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Same-Race and Other-Race Eyewitness Identification Accuracy - The Bracket Lineup is as Good as Old

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Same-Race and Other-Race Eyewitness Identification Accuracy:

The Bracket Lineup is as Good as Old

By

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ABSTRACT

The simultaneous and sequential lineups have been widely researched. Although historically research has supported the use of the sequential lineup over the simultaneous lineup, recent research has questioned the effectiveness of the sequential lineup. Despite the abundance of research, both procedures result in a high number of false identifications. Furthermore, although it is widely supported that people are worse at identifying faces of a different race than themselves, research investigating the effectiveness of lineup procedures with other-race identifications is sparse. The present research aimed to develop and test a new lineup procedure to improve eyewitness identification accuracy for same-race and other-race identifications. The new lineup, referred to as the bracket lineup, had participants compare lineup members two at a time and select the most similar looking lineup member to the culprit from each pair until one lineup member remained. After the lineup was narrowed down to one remaining lineup member, participants were asked to either identify or reject the member. In Study 1, Caucasian participants watched a mock crime video of a Caucasian man and made an identification using the simultaneous, sequential, or bracket lineup. Results showed that there were no differences between the three lineups for both correct identifications and correct rejections. However, participants who made an identification were more likely to be correct when the simultaneous or bracket lineup was used. In Study 2, Caucasian participants watched a mock crime video of an East Asian man and made an identification using the simultaneous, sequential, or bracket lineup procedure. The bracket lineup resulted in more correct identifications than the sequential lineup. The bracket lineup also resulted in fewer correct rejections than the simultaneous lineup.

Similar to Study 1, participants who made an identification were more likely to be correct when the simultaneous or bracket lineup was used. Overall, all three procedures appeared to be equally diagnostic for same-race identifications, but the simultaneous and bracket lineup resulted in higher diagnosticity for other-race identifications. This suggests, that allowing witnesses to compare faces at the same time may help to improve accuracy, especially for other-race identifications.

DEDICATION

Mike, you can be et al.

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CHAPTER I

Introduction

Memory for faces plays an important role in our everyday social experiences, and it plays an especially critical role for witnesses of crime. Unfortunately, memory for faces in the eyewitness context is often poor, with memory for other-race faces being even poorer. Problematically, this leads to innocent suspects being falsely convicted, with a high number of these false convictions involving witnesses and suspects of differing races. According to the Innocence Project (2009), 53% of the first 239 DNA exonerations in the United States involved an innocent suspect of a different race from the person(s) who identified them, with the majority being African American. Additionally, not only does poor facial memory lead to false identifications, it may also lead to the release of guilty suspects, as lab-based research shows approximately 24% of witnesses falsely reject the lineup when the suspect is present (Steblay, Dysart, & Wells, 2011). Further, real eyewitnesses identify a known innocent lineup member (known as a *filler* or *foil*) approximately 20% of the time (Greene & Evelo, 2014). Although a variety of lineup procedures have been created and explored to help increase correct identification rates and decrease false identification rates, current procedures remain inadequate. The overall goal of this research was to create a new lineup procedure that would improve correct identification rates while also decreasing false identifications for both same- and other-race identifications.

Traditionally, the simultaneous lineup was the procedure most commonly used by police when asking eyewitnesses to identify a culprit. In the simultaneous lineup, the witness is shown all members of the lineup at once using either photos or a live array of people. The witness is then asked to identify the culprit or to reject the lineup by not identifying anyone as the culprit. Meta-analyses indicate a modest correct identification rate (50% to 52%) when the culprit is present in the lineup (Steblay, Dysart, Solomon, & Lindsay, 2001; Steblay et al., 2011). However, there is also a high false identification rate of any lineup member (51% to 57%) when the culprit is absent (Steblay et al., 2001; Steblay et al., 2011). These rates are problematic given that in reality it is rarely known whether the suspect is truly guilty. Furthermore, despite research that has investigated modifications to the simultaneous procedure that can improve accuracy, such as ensuring a fair lineup and using unbiased instructions, the accuracy rates obtained with a simultaneous lineup remain concerning.

