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Improving Witnesses' Recollection by Reinforcing the Cognitive Interview: The 5Ws Questions as an Information-gathering Method

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ABSTRACT

Background/Objective: Witness' interviews within a judicial investigation represent a complex procedure because human memory is subjected to suggestions and personal re-elaboration processes. Therefore, it is necessary to use an interview method that guarantees the accuracy of the testimony. *Method:* This research focused on the development a modified version of the Cognitive Interview based on the use of the five Ws (who, what, where, when and why), commonly used in journalism, which we named the 5Ws-CI. The goal of the present study is to compare this method with two interrogation techniques already present in the literature, the Enhanced Cognitive Interview (ECI) and the Cognitive Interview with the Category Clustering Recall (CCR) and to test the moderating role of Machiavellianism. Seventy-two subjects individually watched a video-clip of a robbery and were randomly assigned to one of the three interview groups (ECI, CCR-CI, or 5Ws-CI) and the veracity condition (truth tellers vs. lie tellers). *Results:* Subjects in the 5Ws-CI and CCR groups remembered significantly more information than subjects in the ECI condition, without impacting on accuracy. Also, truth tellers reported more details than lie tellers. No significant difference was found between the 5Ws-CI and CI-CCR interview groups. *Conclusions:* In conclusion, the results indicate that the 5Ws-CI and CCR techniques might be effective methods and outperform the ECI.

Mejorar el recuerdo de los testigos mediante el refuerzo de la entrevista cognitiva: las 5Qs preguntas como método de recogida de información

RESUMEN

Antecedentes/objetivo: La entrevista a testigos en una investigación judicial supone un procedimiento complejo, habida cuenta de que la memoria humana se somete a insinuaciones y a procesos de reelaboración. De este modo hay que utilizar un método de entrevista que garantice la precisión del testimonio. *Método:* La investigación se centra en la elaboración de una versión modificada de la entrevista cognitiva de acuerdo a las cinco "Q" [Quién, Qué, en Qué momento, en Qué lugar y por Qué] frecuentemente utilizada en periodismo, que nosotros denominamos "las cinco cúes". Este estudio aborda la comparación de este método con dos técnicas de interrogación ya presentes en las investigaciones: la entrevista cognitiva mejorada (ECM) y la entrevista cognitiva estándar con el recuerdo agrupado de categorías (EC-RAC), poniendo a prueba el papel moderador del maquiavelismo. Se proyectó individualmente a 72 sujetos un videoclip de un robo, asignándolos aleatoriamente a uno de los tres grupos de entrevista (5Qs, ECM y EC-RAC) y la condición de veracidad (verdad, mentira). *Resultados:* Los sujetos de los grupos de las técnicas de entrevista 5Qs y EC-RAC recordaron notablemente más información que los sujetos del grupo de ECM, sin que repercutiera en la precisión. Además los que decían la verdad dieron más detalles que los mentirosos. No se encontraron diferencias significativas entre los grupos entrevistados con las técnicas de entrevista 5Qs y EC-RAC. *Conclusiones:* Los resultados indican que las técnicas de 5Qs y la de EC-RAC podrían ser métodos eficaces y superar la técnica de ECM.

Witnesses interview is a key procedure affecting the performance of an investigation (Milne, 1997). It was estimated that in around 85% of judicial cases, the evidence bearing most weight is the testimony (Arce, 2017; Hans & Vidmar, 1986). This underscores that the evaluation of a testimony is crucial for judicial decision making. Today, next to modern investigative techniques, testimony plays an important role in contributing to the reconstruction of facts and it is an element of evaluation in the judge's decision-making process. Specifically, witnesses are classified as either credible (with value as evidence), or not credible (without value as evidence), which correspond to the honest or dishonest witness in the psychology of testimonies. Nevertheless, research on the memory of witnesses

has found the accounts of honest witnesses can contain inaccurate information (Köhnken et al., 1999; Memon et al., 2010; Memon, Wark, Bull, et al., 1997; Memon, Wark, Holley, et al., 1997). In particular, the literature suggests that 10 to 20% of the information of an honest witness is inaccurate (Arce, 2017). It is therefore important to conduct proper interviews.

According to Arce and Fariña (2012), the guiding principles for an interview that is valid for credibility assessment are: i) to collect as much information about the event as possible, ii) not to contaminate evidence (memories; see also Arce et al., 2023), and iii) to collect statements while safeguarding all procedural guarantees (Arce & Fariña, 2012; Colomb & Ginet, 2012; Colwell et al., 2002). To fulfil such principles, specific interview techniques which allow not to interfere with the contents of the testimony and to facilitate recall, maximise recall, maximise accuracy, and minimise contamination need to be used. Indeed, to conduct a proper investigation, the investigator need to collect as much information as possible (Arce & Fariña, 2012), as this can, amongst other, influence the course of the investigation itself.

The Cognitive Interview (CI; Geiselman et al., 1985) is accepted as one of the most successful procedures for improving the recall of witnesses. It involves the use of four mnemonic techniques: i) context reinstatement, which consists of asking witnesses to mentally recreate the physical and personal context of the event that occurred at the crime scene. It is based on the premise that the accessibility to memory information increases when the original context of the event is reconstructed during recall (Tulving et al., 1983; Tulving & Thompson, 1973); ii) report everything mnemonic, which consists of in instructing witnesses to report everything they can remember, even if it seems irrelevant (Fisher & Geiselman, 2010); iii) change order mnemonic, consisting of asking the witness to recall the event in a non-sequential order to promote a complete reconstruction of the event; iv) change perspective technique, consisting of asking the witness to recall the event from different points of view. In this way the recovery of the latent elements can be facilitated.

In addition to the above, advancements in the CI also considered the importance of social and communicative factors, such as the well-being of the witness during the interview. Fisher and Geiselman (1992) developed a newer version of the CI, called Enhanced Cognitive Interview (ECI), which includes several procedures: efforts to build a relationship between the interviewer and the interviewee, transferring control to the witness, the use of witness-compatible questioning, and mental or guided imagery.

First, the interviewer introduces themselves and explains to the witness their role and what will happen during the interview to reduce anxiety in the subject. Nonverbal language is also an important component, so the interviewer actively listens and shows interest in the story. The technique of building a relationship between the interviewer and the interviewee contributes to the well-being of the witness and increases the amount of information remembered. The theoretical assumption is that a peaceful witness is usually able to recall more details than an agitated person.

The transfer of control of questioning to the witness is accomplished by specifying that even if the interviewer is present to help if needed, most of the work will be done by the witness, since only they know the useful information. It should also be explained that the interviewee may take breaks.

Witness-compatible questioning is achieved by asking the right questions at the right time. In other words, all questions must be compatible with the witness' retrieval pattern, and the information described at that time.

The last procedure, mental or guided imagery (Dando et al., 2009), is very similar to the context reinstatement procedure, but instead of asking the witness to recreate large-scale scenarios, the interviewer asks the subject to reconstruct more specific details. The use of multiple sensory modalities is recommended because they activate different retrieval strategies and increase the amount of information recalled.

To conclude, a summary and closure phase should be conducted before ending the interview. In the summary phase, the interviewer should summarise the witness' story, emphasising to correct any errors and add new information if it comes to mind. This increases not only accuracy but also the amount of information. At the end, in the closing phase, the interviewer should minimise any emotional distress of the witness and show gratitude for cooperation. However, it is important to note that the mnemonics and procedures previously described above should not be used systematically in all interviews as each interview is unique, thus the interviewer should choose which strategies to use, as well as the best time to employ them.

Importantly, multiple studies have demonstrated the effectiveness of the CI in different countries, such as the USA, England, Australia, Brazil, and Portugal (Paulo et al., 2016; Stein & Memon, 2006), with different types of witnesses, such as children, adults, and elders (Verkampt & Ginet, 2010; Wright & Holliday, 2007), different timings between the crime and the interview (Larsson et al., 2003), and various types of events (Campos & Alonso-Quecuty, 1999, 2008), both in the laboratory and in the field (Colomb & Ginet, 2012; Holliday, 2003; Mello & Fisher, 1996; Wright & Holliday, 2007).

