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Corresponding Author:	Catriona Havard, Ph.D. The Open University Milton Keynes, UNITED KINGDOM
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	The Open University
Corresponding Author's Secondary Institution:	
First Author:	Catriona Havard, Ph.D.
First Author Secondary Information:	
Order of Authors:	Catriona Havard, Ph.D.
	Phyllis Laybourn, PhD
	Barbara Klecha, MSc
Order of Authors Secondary Information:	
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The Mystery Man can increase the reliability of eyewitness identifications for older adult witnesses.

Catriona Havard¹, Phyllis Laybourn² & Barbara Klecha²

¹Department of Psychology, The Open University, UK

² School of Life, Sport and Social Sciences, Edinburgh Napier University, Edinburgh, UK.

Address correspondence to:

Catriona Havard

Department of Psychology

The Open University

Walton Hall

Milton Keynes

MK7 6AA

UK

Email: catriona.havard@open.ac.uk

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Abstract

Some groups of eyewitnesses, such as older adults and children, are less likely to correctly reject a target absent (TA) lineup, as compared to younger adults. Previous research reports that using a silhouette in a video lineup called '*the mystery man*' could increase correct rejections for TA lineups for child eyewitnesses, without reducing correct identifications for target present (TP) lineups (Havard & Memon, 2013). The current study, using older and younger adults, investigated whether using the mystery man would also increase the identification accuracy for older adults, without impairing younger adults' identification accuracy. The results found that older adults in the 'mystery man' condition, rejected TA line-ups significantly more often than those in the control condition (52% vs. 24%), with no significant effect upon the TP lineups. For the younger adults', the mystery man had no influence on identification responses for the TA or TP line-ups. Our findings suggest the '*mystery man*' technique may be beneficial for older adults, without detrimentally affecting the accuracy for younger adults, and thus could increase the reliability of eyewitness evidence, where video lineups are employed.

Introduction

As the average age of the population in many countries increases (Office of National Statistics, 2012), a growing number of older adults will become witnesses and view identification parades in the UK (Wilcock, 2009). Over the last few years, more research has begun to examine the accuracy of older adult witnesses, (see Bartlett & Memon, 2007 for a review and Erickson, Lampinen & Moore, 2015, for a meta-analysis) and has explored methods that may improve older adults' eyewitness accuracy (Wilcock & Bull, 2010; 2014). The aim of the current study was to investigate whether a technique previously used to improve children's lineup identifications (Havard & Memon, 2013), namely the use of a silhouette (mystery man) in a lineup would also increase the reliability of older adults' identification decisions. If this technique can increase the reliability of identifications made by older adults and children, without reducing the identification accuracy of younger adults, then it could be employed by the police for witnesses of all age groups.

Older adult witnesses

Research in gerontology make several categories for older adults (young-old, middle-old, old-old), however eyewitness research has tended to use only one inclusive group for older adults being all those over 60 years of age, often comparing them with a group of young adults aged between 20-35 years of age. Therefore all the studies cited here have employed older adults within the 60-85 year age range and not made comparisons within that age range. A number of studies have reported that when a culprit or 'target' is present in a lineup (TP), older adults can identify a target as accurately as younger adults (Memon, Bartlett, Rose & Gray, 2003; Memon & Gabbert, 2003; Memon, Hope, Bartlett & Bull, 2002; Yarmey & Kent, 1980). However, when presented with a lineup where the target is absent (TA), older adults are significantly more likely to make a false identification from a lineup, as compared to younger adults (Havard & Memon, 2009; Memon, et al., 2003; Memon & Gabbert, 2003; Rose, Bull & Vrij, 2003; Rose, Bull & Vrij, 2005; Searcy, Barlett, Memon & Swanson, 2001; Wilcock, Bull & Vrij, 2005; 2007). Bartlett and Memon (2007) reviewed 19 data sets and found no differences in accuracy on TP lineups for older and younger adults, however older adults were significantly less accurate on TA lineups. In a recent meta-analysis, it was reported that young adults were 2.15 times more likely to correctly reject a TA lineup, as compared to older adults (Erickson et al 2015). A field study conducted with real witnesses in Scotland confirmed previous experimental work, finding that older adult witnesses (over 65 years of age) were more likely to choose someone from a lineup who was a known innocent, as compared to those under 65 years of age (Havard, Memon, Chaudhry, Clifford & Gabbert, 2008). Research has also found a similar pattern for child witnesses, who are more likely to make false identifications

from TA lineups, but can be as accurate as young adults for TP lineups (for a review of the literature on child witnesses please see Havard, 2014).

One theoretical explanation for why older adults may be more inclined to choose from a TA lineup as compared to younger adults comes from the cognitive ageing domain and relates to encoding and retrieval issues and dual process theories of recognition. In dual process theories, recognition is often divided into familiarity and recollection based recognition (Yonelinas, 2002). Familiarity is fast, unconscious and based on feelings of familiarity, whilst recollection is slower, conscious and based on contextual details and the source of the information. Memory research suggests that older adults show a decline in conscious recollection processes, but little decline in unconscious familiarity based processes (Prull, Dawes, Martin, Rosenberg & Light, 2006). As a result of this familiarity-based processing, when older adults are presented with a face identification decision, they may rely more on general familiarity (*e.g. I think I've seen this face before*), rather than using a more detailed, conscious decision making process i.e. *Is this person the perpetrator of the crime?* (Bartlett, 1993; Bartlett & Fulton, 1991; Bartlett, Strater, & Fulton, 1991; Memon, et al., 2002). When eyewitnesses base a decision upon general familiarity, this can be beneficial for correct identification from a TP lineup, as there is a good chance the culprit looks familiar to the witness. However, when a witness is faced with a lineup that does not contain the perpetrator, decision making, based on general familiarity may be more likely to lead to a false identification. Memon et al. (2002) found support for the 'familiarity-based strategy' when witnesses were shown mugshots prior to seeing a lineup. They found that those who had viewed the mugshots were more likely to make a false identification from a TA lineup, and choose a critical foil previously seen in the mugbook, as compared to those who had not viewed mugshots. Brewer, Weber and Semmler (2007) suggest that controlling choosing behaviour is the key to maximising eyewitness identification performance. Therefore, if older adults' choosing behaviour can be influenced, so that there is less reliance on general familiarity, it may reduce false identification decisions.