Problems with the simultaneous lineup have been theorized to be related to the type of judgment strategy the procedure elicits from witnesses. Lindsay and Wells (1985) proposed that witnesses viewing lineup members simultaneously were likely to make a relative judgment whereby they compared each lineup member to the others, and identified the most similar looking member as the culprit. This can be problematic, especially without other safe-guards in place such as unbiased instructions, because there will nearly always be someone who more closely resembles the culprit relative to the other options presented. Alternatively, Lindsay and Wells hypothesized that in order to be more accurate, witnesses need to make an absolute judgement in which the witness compares each lineup member to his memory of the culprit, and to a criterion threshold that determines whether the witness will identify the member as a match to the culprit.

Guided by the absolute/relative judgement theory of eyewitness identification, Lindsay and Wells (1985) created the sequential lineup procedure. In the original procedure, participants were shown lineup members one at a time in a sequential order and asked to either reject or identify the lineup member before seeing the next member. By having participants view one face at a time, it was hypothesized that participants would rely less on a relative judgement strategy and instead rely more on an absolute judgment strategy. Results from their original study found comparable correct identification rates between the simultaneous and sequential lineup procedures, but more importantly found that false identification rates in target-absent lineups were significantly lower with the sequential lineup than with a simultaneous lineup. Researchers subsequently generated an abundance of studies over the next three decades focused on exploring the characteristics of sequential procedures, along with possible modifications that could improve outcomes. Numerous studies found similar results: that the sequential lineup significantly reduced mistaken identifications, with only a small reduction in correct identifications. This finding was so widely replicated that it became known as the *sequential superiority effect* (Cutler & Penrod, 1988; Lindsay, Lea, & Fulford, 1991; Lindsay, Lea, Nosworthy, et al., 1991). Further, two meta-analyses found support for the sequential superiority effect (Steblay et al., 2001; Steblay et al., 2011), indicating that although the sequential lineup reduced the number of correct identifications, it also reduced the number of mistaken identifications. Overall, it was determined that the sequential lineup resulted in lower overall choosing rates (i.e., making an identification) compared to the simultaneous lineup. Thus, when the culprit is absent, lower choosing rates results in fewer false identifications, but also results in lower correct identification rates when the culprit is present. In other words, when using the simultaneous lineup, culprits are more likely to be identified, whereas when using the sequential lineup, innocent people are more likely to be protected and not mistakenly identified.

In terms of diagnosticity ratios, findings from the meta-analysis by Steblay et al. (2011) provide further support for the sequential superiority effect. Specifically, sequential lineup identifications were 1.34 to 1.58 times more diagnostic than simultaneous lineup identifications. Diagnosticity ratios are used as in index of probative value and provide information about the probability that the chosen lineup member is actually guilty (Steblay et al., 2011; G. L. Wells & Lindsay, 1980). Diagnosticity takes into consideration the correct identification rate from target-present lineups, and the false identification rate from target-absent lineups. The resulting ratios can be compared to indicate the superiority of one lineup over another (Steblay et al., 2011; G. L. Wells & Lindsay, 1980). Further, Steblay et al. note that the sequential superiority effect is not attributed solely to lower choosing rates, but rather due to a larger reduction in the choosing rate when the culprit is absent than when present, which is accounted for in the diagnosticity ratios.

Research has found support for the benefits (in terms of reducing mistaken identifications) of the sequential lineup, and in particular has found that the procedure is superior to the simultaneous lineup when certain biases exist. For example, when there is an unfair lineup such that the suspect stands out from the foils in physical appearance (i.e., foil bias) or because of unique clothing (i.e., clothing bias), there is a lower false identification rate with the sequential lineup (Lindsay, Lea, Nosworthy, et al., 1991). Similarly, Carlson, Gronlund, and Clark (2008) found that the sequential lineup was less vulnerable to changes in lineup fairness, although they only found the sequential lineup to be superior when the lineups were biased. The sequential lineup has also been found to be superior when there were biased instructions that did not inform the witness that the culprit may not be present (Lindsay, Lea, Nosworthy, et al., 1991; Steblay et al., 2011).

