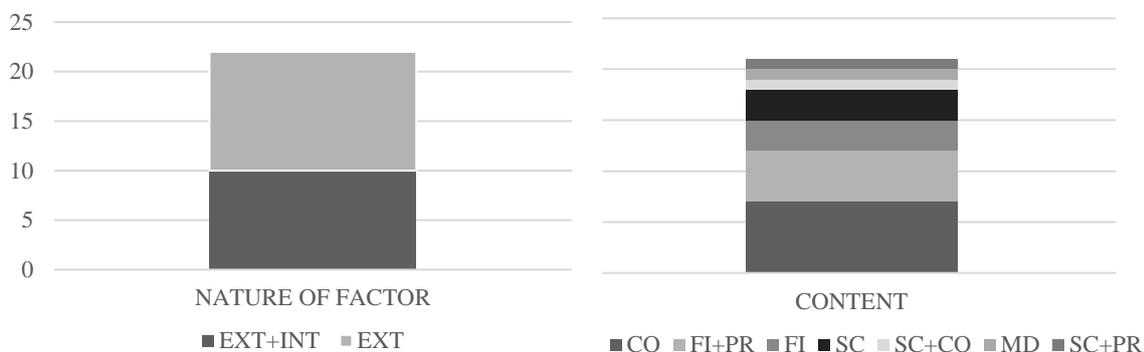
Originally, when the documents were first revised, those articles that fitted perfectly the topic of this essay were selected, arriving to 19 documents. Parallely, a group of 21 articles that did not meet all the desired criteria at first, but had some interesting characteristics, were reserved on a “maybe” pile, that was later revised a second time, finally choosing to add 3 of them to the definite group of 21 articles.

### Results of the literature search

By using the procedures stated on the previous section the final count of articles was of 21. The dual division of essays, between the nature of the factor in which the study is focused and the specific content of the factor, can be observed on Figure 3.

Figure 3.

*Distribution of articles according to the topic.*



The need of this division was perceived while revising each article, because there is a great variety of external sources of misinformation that provide different types of

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information. Furthermore, the effect that the external factor has with the internal one, is different depending of where the message is coming, and in which form. Actualising the internal/external source paradigm is another reason to make this additional division, to give more detailed information about the phenomena that has a consequence on the misinformation effect.

A relevant characteristic observed is whether the content of the essay has or could have a protective value when trying to design a strategy to prevent memory fails, especially when it is required on a legal or police investigation. Although the article does not specifically state the protective value, it is a personal consideration that will be described during the Discussion.

On Table 1, specific characteristics of each study can be found. The details exposed are the most relevant ones for the following discussion. The number of subjects tested on each article is presented to acknowledge that most of the research used for this revision is has a great scope and validity. This can also be observed on the  $p$  column. Although the value used was  $p < .001$ , all of the articles presented a  $p$  smaller than  $.005$ , explaining that all of the factors researched have a significant effect on the misinformation effect. The reason to point out which ones are below  $.001$  is to analyse which ones have more effect than the rest. For each experiment present in each article, the separate count of subjects is present.

All of the articles present similar empiric situations. In 18 out of the 21 studies, recorded information is presented to the subjects. Most of them on a video format, although pictures and slides are also found. 6 articles include the observation of a human model, both along with recorded information and by itself. The models were mostly confederates that presented information to the subjects. Another category is the written information, which only a few of the articles include, but was pertinent to distinguish this kind of message from the rest.

Most of the articles include the presence of a control group to compare the results of the experimental one. These control groups were provided with the information before the misinformation was added or were given the correct information instead of misled one. Only 3 articles do not include the control group, but still compare different experimental situations.

There are also some characteristics that are not included on the chart, one of the is the use of memory tests before or after the presentation of the post-event information(PEI), or by which means the misinformation was measured after it was showed. Ad hoc questionnaires were present in some of the articles, while others used standardised ones, but the principal way to retrieve data was by formulating specific questions about each empiric situation.