Several studies also showed that the CI can increase the amount of correct information recalled by the witness, while maintaining accuracy (Campos & Alonso-Quecuty, 2008; Centofanti & Reece, 2006; Dando et al., 2009; Davis et al., 2005; Gwyer & Clifford, 1997; Verkampt & Ginet, 2010). Two meta-analyses (Köhnken et al., 1999; Memon et al., 2010) showed that the Cognitive Interview, in contrast to the Standard Structured Interview generally used by police, allows more correct details of the event to be remembered: d = 1.20 in the study by Memon et al. (2010) and d = 0.87 in the study by Köhnken et al. (1999). According to Cohen's (1988) classification, from the above d-values about 80% of the cases subjected to a Standard or Structured Interview obtain below-average correct information (Arce & Fariña, 2012). On the top of that, the CI is particularly effective for remembering complex events (Geiselman et al., 1985), although Mantwill et al. (1995) pointed out that the CI is more useful with episodic memory than semantic memory.

From the above it is clear that, although the effectiveness of CI is influenced by factors such as the interviewer's skill, the interviewee's degree of cooperation, and the time from the event, the CI is useful and more productive compared to other interviewing models (Arce & Fariña, 2012).

Yet, even though several studies have documented that certain procedures of the CI are effective, such as the relationship building (Kieckhaefer et al., 2014; Nash et al., 2016; Vallano et al., 2015), free storytelling (Lamb et al., 2008) and context reinstatement (Milne et al., 1999), other CI procedures are less effective. Specifically, the change order and change perspective mnemonics are considered controversial (Boon & Noon, 1994; Brown et al., 2008; Clifford & George, 1996; Dando et al., 2008; Kebbell et al., 1999; Mello & Fisher, 1996; Milne et al., 2019). For example, remembering in reverse order is a very arduous task that can compromise recall as it requires high levels of cognitive resources (Vrij et al., 2008; Vrij et al., 2012). Furthermore, in the reduced versions of the CI, the techniques of change of order and change of perspective are generally omitted (Brown et al., 2008; Clifford & George, 1996; Dando et al., 2008; Haussen Pinto & Milnitsky Stein, 2015; Kebbell et al., 1999) as: i) they are considered difficult to apply (respondents often do not understand them); ii) they are the least decisive in favouring recollection compared to other techniques (e.g., context recreation Memon et al., 2010; Milne & Bull, 2002); (iii) and they may lead to increased recall of incorrect information (Dando, Ormerod, et al., 2011; Dando, Wilcock, et al., 2011; Oxburgh & Dando, 2011).

Consequently, several studies replaced the change order and change perspective techniques with new strategies. Paulo et al.

(2016) developed a new interview strategy which they labelled Category Clustering Recall (CCR). The CCR is based on the spreading activation theory (Collins & Loftus, 1975), which suggests that memory is organised based on semantic similarity. The theory further proposes that memory is a result of a series of cognitive processes represented by a network, a link between categories and concepts. To provide a practical example, the activation of the semantic category "desk" helps the recall of related categories, such as notepad, pencil, and pen. Interestingly, this organisation takes place during both encoding (the acquisition of a memory) and retrieval (the recall of such memory). In this regards, it has been observed that when people are asked to memorise random word lists, they organise these words into semantic categories (e.g., animals, objects, and plants) during encoding and/or recall (Dalrymple-Alford & Aamiry, 1969; Manning & Kahana, 2012; Robinson, 1966). Furthermore, when people use this recall strategy, either spontaneously or after being instructed to do so, they generally remember more details than when they do not (Dalrymple-Alford & Aamiry, 1969; Robinson, 1966). Therefore, asking witnesses to recall an event in groups of categories could be an effective retrieval strategy, which is the base assumption of Paulo et al. (2016). In their case, the clustering was done on the following categories: people, location of people, objects, locations of objects, and sounds. The advantage of such an approach is that it is compatible with witness' mental organisation. Also, familiarity with this type of task requires less cognitive resources, resulting in easier access to the stored information (Fisher & Geiselman, 2010).

Paulo et al. (2016) tested the effectiveness of their CCR in an experiment. The method involved the comparison between three techniques: the Enhanced Cognitive Interview (ECI), the Category Clustering Recall, where the change order mnemonic was replaced by the CCR, and the CCR, with the addition of the "eye closure" instruction and follow-up questions. The results showed that participants who used the CCR recalled more correct details, without compromising accuracy, compared to participants who were interviewed via the ECI. However, the eye closure instruction and follow-up questions did not improve recall, thus showing that the positive role on participants' recall was due to the clustering embedded within the CCR itself.

Paulo et al. (2017) carried out a further study on the CCR to observe whether it could be a viable alternative to witness-compatible questioning. The experimental procedure involved the same materials and methods as the previous study (Paulo et al., 2016). Differences include: in Phase 3 (first recall) for the ECI group witness-compatible questioning was used, while in the other condition (named Revised Cognitive Interview, RCI) the CCR was used; in Phase 4 (second recall) the ECI participants were asked to report everything they remembered about the video in reverse order, in contrast to the RCI group who was asked to focus on the video and report further details; finally in Phase 5 (third recall) participants in the ECI condition were asked to adopt a different perspective, whereas this phase was not conducted for the RCI group. The results obtained indicate that the participants interviewed with the CCR (RCI condition) were able to recall considerably more correct new details with very high accuracy than participants in the ECI group. In this regard, it can be argued that a second retrieval attempt with the CCR is more effective than witness-compatible questioning. Specifically, participants recalled more new information during recall with the CCR than in the initial free narrative. This finding is unusual compared to findings in previous literature that see free recall as useful in recalling more new details than other strategies (Fisher & Geiselman, 1992; Paulo et al., 2013). Therefore, using category clustering to guide recollection of a criminal event may be even more effective than free recollection.

Paulo et al. (2021) further refined their CCR and compared the effectiveness of three retrieval strategies: a free recall, CCR, and the Location Clustering Recall (LCR). All interviews started with the instructions as from Fisher and Geiselman (1992). Then, participants in the free recall (FR) group were asked to recall everything they could

remember about the crime in any order and at the pace they desired. Participants in the CCR group were asked to use Category Clustering Recall instead. Participants in the LCR group were asked to recall the event using Location Clustering Recall, where spatial clustering instead of semantic clustering was adopted. The results showed that participants interviewed with CCR or LCR recalled a higher number of correct details than participants in the FR. Furthermore, it was found that participants interviewed with LCR recalled more details about objects and places than in the FR and CCR. This can be interpreted on the assumption that asking witnesses to focus on a specific location in the crime scene helps them to recall new spatial details, which is corroborated by previous research showing that it is possible to increase the amount of a specific category of details (e.g., spatial or temporal) by guiding the interviewee to focus on such specific categories (Porter et al., 2021; Porter et al., 2018), an instruction that works regardless of whether it is provided in a verbal or written format (Porter & Salvanelli, 2020).

The results from Paulo et al. (2016) and Paulo et al. (2021) are encouraging but it is possible to further develop enhanced versions of the CI. First, a focus can be put on information that is relevant to a forensic context, as any criminal event includes information on the actors that took part in the event (Who), what they did and the objects present at a scene (What), where people and objects were located as well as where the event took place (Where), the timing of the entire event, such as the time of the day and the sequence of events/actions that took place (When), and on the reasons behind actors' actions (Why). Furthermore, exploring the link between these five categories is also important.