Despite the findings in support of the sequential lineup, other research has focussed on limitations of the approach. For example, young adults are more likely to incorrectly reject a sequential lineup than a simultaneous lineup when the culprit changes appearance (e.g., shaves facial hair, changes hairstyle) between the time of the crime to the time of the lineup (Memon & Gabbert, 2003). Having witnesses rely on an absolute judgement when the culprit changes appearance may result in lower accuracy when the culprit is present, because there is a mismatch between the culprit's appearance and the witness's memory (Memon & Gabbert, 2003). However, it is unknown whether the sequential lineup would be advantageous in a target-absent lineup when the culprit changes appearance, as target-absent lineups were not included in this study. Another limitation of the sequential lineup is that it is ineffective with children (Lindsay, Pozzulo, Craig, Lee, & Corber, 1997; Parker & Ryan, 1993; Pozzulo & Lindsay, 1998; Steblay et al., 2001; Steblay et al., 2011), and in fact, children under 13 years of age have been found to have lower accuracy with the sequential lineup relative to the simultaneous lineup (Pozzulo & Lindsay, 1998). Children are also more likely than adults to make multiple identifications with a sequential lineup (Lindsay et al., 1997; Parker & Ryan, 1993). Finally, the sequential lineup may not be effective for use with witnesses making other-race identifications, as previous research has found that the simultaneous lineup results in higher diagnosticity relative to the sequential lineup (Pascal, 2013).

There are also numerous modifications and procedural considerations that affect the accuracy rates obtained with the sequential lineup. First, there is the issue of *the* *stopping rule* which is concerned with how multiple identifications are handled, and whether administration of the lineup should stop after a lineup member has been identified. There is variation amongst research studies regarding the stopping rule and the handling of multiple identifications (McQuiston-Surrett, Malpass, & Tredoux, 2006; Steblay et al., 2011), and what is followed in the lab does not always reflect what is done in the field (G. L. Wells, Steblay, & Dysart, 2015). Second, there is variation amongst studies due to the numerous available modifications to the procedure, which makes comparisons between studies difficult (McQuiston-Surrett et al., 2006; Steblay et al., 2011). It also opens the opportunity, especially without guidelines, for police to make their own modifications that may reduce the effectiveness of the lineup procedures established in lab research. For example, Lindsay and Bellinger (1999) found that police employing the sequential lineup made modifications to the original procedure (e.g., allowing participants to self-administer the lineups), some of which increased mistaken identifications. Other modifications specific to the sequential lineup that may affect the sequential superiority effect include *backloading* of lineups (i.e., the witness is unaware of the number of lineup members), allowing a second viewing of the lineup (G. L. Wells et al., 2015), and position in which the suspect is placed in the lineup (McQuiston-Surrett et al., 2006; Steblay et al., 2011).

Despite some limitations, support for the sequential lineup was thought to be strong enough that policy recommendations were made and jurisdictions began implementing or requiring the use of the sequential lineup. However, in the last 5 to 10 years a debate, and subsequent divide, has risen over the superiority of the sequential lineup. Further, in the last 5 years there has been in increase in ongoing commentaries and replies between the two camps of researchers. One such exchange involved a satire-like commentary by Newman and Loftus (2012) in response to an article by Steven Clark (2012) in which they chronicled a conversation between a defence attorney and an expert witness (named Professor Cleve Stark) about increasing the hit rate through suggestive procedures. The commentaries between Newman, Loftus, and Clark, highlight that at the crux of the debate, and perhaps what influenced the debate to begin with, is the disagreement between what type of error should be prioritized – type I (false positive) or type II (false negative). Hence, the debate is between whether lineup procedures should identify the guilty or protect the innocent, and there is an inherent trade-off between the two. In general, by increasing the rate of identifying a guilty suspect, the rate of making a false identification can also increase. Similarly, by decreasing the false identification rate, it is possible that more guilty suspects will go free. Although it has never been explicitly mentioned by researchers, and many argue the decision needs to be left to policy makers, it is possible that the recent debate and movement by some to discredit and caution against the use of the sequential lineup, is driven by the higher false negative rate (failure to identify a guilty culprit) seen with the sequential lineup. However, as researchers point out, a true cost-benefit analysis cannot be determined through lab research, as benefits and costs in terms of the false identifications and correct identifications are dependent upon base rates (which have been estimated but are impossible to know) that an innocent person is in a lineup (Horry, Brewer, Weber, & Palmer, 2015). Further, researchers point out that there is an asymmetrical trade-off between making a correct identification and a mistaken identification, that should preclude others from viewing the loss and gains as an equal trade-off (Steblay et al., 2011; G. L. Wells, Steblay, & Dysart, 2012). Specifically, some researchers note that mistaken identification results in a greater error (i.e., two errors) because an innocent person is identified *and* the guilty person escapes, whereas a false negative, or failure to make an identification, results in only one error, in that the guilty person escapes (Steblay et al., 2011; G. L. Wells et al., 2012). Finally, one camp of researchers point out that any losses in the correct identification rate that occur when moving from a simultaneous to a sequential lineup, may be due to the loss of lucky guesses, and that the higher identification rates seen in the simultaneous lineup are not due to better recognition accuracy, but rather to more guessing (Lindsay, Mansour, Beaudry, Leach, & Bertrand, 2009; G. L. Wells et al., 2012).