Another feature that is not present on Table 1 is when the subjects were questioned. Most studies include the retrieval delay on their empiric situation, with a variety of delays times; from days to a week or several weeks. Another significant procedure is whether subjects were questioned once or more times, for example, if they needed to answer questions before the information was provided and then some time after, or right before the misled information was shown and then after. Each study chooses the most suitable option for their specific experimental situation and remarkable aspects will be discussed on the following section.

In general terms, the search's results offer a wide range of articles about the misinformation paradigm and the post-event information effects. By ruling out studies too focused on non-malleable internal sources, such as stress, emotion, and neuropsychological effects, I was able to focus on much more social internal sources, like prejudice bias, conformity, or suggestibility. What most essays have in common is that they give an image of what can be done about the misinformation effect, and not of something unavoidable, stable and homogeneous for each subject.

## **Discussion**

As it was stated on the Method paragraphs, the articles that were part of this revision were read under the prism of identifying internal and external sources of misinformation, following the classification described by Davies and Loftus in 2007. Nonetheless, this essay also pretends to give special attention to the interaction of both kinds of sources and possible ways to prevent or lessen the misinformation effect on eyewitnesses, thus will be the different parts of the analysis.

### **Recent approaches to the study of the co-witnesses' influence on the creation and credibility of misinformation**

It is well known that witnesses to a crime talk with each other about the particular event that they have experienced. It may be the case that acquaintances find themselves on the same situation, like in the case of Brenda J. and her friend, who were victims of an armed robbery on 2015 (Eisen, Gabbert, Ying & Williams, 2017), or they are confronted with other unknown witnesses during the different legal. In any case, information will be shared and contrasted, if allowed by the circumstances. This factor had been already identified as a potential source for misinformation in the past (Davies & Loftus, 2007), but the recent decades offer us new ways of studying this phenomenon.

Studies conducted earlier on the past decade gave proved that the information acquired while talking with other co-witnesses is present on a later individual recall (Menor & Carnero, 2013), which drawn academic attention upon possible situations and variations that may broaden the understanding of the co-witness influence. Nonetheless, we will find that studies about the effect of the interaction with co-witnesses on misinformation are contradictory, which may be a result of the difficulty for observing accurately the human interaction in these situations (Rivardo et al., 2013).

In order to properly analyse how co-witnesses, have an impact on conducting misinformation, it is important to distinguish between a collaborative recall and co-witness discussion. The first term is used when subjects are asked to remember events and its details in teams with another witness of the same event, in some of the present studies we can observe the use of “fake witnesses” as co-witnesses in order to transmit the misinformation to the actual participants (Rivardo et al., 2013). On the other hand, co-witnesses’ discussions happen when witnesses to the same event share their insights and theories about it without any requirement of it. A clear example of a witness discussion is the Brenda J. case, in which she and her friend together concluded that the robber had tattoos on his face based on each other version of the robbery (Eisen, Gabbert, Ying & Williams, 2017). The main difference between the two phenomenon is that one is asked for and planned, while the second one is spontaneous and less controlled.

Studies about collaborative recall indicate that it can be a double-edged weapon when it comes to give an accurate recall. We find that the presence of confederates inside the witnesses’ groups can alter the outcome when a piece of misinformation is included in their testimony (Menor & Carnero, 2013; Rivardo et al., 2013). The misinformation effect will be greater if more than one confederate is present on the group, but the difference between the amount of confederates only gives a significant result when it is more than one, as it appear to not be relevant if they are two or five (Mojtahedi, Hammond & Ioannou, 2017). Nonetheless, research has also shown the collaborative recall as a tool that boost witnesses’ confidence and accuracy on their testimonies (Goodwin, Hannah, Nicholl & Ferri, 2017).

There are fewer researches about the co-witness’s discussions, as it is a much less controllable situation, where many variables may interfere in the subject’s memory. But, as it is something inevitable, some researchers have looked into it. It has been found that subjects that receive a negative feedback about their memory performance could present a lower

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confidence on their own memories, which could make them more prone to believe PEI when it appears and to change their testimonies (Monds, Howard, Paterson & Kemp, 2019).