Second, the effectiveness in distinguishing between honest and deceptive interviewees of the CCR was not tested, but this distinction is important as witnesses can lie for different reasons, such as protecting a guilty relative or avoid self-incrimination. When looking at the differences between truth telling and lying, research shows that when people lie, they usually offer shorter and less detailed statements than truth tellers (Amado et al., 2015; Amado et al., 2016; Gancedo et al., 2021; Sporer & Schwandt, 2006), which is thought to result from increased demands on working memory associated with constructing, verbalising, and maintaining a deceptive account (DePaulo et al., 2003; Sporer & Schwandt, 2006; Vrij et al., 2006; Zuckerman et al., 1981). In contrast, truthful respondents typically provide more elaborate accounts of events (Colwell et al., 2002; Gilovich et al., 1998). Despite these differences, making judgments about veracity in legal contexts is difficult because cues to verbal deception are not readily discernible (Dando & Bull, 2018; Dando et al., 2018), hence effective interviewing techniques are required.

Considering the two points above, we developed a modified version of the ECI to evaluate its effectiveness for information elicitation and lie detection, while building on the spreading activation theory and on the CCR. We called this modified version 5Ws-CI, as it builds on the use of the five Ws questions (who, what, where, when, why) commonly used in journalism with the aim of collecting as much information as possible regarding a specific topic: Who, What, When, Where, and Why. Yet, we decided to disregard the "Why" component, as witnesses' reports of why something happened would not be related to the actual event under investigation, but rather on their inferences about the reason behind the events. Also, we decided to develop this new questioning approach as its use is easy: asking interviewees to focus on the Ws questions and on the links between them is a clear and basic instruction to provide, as it belongs to everyday language. Thus, it should also be easily implemented in practice without the need for difficult training for the interviewers.

The two goals of the present study were thus to compare three interviewing techniques: the original ECI, the CCR, and the 5Ws-CI, with a specific focus on two outcome variables namely the amount of information obtained by the interviewees and the efficacy for discriminating truth tellers from lie tellers.

Furthermore, considering the important role of interpersonal differences in investigative interviewing (Caso et al., 2018; Palena & Caso, 2021; Palena et al., 2021; Palena et al., 2023), we also aimed at evaluating whether the efficacy of the three interviewing techniques was affected by the level of Machiavellianism, a personality trait entails distrust in other people, a manipulative interpersonal style, as well as a tendency to exploit other people for a personal gain (Brewer & Abell, 2015; Brewer et al., 2016). Indeed, Machiavellianism showed to be relevant in deceptive behaviour (DePaulo & Rosenthal, 1979; Geis & Moon, 1981; Riggio & Friedman, 1983; Riggio et al., 1988), with people high on Machiavellianism showing more deceptive behaviours and intentions (Hogue et al., 2013; Palomäki et al., 2016). Furthermore, if Machiavellianism is related to lying, and considering that deception might occur in investigative interviews, it follows that Machiavellianism can influence (i.e., moderate) the efficacy of an interviewing technique.

Based on the above background, we made the following predictions.

$H$1: Main effect of interviewing technique. The interviewees will provide more (total and accurate) information when interviewed with the 5Ws-CI than with the CCR (H1a). Furthermore, we also expected that participants interviewed with the CCR would provide more (total and accurate) information than those interviewed with the ECI (H1b).

$H$2: Main effect of veracity. Participants in the lie condition would report fewer details than honest subjects, and we expect this effect to be moderated by Machiavellianism ($H$2). We made this prediction based on the following assumptions: i) lying is a demanding task that requires high levels of cognitive resources (Warmelink et al., 2019), which might impact on the amount of information provided; ii) lie tellers try to keep their stories simple (Verigin et al., 2019; Verigin et al., 2021); and iii) Machiavellianism plays a relevant role in effective lying (Palena et al., 2021).

$H$3: When focusing on the total number of information, the 5Ws-CI will outperform the CCR for the discrimination between honest and lying participants (H3a) and the CCR will in turn outperform the ECI (H3b).

The hypotheses are built on the literature suggesting that subjects spontaneously encode, organise and recall memories into categories (Dalrymple-Alford & Aamiry, 1969; Manning & Kahana, 2012; Robinson, 1966). Therefore, the 5Ws-CI is a technique compatible with the mental organisation of the participant, which allows to employ a lower cognitive effort, which in turn allows the interviewee to focus on remembering (more) correct details (Fisher & Geiselman, 2010). In addition, the use of the 5Ws questions is a clear and simple instruction, familiar to the people as the 5Ws questions belong to everyday language. Additionally, prompting interviewees with the 5Ws-CI allows them to recall a more complete memory as they will focus on aspects that would probably overlook otherwise. Furthermore, considering that the 5Ws-CI is expected to increase the amount of information recalled by the witnesses, but that at the same time lie tellers usually keep their stories simple and report fewer details than truth tellers (Verigin et al., 2019), we expected the difference between truth tellers and lie tellers (although being always present and reflected in a veracity main effect) to be larger in this interview condition than in the CCR and the ECI. In short, thanks to its compatibility with the organisation of memories, the 5Ws-CI is expected to encourage truth tellers to report more details than lie tellers. Last, for what concerns Machiavellianism, since it is associated with better lying (Hart et al., 2020), we expected higher Machiavellianism to be positively associated with the amount of details reported by the interviewees and as a consequence of moderating the veracity effect, and that the difference between truth tellers and lie tellers might be smaller at higher levels of Machiavellianism than at lower levels.

Method

Participants

The study was advertised as an investigative interviewing study. Participants were reached through various psychology courses. People agreeing to participate were not rewarded, but were motivated to perform well in the experiment. This was done by telling them that their efforts in performing well were important for the development of effective interviewing techniques and by measuring their level of motivation.

In total, we collected data from 72 participants (all from the same country), 69% of whom were females. Their age ranged from 20 to 60 years old ($M = 27.38$, $SD = 9.63$). Four were married, 32 were engaged in a stable relationship, 32 were not married and four were single. As for education, 3% of the participants had a middle school certificate, 40% had a high school diploma, whereas the rest had a university-level education. Further, 50% of the participants were university students, 15% were working-students, two participants were unemployed, and the rest were active workers.

Procedure and Design

We employed a 3 (Interview: ECI vs. CI-CCR vs. 5Ws-CI) × 2 (Veracity: truth tellers vs. lie tellers) between-subjects design. For the interview condition, participants were interviewed through the ECI, the CCR, or the 5Ws-CI. For the veracity condition, participants were either required to truthfully report what they had seen in the video or to lie about it.

An a-priori sample size calculation conducted in GPowe[1], setting α at .05, power at .80, and an effect size of medium magnitude of f² (0.25) and seven predictors (the three predictors plus the two and three-ways interactions[2]) returned a required minimum sample size of 66.

The study was approved from the ethical board of the University of Rome LUMSA and in accordance with the Italian psychological association (reference not reported for blind review), the Declaration of Helsinki (AIP, 2015; World Medical Association, 2001), and the guidelines of the American Psychological Association.

Those who decided to participate were contacted through social media groups and were provided with a link that allowed access to the Doodle platform, where they could book their interview. The same platform contained the link to access a Google Meet call. The interviews were conducted online, as internet transforms how we communicate (Braeutigam, 2006), and there is a growing interest in exploring online investigative interviewing (Hamilton et al., 2017; Nash et al., 2014; Taylor & Dando, 2018). Participants were randomly assigned to one of the three interview groups (ECI, CCR, 5Ws-CI) and the veracity condition (truth, lie). First, the experimenter instructed the participants to read the informed consent form. If the subjects accepted to participate in the experiment, they were instructed to indicate in a Google Forms a self-generated code to allow the tracking of the participant and the participant number. After this first phase, the participants saw a video of a bank robbery with hostages, which they were warned to pay attention to. The participants were presented with a sequence from a movie depicting a bank robbery with hostages, lasting approximately 6 minutes. The presentation of the movie was conducted equally across all conditions. It is worth noting that the clip contained no extreme violence scenes and participants were informed that they could leave the experiment at any time and for any reason. Furthermore, participants were either instructed to report honestly what they had observed in the video (e.g., "You are going to be interviewed about what you have just seen. Since we are testing the effectiveness of specific interviewing techniques, we ask you

to tell the truth during the interview. Your efforts in properly performing the task are very important for the development of an effective interviewing strategy") or to lie about it as believably as possible (e.g., "You are going to be interviewed about what you have just seen. Since we are testing the effectiveness of specific interviewing techniques, we ask you to lie as believably as possible during the interview. Your efforts in properly performing the task are very important for the development of an effective interviewing strategy"). It was also made clear that the interviewer was unaware of the content of the video. The experimenter then left the call and the interviewer appeared and interviewed the participants according to the interviewing condition to which they were randomly assigned. The questionnaire was filled in after the interviews took place.