The other main theoretical explanation for why older adults may make more false identifications, relates to meta-cognitive and social factors, and the understanding of the lineup task. When presented with a lineup, eyewitnesses have a strong expectation that the culprit is going to be among the set of faces they are shown (Memon, Hope & Bull, 2003). A study by Malpass and Devine (1981) found that if witnesses were given non-biased instructions they were significantly less likely to make a false identification from a TA lineup (33%), as compared to when they were told the culprit was likely to be in the lineup (78%). A meta-analysis of 18 studies found that if participants

1 were told “*the person may or may not be there*”, there was a decrease in choosing from a TA lineup,
2 leading to increased accuracy (Stebly, 1997). Older adults in particular, assume that the culprit
3 must be present in a lineup, even if they are told ‘*the person may or may not be there*’ (Memon et
4 al., 2003). However, research with older adults has found that even when non-biased instructions
5 are given, older adults still perform more poorly on TA lineups as compared to younger adults.
6 Therefore, an additional factor may be that older adults are more likely to forget the instructions, as
7 compared to younger adults (Rose, Bull & Vrij, 2003; 2005; Wilcock, Bull & Vrij, 2005).
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14 In an attempt to make the non-biased instructions more memorable, so that they could increase
15 older adults’ lineup accuracy, Wilcock, Bull and Vrij (2005) created enhanced instructions. The
16 enhanced instructions involved giving witnesses a hypothetical example of a person who was
17 incorrectly picked from a lineup and convicted of a crime they did not commit. Furthermore, the
18 instructions also described how some prisoners were misidentified from lineups and not released
19 until DNA evidence showed them to be innocent. Wilcock et al (2005) found that although older
20 adults were more likely to have remembered the non-biased instructions in the enhanced condition,
21 their memory for the non-biased instructions was still poorer than that of younger adults .
22 Furthermore, the enhanced instructions did not appear to reduce false identifications from TA
23 lineups. Thus, even when the enhanced instructions were employed, older adults were still less
24 likely to remember them and also more likely to falsely choose someone from a TA lineup, as
25 compared to the younger adults. Further research has shown that even when older adults have
26 remembered hearing the unbiased instructions, they were still more likely to report that they
27 thought the perpetrator would be there. One participant even said ‘*Why ask if the man is not there?*’
28 providing more evidence that older adults assume that the culprit is going to be in the lineup
29 (Memon, 2001 cited in Wilcock & Bull, 2010) and they should therefore choose someone.
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44 In another study, Wilcox and Bull (2010) attempted to reduce older adults’ expectations that the
45 culprit would be in a lineup, and that choosing isn’t always the best option. Wilcock and Bull
46 (Experiment 1, 2010) presented older adult witnesses with a practice TA (simultaneous) lineup that
47 contained six famous women and asked them to identify the Queen before being shown the real
48 lineup. This was to illustrate and reinforce the idea that lineups can contain innocent people, and
49 that sometimes the correct decision is to say ‘*none of them*’. They found that the practice lineup
50 significantly increased accuracy on TA lineups for older adults (59 %), as compared to the no practice
51 control condition (25%) for simultaneous photo lineups. In Wilcock and Bull’s second experiment,
52 older adult witnesses identified two targets (a young and an old perpetrator), and the results found
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that those who had viewed the practice lineup were significantly more accurate on TA lineups (72 %) as compared to the control condition (14%). The experiments by Wilcock and Bull (2010) appear to demonstrate that showing older adult witnesses a practice lineup, where it is apparent that the target is not present, can significantly improve accuracy and reduce subsequent false identifications.

Although practice lineups can increase the accuracy of older adult witnesses, findings with child witnesses have not always found consistent results. Goodman, Bottoms, Schwarz-Kenney and Rudy (1991) found a practice lineup could increase children's accuracy for TA lineups, however, Parker and Ryan (1993) found no increase in children's accuracy for practice lineups. Research with children suggests that practice lineups might not be beneficial for all age groups.

Using a silhouette as an additional option in a lineup

One technique that has been successful for increasing the accuracy of decisions for TA lineups for child witnesses, but has yet to be tested with older adult witnesses, is inserting an additional option of a silhouette within a lineup. Zajac and Karageorge (2009) used a simultaneous photo array where a silhouette with a question mark was placed between two rows of three photos. They called this silhouette the 'wildcard' and asked children (aged 8-11 years) to point to this special photo if they did not see the person in the lineup. Zajac and Karageorge (2009) found in the control condition, that correct rejections were made on 46 percent of occasions, however when there was the option of the wildcard, correct rejections were made 71 percent of the time. What is more, using the wildcard also did not reduce correct identifications with TP arrays. Zajac and Karageorge (2009) suggest that their findings illustrate that there is a social component associated with rejecting a lineup, rather than any cognitive factors, such as a memory trace, or memory strength. Furthermore, that using a silhouette in a lineup may highlight the issue that rejecting a lineup is a valid option. In a further study Karageorge and Zajac (2010) found that the 'wildcard' was also effective at increasing TA lineup accuracy for younger children aged 5-7 years of age, as well as children aged 8-11 years. They suggested that using the silhouette within the lineup could decrease children's expectations that the target was in the lineup.

Havard and Memon (2013) investigated whether the benefit of using of a silhouette in a lineup would transfer from a simultaneous photo lineup, to a video lineup, which is the current procedure used throughout the UK. They presented children aged 5-7 and 8-11 with a video lineup, where each lineup member, including the 'mystery man' (silhouette) was presented serially, as a moving image. For the 'mystery man' (silhouette) condition, children had to either say the number of the culprit, or