What it has also been deduced, is that other individual characteristics of the subject, personality in this case (i. e. wanted control) could make them more likely to believe the pieces of misinformation and report them later (Mojtahedi, Hammond & Ioannou, 2017). Researchers conclude that the lack of investigation of this phenomenon is a limitation, but also hope that approaches could be made soon.

Characteristics of the witnesses that are a part of both a collaborative recall and a witness discussion can influence how other witnesses interiorise their testimony. One of these characteristics the confidence the witness shows. Goodwin's team investigation on 2017 tested the confidence of the confederates, getting a high-low distinction, before the tasks. During the tasks, the confederates were instructed to give correct, neutral or subtle misleading information, (i. e. "What textbook was the man carrying?" "Correct=Statistics; Mised=Calculus;"). After the discussion, when participants were individually tested, the results showed that those subjects that were paired with a high-confidence confederate that provided them misleading information, reported higher misleading information themselves.

Another characteristic that has gained attention lately has been the co-witness appearance's and communication style's effect on the other witnesses. In Goodwin's study we already see a glimpse of how statements that are transmitted confidently (i. e. without stuttering, with concise sentences) are more likely to convince others of their content (Goodwin et al., 2017). Confidence is related to a powerful speech style, that has also been proved to provide misinformation, especially when paired with a professional dress style. These findings are not as remarkable as the high-low confident ones, but the time factor was different in both studies, as the second one showed the information and post-event

information in a smaller period of time (Gojkovich et al., 2019). Despite the limitations of this study, witnesses' appearance is a line of investigation that may present interesting findings within the field of eyewitness testimony.

On these studies we could see the impact of the direct interaction of witnesses between them, but other ways of communicating have also been looked into. One of them is the written communication. In an empiric situation that included the information transmission through written material, the subjects were paired with 'fake witnesses' who facilitated them wrong information about the scenes they needed to see. Both written and spoken situations were proved, but, although it proved that written information can also alter the original memory of an event, no significant differences were found between written and spoken (Menor & Carnero, 2013).

A shared characteristic of every empiric situation analysed is the temporalisation of the information showed to the participants, the retrieval of it and for how long the information was displayed. About retrieval, we can find both immediate and delayed, while we find different exposure times as well.

There are mixed results about the immediate condition. For some studies, testing the subjects right after the PEI and testing the subjects reduced the misinformation reported, when in similar empirical situations the misleading information was present (Menor & Carnero, 2013; Gojkovich et al., 2019). On the other hand, Eisen's team included a very detailed following of the participants, that were tested 5 min after the information, 50 minutes, 2 days and a week and their results showed how the misleading information appears more frequently after the 50 minutes, but then decreases, until the week after test shows a similar result to the 5 minutes tests (Eisen et al., 2017).

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We could find the answer to the differences on these results on the exposure time. Menor and Carnero reported that their subjects had less time to encode the information than the studies they based their study on (2013), and so did Gojkovich's team (2019). For instance, studies with longer and recorded exposure, like videos, show a clearer significance on misinformation reported by the subjects (Eisen, Gabbert, Ying & Williams, 2017; Goodwin, Hannah, Nicholl & Ferri, 2017; Mojtahedi, Hammond & Ioannou, 2017; Rivardo et al., 2013;). The hypothesis is that witness that have more time to observe the PEI will interiorise it better than the ones that have less (Menor & Carnero, 2013).

General findings point out that the misinformation reported not only prevails for days after the exposure, but in some cases is even greater as time passes (Rivardo et al., 2013). Empiric situations that test the participants after some days or even a week haven proven this first point (Eisen, Gabbert, Ying & Williams, 2017; Goodwin et al., 2017; Monds, Howard, Paterson & Kemp, 2019). To summarise; information that is shown for longer is easier to encode, therefore, to retrieve; and PEI will appear from minutes after the exposure to even weeks, current studies show.

### **Current visions on the effects of forensic information on the transmission of post-event information**

When receiving external information about an event, especially those when a crime is committed, the other prominent source apart from our equals, is the professionals taking care of the event, like law enforcement agents such as police agents, lawyers, or judges.