Interviews and Coding

The interviews were conducted by a research assistant who was trained by two experts in the topics (first and last authors). Also, the interviewer was blind to the experimental conditions and to the aims of the study.

The Interviews included seven phases: i) rapport building (e.g., "Your input is important, as only you having reviewed the video can explain to me what happened…"); ii) free storytelling (e.g., "I kindly ask you to report anything you remember about the video…"; iii) open questions (e.g., if the participants talk about a weapon they were asked to describe it); iv) second story (e.g., "…tell me about the last episode you remember, then tell me about the previous one, etc…"; v) third story (e.g., "I ask you again to tell me about the video from the perspective of…"; vi) summary e.g., "I will summarize your story so correct me if I make any mistakes…."; vii) closure (e.g., "I thank you for your work, it was very helpful…".

The ECI condition included the four mnemonics: context reinstatement (phase i), report everything (phase ii), change order (phase iii), and change perspective (phase iv). The other procedures contained the same recovery strategies – in the same steps – except for the mnemonic change order, excluded for the reasons described above. The change of perspective was preserved, although it is considered controversial, as previously stated, because only by eliminating one technique at a time it is possible to analyse its effectiveness. In this case, the mnemonic of change order was excluded in this study, as it is criticized even in the credibility research area (Dando, Ormerod, et al., 2011; Dando, Wilcock, et al., 2011; Dando et al., 2009). Indeed, in the CCR condition, during the second recall (phase iv), the participants were asked to remember the video by organizing their memory into categories: objects, position of objects, people, position of people, actions, conversations, and sounds (e.g., "I ask you to organize the recollection into categories… first tell everything you remember about the objects you saw in the video…"). In the 5Ws-CI condition, instead of changing the order (phase iv), the interviewer proceeded by dividing the participant's narrative into three time steps – before, during, after the event X – within which he asked questions based on the 5Ws (e.g., "tell me everything you remember about who was present in this part of the video". All interview scripts can be found in the Supplementary Material.

At the end of this phase, the interviewer left the call and the experimenter returned. From this moment the last phase began, relating to the participant filling in a questionnaire that evaluated the role of psycho-social factors in the effectiveness of the interview. All subjects were instructed to answer all questions honestly.

Once all the interviews were conducted, two coders [blinded to the experimental condition and hypotheses] coded all interviews. To determine the level of agreement between them inter-rater reliability was calculated on 100% of the transcripts using a two-ways random, single measure (model ICC 2.1). The results showed that the ICC ranged from .69 to .95, indicating a sufficiently high degree of agreement. Subsequent analyses were based on responses from only one coder, randomly selected. The coding process utilised a checklist that contained all information presented in the video. The information was divided into units and recorded in a coding grid that categorised the information into five units: objects, actions, sounds, people, places, and temporal information. A total of 398 items were identified and coded from the audio recordings of each participant. The study involved counting the number of accurate and inaccurate and made-up details in a given sentence. For instance, the sentence "five boys arrived in a white van" contains six details: five, boys, arrived, in, a (indicating one van), and white. Also, since some participants might be more talkative than others and show individual differences (Schutte et al., 2021), accuracy was also calculated as correct details/total details.

Measures

The first questionnaire concerned the interview experience: the subject had to indicate the degree of agreement on a 5-point Likert scale, 1= *strongly disagree*, 2 = *disagree*, 3 = *neither yes nor no*, 4 = *agree*, and 5 = *strongly agree*. This questionnaire investigated the level of motivation, nervousness, perceived interview difficulty, previous knowledge of the videoclip, and the amount of lying.

The second questionnaire was the Italian version of the Machiavellian Personality Scale (Bianchi & Mirkovic, 2020). Machiavellianism indicates the prestige for oneself, the propensity to distrust others, engage in amoral manipulation, and seek to control others (Dahling et al., 2009). The questionnaire contains four subscales: amorality, desire for control, desire for status, and distrust. The four subscales themselves load on a general Machiavellianism second order factor. The translated version of the original validation paper (Bianchi & Mirkovic, 2020) showed a reliability of α = .86; reliability of the present study was α = .87. The participant had to indicate their degree of agreement in a range from 1 to 5 (1 = *strongly disagree*, 5 = *strongly agree*), but a total score can be computed by summing up all the answers.

Results

Preliminary Analyses and Manipulation Checks

Participants' motivation was high and almost at the maximum possible score of 5 (M = 4.51, SD = 0.63), whereas their nervousness (M = 2.03, SD = 1.24), perceived interviewing task difficulty (M = 2.67, SD = 1.19), and knowledge of three video clips (M = 2.06, SD = 1.56) were low. ANOVAs showed that no statistically significant results appeared for the above variables when considering the interview condition main effect and the interview condition by veracity interaction (see Table 1). The main effect of veracity was significant for nervousness and perceived interview difficulty. In line with previous research (Zuckerman et al., 1981), truth tellers felt less nervous and perceived the interview to be less difficult than lie tellers. Further, the main effect of veracity was also significant for lying, with lie tellers lying more than truth tellers, indicating that the participants complied with the experimental condition (see Table 1).

To examine whether the trained interviewer consistently interviewed the participants, a series of Mann-Whitney *U*-tests were conducted. To do so, within each experimental condition the participants were divided into two subsamples that were set as the independent variables. The dependent variables were total amount of information, correct details, incorrect details, made-up details, and accuracy. None of the tests was significant (see Table 2), which indicates that the interviewer conducted the interviews in a consistent manner.

Table 1. Manipulation Checks Analyses and Descriptives

	$F(df)$			$M(SD)$	
	Interview condition	Veracity	Interview condition* veracity	Truth tellers	Lie tellers
Motivation	0.65	0.86	0.45	4.44 (0.69)	4.58 (0.55)
Nervousness	0.32	13.50***	1.16	1.53 (0.97)	2.53 (1.30)
Perceived interview difficulty	0.22	5.99*	1.22	2.33 (1.01)	3.00 (1.26)
Previous knowledge of the video clip	1.73	0.83	0.85	2.22 (1.61)	1.89 (1.53)
Lying	1.54	321.64***	0.90	1.03 (0.17)	3.81 (0.92)

*$p < .05$, ***$p < .001$.

Table 2. Mann-Whitney U-tests for Interviewer's Consistency

	Mann-Whitney U	p
Total amount of information	627.50	.822
Accurate details	634.00	.879
Inaccurate details	573.50	.399
Made-up details	631.50	.852
Accuracy	614.00	.706

Hypothesis Testing

Information Elicitation

Total Amount of Information. A general linear model was employed to test $H$1 and $H$2. The interview condition, the veracity condition, Machiavellianism, and all possible interactions were the factors; the total number of details (obtained by summing up correct, wrong/falsified, and made-up details) was the dependent variable. The model explained 74% of the variance and was statistically significant, $F(11, 60) = 15.67$, $p < .001$, $\eta_p^2 = .742$. Further, the interview condition, $F(2, 60) = 11.66$, $p < .001$, $\eta_p^2 = .280$, veracity, $F(1, 60) = 103.50$, $p < .001$, $\eta_p^2 = .633$, and the interaction effect between the interview condition and veracity, $F(2, 60) = 8.12$, $p < .001$, $\eta_p^2 = .213$, were significant. Machiavellianism did not appear to be associated to the dependent variable to a statistically significant level, $F(1, 60) = 0.14$, $p = .71$, $\eta_p^2 = .002$, nor did it interact with veracity, $F(1, 60) = 0.99$, $p = .32$, $\eta_p^2 = .016$; on the contrary it interacted with the interview condition, $F(2, 60) = 5.25$, $p = .008$, $= .149$. Furthermore, the three way interaction was also statistically significant, $F(2, 60) = 9.46$, $p < .001$, $\eta_p^2 = .240$.