1 if they did not see the culprit, the number of the mystery man. Havard and Memon (2013) found
2 that using the silhouette could help to increase the accuracy for TA lineups for both age groups, from
3 41 percent to 60 percent. They suggested that giving children the option to choose the silhouette in
4 the lineup aligns the rejection decision more closely to the identification decision, and allows the
5 witness to give in to the potential social demands to choose someone.
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10 Although the majority of research has found that using a silhouette can increase accuracy for TA
11 lineups, one study suggests that the properties of the silhouette may be important to obtain the
12 increase in accuracy. Zajac and Jack (2015) presented children (aged 7-11 years) with either a short-
13 haired male target, or a female with mid-length hair. In the lineup phase witnesses were presented
14 with a wildcard that had hair length that was either congruent, or incongruent with the previously
15 seen target. They found that there was only a benefit for a silhouette if it had congruent hair to the
16 target. They concluded that a wildcard would need to be plausible for it to increase accuracy for
17 target absent lineups.
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26 Another eyewitness study using a silhouette, but with young adults also found mixed results. Bruer,
27 Fitzgerald, Therrien and Price (2014) found that although the silhouette increased correct rejections
28 for TA lineups, this benefit was offset by a reduction in correct identifications for TP lineups. Bruer et
29 al. (2014) suggested that using the silhouette made the option to reject the lineup more salient,
30 which was beneficial for TA lineups, but had the detriment that it also increased rejections for TP
31 lineups. They proposed that the costs of using the silhouette outweighed its benefits with young
32 adult participants. However, a further study that employed a silhouette option with young adults,
33 found that the silhouette made no difference in accuracy for TP lineups or TA lineups, as compared
34 to simultaneous and sequential lineup procedures (Pozzulo, Reed, Pettalia & Dempsey, 2015).
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44 In summary, previous research has shown that children and older adults, in particular, appear to be
45 less accurate for TA lineups, as compared to younger adults (Havard, 2014; Wilcock & Bull, 2014). A
46 variety of procedures for improving response accuracy and reducing false identifications from target
47 absent lineups have been developed, however as of yet there is not one specific technique that
48 appears to be beneficial for older adults and children for video lineups. As Pozzulo, Dempsey, Cory,
49 Girardi, Lawandi & Aston (2008) point out, having different methods for different ages could be
50 problematic, for example, until what age would a child continue to benefit from a procedure
51 designed to help children, or at what age would an older adult become eligible for an intervention to
52 help older adults. If there is one technique that can aid the identification of all witnesses of all age
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groups, then this has the application of being implemented in real police lineups. The aim of the current research was to investigate whether or not the 'mystery man' (silhouette) technique, which has been found to be beneficial with children (Havard & Memon, 2013; Karageorge & Zajac, 2010; Zajac & Karageorge, 2009) would also work with older adults.

The current study hypothesised that using a silhouette in a lineup might be beneficial for older adult witnesses, for a number of reasons. Firstly, if, as research suggests, older adults fail to remember the non-biased instructions that the target 'may or may not be there' (Rose, et al., 2003; 2005; Wilcock, Bull & Vrij, 2005), using the silhouette may act as a memory aid for this instruction. Furthermore, if older adults, like children, feel under pressure to choose from a lineup, then having the option of a silhouette would allow older adults to satisfy their tendency to choose. If older adults also have a high expectancy that the culprit will be in the lineup, the use of a silhouette in a lineup could help to reduce this expectancy, and increase accuracy. A further explanation for the benefit of using the mystery man could be that the silhouette disrupts familiarity based decision making, and so that the older adults don't *just choose the person who appears most familiar*, but try to determine whether they are actually picking the culprit, or whether he is absent. Bruer and colleagues (2014) suggest that using a silhouette may increase accuracy on TA lineups by making the decision to reject the lineup more salient, therefore this might also help to increase the accuracy for older adults presented with TA lineups, as they often feel that the person will be in the lineup and they should choose someone. However from the findings with young adults it was predicted that the silhouette would have little influence on the responses for TA lineups as they would already be more accurate than the older adults and as there is no consistent evidence the silhouette reduces accuracy for the TP lineups.

Additional lineup viewings

The current procedure for showing video lineups in the UK is for the witness to view the whole set of lineup images twice before being asked to make an identification decision. Once the witness has seen all the images twice they are asked if they want to see all or any of the images again, before being asked to make an identification decision (Police and Criminal Evidence Act Code D, 2011). A field study of real eyewitness decisions, found that 47% of witnesses asked for an additional viewing of one or more lineup members after the second lineup viewing, and they were more likely to choose a known innocent from the lineup (38% versus 16%) as compared to those who did not ask for an additional viewing (Horry, Memon, Wright & Milne, 2012).

Laboratory research that has investigated the effect of repeated lineup viewing has also found that when participants ask for repeated views, they were more likely to make false identifications (Duckworth & Kreiner, 2009; Havard & Memon, 2013, Lindsay, Lea & Fulford 1991; MacLin & Phelan, 2007; Steblay, 2011). Steblay (2011) suggest that repeated viewing of a lineup indicates a weaker memory trace of the target, and that the witness needs to see the lineup again to confirm their initial decision. However Horry et al (2015), found that a second viewing of a sequential TP photo lineup could also increase correct identifications, as well as foil identifications. They suggested that participants become more lenient in responding from the first to the second viewing with 40% changing their initial response of not making an identification to choosing someone from the lineup. Horry et al., (2012) point out that laboratory research compares viewing photo lineups once versus twice; whereas field research in the UK, examines viewing a video lineup for a third time.

The current study also investigated whether repeated viewing of a lineup, after viewing the lineup twice (the convention in the UK), would influence identification accuracy. It was predicted that participants who asked to view lineup members for a third time may be less likely to correctly reject the TA lineups. Furthermore, research has shown that older adults are less able to form elaborate memories (Craig, & Rose, 2012) and therefore the older adults may form weaker memory traces of the culprit and be more likely to ask for additional views of the lineup, as compared to the younger adults.

In light of some of the findings from previous research using a silhouette to increase identification accuracy and also research comparing older and younger adults' identification some tentative hypotheses were made.

- Older adults will be less accurate than younger adults for TA lineups.
- The use of the mystery man (silhouette) will increase accuracy for TA lineups for older adults, but not younger adults.
- The use of the mystery man should have no influence on older or younger adults' responses for TP lineups.
- Older adults may ask for more additional lineup views as compared to younger adults.

Method

Participants

A total of 200 participants took part in the study. There were 100 in the younger adult group aged 19 to 36 (M age = 27 years, SD = 4.5 years, 73 female) and 100 in the older adult group aged 60 to 84

years (M age = 66.5 years, SD = 6.4 years, 65 female). The younger adults were undergraduate students at Edinburgh Napier University and professionals. The younger adults were a convenience sample recruited individually, via student e-mail and during lectures. The older adults were recruited through adverts on the Open University intranet, the University of the Third Age (U3A) Milton Keynes, and posters in the local community around the Milton Keynes area.

The older adults completed the Mini Mental State Exam (MMSE) as a screening evaluation (Folstein, Folstein & McHugh, 1975). The MMSE provides a reliable measure for cognitive impairment and the cut-off limit of < 24 was used which has a good sensitivity for dementia in older adults (Chayer, 2002). Initially 104 older adults took part in the study, however four participants were dropped from the analyses as their score on the MMSE was below 24.