For the means of this study, I will consider as Forensic Information all the information that is provided by someone in charge of the subjects, with a certain degree of responsibility over them, and the investigation. In a life-like situation, the mechanism would be similar: you are given a piece of information about something you witnessed by someone looking into this

particular event. On the other hand, how and when participants are questioned about the information is also included in this category, as questions are a source of verbal information that can influence the subject's answer (Daniel, 1972; Loftus & Zanni, 1975).

A relevant part of the process is how the information is transmitted. The method that resembles the reality the most is the verbal. Some of the empiric situations included in these analyses used this mechanism at some point of their experiments, although we can assume that all participants on each study were addressed verbally at some point of the investigation. The use of verbal communication arises the question of whether memory is the only mechanism involved in the formation and retrieving of misinformation (Polak, Dukała, Szpitalak & Polzyck, 2016), but these studies do not particularly investigate the features of verbal communication within the legal processes. Some details are observed, for example, the transmission of misleading PEI through a narration has proven to easier influence witnesses to believe the misinformation (LaPaglia & Chan, 2019; Lee & Chen, 2013).

Nonetheless, Gurney's study (2015) looked into a pertinent aspect of human conversations: non-verbal communication. The study included two different speeches, a factual one and a misleading one, and transmitted it to the subjects in two ways: with and without adding gestures. The findings of this comparison showed that gestures can pass on the same amount of misinformation than words and sentences. Although monitoring which gestures are used when giving forensic information seems improbable, being aware of the capacity they have to modify witnesses could be useful and will be discussed on another part of the essay.

Apart from verbal and non-verbal information, studies commonly use recorded videos, slides and voice messages to transmit both correct and misleading information (Lee & Chen, 2013; Hellman & Memon, 2016). Furthermore, written information is also provided in

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some empiric situations (Highman, Blank & Luna, 2017; LaPaglia & Chan, 2019; Polak et al., 2016). Comparison between these two methods is not given and researchers use them mostly indistinctly or combined, assuming the similarity on the results.

Instead, the present studies have focused their attention on which information is given. Conceptualization of the material's nature is different for each essay. For instance, the information given can address the event witnessed, or the suspects and/or culprits of the crime (Hellman & Memon, 2016). Inside the event-related situation, we can find various kinds of comparisons, for example, between action information and detail information (Sarwar, Allwood & Innes-Ker, 2014), specific versus general (Highman et al., 2017) or peripheral (Sarwar et al., 2014).

In the action information versus detail information, being the action what happened during the event, and the details those about the objects or persons involved, it was found that subjects reported a higher number of misinformation when the PEI was about the details than when the information was about the action (Sarwar et al., 2014). Another finding points out that the presence of context while narrating the PEI can affect the suggestibility of the subjects to incorporate the misinformation to their memory (LaPaglia & Chan, 2019).

Apart from information about the event witnessed, details about the suspects of the crime are also a source of misinformation. It has been found that providing ideas about the motives of a suspect can alter the witness memory, inclining them toward the suspect whose motives seem more dispositional (the suspect is believed to have a stable behaviour) than situational (the suspect acted in a certain way because the situation drew him or her to). Therefore, when receiving consistent PEI about the suspect's motives, even though it is misleading, witnesses would accept it easier, and give more severe judgement to the ones judged as dispositional (Hellman & Memon, 2016).

Regardless of the kind of information being shown to the subjects, meta-information\* can be also provided in the form of warnings about the details that have been heard or seen. Although warnings can be given before and after the PEI, only post-warnings will be addressed for this essay. Post-warnings report the participants about the presence of misleading information among the one that they just received.

A general warning alone, the one that tells the participants the presence of misleading details, does not reduce the impact of misinformation, but a specific warning does (Highman et al., 2019), because knowing where the non-factual PEI is help witnesses choose the appropriate recall strategy to avoid the unwanted details. On the other hand, post-warning is not the only way to reduce misinformation, neither the most efficient (Szpitalak & Polczyk, 2013), but other methods will be discussed later.