Regardless of the costs and benefits of implementing the sequential lineup, one group of researchers questions the existence of the sequential superiority claim itself and argues that there is insufficient evidence supporting the claim. McQuiston-Surrett et al. (2006) argued that many studies reporting a sequential superiority effect stemmed from a single laboratory and included R. C. L. Lindsay as an author, which may affect the validity of the findings. Further they claimed that there was no evidence of a sequential superiority effect when only studies that did not include Lindsay as an author were included in analyses; however, this finding may be accounted for by differences in procedural elements and variations in methodology (McQuiston-Surrett et al., 2006). In contrast, Steblay et al. (2011) found that the benefits of the sequential lineup were found in both Lindsay's laboratory and in studies generated from outside laboratories, and concluded that the sequential superiority effect was not just an artifact of studies emanating from a single research group.

Another focus of the debate has been over the cause of the sequential superiority effect, and whether the reduction in false identifications is due to absolute judgment strategy, or due to a shift in response criterion such that the sequential lineup induces more conservative responding (Lindsay et al., 2009; Meissner, Tredoux, Parker, & MacLin, 2005). Using signal detection theory, researchers have determined that the sequential advantage is due to a criterion shift in which witnesses viewing a sequential lineup become more conservative in responding, and not due to better discrimination abilities (Dobolyi & Dodson, 2013; Palmer & Brewer, 2012). Thus, because witnesses are less likely to choose with the sequential lineup, their overall accuracy tends to be higher. The finding that the sequential lineup results in a conservative criterion shift does not necessarily mean it is incompatible with the absolute judgment theory. Dobolyi and Dodson (2013) noted that the sequential lineup likely influences witnesses to require more memory details before making a positive identification (i.e., make an absolute judgement), thus resulting in the criterion shift.

Although both sides of the debate agree that the sequential lineup findings occur because of a criterion shift and not due to better discriminability, some view this as potentially problematic, whereas others see it as having no bearing on the ultimate outcome that the sequential lineup protects innocent people (McQuiston-Surrett et al., 2006; Palmer & Brewer, 2012). Further, Lindsay and colleagues debate the usefulness and appropriateness of using signal detection theory to conceptualize eyewitness identification, as they claim it is not a theory of memory and cannot account for the complexities of eyewitness identification (Lindsay et al., 2009).

Along similar lines, there has also been debate over what constitutes the "sequential lineup" and whether it truly is the sequential presentation of lineup members that accounts for the findings associated with the method (Malpass, Tredoux, & McQuiston-Surrett, 2009). Malpass et al. (2009) argues that it is unknown whether it is the sequential presentation of photographs that serves to reduce the false identification rate, or a package of procedures labeled as the sequential lineup. Malpass et al. go as far as to refer to the sequential lineup as the Lindsay-Wells lineup throughout their paper to emphasize this point. However, in their reply Lindsay et al. (2009) argues that Malpass et al. misrepresented the sequential lineup, and argued that the sequential lineup consists of a variety of techniques that are combined into one package in order to reduce mistaken identifications.