A post hoc test shows that the mean difference in the number of information collected with CCR and 5Ws-CI was of 0.16; on the contrary, a difference of 24.88 was observed between the ECI and 5Ws-CI condition; finally between ECI and CCR there was a difference of 25.04. Participants in the CCR condition (est. marg. $M = 84.52$, $SE = 5.14$, $M = 79.79$, $SD = 49.90$) reported more information than participants in the ECI condition (est. marg. $M = 51.51$, $SE = 5.08$, $M = 54.75$, $SD = 31.02$), $t(60) = -4.57$, $p < .001$, $d = 0.60$, supporting

hypothesis H1b. Similarly, participants in the 5Ws-CI condition (est. marg. $M = 77.39$, $SE = 4.91$, $M = 79.63$, $SD = 39.99$) reported more information than participants in the ECI condition, $t(60) = -3.67$, $p < .001$, $d = 0.69$. However, no significant difference appeared when comparing the CCR and the 5Ws-CI interview conditions, $t(60) = 1.00$, $p = .32$, $d = 0.00$, hence hypothesis H1a was not supported.

As for the effect of veracity, truth tellers (est. marg. $M = 100.77$, $SE = 4.17$, $M = 100.78$, $SD = 37.62$) reported more detail than lie tellers (est. marg. $M = 41.51$, $SE = 4.07$, $M = 42.00$, $SD = 20.31$), $t(60) = -10.17$, $p < .001$, $d = 1.94$. In particular, honest participants in the CCR and 5Ws-CI conditions reported the most information (respectively, $M = 118.42$, $SD = 40.90$ and $M = 112.67$, $SD = 22.44$, $d = 0.17$) compared to honest participants in the ECI condition ($M = 71.25$, $SD = 29.70$, $d_{CCR} = 1.95$, $d_{5Ws-CI} = 1.57$). In all three interview conditions, lie tellers reported fewer details (ECI $M = 38.25$, $SD = 23.16$; CCR $M = 41.17$, $SD = 16.70$; 5Ws-CI $M = 46.58$, $SD = 21.41$; $d_{ECI-CCR} = 0.13$, $d_{CCR-5Ws-CI} = 0.36$, $d_{CCR-5Ws-CI} = 0.28$). A greater difference between honest and liars was observed in the CCR ($d = 2.47$) and 5Ws-CI ($d = 3.01$) than in the ECI ($d = 1.24$). However, considering that as reported above there was no moderating role of Machiavellianism, $H$2 was only partially supported.

Last, when looking at the three-way interaction through simple effect analyses, the number of total details reported by truth tellers and by lie tellers statistically differed in all three interviewing conditions when the Machiavellianism was at its mean or 1 standard deviation below it. On the contrary, for participants scoring 1 standard deviation above the mean of Machiavellianism, the difference between truth tellers and lie tellers was still statistically different for the CI-CCR and the 5Ws-CI but not significant for the standard CI, indicating that these two interviewing techniques might still elicit differences between truth tellers and lie tellers when interviewees show high levels of Machiavellianism[3] (see Table 3).

Accuracy: Correct, Wrong, and Made-up Details. When focusing on participants' accuracy we found the following. For details correctly reported, the pattern was identical to that of the total number of details. This model explained 79% of the variance and was statistically significant, $F(11, 60) = 20.55$, $p < .001$, $\eta_p^2 = .790$. The interview condition, $F(2, 60) = 11.63$, $p < .001$, $\eta_p^2 = .279$, veracity, $F(1,$

Table 3. Three-ways Interaction Analyses for Total Details

Machiavellianism	Interview condition	Contrast	Estimate		95% Confidence Interval Lower	Upper	B	df	t	p
Mean − 1SD	ECI	Truth tellers - lie tellers	-54.19	14.00	-82.20	-26.18	-1.29	60.00	-3.87	<.001
	CCR	Truth tellers - lie tellers	-56.15	14.16	-84.48	-27.83	-1.33	60.00	-3.97	<.001
	5Ws-CI	Truth tellers - lie tellers	-87.25	15.15	-117.55	-56.95	-2.07	60.00	-5.76	<.001
Mean	ECI	Truth tellers - lie tellers	-28.47	10.16	-48.78	-8.15	-0.68	60.00	-2.80	.007
	CCR	Truth tellers - lie tellers	-86.27	10.28	-106.84	-65.69	-2.05	60.00	-8.39	<.001
	5Ws-CI	Truth tellers - lie tellers	-63.05	9.82	-82.69	-43.41	-1.50	60.00	-6.42	<.001
Mean + 1SD	ECI	Truth tellers - lie tellers	-2.74	17.49	-37.73	32.25	-0.06	60.00	-0.16	.876
	CCR	Truth tellers - lie tellers	-116.38	13.24	-142.86	-89.90	-2.76	60.00	-8.79	<.001
	5Ws-CI	Truth tellers - lie tellers	-38.85	17.27	-73.39	-4.31	-0.92	60.00	-2.25	.028

Note. ECI = enhanced cognitive interview; CCR = category clustering recall; 5Ws-CI = 5Ws cognitive interview.

Table 4. Three-ways Interaction for Correctly Reported Details

Moderator Levels					95% Confidence Interval					
Machiavellianism	Interview condition	Contrast	Estimate	SE	Lower	Upper	B	df	t	p
Mean – 1 – SD	ECI	Truth tellers - lie tellers	-62.02	13.74	-89.51	-34.54	-1.35	60.00	-4.51	<.001
	CCR	Truth tellers - lie tellers	-63.84	13.90	-91.64	-36.05	-1.39	60.00	-4.59	<.001
	5Ws-CI	Truth tellers - lie tellers	-100.90	14.86	-130.63	-71.16	-2.20	60.00	-6.79	<.001
Mean	ECI	Truth tellers - lie tellers	-39.78	9.97	-59.72	-19.85	-0.87	60.00	-3.99	<.001
	CCR	Truth tellers - lie tellers	-95.76	10.09	-115.95	-75.58	-2.09	60.00	-9.49	<.001
	5Ws-CI	Truth tellers - lie tellers	-74.89	9.64	-94.16	-55.61	-1.63	60.00	-7.77	<.001
Mean + 1 – SD	ECI	Truth tellers - lie tellers	-17.54	17.17	-51.88	16.79	-0.38	60.00	-1.02	.311
	CCR	Truth tellers - lie tellers	-127.68	12.99	-153.67	-101.70	-2.78	60.00	-9.83	<.001
	5Ws-CI	Truth tellers - lie tellers	-48.88	16.94	-82.77	-14.99	-1.07	60.00	-2.88	.005

Note. ECI = enhanced cognitive interview; CCR = category clustering recall; 5Ws-CI = 5Ws cognitive interview.

$60) = 150.60$, $p < .001$, $\eta_p^2 = .715$, and the interaction effect between the interview condition and veracity, $F(2, 60) = 7.98$, $p < .001$, $\eta_p^2 = .210$, were significant. Machiavellianism was not statistically associated to the dependent variable, $F(1, 60) = 0.07$, $p = .79$, $\eta_p^2 = .001$. Also, it did not interact with veracity, $F(1, 60) = 0.70$, $p = .41$, $\eta_p^2 = .011$, but it did interact with the interview condition, $F(2, 60) = 5.43$, $p = .007$, $\eta_p^2 = .153$. The three way interaction was also statistically significant, $F(2, 60) = 10.13$, $p < .001$, $\eta_p^2 = .252$.