The last type of information that will be discussed is the original source of the witnessed event. This can be provided in a video or picture form, allowing participants to review it whenever they want. In a study conducted by Polak's team in 2016, participants had the video recording of the accident and slides with misinformation on critical details (i. e. the colour of a scarf). They could revise the information while answering a memory test. On the first trial, participants remembered as much misleading details as the ones without the slides. The team tried to make sure that they used the material on their second trial, in which they discarded participants that did not consult it, and on a third trial where the accessible information was in a voice-recorded format. These two trials showed a slightly weaker misinformation effect than in the first one, but still, the amount of misleading details recalled was higher than expected.

There is also the possibility of transmitting information through question formulation. This phenomenon has been studied in different occasions. A recent discovery is that, the

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misinformation that is presented in a question form, as opposed to information presented on an affirmative sentence, eliminates the misinformation effect (Lee & Chan, 2013). The difference between this study and other is that participants are not supposed to answer the question that contains the PEI, but the only purpose of it is to transmit it.

A final forensic aspect that is related to the misinformation effect is when the witnesses are called for questioning. Remarks about how the retrieval delay affects the settling of misleading information in memory are not a remarkable part of articles whose content is more focused on the content and transmission of PEI. However, results did not differ from those articles that added a delay (LaPaglia & Chan, 2019; Sarwar et al., 2014), and one study that tested participants immediately found the same results as similar studies that used the delay (Hellman & Memon, 2016).

### **How society and mass media communication can affect subject's recall of an event**

So far, only the moments when the witnesses are being tested has been addressed. In a real-life crime, witnesses do not normally testify right after the event has happened, normally, they go back home, talk about it with their friends (Eisen et al., 2017), and, if the case catches the attention of the media, they will be exposed to various interpretations of the events (LaPaglia & Chan, 2019). It is also relevant to acknowledge that, both real witnesses to crimes and studies' participants, do not exist solely on the police department or the laboratory; they are part of a society bigger than them, with rules which are normally followed unconsciously.

*Talking about societal characteristics that affect the witness' memory means assuming that memory has a social nature, hence, the misinformation paradigm does not only reside on memory errors and capacity.*

Recently commented essays did not pay much attention to the social nature of information transmission, by providing the PEI through recordings or written reports (see previous sections). Nevertheless, there have been studies that have included comparisons between social and non-social methods to pass on PEI (Blank et al., 2013). Social transmission is given from person-to-person, preferably face-to-face; para-social information is the one that is given by someone known by the witness but in a written or recorded way, and in the impersonal, or non-social, transmission PEI is provided by an unknown person that is not present (Szpitalak, Polak, Polczyk & Dukala, 2016).

On a study that compared directly transmitted information, or social, and indirectly transmitted information, the non-social one, results showed that the effect of misinformation is slowly higher on the direct condition. Nonetheless, these results contradict the reviewed by the authors, in which the directly transmitted group showed a significant difference with the indirect one (Blank et al., 2013).

Something similar occurred on a more recent study, that compared, across three different experiments, the effects of social, para social and non-social transmission. Some differences were found, specially between the social and impersonal conditions (Szpitalak et al., 2016). Evidence now is more in concordance to what Blank's team found, but still the difference was not the expected by the investigators.

These results may seem irrelevant as they point out that both social and non-social misinformation has the same effect on eyewitnesses' memory. Nonetheless, previous studies' conditions were less real-life like than the ones providing PEI through face-to-face interaction. Under the light of these findings, it could be deduced that both types of communication transmit misinformation, and that social interactions are slightly more prone to affect eyewitnesses' suggestibility to it.

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The way in which we interact with other people can have an influence in our capacity to remember events and accept misleading PEI into that memory. More specifically, how we interact with other witnesses, and in groups of witnesses, may influence the memory tests. This interaction has a personality component but is also culturally shaped.