Materials

A short film was created using a young Caucasian male aged 27 years of age as the target (actor). The film began with the target walking along a corridor towards the camera and trying the handles of doors, until one opened. The next scene was of the target entering an office, looking around and taking a wallet from a table, then a laptop from another desk. The target then looked through several drawers and also stole a mobile phone. The target took one final look around the room before leaving. The last scene was of the target walking back up the corridor with the laptop bag over his shoulder. The total duration of the film was 1 minute and 30 seconds. The target was seen in full-face frontal and profile views throughout the film.

Eight 9-person lineups were created, according to VIPER (Video Identification Parade Electronic Recording) specifications. Half of the lineups were target present (TP) and half target absent (TA), and half contained the 'mystery man' and half did not. The lineups were created by an experienced VIPER operator, in the same manner as a real identification parade, and foils were chosen from the VIPER database using the same procedure as reported by Havard, Memon, Clifford and Gabbert (2010) and Valentine, Darling and Memon (2007). The VIPER database was searched by entering keywords of the suspect's description (e.g. white, male, 27 years old, short brown hair, medium build). The search results were thumbnail images from which foils who matched the suspect on the relevant criteria (age and general appearance) were selected.

The same foils were used for TP and TA lineups, apart from a designated target replacement foil that was used in both of the TA lineups. The target was filmed at a VIPER suite at a local police station in

1 order that the lineup met the standard specifications for VIPER lineup members. The positions of
2 both the designated target replacement foil (TA lineup) and target (TP lineup) were manipulated so
3 that for half of the relevant lineups (TP or TA) they appeared at position 4, hereafter referred to as
4 Lineup A and for the other half at position 6, hereafter referred to as Lineup B. This manipulation
5 was to try to detect any bias for choosing early or late in the sequence of faces. Each lineup member
6 appeared as a standard VIPER film clip: a 15 second video of the person looking straight to the
7 camera, turning their head to the right, then to the left, before returning to full-face. In the VIPER
8 lineups, each member of the lineup was presented sequentially. The entire lineups were shown
9 twice before the witness was asked to make a decision. This procedure followed the typical UK
10 police procedure as required by the Police and Criminal Evidence Act (PACE 1984) Codes of Practice
11 D (2011), in England and Wales.

21 To ensure that the line-up was non-biased and the target did not differ significantly in appearance
22 from the other line-up members, two additional measures were taken to replicate Havard and
23 Memon (2013). Firstly, to control for factors that might affect identification accuracy, such as the
24 distinctiveness of the faces used in the line-ups (including the target), the faces were rated by 31
25 individuals who did not participate in the identification part of the study. Each face was rated on a
26 1–7 scale for distinctiveness, operationalised by the question ‘if you had to pick this person out of a
27 crowd at a railway station, how easy would it be?’ The ratings indicated no significant differences
28 between the target and foils ($F(9, 261) = 1.57, p=.12$).

37 Secondly, a further five individuals who were the same age and ethnicity as the target were asked to
38 give a description of the target after viewing a full-face image for 10 seconds. These descriptions
39 were used to generate a modal description of the target. The final description was, ‘Caucasian male,
40 early 30s, average build, short dark hair, dark eyes.’ The line-ups were pre-tested for functional size
41 using a mock witness paradigm. Thirty mock witnesses, who had not taken part in previous tasks,
42 were provided with the modal description of the target and asked to select the person from the line-
43 up who they thought was the best fit to the description. The proportion of mock witnesses who
44 identified the target from the lineup was .10, which was not found to be significantly different to the
45 proportion expected by chance alone for a 9-person lineup, that is .11 ($\alpha = .01$ level).

55 For the ‘mystery man’ lineup a black mask with a white question mark was created using *Adobe*
56 *After Effects* software that gave the illusion that the lineup member was a silhouette. The mask was
57 animated so that it moved with the image, and the profiles were also presented as silhouettes (see
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Figure 1). The silhouette had no distinguishing features and there was no visible hairstyle or specific feature shapes. The 'mystery man' was always located at position 5 (the middle of the lineup) to replicate previous research by Havard and Memon (2013) and to replicate Zajac and Karageorge (2009) study as they presented a silhouette (wildcard) in the middle of the array.

PLEASE INSERT FIGURE 1 HERE

Design

The study employed a 2 (witness age: younger adult vs. older adult) X 2 (lineup: control vs. mystery man) X 2 (lineup type: TP vs. TA) between subjects design. A total of 50 younger adults aged 19-35 years and 50 aged 60-84 years viewed the TP lineups and 50 younger adults aged 19-36 years and 50 aged 60-84 years viewed the TA lineups. The dependent variables were the lineup identification decisions. For the TP lineups there were three possible responses: a correct identification (hit), a foil identification (false positive) or an incorrect rejection (miss). For the TA lineups, responses were either a correct rejection, or a false identification. Data from the TP and TA lineups were analysed separately.

Procedure

The study took place in two phases. In the first phase, after completing a consent form, participants were asked to watch the video (either individually or in groups of 2 to 3) and were told they would be asked some questions about it in one or two days' time. In the second phase, one to two days later, the identification task was conducted individually with each participant. The participants were asked if they remembered the film as a memory prompt, however recall data was not recorded. The exact instructions were:

"Do you remember on [X day] someone showed you a film with a man in it? What do you remember about the film? Today I am going to show you a video lineup and the person you saw in the film may or may not be there. We will view the whole lineup twice. Then if you see the man from the film I want you to tell me what number he is."

For the control condition there was the additional instructions:

"If you don't see the man from the film you can say I don't think he's there."

For the experimental condition there were the additional instructions:

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“There is also a ‘mystery man’ who looks like this [they are shown a card with the silhouette] and if you don’t see the man from the film I want you to tell me the number of the ‘mystery man’.”

Then for all conditions the witnesses were asked:

If you want to pause the video at any time, or you want me to go back and show you a person again just say so.”

The participants viewed the lineup twice and after the second viewing they were asked if they wanted to view any part of the lineup again. They were then asked if the person they saw in the film was in the lineup. If they identified a person, they were shown the lineup member and asked, *‘is this the person you saw?’* This procedure is used throughout the police forces in England and Wales under the current PACE codes (2011). All the responses were recorded in writing by the researcher.