Participants in the CCR condition (est. marg. $M = 77.83$, $SE = 5.05$, $M = 72.67$, $SD = 53.83$) reported more accurate information than participants in the ECI condition (est. marg. $M = 44.26$, $SE = 4.98$, $M = 47.13$, $SD = 33.78$), $t(60) = -4.73$, $p < .001$, $d = 0.57$. Similarly, participants in the 5Ws-CI condition (est. marg. $M = 66.39$, $SE = 4.82$, $M = 68.79$, $SD = 45.45$) reported more information than those in the ECI condition, $t(60) = -3.19$, $p < .001$, $d = 0.54$. However, no significant difference appeared when comparing the CCR and the 5Ws-CI interview conditions, $t(60) = 1.64$, $p = .11$, $d = 0.08$.

Concerning the effect of veracity, truth tellers (est. marg. $M = 97.90$, $SE = 4.09$, $M = 97.75$, $SD = 37.53$) reported more accurate details than lie tellers (est. marg. $M = 27.75$, $SE = 3.99$, $M = 27.97$, $SD = 18.95$), $t(60) = -12.27$, $p < .001$, $d = 2.35$.

When looking at the three-way interaction through simple effect analyses, the number of accurate total details reported by truth tellers and by lie tellers statistically differed in all three interviewing conditions when the Machiavellianism was at its mean or 1 standard deviation below it. On the contrary, for participants scoring 1 standard deviation above the mean of Machiavellianism, the difference between truth tellers and lie tellers was still statistically different for the CCR and the 5Ws-CI but not significant for the ECI, indicating that these two interviewing techniques might still elicit differences between truth tellers and lie tellers when interviewees show high levels of Machiavellianism (see Table 4).

When focusing on distorted (inaccurate) details, the model explained only 27% of the variance, $F(11, 60) = 2.04$, $p = .039$, $\eta_p^2 = .273$. Further, only veracity showed a statistically significant effect, $F(1, 60) = 12.11$, $p < .001$, $\eta_p^2 = .178$, with truth tellers reporting fewer (est. marg. $M = 2.15$, $SE = 0.91$, $M = 2.25$, $SD = 4.07$) of these details than lie tellers (est. marg. $M = 6.56$, $SE = 0.88$, $M = 6.53$, $SD = 5.88$), $d = -0.87$. The main effect for the interview condition, $F(2, 60) = 2.66$, $p = .078$, $\eta_p^2 = .81$, Machiavellianism, $F(1, 60) = 0.06$, $p = .813$, $=.001$, the Interview × Veracity interaction, $F(2, 60) = 0.55$, $p = .058$, $=.018$, the Interview × Machiavellianism interaction, $F(2, 60) = 0.10$, $p = .905$, $\eta_p^2 = .003$, the Veracity × Machiavellianism interaction, $F(1, 60) = 0.12$, $p = .727$, $\eta_p^2 = .002$, and the three-way interaction, $F(2, 60) = 1.12$, $p = .334$, $\eta_p^2 = .036$, were all not significant.

An identical outcome was reached when focusing on made-up details, which explained 41% of the variance, $F(11, 60) = 3.77$, $p < .001$, $\eta_p^2 = .409$. Also here veracity was the only significant effect, $F(1, 60) = 30.09$, $p < .001$, $\eta_p^2 = .334$, (Truth tellers: est. mar. $M = 0.72$, $SE = 0.85$,

$M = 0.78$, $SD = 1.66$; lie tellers: est. marg. $M = 7.20$, $SE = 0.82$, $M = 7.50$, $SD = 6.22$), $d = -1.48$. The main effect for the interview condition, $F(2, 60) = 0.76$, $p = .473$, $\eta_p^2 = .025$, Machiavellianism, $F(1, 60) = 0.10$, $p = .751$, $= .002$, the Interview × Veracity interaction, $F(2, 60) = 0.38$, $p = .685$, $\eta_p^2 = .013$, the Interview × Machiavellianism interaction, $F(2, 60) = 0.21$, $p = .811$, $\eta_p^2 = .007$, the Veracity × Machiavellianism interaction, $F(1, 60) = 0.24$, $p = .628$, $= .004$, and the three-way interaction, $F(2, 60) = 0.25$, $p = .777$, $\eta_p^2 = .08$ were not significant.

Last, when looking at accuracy scores (accurate details/total details), the model explained 60% of the variance and was statistically significant, $F(11, 60) = 8.17$, $p < .001$, $\eta_p^2 = .600$. Furthermore, among all effects, only that of veracity was statistically significant, $F(1, 60) = 75.57$, $p < .001$, $\eta_p^2 = .557$, with truth tellers (est. marg. $M = 0.97$, $SE = 0.03$, $M = 0.97$, $SD = 0.04$) being more accurate than lie tellers (est. marg. $M = 0.65$, $SE = 0.03$, $M = 0.65$, $SD = 0.19$), $t(60) = -8.69$, $p < .001$, $d = 2.33$. The main effect for the interview condition, $F(2, 60) = 1.24$, $p = .298$, $= .040$, Machiavellianism, $F(1, 60) = 0.02$, $p = .896$, $\eta_p^2 = .000$, the Interview × Veracity interaction, $F(2, 60) = 0.57$, $p = .571$, $\eta_p^2 = .018$, the Interview × Machiavellianism interaction, $F(2, 60) = 0.02$, $p = .976$, $\eta_p^2 = .001$, the Veracity × Machiavellianism interaction, $F(1, 60) = 0.05$, $p = .829$, $\eta_p^2 = .001$, and the three-way interaction, $F(2, 60) = 0.14$, $p = .872$, $\eta_p^2 = .005$ were all not significant.

Lie Detection

To explore the veracity discrimination accuracy of the three techniques we conducted a binary logistic regression with the veracity as the outcome variable and the number of total details as the predictor, one for each interviewing technique. The three models were significant: ECI , $\chi^2(1) = 8.12$, $p = .004$, Cox & Snell's $R^2 = .29$, Nagelkerke's $R^2 = .38$, $Z = -2.32$, $p = .02$, classification accuracy .83; CCR, $\chi^2(1) = 24.91$, $p < .001$, Cox & Snell's $R^2 = .65$, Nagelkerke's $R^2 = .86$, $Z = -1.99$, $p = .04$, classification accuracy .92; 5Ws-CI, $\chi^2(1) = 23.37$, $p < .001$, Cox & Snell's $R^2 = .62$, Nagelkerke's $R^2 = .83$, $Z = -2.47$, $p = .01$, classification accuracy .92. These results partially supported *H*3.

Discussion

The goal of this study was to compare different interviewing techniques and to examine their effectiveness through measuring the amount of information reported by honest and liar participants and how well they could discriminate truth tellers from lie tellers.

The results showed that there was a significant difference in the amount of information reported by the participants based on the type of interview they were administered. Specifically, the number of details remembered in the classic ECI was lower than that obtained in the CI-CCR and 5Ws-CI conditions, this difference being observed especially for truth tellers. In line with our predictions, participants

in the CCR condition reported more (total and accurate) information than participants in the ECI condition, without impacting on accuracy; however, no significant difference emerged between the CCR and 5Ws-CI interview conditions. This latter result was unexpected but it can be interpreted on the basis of the spreading activation theory (Collins & Loftus, 1975). Indeed, both techniques entail correct and clear instructions that are compatible with participants' mental organisation of memory, bringing to a similar recall. In other words, although different questions are asked in the CCR and the 5Ws-CI, it is possible that both activate the same memory recall processes and that interviewees benefit from questions that cluster together similar or highly related information, regardless of whether such questions focus on the categories of the questions. Such an interpretation implies that the interviewer can ask questions that aim at obtaining specific information (Porter & Salvanelli, 2020). For example, in case the main goal of the interview is to collect information about the people involved in a crime and their activities, the interviewer can ask "Who" and "What" questions after the interviewee has provided a first free recall. On the contrary, if more information about objects that were present at a crime scene were required, the interviewer can ask for information that pertains to objects. In this regard, it is interesting to note that the act of asking "cluster" questions (regardless of its content) is effective not only because, clearly, the interviewee is asked to provide that very specific information (as for example about objects). It is also effective because cluster questions might help memory recall due to the networking nature of memory, whereby remembering a piece of information might trigger the recall of an additional, related, piece of information. A similar conclusion was reached by Porter et al. (2018), who found that a model statement focused on spatial details elicited more spatial details than a model statement focused on temporal detail, and the other way around.