Finally, the most recent focus of the debate has been around how to determine which procedure is best and how to accurately assess probative value. In order to determine which lineup procedure is more diagnostic, findings from both target-present and target-absent lineups need to be considered. Traditionally, diagnosticity ratios, which were described earlier, were used as measures of probative value and to determine which lineup procedure was superior. Sequential lineups have historically produced higher diagnosticity ratios than the simultaneous lineup, resulting in the conclusion that the sequential lineup is superior. However, some researchers have questioned the use of diagnosticity ratios, suggesting they should not be used to assess superiority because diagnosticity ratios are influenced by response bias (Gronlund, Wixted, & Mickes, 2014; Mickes, Flowe, & Wixted, 2012; Wixted & Mickes, 2012). More specifically, because diagnosticity is influenced by a response bias (i.e., inclination to pick), the higher diagnosticity ratio seen with sequential lineups is attributed to the conservative criterion shift produced by the sequential lineup, and not because the sequential lineup results in better discrimination. Gronlund et al. (2014) argue that the best lineup procedure should be determined based on discriminability (i.e., the extent to which a person can distinguish between a guilty and innocent suspect) and not by response bias which occurs when diagnosticity is used. Alternatively, they argue, that receiver-operating characteristic (ROC) curves, which assess discriminability, should be used to determine the superior lineup. Using an ROC approach, some researchers have claimed that the simultaneous lineup is superior due to the fact that it results in better discriminability (e.g., Gronlund et al., 2014; Mickes et al., 2012). However, Wells (2014) maintains that even though diagnosticity is influenced by response bias, the sequential lineup still results in higher probative value (i.e., the member identified when using the sequential procedure is more likely to be truly guilty despite lower identification rates), and that it is up to policy makers to decide which criteria determines the superiority of one procedure over another.

In summary, much of the last two decades has focused on modifying the sequential lineup and debating its effectiveness and recommended use. Nevertheless, the problem remains that no current procedure results in acceptable correct identification rates (Dupuis & Lindsay, 2007; Lindsay et al., 2009). In a recent field study, Wells et al. (2015) found that 4 out of 10 witnesses identified a filler (i.e., known innocent lineup member) when presented with the simultaneous lineup, and 3 out of 10 witnesses shown a sequential lineup identified a filler. Instead of focusing on the debate and modifying the sequential lineup, there have been calls to focus on the development of novel procedures to improve eyewitness identification (Brewer & Palmer, 2010; Brewer & Wells, 2011;

Lindsay et al., 2009). Although some researchers have begun to explore other alternatives, such as using multiple lineups (Pryke, Lindsay, Dysart, & Dupuis, 2004), using confidence judgments under time constraints (Brewer, Weber, Wootton, & Lindsay, 2012), or creating the elimination lineup for use with children (Pozzulo & Lindsay, 1999), relatively little research overall has focused on developing new methods to improve eyewitness identification.

Other-Race Identifications

Another problem with research on lineup procedures to date has been that it largely ignores the impact of the racial match between culprits and witnesses on eyewitness identification, despite the large body of findings that indicate race plays a critical role in facial recognition. The *cross-race effect* is the robust finding that people are better at recognizing previously seen own-race faces than faces of other races (Meissner & Brigham, 2001). The cross-race effect has been replicated across numerous ethnic groups (e.g., Caucasians, African Americans, Japanese, Chinese, and First Nations), although the effect is often stronger when majority ethnic groups are identifying faces from minority ethnic groups (Brigham, Bennett, Meissner, & Mitchell, 2007; Jackiw, Arbuthnott, Pfeifer, Marcon, & Meissner, 2008; Meissner & Brigham, 2001). Further, although research investigating the cross-race effect has been primarily conducted in North America using Caucasian and Black participants, the effect has been replicated outside of North America and with other racial/ethnic groups (e.g., Brigham et al., 2007; Sangrigoli, Pallier, Argenti, Ventureyra, & de Schonen, 2005; Wright, Boyd, & Tredoux, 2001).