Results

Total accuracy scores

Responses for both lineups were analysed looking at correct and incorrect responses. There were no differences in accuracy between viewing the lineup either 1 or 2 days later ($\chi^2 (1, N = 200) = 1.03, p = .31$). Accuracy for the TP lineups was 52% and for TA it was 48%. A hierarchical loglinear analysis (HILOG) was conducted to investigate the effects of age group (younger, older adult), lineup procedure (control, mystery man), target presence (TP, TA lineup) and accuracy (correct, incorrect). The likelihood ratio of the model was ($\chi^2 (10, N = 200) = 5.41, p = .86$), however there were no significant main effects, or interactions (all $ps > .1$). Separate analyses were conducted with the younger and older adults, using response (correct ID, foil ID and incorrect rejection) and condition (mystery, control) as factors, for the target present and target absent lineups. Table 1 shows the percentage of responses for target present and target absent lineups, according to age group and lineup condition.

INSERT TABLE 1 HERE

Target Present Lineups

Overall, for the TP lineups 50 % of participants (50 out of 100) correctly identified the target (correct ID), 28 % incorrectly chose a foil from the lineup (foil ID) and 22 % incorrectly rejected the lineup

saying the target was not present. A hierarchical loglinear analysis (HILOG) was conducted to investigate the effects of age group (younger, older adult), lineup procedure (control, mystery man), and response (correct ID, foil ID, incorrect rejection). The likelihood ratio of the model was (χ^2 (9, N =100) = 4.46, p = .89), however there were no significant main effects, or interactions (all ps >.1)

As an additional measure the responses for lineup A (target position 4) and lineup B (target position 6) were also analysed, to see if there was any influence of the target's position in the lineup on identification decision. This was also found to be non-significant (χ^2 (2, N = 100) = 2.04, p = .36, Φ =.49).

Target Absent Lineups

For the TA lineups 48% of participants (48 out of 100) correctly stated the target was not present (correct rejection) and 52 % chose a member from the lineup (false ID). A hierarchical loglinear analysis (HILOG) was conducted to investigate the effects of age group (younger, older adult), lineup procedure (control, mystery man), and response (correct rejection, false ID). The likelihood ratio of the model was (χ^2 (7, N =100) = 3.95, p = .79). There was a significant three way interaction for age group, condition and response (χ^2 (7, N =100) = 4.46, p = .04). An χ^2 test examining overall accuracy of responses found that younger adults made significantly more correct rejections, as compared to older adults (60 % vs. 38% χ^2 (1, N =100) = 4.01, p = .045, Φ = .2).

Follow-up analyses were carried out using a Bonferroni correction to elucidate the drivers of the interaction found above. When the data were examined according to the lineup procedure, there were significantly more correct rejections for the mystery man lineup, as compared to the control lineup, for the older adults (52% vs. 24%; χ^2 (1, N =50) = 4.16, p = .04, Φ =.3), but not the younger adults (56% vs. 60%; χ^2 (1, N = 50) = 0.78, p = .78, Φ =.04). However, while the former pattern was nominally significant, it did not survive the Bonferroni corrected alpha level (α =.0125). When the lineups were analysed separately according to age group, they revealed that for the control lineup, younger adults made significantly more correct rejections as compared to older adults (60% vs. 24%; χ^2 (1, N =50) =6.65, p = .01, Φ =.4). Whilst in the mystery man lineup correct rejections for younger and older adults were very similar (56% vs 52%; χ^2 (1, N =50) = .08, p = .7, Φ =.04).

As an additional measure, the responses for lineup A (target position 4) and lineup B (target position 6) were also analysed, to see if there was any influence of the target's position in the lineup on

identification decisions. This was also found to be non-significant ($\chi^2 (2, N = 100) = .64, p = .42, \Phi = .08$).

Additional lineup viewing

The participants were given the opportunity to view the lineup again after the second viewing. 40 % of the participants asked for additional viewing of one or more lineup members. Participants who viewed the control lineup were more likely to ask to view the lineup again, as compared to those who viewed the mystery man lineup (58% vs 42%; $\chi^2 (1, N = 200) = 4.67, p = .047, \Phi = .13$). Older adults were more likely to ask for an additional viewing, as compared to younger adults (48% vs 33%; $\chi^2 (1, N = 200) = 4.67, p = .031, \Phi = .15$). Older adults were also more likely to ask for additional viewing in the control condition, as compared to the mystery man condition (36% vs. 56%; $\chi^2 (1, N = 100) = 5.77, p = .016, \Phi = .24$). However the same pattern of results was not found for the younger adults, as lineup condition did not appear to significantly increase the number of participants who asked for additional lineup viewing (25 % vs. 31%, $\chi^2 (1, N = 100) = .12, p = .72, \Phi = .04$).

INSERT TABLE 2 HERE

For the TP lineups, there were no significant differences in correct responses when participants asked for additional viewing, compared to when they did not, for the younger adults (50 % vs. 54 %; $\chi^2 (1, N = 50) = 0.67, p = .78, \Phi = .23$). Although the older adults made more correct responses when they did not ask for additional viewing, this was found not to be statistically significant (59 % vs 39 %; $\chi^2 (1, N = 50) = 0.78, p = .16, \Phi = .29$).

For the TA lineups, there were no differences in correct responses for additional viewing compared to no additional viewing for the younger adults (53 % vs. 63 %; $\chi^2 (1, N = 50) = 0.55, p = .46, \Phi = .09$). However, the older adults were significantly more likely to make a correct response if they did not ask for an additional viewing of any lineup members, compared to when they did ask for an additional viewing (56% vs. 20%; $\chi^2 (1, N = 50) = 6.88, p = .009, \Phi = .37$).

Discussion

The aim of the study was to investigate whether using a silhouette, termed the 'mystery man' as an alternative method to reject a lineup, would increase the accuracy of older adult witnesses viewing

1 video TA lineups, without affecting the accuracy for target present lineups. As video lineups are
2 shown twice to witnesses in the UK, and witnesses have the option of additional viewings, a
3 secondary line of investigation was whether using a silhouette in a lineup would influence whether
4 participants would ask for any additional views and whether this affected identification accuracy.
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9 The first hypothesis predicted that older adults would be less accurate than young adults for the
10 target absent lineups and this was found to be the case. These findings replicate a wealth of
11 research that has found older adults to be less accurate than young adults when correctly rejecting a
12 TA lineup (Havard & Memon, 2009; Memon, et al., 2003; Memon & Gabbert, 2003; Memon, et al.,
13 2002; Rose, et al., 2003; 2005; Searcy, et al., 2001; Wilcock, et al., 2005; 2007; Wilcock & Bull, 2010).
14 Whilst the target present lineups found no differences in accuracy as a function of age with young
15 adults and older adults performing comparably. Previous research has also found that older adults
16 can perform comparably to young adults for TP lineups (Memon, et al., 2003; Memon & Gabbert,
17 2003; Memon, et al., 2002; Yarmey & Kent, 1980).
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26 *The Mystery man silhouette*