Notwithstanding the above, we cannot exclude that the length of the 5Ws-CI technique, which was longer and took more time than the CCR (the CCR lasted an average of 23 minutes while the interview with 5Ws-CI lasted an average of 37 minutes), could have caused fatigue in the interviewees, not allowing them to report additional information. Also, because of the iterative nature of questioning in the 5Ws-CI technique, participants may have thought they were making mistakes and preferred repeating information that they had already provided. For this reason, a future perspective may be to replicate the experiment and also to compare a shorter version of the 5Ws-CI technique to a longer version. In any case, also when considering its limitations, this 5Ws-CI technique could have potential and could be studied in more detail and refined as it allowed to improve the effectiveness of the classic Cognitive Interview.

When focusing on the veracity effect, we found that truth tellers reported more details than lie tellers, which is consistent with previous literature on the topic (Sporer & Schwandt, 2006; Vrij et al., 2017). Also, our results indicated that the CCR and 5Ws-CI techniques outperformed the ECI when looking at differences between truth tellers and lie tellers, particularly when dealing with interviewees with high levels of Machiavellianism. In short, although with low to average levels of Machiavellianism the difference in details between truth tellers and lie tellers was significant for all the three interviewing techniques, this was not the case for high levels of Machiavellianism. In this situation, the difference between truth tellers and lie tellers was significant only for the CCR and the 5Ws-CI. These results support the assumption that Machiavellianism makes better liars (Hart et al., 2020; Palena et al., 2021; Palena et al., 2023), as with the ECI high Machiavellian liars could not be discriminated by high Machiavellian truth tellers, as well as that interviewers can deal with this by adopting effective interviewing strategies (as high Machiavellian liars were distinguishable from high Machiavellian truth tellers in the CCR and 5Ws-CI techniques conditions).

The reason behind liars' inability to lie successfully in the CCR and 5Ws-CI conditions might be explained on the basis of the memory processes that are exploited in these interviewing techniques as well as on strategy selection. Concerning the former, if there is not a real memory trace the clustering of information cannot help lie tellers' recall. Simply put, there is no memory network to activate to help recall. Concerning the latter, liars usually prepare themselves for the interview (Verigin et al., 2019) and the request to cluster information can catch liars unprepared for this, with the consequence of them having difficulties changing their story on the spot and making them discernible from truth tellers.

The better performance of the CCR and the 5Ws-CI techniques is also reflected in the logistic regressions analyses, where the CCR and the 5Ws-CI brought to higher accuracy rates (92%) than with the ECI (83%). In this regard, however, it is important to note that the high accuracy rates should be taken with great caution as they: i) are statistically driven, meaning that humans' lie detection abilities can differ for these figures, and ii) cannot be generalised to other samples. Indeed, our sample was too small to conduct any informative cross-validation analyses.

Regarding inaccurate information, the results indicate truthfulness as the only statistically significant factor, with honest participants reporting fewer distorted details than liars. Similarly, when examining made-up details, truthfulness is again the only significant factor with truth tellers reporting fewer made-up details than lie tellers. No other main or interaction effects are significant in either case. Consequently, the truthfulness of information significantly affects the amount of incorrect information. This is because being more likely to provide accurate information tends to provide less distorted or invented details (Sporer & Schwandt, 2006). Also, the veracity effect on inaccurate and made-up details can be explained by our experimental procedure: as lie tellers were required to lie, they were more likely to report these types of details.

Limitations

Our study had several limitations. First, although we evaluated the moderating role of Machiavellianism, we did not account for other potentially moderating variables related to the interviewee. This is relevant as research suggests that the efficacy of any interviewing technique can vary due to interpersonal and contextual differences, which should be accounted for (Caso et al., 2023; Palena & Caso, 2021). Second, we did not offer a reward to the participants, yet high stakes situations might differ from low stake situations as a lab experiment. Third, we did not test the efficacy of the three interviewing techniques in face to face interactions. Fourth, an immediate recall was used and, although research shows that our memory is most subjected to forgetting immediately after the event and then "levels off" while time passes, it is important to take into account the possible effect of delayed recall on the efficacy of the three techniques (Ryan & Frankland, 2022; Wixted & Ebbesen, 1991). Future research should thus deal with the limitations of our study and aim at further refining and shortening the 5Ws-CI to make it more effective.

Conclusions

In the present experiment, we compared the efficacy of the ECI, the CCR, and the newly developed 5Ws-CI interviewing techniques on interview outcomes. Interestingly, we found that the CCR and the 5Ws-CI outperformed the ECI in terms of the number of details reported by the interviewees, without negatively affecting recall accuracy, and in terms of lie detection, although the CCR and the 5Ws-CI did not differ one another. The results thus indicate that it is possible to develop interviewing techniques on the basis that are based on the spreading activation theory (Collins & Loftus,

1975) while benefiting from it, regardless of how the request to cluster information is presented. This has practical implication as interviewing techniques developed based on the spreading activation theory might be potentially applied with real-life witnesses, although it is of foremost importance to first accumulate more evidence on this topic.

Conflict of Interest

The authors of this article declare no conflict of interest.

Notes

[1] Test family: *F*-test; Statistical test: linear multiple regression. A moderate effect size was entered in the analysis as we were interested in effects that are practically relevant.

[2] Although the design involved three independent variables (interview conditions, veracity conditions, and Machiavellianism) and six groups in total given by the multiplication of the three interview conditions with the two veracity conditions, we employed a full model to account for all possible two-ways and the three-ways interactions. This resulted in seven predictors in the model: interview condition, veracity, Machiavellianism, interview * veracity, interview * Machiavellianism, veracity * Machiavellianism, and interview * veracity * Machiavellianism.

[3] Three-ways interaction analyses for total details.

Author Contributions

Conceptualization, first and second authors; methodology, first and second authors; formal analysis, all authors; investigation, third and fourth authors; data curation, third and fourth authors; writing original draft preparation, first, second, and third authors; writing-review and editing, all authors. All authors read and agreed upon the published version of the manuscript.

Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki for studies involving humans, the guidelines of the American Psychological Association and those of the country where the data were collected (Italy). The study was approved by the Ethics Committee of the Lumsa University of Rome.

Data Availability

Raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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Supplementary Material

Interviews Scripts

Enhanced Cognitive Interview

Phase One

"Hello, welcome, how are you?".
The participant replies.
"You are participant number.... , I remind you that as indicated in the informed consent the interview will be recorded."
"My role is to ask you some questions regarding the video you just watched. Your input is important as only you, having reviewed the video, can explain to me what happened in the video. Before I begin, I will give you some information: it is important that you report everything you remember, even what may seem irrelevant to you, at your own pace and even taking pauses if you feel the need. Is everything clear?".
Yes: The interviewer proceeds to the next point.
No: The interviewer answers the interviewee's questions.

Phase Two

"Well if everything is clear we can start with the interview. First, I kindly ask you to report everything you remember about the video, in whatever order you prefer. In doing so, I ask you to try to remember the moment you saw the video, picture the crime scene in your mind as clearly as you can, and picture all the sounds, objects, people, what happened, and what you felt. Well, go ahead and tell me everything you can remember."
The interviewer listens without interrupting the participant.

Phase Three

"Perfect, now I'm going to ask you a few questions..." (questions are asked according to the narrative: e.g., if the participant talks about the robbers' weapons the interviewer may ask, "Describe the weapon to me by helping you with mental images, close your eyes if you want and think about the color of the weapon, its shape and when you have a complete picture in your mind describe everything you remember.").
The interviewer listens without interrupting.