A research used the co-witness situation to compare interdependent and independent subjects, using a previous test to classify the witnesses in those two categories. The results showed that subjects that relied more on what the co-witness -a confederate- said, had a higher grade on the interdependent scale and reported more misleading detail on a free recall questionnaire about the witnessed event (Pettersen & Paterson, 2012). There are not many other examples of the influence of socially inherited personality traits affect the witness testimony, but studies like this one open the path to many others.

However, the culture we are immerse in does not only influence our personality, but also how we feel about other individuals. We tend to agree and trust people similar to us, and to reject those who are different. This phenomenon is called prejudice, and it is present on our society, so we can assume that it also affects our memory. Actually, the effect of prejudice has been studied by authors such as Lindholm and Christianson (see Introduction), concluding that witnesses are more prone to identify a suspect as the culprit if they are from a different race (1998).

The effects of prejudice surpass the witness memory topic, creating injustice not only in the legal system but in the society in general. Nonetheless, not every result is negative. On a recent study, subjects were presented with two male characters from a dating app. They were given information about the characters' in the form of a memory test. The critical information here was each character's job, because it featured stereotypically assigned occupations. After one week, participants needed to fill a memory test about the two

character with accurate information. The difference was that one of the groups was informed that both the occupations they were showed were false. This group did not show biased memory retrieval on their memory test, while the other did (Blank et al., 2019). The conclusions of this study show that subjects that are remembered of stereotypical assumptions, are both able to avoid them and not to include them on their memories of an event.

However, race and looks are only a part of what defines a stereotype. Other characteristics, such as accent and speech (LaPaglia & Chan, 2019), also influence how others remember subjects that follow these stereotypes, making them more easily misjudged and mistrusted.

Results like these support the idea that memory misinformation is a phenomenon by many other processes apart from memory. This hypothesis has appeared before (Frenda et al, 2011; Loftus, 2019), arguing that memories of subjects that have witnessed some sort of PEI are not distorted, instead, retrieval is not accurate because the subject is unable to differentiate the original memory from the misleading PEI. This phenomenon has been called a failure to correctly monitor the source by other authors that have arrived at this same conclusion (Polczyk, 2017).

On the cited study by Polczyk in 2017, he conducted three experiments in which subjects witnessed a video in groups and received the PEI while they were filling up a questionnaire about the video. On the third trial, after having read the PEI and finished the questionnaire, subjects were asked about what they saw on the video and what they read after it. This experiment showed two interesting outcomes. The first is that an important percentage of subjects that were aware of the discrepancies between the misleading text and the original source, the video, still yielded to the misinformation effect. The second is that

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this experiment had the lowest rate of discrepancy awareness out of the three, being the only one in which the subjects needed to verbally answer a question in front of the group.

However, personality traits were not measured in this last experiment, so there is no feasible way to deduce the reason for this set of results, although the effects of social influence seem to be a reasonable candidate.

During this essay, most of the empiric studies analysed had in common that the subjects were tested on the laboratory, and the only information considered was the one provided by the researchers. Some of the articles mentioned that subjects were exposed to information when they returned home, and that retrievals made during the space in-between the memory tests can influence the results (LaPaglia & Chan, 2019). But, aside from this kind of information, witnesses to a crime also receive reports from the event from the news.

Although nowadays there are many ways in which news are broadcasted (TV, on-line newspapers, magazines, radio, etc.), only one will be commented here: news articles. These can be found in many ways, but normally follow a similar structure. On a study, the effects of the information included on the headline, and the relationship with the picture that came with it, were looked into in order to prove whether they can influence reader's memory.

For this task, subtle misinformation was included in headlines, both congruent and non-congruent with the rest of the text. On the second trial, the effect of the picture included on the article was tested as well. Results showed that a misleading headline can alter the memory for the rest of the article, even when the subject has completely read it. Another effect that was observed is that the appearance of a picture next a news headline, automatically makes the reader think that the pictured person could be the culprit of the crime (Ecker et al., 2014).