Despite the robust finding of the cross-race effect, research on eyewitness lineup procedures has tended to ignore the racial match between the witness and the culprit and the impact it may have on accuracy. In a meta-analysis by Meissner and Brigham (2001) that examined the cross-race effect, fewer than 10% of the studies included involved an eyewitness lineup procedure. Further, the majority of eyewitness identification studies fail to mention the racial composition of the sample. Additionally, despite the limited amount of research involving different races and the lack of consideration for the impact that race may have, policy recommendations regarding other-race identifications are still made (e.g., Wilson, Hugenberg, & Bernstein, 2013). Consequently, any lineup procedure developed needs to consider its effectiveness with both same-race and other-race identifications.

Theories attempting to explain the cross-race effect suggest the causal mechanisms are multifaceted and can be attributed to both social and cognitive processes. Social explanations suggest that the quality and quantity of interracial contact moderates the effect (Brigham et al., 2007; Brigham & Malpass, 1985; Meissner & Brigham, 2001), such that people become better at identifying other-race faces as they spend more time interacting with members of other racial groups. Interestingly, racial attitudes have not been found to be directly associated with the cross-race effect. In other words, people who have more negative racial attitudes have comparable accuracy to people who have more positive racial attitudes (Meissner & Brigham, 2001; Platz & Hosch, 1988). However, racial attitudes are thought to mediate the relationship between interracial contact and identification accuracy, such that interracial attitudes may influence the amount of interracial contact a person has. Despite the general lack of support for a direct relationship between racial attitudes and identification accuracy, it is possible that the influence of racial attitudes depends on the type of lineup procedure used. Consistent with previous research, Edlund and Skowronski (2008) found that prejudice was unrelated to identification accuracy when a simultaneous lineup was used. In contrast, they found that participants high in explicit prejudice, regardless of race, were more accurate at identifying African American faces than Caucasian faces, but only when a sequential lineup was used. Although prejudice has not been shown to account for the cross-race effect, stereotypes and the type of crime committed can affect who is more likely to be identified in a lineup (Davies, Hutchinson, Osborne, & Eberhardt, 2016; Knuycky, Kleider, & Cavrak, 2014; Osborne & Davies, 2012). For example, Black men who have more stereotypical Black features are more likely to be misidentified in a lineup than Black men with faces with nonstereotypical features (Knuycky et al., 2014). Finally, individuals also become worse at identifying other-race faces, or even faces in general, when they categorize the other person as a member of an out-group based on a characteristic such as race (Sporer, 2001).

Cognitive explanations of the cross-race effect often focus on how individuals process other-race faces compared to same-race faces. Research suggests that individuals visually process other-race faces differently. For example, people viewing same-race faces tend to encode diagnostic features (e.g., nose, eyes, lips, hairline etc.) that are useful in discriminating between other own-race faces, but fail to encode features that are useful in discriminating amongst other-race faces (Brigham et al., 2007; Meissner & Brigham, 2001). In other words, in one racial group a certain feature (e.g., noses) might be particularly useful in distinguishing between individuals, but may not be as useful in distinguishing individuals belonging to another racial group. The tendency to encode certain diagnostic features strengthen as individuals gain experience viewing and encoding own-race faces, which then increases the likelihood that these same features, despite their diagnostic ineffectiveness, are encoded when the individual encounters an other-race face (e.g., encode nose shape for all racial groups; G. L. Wells & Olson, 2001). Additionally, individuals are more sensitive to differences in facial features amongst same-race faces than amongst other-race faces (Mondlock et al., 2010).

Other findings suggest that individuals are more likely to encode same-race faces configurally (i.e., relationally, taking into account the spatial relations between facial features), whereas features of other-race faces are encoded without regard to the spatial relations amongst the features (Meissner & Brigham, 2001; G. Rhodes, Brake, Taylor, & Tan, 1989). Similarly, some research suggests that there are less attentional resources used when viewing other-race faces, resulting in superficial or poorer encoding of other-race faces relative to same-race faces (Brigham et al., 2007; Rodin, 1987; Sporer, 2001). Indeed, participants report experiencing poorer memory for other-race faces (Smith, Stinson, & Prosser, 2004). Additionally, recognition of same-race faces tends to rely more on recollection, whereas recognition of other-race faces relies more on familiarity (Marcon, Susa, & Meissner, 2009).