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28 The second hypothesis predicted that using the mystery man silhouette would increase the accuracy
29 for TA lineups for older adults. This was found to be true as the mystery man increased correct
30 rejections for the older adults, and not for the younger adults. When older adults were given the
31 additional option to choose the mystery man (silhouette) from a TA lineup, they were more likely to
32 correctly reject the lineup, as compared to the control condition. Furthermore, when the older
33 adults were given an alternative choice to reject the TA lineup, their accuracy became comparable to
34 that of younger adults. This research replicates similar research with child witnesses, who like older
35 adults are also more inclined to falsely choose from a TA lineup, but can benefit from a silhouette
36 option (Havard & Memon, Karageorge & Zajac, 2010; Zajac & Karageorge, 2009).
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46 The findings for the TA lineups appear to show a benefit in using the silhouette for the older adults,
47 i.e. they are able to correctly reject the lineup at a higher rate, as compared to the control condition.
48 It is interesting to speculate whether using the silhouette works in a similar manner to using a
49 practice lineup for older adults, as it highlights the issue that the culprit may not be present in the
50 lineup, and therefore makes rejecting the lineup more of a valid option. If so, this would suggest that
51 the higher target absent error rates for older adults, may relate more to metacognitive and social
52 issues and the high expectancy that the culprit will be present in the lineup (Memon, et al, 2003).
53 Additionally, if the older adults ignore, or do not remember the non-biased instructions, as previous
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research has shown (Rose, Bull & Vrij, 2003; 2005; Wilcock, Bull & Vrij, 2005), the silhouette may act as a memory cue for the unbiased instructions. Furthermore, the silhouette may disrupt familiarity processing that older adults often use leading to higher false identifications (Memon et al., 2002), so that choosing is no longer solely based on feelings of familiarity.

For the younger adults, as predicted the silhouette had little effect on responses for the TA lineups, replicating Pozzulo and colleagues (2015) research with young adults. In contrast Bruer and colleagues (2014) found that using a silhouette could increase the accuracy of TA lineups for young adults. In the current study the data showed the younger adults were already more accurate than the older adults, and therefore more inclined to correctly reject the TA lineup, and the silhouette had no significant effects on either the TA or TP lineups. It is reassuring to have empirical evidence that using the mystery man is not detrimental to identification accuracy for younger adults viewing video lineups.

The third hypothesis also held true and the data from the TP lineups found there were no differences according to whether the lineup contained the mystery man, for either the younger or older adults. This replicates previous research with children, which also found using a silhouette in a lineup had no significant effect upon responses for target present lineups (Havard & Memon, 2013; Karageorge & Zajac, 2010; Zajac & Karageorge, 2009). Although the current study supports previous research with children, research with young adults using the silhouette has found mixed results. Bruer and colleagues (2014) found that using a silhouette reduced the accuracy for TP lineups, by increasing the incorrect rejections. They suggested that this was because using the silhouette in the lineup made rejecting the lineup too attractive, by over-reinforcing the unbiased instructions that the person *'may or may not be there'* and younger adults did not need these extra precautions. The increase in rejections for both TA and TP lineups found by Bruer and colleagues, seems to suggest that including the silhouette encouraged participants to use a stricter decision criterion and reject the lineup if they were not absolutely certain that the culprit was present. In the current study this was not found to be the case, as the mystery man did not affect accuracy for the TP lineups, for either age group. This might suggest that for the participants in our study, the mystery man did not change their decision strategies to a stricter approach, since a stricter decision criterion might have been expected to increase incorrect rejections for the TP lineups. On the other hand, it could be argued that the adoption of a stricter criterion might not necessarily lead to higher rates of TP rejection since with TP lineups, provided some encoding of the target had occurred, the memory trace would be qualitatively different and expected to generate a *'match'* decision.

1 It should be noted that there are several methodological differences between the current study and
2 that conducted by Bruer and colleagues (2014). The current study used video lineups presented
3 serially which is the procedure employed in the UK, whilst Bruer et al. (2014) used simultaneous
4 photo lineups, the procedure utilized in the US. The serial presentation used in the current study
5 may have resulted in higher rates of accuracy for the younger adults in the control TA condition of
6 the current study, as compared to the study by Bruer et al. (2014). A further difference is that the
7 current study implemented a longer delay of 1-2 days between seeing the mock crime and then
8 viewing the lineup, compared to Bruer et al.'s 20 minute delay. Other studies that have employed a
9 1 to 2 day delay between witnessing a mock crime and seeing a lineup have found no detriment of
10 using the silhouette for TP lineups (Havard & Memon, 2013; Karageorge & Zajac, 2010; Zajac &
11 Karageorge, 2009).

12 In comparing the two age groups for TP lineups, the younger and older adults had similar responses,
13 and although younger adults made more correct identifications as compared to older adults, these
14 differences were not statistically significant. This pattern confirms previous research that found no
15 significant differences in correct TP identifications between older and younger adults (Memon et al.,
16 2003; Memon & Gabbert, 2003; Memon et al., 2002; Yarmey & Kent, 1980).

17 *Additional Viewings*

18 According to UK police procedure as required by the Police and Criminal Evidence Act (PACE 1984)
19 Codes of Practice D (2011), in England and Wales, witnesses are asked if they want to see any lineup
20 member, or the entire lineup again, after the initial two viewings. In the current study, nearly half of
21 the participants asked to view one or more lineup members for a third time. This is a significant
22 contrast with child witnesses, where research with video lineups found that very few (4%), asked to
23 see any lineup members for a third time (Havard & Memon, 2013). However, Horry et al (2011) also
24 reports that nearly half of witnesses surveyed asked to see the lineup for a third time.

25 Our final hypothesis predicted that older adults would be more likely to ask for additional viewings
26 as compared to younger adults. This was found to be the case as older adults were more likely than
27 younger adults to ask for repeated viewing. Horry et al. (2012) suggest that repeated viewing may
28 lead to more guessing behaviour, which, according to Parker and Carranza (1989) may also be
29 associated with child witnesses. It is interesting to speculate whether older adults may also have
30 been more inclined to guess, or were perhaps just unsure of their decision and looking for

confirmation. Steblay (2011) suggests that asking for additional views of a lineup indicates a weaker memory trace of the target. Memory research with older adults has found that they tend to create less elaborate memories with less contextual details and this could result in a weaker memory trace (Craik & Rose, 2012). This may explain why the older adults were more inclined to ask for additional views to confirm their decision.