Phase Four

"Well, now I will ask you to tell me again what happened in the video. This time I ask you to do it in a reverse order: that is, tell me about the last episode you remember, then tell me about the previous one, etc. Although it may seem repetitive to you, it is very important that you tell me again what happened in the video, also I ask you to report to me not only the new information that comes to your mind but also all the data that you have already reported to me."
The interviewer listens without interrupting.

Phase Five

"Very well, thank you. Now, I know this may seem repetitive, but I ask you to tell me about the video from the perspective of... (one of the subjects mentioned by the participant).
The interviewer listens without interrupting.

Phase Six

"Now, I will summarize your story so correct me if I make any mistakes and interrupt me if you remember any new details."
The interviewer summarizes.
"Well, if you have any questions for me please ask me."
Yes: The interviewer replies

Phase Seven

No: "I thank you for your work, it was very helpful. You don't have to disconnect because I will call my colleague and you can continue the experiment with her. Goodbye and have a nice day."

Category Clustering Recall

Phase One

"Hello, welcome, how are you?".
The participant replies.

"You are participant number...., I remind you that as indicated in the informed consent the interview will be recorded."

"My role is to ask you some questions regarding the video you just watched. Your input is important as only you, having reviewed the video, can explain to me what happened in the video. Before I begin, I will give you some information: it is important that you report everything you remember, even what may seem irrelevant to you, at your own pace and even taking pauses if you feel the need. Is everything clear?".

Yes: The interviewer proceeds to the next point.

No: The interviewer answers the interviewee's questions.

Phase Two

"Well if everything is clear we can start with the interview. First, I kindly ask you to report everything you remember about the video, in whatever order you prefer. In doing so, I ask you to try to remember the moment you saw the video, picture the crime scene in your mind as clearly as you can, and picture all the sounds, objects, people, what happened, and what you felt. Well, go ahead and tell me everything you can remember."

The interviewer listens without interrupting the participant.

Phase Three

"Perfect, now I'm going to ask you a few questions..." (questions are asked according to the narrative: e.g. if the participant talks about the robbers' weapons the interviewer may ask, "Describe the weapon to me by helping you with mental images, close your eyes if you want and think about the color of the weapon, its shape and when you have a complete picture in your mind describe everything you remember.").

The interviewer listens without interrupting.

Phase Four

"Well, now I will ask you to tell me again what happened in the video. This time, however, I ask you to organize the recollection into categories of information. Let's proceed one step at a time, first tell everything you remember about the objects you saw in the video and describe them one by one."

The interviewer listens without interrupting.

"Perfect, now I ask you to describe the location of these objects."

The interviewer listens without interrupting.

"Good, now I ask you to tell me about the people you saw in the video."

The interviewer listens without interrupting.

"Perfect, now I ask you to describe to me the positions of these people."

The interviewer listens without interrupting.

"Good, now I ask you to tell me about the actions depicted in the video."

The interviewer listens without interrupting.

"Good, now I ask you to focus on the conversations, what did the subjects in the video talk about?"

The interviewer listens without interrupting.

"Perfect, now I ask you to tell me what other sounds you heard."

The interviewer listens without interrupting.

Phase Five

"Very well, thank you. Now, I know this may seem repetitive, but I ask you to tell me about the video from the perspective of... (one of the subjects mentioned by the participant)."

The interviewer listens without interrupting.

Phase Six

"Now, I will summarize your story so correct me if I make any mistakes and interrupt me if you remember any new details."

The interviewer summarizes.

"Well, if you have any questions for me please ask me."

Yes: The interviewer replies.

Phase Seven

No: "I thank you for your work, it was very helpful. You don't have to disconnect because I will call my colleague and you can continue the experiment with her. Goodbye and have a nice day."

5Ws-CI

Phase One

"Hello, welcome, how are you?".

The participant replies.

"You are participant number.... , I remind you that as indicated in the informed consent the interview will be recorded."

"My role is to ask you some questions regarding the video you just watched. Your input is important as only you, having reviewed the video, can explain to me what happened in the video. Before I begin, I will give you some information: it is important that you report everything you remember, even what may seem irrelevant to you, at your own pace and even taking pauses if you feel the need. Is everything clear?"

Yes: The interviewer proceeds to the next point.

No: The interviewer answers the interviewee's questions.

Phase Two

"Well if everything is clear we can start with the interview. First, I kindly ask you to report everything you remember about the video, in whatever order you prefer. In doing so, I ask you to try to remember the moment you saw the video, picture the crime scene in your mind as clearly as you can, and picture all the sounds, objects, people, what happened, and what you felt. Well, go ahead and tell me everything you can remember."

The interviewer listens without interrupting the participant.

Phase Three

"Perfect, now I'm going to ask you a few questions..." (questions are asked according to the narrative: e.g. if the participant talks about the robbers' weapons the interviewer may ask, "Describe the weapon to me by helping you with mental images, close your eyes if you want and think about the color of the weapon, its shape and when you have a complete picture in your mind describe everything you remember.").

The interviewer listens without interrupting.

Phase Four

"Good. Now I ask you to focus only on what happened from the beginning of the video to event X (e.g., the beginning of the robbery if the participant had mentioned it). Tell me everything you remember about it."

The interviewer listens without interrupting.

"Good, regarding the next questions, I ask you to focus only on this part of the video and first, I ask you to tell me everything you remember about What happened at this juncture."

The interviewer listens without interrupting.

"Perfect, now tell me everything you remember about Who was present in this part of the video".

The interviewer listens without interrupting.

"Very good. Now tell me about everything you remember about Where, that is the spatial information of the people and objects in this part of the video."

The interviewer listens without interrupting.

"Very good. Now I ask you to tell me everything you remember about When, that is the temporal information, the sequence of events in this part of the video."

The interviewer listens without interrupting.

"Alright, now I ask you to focus only on the central scene of the video, from moment X (e.g. the robbers' intrusion into the bank) until moment X (e.g. when the scene shifts outside the bank). Tell me everything you remember about it."

The interviewer listens without interrupting.

"Good, for the next questions, I ask you to focus only on this part of the video and first, I ask you to tell me everything you remember about What happened at this juncture."

The interviewer listens without interrupting.

"Perfect, now tell me everything you remember about Who was present in this part of the video".

The interviewer listens without interrupting.

"Very good. Now tell me about everything you remember about Where, that is the spatial information of the people and objects in this part of the video."

The interviewer listens without interrupting.

"Very good. Now I ask you to tell me everything you remember about When, that is the temporal information, the sequence of events in this part of the video."

The interviewer listens without interrupting.

"Perfect, I ask you for one last effort. Focus on what happened from moment X (example scene change) until the end of the video. Tell me everything you remember about it."

The interviewer listens without interrupting.

"Good, for the next questions, I ask you to focus only on this part of the video and first, I ask you to tell me everything you remember about What happened at this juncture."

The interviewer listens without interrupting.

"Perfect, now tell me everything you remember about Who was present in this part of the video."

The interviewer listens without interrupting.

"Very good. Now tell me about everything you remember about Where, that is the spatial information of the people and objects in this part of the video."

The interviewer listens without interrupting.

"Very good. Now I ask you to tell me everything you remember about When, that is the temporal information, the sequence of events in this part of the video."

The interviewer listens without interrupting.

Phase Five

"Very well, thank you. Now, I know this may seem repetitive, but I ask you to tell me about the video from the perspective of... (one of the subjects mentioned by the participant)."
The interviewer listens without interrupting.

Phase Six

"Now, I will summarize your story so correct me if I make any mistakes and interrupt me if you remember any new details."
The interviewer summarizes.
"Well, if you have any questions for me please ask me."
Yes: The interviewer replies

Phase Seven

No: "I thank you for your work, it was very helpful. You don't have to disconnect because I will call my colleague and you can continue the experiment with her. Goodbye and have a nice day."