In the eyewitness context, few studies have examined the differences between same-race and other-race identifications, or have investigated factors that may improve other-race eyewitness identifications. In one study, Evans, Marcon, and Meissner (2009) attempted to improve cross-race identification accuracy by using context reinstatement during administration of the simultaneous lineup. While context reinstatement improved same-race identification accuracy, context reinstatement did not improve other-race identification accuracy. In another study, Smith et al. (2004) examined whether judgment strategy (absolute versus relative) varied between participants making a same-race or other-race identification. They found no differences between judgement strategy used for both choosers (i.e., those who make an identification) and nonchoosers (i.e., those who do not make an identification and reject the lineup) making same- or other-race identifications. However there was a trend for participants making other-race identifications to use a relative judgment strategy. Finally, results from Pascal (2013) which compared the simultaneous, sequential, and elimination lineups for same- and other-race identification suggested that accuracy rates differ depending on lineup procedure used and type of identification being made. In that study, 268 adult Caucasian participants viewed a mock crime video containing either a Caucasian or East Asian culprit and were asked to make an identification for a target-present or target-absent lineup using either the simultaneous, sequential, or elimination lineup procedure. One of the main goals of the research was to determine the effectiveness of the different lineup procedures across same-race and other-race identifications, and to determine if any of the lineups could moderate the cross-race effect. Results showed that the patterns in accuracy amongst the different lineup procedures differed between those making same-race identifications and those making other-race identifications, suggesting the importance of considering the differential impact lineup procedures may have in different contexts. For example, for same-race identifications, conditional probability of diagnosticity was higher for the simultaneous and elimination lineups than the sequential lineup; but for other-race identifications, the simultaneous lineup resulted in better diagnosticity than the elimination and sequential lineups. Additionally, across procedures, cross-race identification accuracy was poorer than same-race identification accuracy, but the cross-race effect was eliminated for correct identifications in target-present lineups when the simultaneous and sequential lineups were used but not when the elimination lineup was used. Taken together, these findings further suggest the importance of considering race when exploring factors affecting eyewitness identification. Indeed, without knowing the racial composition of samples used in prior published studies, it cannot be ruled out that racial match between those making identifications and lineup members is not a serious confound in preceding research. Overall, little focus has been given to other-race identifications in the context of eyewitness situation despite the large problem it poses. Consequently, given the robust finding that people are poorer at identifying other-race faces, and the sparse amount of research involving an eyewitness paradigm in a cross-race context, one focus of this research was to develop a new lineup procedure that had the potential to improve eyewitness identification for other-race faces.

Creating a New Lineup Procedure

The overall goal of this research was to develop and test a new lineup procedure that had the potential to improve eyewitness identification accuracy for same-race and, in particular, other-race identifications. An effective lineup procedure is one that maximizes the absolute number of correct identifications while at the same time minimizes the absolute number of mistaken identifications. This can be done by improving discriminability and inducing a conservative response bias. When developing a lineup procedure it is helpful to consider findings from prior research and integrate findings from research outside the eyewitness context. Historically, research on eyewitness identification, including the creation and modification of lineup procedures, has largely been atheoretical, and findings from other research domains are often not integrated. In other words, modifications to lineup procedures tend to be made in order to see what happens, rather than basing modifications on existing research on human perception and cognition. Thus, this study sought to create and test a new procedure that was guided by previous research and knowledge about cognition, the visual-perceptual system, and other aspects of human functioning. Before explaining the proposed lineup procedure, research that influenced the development of this new identification procedure will be reviewed.

Diagnostic Feature-Detection Hypothesis

As mentioned previously, researchers have found that presenting photographs simultaneously increases a witness's ability to discriminate between a guilty and innocent suspect. To account for this finding, Wixted and Mickes (2014) proposed a Diagnostic Feature-Detection Hypothesis which states that in order to discriminate between the suspect and the lineup fillers, all lineup members need to be presented simultaneously to better facilitate the eyewitness's detection of diagnostic facial features. When a face is viewed, certain features (e.g., eyes, nose, lips, etc.) are encoded. At test, some of these features will be common amongst all individuals (e.g., all may have large noses) and will not be useful in discriminating between the culprit and the fillers. But some features will be unique to the culprit (e.g., perhaps a larger space between the eyes) and therefore will be diagnostic and useful for discriminating between the culprit and fillers. However, the identification of diagnostic (i.e., unique features) and non-diagnostic (i.e., shared features) can only be adequately facilitated by the simultaneous presentation of multiple faces.