Further exploration of additional viewing data reveals another interesting finding. When the mystery man was presented in the lineup, participants were less likely to ask for any additional viewing, as compared to the control condition. Older adults who asked for an additional viewing of a TA lineup were significantly more likely to falsely choose someone compared to those who did not. This seems to suggest older adults who asked for an additional viewing were much more likely to guess, or base their decision on a familiarity-based strategy (Memon, et al., 2002), and thereby make a false identification when viewing a TA lineup. However, if the lineup contained the mystery man, older adults were less likely to ask for any additional viewing, and to subsequently make a false identification. This suggests a further benefit of using the mystery man, as older adults are less inclined to ask for an additional viewing of TA lineups that contains the mystery man, and this in turn may increase identification accuracy.

When witnesses were presented with TP lineups there were no differences in correct responses for additional viewing versus the standard viewing. It appears therefore, that viewing the lineup members a further time after seeing the lineup twice, does not increase correct identifications. These data suggest that there is no benefit of viewing the lineup members for a third time.

These findings are especially pertinent to real life situations, where the police may have arrested the wrong person and the witness is an older adult, as there is a greater chance that the innocent suspect will be falsely identified. It should be noted the findings from the additional viewing analyses be taken with caution, as they used small sample sizes, with only 40% of the participants (81 participants in total) who asked for an additional viewing.

Limitations and directions for future research

All of our older adults recruited for this study were healthy and active, as they were either members of staff at the Open University, or Members of the University of the Third Age (U3A), and therefore they may not be representative of the types of older adults that are generally witnesses to crimes.

Further research could try to determine whether using the mystery man is also useful to older populations, e.g. those over 80 years, or less healthy populations.

In the current study only one target was used, a young Caucasian male, furthermore, the mystery man was very nondescript showing nonspecific hair characteristics. Further research could explore whether the mystery man is effective for culprits of different ethnicities. Also, previous research has found that 34% of lineups in England and Wales are digitally manipulated due to suspects having distinctive features (Zarkadi, Wade, & Stewart, 2009), and future research could also investigate whether employing the mystery man would be effective in these types of lineups. The appearance of the silhouette has also been shown to be important, and Zajac and Jack (2015) have found that for the silhouette to be effective it needed to have hair which was congruent to the culprit. Therefore, any future research will need to take the appearance of the silhouette into consideration to evaluate its effectiveness.

Although, our data appears to show that using the mystery man increases accuracy as it makes a TA lineup easier to reject, we can only hypothesize that this is due to reducing the expectations that the culprit is in the lineup, reducing the pressure to choose, or disrupting familiarity-based processing. To further investigate why the mystery is effective, future research could include a questionnaire and ask older adults if they feel under pressure to choose, if they expected the culprit to be in the lineup, and if they remember the non-biased instructions. A confidence measure could also be collected immediately after making a lineup decision, to investigate whether accuracy is related to witness confidence as previous research has found (Sporer, Penrod, Read & Cutler, 1995).

In conclusion, the aim of the study was to determine whether a technique previously employed to increase the reliability of child witnesses' identification, would also increase the accuracy of older adult witnesses' identification decisions. It has been shown that using a silhouette in a lineup is a simple technique that increases the reliability of older adults' identification decisions. The use of the silhouette also appears to reduce the chances that an older adult will ask for an additional viewing of a lineup, that has been linked to reduced accuracy. Furthermore, using a silhouette in a video lineup does not affect younger adults' identification decisions, or reduce correct identifications for any age group. Therefore the authors of this paper suggest that the use of silhouettes in lineups may be a useful tool for police forces where video lineups are employed, to increase the reliability of eyewitness evidence and to increase the reliability of older adults' identification evidence.

Figure 1. The Mystery man: In full face initially, then looking right and left.

Table 1. shows the percentage of responses for both age groups according to the lineup condition and target presence (frequencies are in parentheses).

Lineup Response	Younger Adults		Older Adults	
	Control	Mystery Man	Control	Mystery Man
<i>Target present</i>				
Correct ID	50.0 (13)	54.0 (14)	48.0 (12)	44.0 (11)
Foil ID	16.7 (4)	27.0 (6)	36.0 (9)	36.0 (9)
Incorrect rejection	33.3 (8)	19.0 (5)	16.0 (4)	20.0 (5)
<i>Target Absent</i>				
Correct Rejection	60.0 (15)	56.0 (14)	24.0 (6)	52.0 (13)
False ID	40.0 (10)	44.0 (11)	76.0 (19)	48.0 (12)

Table.2 shows the percentage of correct and incorrect responses for both age groups, according to additional lineup viewing, target presence and whether the lineup contained the Mystery Man.

Lineup Response	Younger Adults				Older Adults			
	Mystery Man		Control		Mystery Man		Control	
Additional viewing	No	Yes	No	Yes	No	Yes	No	Yes
Target present								
Correct	38.5 (10)	15.4 (4)	37.5 (9)	12.5 (3)	28(7)	20 (5)	36 (9)	16 (4)
Incorrect	30.8 (8)	15.4 (4)	37.5 (9)	12.5 (3)	36 (9)	16 (4)	8 (2)	40 (10)
Target Absent								
Correct	40 (10)	16 (4)	36 (9)	24 (6)	40 (10)	12 (3)	16 (4)	8 (2)
Incorrect	28 (7)	16 (4)	20 (5)	20 (5)	24 (6)	24 (6)	20 (5)	56 (14)

Footnote. As table 2 shows more than 20 percent of the cells have values less than 5, therefore the data were collapsed to conduct the Chi Square analyses.

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Thanks you for your comments on the paper retitled as "The Mystery Man can increase the reliability of eyewitness identifications for older adult witnesses". I am confident that I have addressed the comments made by both reviewers satisfactorily, and hope the amendments made to the manuscript, are sufficient to merit publication the Journal of Police and Criminal Psychology. I will now address each comment in turn.

Reviewer 2.

1. *the manuscript is unevenly written. In some points, APA style is followed; in others, it is not (e.g., sometimes the "and" is used in citations when "&" should be; extra spaces between paragraphs; improper heading formatting). There are also inconsistencies in the references (the title of articles should be in sentence, not title, case). Further, there are grammatical distractions, like commas inserted in the wrong place (e.g., between research and reports on line 12 of page 2), plurals turned into possessives (e.g., adults' instead of adults on line 18 of page 3), and consistency between past and present (e.g., disrupts and encouraged, on lines 9 and 10 of page 15).*

The whole paper has been re-written and edited.