### **Possible prevention or protection to witnesses that encounter misinformation**

Along this analysis, some of the studies found protective factors to the misinformation effect in the form of conducts performed by the investigators and in the conditions the subjects are tested. Not all of them consider these findings to be of practical application, however, I reckon these discoveries worthy of recollection in order to offer prospect investigations on prevention of the misinformation effect a starting point. Nonetheless, during this section only malleable factors and situations will be shortly discussed.

First, about the way in which subjects receive the information. It was proved that showing PEI in a question form, which it is not meant to be answered by the witnesses, reduces significantly the misinformation effect (Lee & Chen, 2013). It is not clear the reason for this effect, but this could be a way to reduce the misinformation transmitted, for example, by news headlines (Ecker et al., 2014).

On the other hand, we have discovered that the type of information that witnesses receive when taking part in an investigation affects their memory. It was found that subjects remember better and more accurately action information (the one that describes what happened) than detail information (the one that describes characteristics of the people or objects involved) (Sarwar et al., 2014). Therefore, avoiding the questioning about details, and focusing on the action, may help to achieve more accurate testimonies.

Participants can also receive meta-information about the report they have been shown. On other words, subjects can be given warning about the existence of misleading details among the report they received. Warnings can be useful, but their effect is enhanced in different situations. The most remarkable finding is that subjects that are informed about the stereotypes inside a statement are able to reject this information and not add it to their

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memory, reducing the amount of prejudiced misinformation (Blank et al., 2019). Thus, adding this procedure to investigations could improve the quality of testimony.

Warnings can address the information differently; it can be both general (stating that there is misinformation on the statement) or specific (pointing out where exactly could the misleading details be). Specific warning has proven to be more efficient, as subjects are able to modify their strategy to remember (Highman et al., 2017), and focus on potential sources of misinformation, like news headlines (Ecker et al., 2014) or co-witnesses (Eisen et al., 2017). Despite the proven usefulness of warning, there has been another method that has achieved better results at reducing the misinformation effect: reinforced self-affirmation (Polak et al., 2013). Therefore, a combined technique that warns participants and make them feel confident about their testimonies could significantly reduce the amount of reported misinformation.

Regardless the positive results of providing the witnesses with some kind of information, not all the information has the same influence. An example of this is the findings that show how participants that have access to both the original source and the PEI source, still yield to misinformation, even though they review the material given (Polak et al., 2016). This discovery is in concordance with the hypothesis that defends a view of misinformation like an effect which mechanism is not only memory related (Polczyk, 2017). For instance, a recommendation would be to not give witnesses all the information, but to warn the subjects about the information they have already received.

All of these suggestions are based on the results obtained by each commented study, but they are only hypothesis that could not be accepted without conducting more research about this topic. Nonetheless, this field of study has the potential to give beneficial knowledge to the legal practice, among others.

## Conclusions

### Practical applications and further investigation

Along this essay, some of the most recent research about misinformation has been commented and analysed. This study is focused on the sources of PEI, using the categories external and internal, and on the interaction of the information witnesses receive and their personal characteristics. Secondly, external sources have a bigger weight on this essay, due to the amount of research found about it. This is why the analysis specially looked into the co-witnesses' effect on memory retrieval and the influence of the different kinds of forensic information.

Besides, aspects related to the social influence also were commented. This part of the essay was really useful to fully understand the context in which the field of witness memory and testimony takes part. We can see how basic features of human communication and social behaviour can affect the way in which we remember certain events, let alone how we transmit this memory when asked.

On the other hand, results are not entirely clear when it comes to prevention. We can see that there are ways to reduce the misinformation effect, or, even, to eliminate it. Nonetheless, more research and trials would be needed to build a solid theoretical framework about this issue. Which would be useful in many ways, specially to apply to the legal and police work, as witnesses' testimonies are an important part of most investigations. Inaccurate statements can lead to wrongful convictions in some cases, and hindrance of justice in others.

To sum up, there are many different ways in which PEI sources can mislead witnesses and their testimony, but there are also leads that could bring us to a way of protecting witnesses' memory and its influence on the legal system.

### **Limitations**

Some of this essay's limitations have already been commented when talking about certain studies. But most of them reside on the social nature of human interaction, which is hard to measure on a laboratory condition, due to the number of confounding variables that can be found. These variables are hard to predict and to avoid, because they are related to the subjects' personality and what they experience between the memory tests. As we were able to see during the discussion, many sources of misinformation are present when the participants are not in the laboratory. Likewise, some of the empiric situations did not attempt to measure their participants' personality traits, and the ones that did found contradictory results. This may be caused by a poor choice of the tests used or to the effect that the laboratory has on subjects. This is, taking part of one of these experiments could not elicit on the participants the same arousal that an actual police investigation.

Otherwise, the results to these studies have been tightly linked to the psychometric significance of the analysis. I reckon this tendency as a liability when measuring social behaviours, as is the transmission of information and its effect on memory retrieval. A recent opinion agrees that we should not be relying so much on what numbers tells us (Amrhein, Greenland & McShane, 2019). I think this particular field would benefit from a different conceptualization of their experiments' results, which would lead to a higher rate of practical application to the studies' discoveries.

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\*Articles followed by an asterisk are the articles used on the review.

**Annex**

**Annex A. Articles chosen and their characteristics.**

<i>Authors</i>	<i>Year</i>	<i>N</i>	<i>Content</i>	<i>Design</i>	<i>Nature of factor</i>	<i>P</i>
<b>Hellman &amp; Memon</b>	2016	130+79	FI	RO+WI+C/EG	EXT+INT	<.001
<b>Rivardo et al.</b>	2013	161	CO	RO+C/EG	EXT+INT	<.001
<b>Blank et al.</b>	2013	120	SC	RO+C/EG	EXT	<.001
<b>Petterson &amp; Paterson</b>	2012	54	SC+CO	RO+HO+C/EG	EXT+INT	<.001 >.001
<b>Sarwar et al.</b>	2014	89	FI+PR	RO+C/EG	EXT	<.001
<b>Highman et al.</b>	2017	48+44	FI+PR	RO+C/EG	EXT	<.001
<b>Gojkovich et al.</b>	2019	147	CO	RO+HO+EXG	EXT+INT	<.001
<b>Blank et al.</b>	2019	68	SC+PR	HO+C/EG	EXT+INT	<.001
<b>Eisen et al.</b>	2017	289	CO	RO+HO+C/EG	EXT	>.001
<b>Menor &amp; Carnero</b>	2013	40	CO	HO+WI+EXG	EXT	<.001
<b>Mojtahedi et al.</b>	2017	473	CO	RO+C/EG	EXT+INT	>.001
<b>Lee &amp; Chen</b>	2013	72+48	FI+ PR	RO+C/EG	EXT+INT	>.001
<b>Szpitalak &amp; Polczyk</b>	2013	209	FI+PR	RO+C/EG	EXT+INT	<.001
<b>Goodwin et al.</b>	2017	185	CO	RO+HO+C/EG	EXT+INT	<.001 >.001
<b>Monds et al.</b>	2019	159	CO	RO+C/EG	EXT+INT	<.001
<b>Ecker et al.</b>	2014	51+47	MD	WI+C/EG	EXT	>.001 <.001
<b>Szpitalak et al.</b>	2015	103+60+10 8	SC	RO+C/EG	EXT	<.001
<b>Polczyk</b>	2017	424+325+4 87	SC	RO+C/EG	EXT	<.001
<b>LaPaglia &amp; Chan</b>	2019	120+120+1 20	FI	RO+C/EG	EXT	<.001
<b>Polak et al.</b>	2016	130+77+40	FI+PR	RO+EXG	EXT	<.001
<b>Gurney</b>	2014	92	FI	RO+HO+C/EG	EXT	<.001

*Note: N=Subjects, EXT=External, INT=Internal, FI=Forensic Information, CO=Co-Witnesses, SC=Society/Culture, MD=Media, PR=Prevention, HO= Human Observation, RO= Recording Observation, C/EG= Control + Experimental Group, EXG= Experimental group, WI= Written Informatio*