2. *One thing, though, that I am not sure I fully understood was the discussion of whether or not the silhouette affects TP lineups because of older adults adopting a stricter approach. In the Bruer et al (2014) wasn't the focus on younger adults, which were also part of this study? Why, then, did the discussion focus only on older adults in this study?*

The main focus of the study was older adults, who have higher rates of false identification for TA lineups, and the young adults were used as a control group. However in light of this suggestion we do discuss the issue of older adults adopting a stricter approach on page 16.

Reviewer 3.

1. *The second focus of the research - requests to review the lineup an additional time - seemed out of place. While there was a thorough introduction of the mystery man method, that was not the case for requests to see the lineup again. It very much came across as an afterthought. Indeed, it's not mentioned in the title or abstract. This section should be better integrated, and expanded upon.*

The section on additional lineup views in the introduction has been expanded and we have included it in the hypotheses section. As this was a secondary aspect of the research, and due to the low cell sizes of those asking for additional views, we didn't want to over emphasise the findings.

2. *In the introduction many studies are referred to that have looked at "older adults" but no definition for this term is given. If the sample ages across studies vary then at least some range of ages that are considered "older" should be provided.*

A definition has now been included on page 2, along with an age range.

3. *I would like to see clear hypotheses laid out. (This will relate to a comment below regarding the analyses.)*

Clear hypotheses are now laid out at on page 8.

3. *I believe there is some literature suggesting there is a "same age bias" with eyewitnesses being more accurate when identifying faces of their own age. I am admittedly not up to date on that research, but given that the current study used a young adult face, and then compared the ability of younger and older adults to identify it, this same age effect should be acknowledged. If the authors don't feel it is relevant to this study/the interpretations of the results then they can explain why it's not problematic.*

The authors accept that there is a wealth of research on the own age bias, in fact the authors have also published in this area. However, research investigating the own age bias with older adults has not always found consistent results, and as there appeared to be no own age bias in

the current findings, and to ensure the paper did not become too unwieldy, we decided not to include this literature. If the reviewer feels that this will really add something more to the paper then we can include this literature and discuss it.

4. *Regarding the implementation of the "mystery man" - my assumption was that in the control group there were 9 faces and in the "mystery man" group there were 9 faces + the mystery man for a total of 10. (In other words, the mystery man didn't replace a face) -this should be explicitly stated.*

On page 9 it states "Eight 9-person lineups were created, according to VIPER (Video Identification Parade Electronic Recording) specifications. Half of the lineups were target present (TP) and half target absent (TA), and half contained the 'mystery man' and half did not." We are unsure how to make this any clearer, and welcome any suggestions from the reviewer.

5. *The delay was 1-2 days. What determined whether it was 1 or 2 for a given participant?*

The length of delay was determined by what was convenient for the participant. There was no prediction that there would be a difference in accuracy from 1 to 2 days delay and the differences were not statistically significant ($\chi^2(1, N=200) = .97, p = .33$). For the sake of brevity we did not include this information in the paper, however we can include if the reviewer wishes.

6. *I confused by the analyses - likely due to comment above, re: lack of clear hypotheses. There was one large HILOG analysis that found no effects (was lack of power an issue?), and then lots of comparisons using chi square. Given there weren't specific hypotheses laid out it was unexpected to see so many specific tests run after the overall analysis found no effects. And it did not seem that any corrections were made for inflated error given all those comparisons. The comparisons themselves were somewhat unpredictable. For example, in the TA accuracy section, the authors looked for an overall effect of age (younger versus older) but don't look for an overall effect of lineup condition. Rather they look at the effect of the lineup condition within each age group. And then look at that same "interaction" the other way (the effect of age for each lineup condition).*

The authors accept that the first overall global HILOG does appear to show nonsignificant results, and it could be argued that this analysis is somewhat redundant as it compares both the TA and TP lineups together and none of the hypotheses made any predictions comparing both lineups. Having reviewed the literature there is a convention for some papers to conduct these global HILOGs to investigate whether there are significant differences in accuracy for the TP and TA lineups (Bruer et al, 2014; Havard & Memon, 2012; Wilcox & Bull, 2010), however there are other that do not conduct the global HILOG for TP and TA lineup and instead report descriptive statistics, or chi squares comparing TP and TA accuracy, prior to reporting separate analyses for each type of lineup (Karageroge, & Zajac, 2011; Pozzulo et al., 2011; Zajac & Karageorge, 2009). The authors are happy to simply report the descriptive statistics if that would be preferred, but feel that they are justified in conducted further HILOGs, one for the TP and one for the TA lineups using responses rather than accuracy, especially since it does appear for the TA lineups there were some significant effects that could be explored further by Chi Squares. We have also now included the Bonferroni correction.

7. *In the TP results section, I was confused by the second sentence. Specifically, what comparison was the X2 referring to? Four %s are given, and then only 1 X2.*

As the HILOG showed no significant main effects of interaction no further analyses were conducted for the TP lineups, so this has been deleted.

8. *There were a lot of numbers in the discussion section. Rarely is there a good reason to include results in the discussion. If the data being presented are new, they should probably be moved to the results section, and if they are simply reiterating the results then there is no need to provide the exact numbers.*

We totally agree with this point and have re-written the discussion to reflect this suggestion along with clearly stated hypotheses.

9. *The title would be better as : The mystery man can increase the reliability OF eyewitness identifications for older adult witnesses.*

We agree, thank you for the suggestion the title has been changed to this wording.

10. *There were also some minor inconsistencies regarding comma use within in-text citations and use of "and" versus "&" within in-text citations. There were also inconsistencies in the results in terms of decimals. Some % include decimals (e.g., 59.3% on page 13) while others do not (e.g., 56% on page 13).*

This has been corrected.

Minor issues

Page 14, top line: says "effecting" when should be "affecting"

I felt that the discussion could probably be condensed a bit. It seemed a bit redundant sometimes.

Page 3, bottom paragraph: says "A metaanalysis ...were not told... , there was an increase..." I feel it would be better to say "...were told..., there was a decrease..."

The description of the video could be clearer (does "picked up" mean "took"? where did the laptop bag come from- it's unclear if it was taken or the thief already had it?)

The whole paper has been re-written and edited including all the above suggestions.