This hypothesis may account for findings that for the sequential lineup, discriminability increases when the culprit is placed later in the sequence of photographs (e.g., position 5 instead of position 2; Gronlund et al., 2012). Additionally, a study by Gronlund et al. (2012) found that accuracy (determined based on ROC analyses) was comparable between show-ups (i.e., when only one person is presented) and sequential procedures, and that simultaneous procedures resulted in higher accuracy than both showups and sequential procedures when the suspect was in position 2. Sequential procedures that are followed with a simultaneous procedure have also been found to result in higher correct identifications than sequential procedures (Wilcock & Kneller, 2011). Finally, allowing a "second lap" in which a witness gets to view the sequential presentation of photographs twice, increases the number of correct identifications, although it also increases the number of false identifications when the culprit is absent (Horry et al., 2015). Overall, these findings suggest that correct identifications increase after multiple faces have been seen.

Evidence in support of the Diagnostic Feature-Detection Hypothesis comes from perceptual learning studies which indicate that the ability to detect distinctive features, rather than commonalities, is what allows an individual to discriminate visual stimuli (Wixted & Mickes, 2014). For example, Wixted and Mickes (2014) provide an example that a radiologist can differentiate between an x-ray containing a tumor and an x-ray without a tumor because they are experts at identifying the distinctive features between the two x-rays. In comparison, a lay person would not have the ability to discriminate between the two x-rays because they are unfamiliar with which features they should pay attention to as being diagnostic. Further, perceptual learning studies suggest that learning to detect diagnostic features occurs through the simultaneous presentation of the objects to be differentiated (Gibson, 1969 as cited by Wixted & Mickes, 2014). For example, in one study participants were required to learn to discriminate between photographs of faces that had been morphed to be either easy or difficult to discriminate (Mundy, Honey, & Dwyer, 2007). Results showed that presenting photographs simultaneously resulted in better discrimination than presenting photographs sequentially. Similar results were found in a study that required participants to learn a set of faces and then later identify the faces out of a simultaneous array (Megreya & Burton, 2006). Participants were better able to recognize faces that were presented simultaneously during the study phase rather than when they were presented sequentially. However, these findings may not extend to other-race identifications. Pezdek, O'Brien, and Wasson, (2012) found that presenting other-race faces in groups at the encoding phase impaired recognition for other-race faces at the time of recognition. Overall, these studies suggest improved discriminability when faces are studied simultaneously, at least for same-race faces. However, these studies examine how simultaneous presentation at encoding affects subsequent recognition, which may not generalize to the eyewitness situation which focuses on how the presentation of faces at the time of recognition affects identification accuracy.

The importance of presenting photographs simultaneously may be even more important for the detection of diagnostic features within the other-race identification scenario. When adults process faces they look at the shape of the external contour of the face (e.g. chin, hairline), the shape and colour of individual facial features (e.g., eyes), and the distances and special relations between features. However, as mentioned previously, research shows that same-race faces are processed differently than other-race faces, and that people are better at discriminating between same-race faces relative to other-race faces. For example, when viewing other-race faces, individuals have a decreased sensitivity to identifying diagnostic features and the spatial relations between features (Mondlock et al., 2010). It is possible that presenting faces simultaneously may help people shift their attention to the more appropriate diagnostic features for that race (e.g., shift from looking at eyes to noses after realizing eyes were not diagnostic), which would be important for facilitating recognition of other-races faces if people viewing other-race faces are not attending to diagnostic features as suggested by some research (e.g., Hills & Lewis, 2006). Differences in processing same- and other-race faces begin early in infancy. Researchers have found that infants as young as 8 months old tend to process same-race faces holistically, but do not process other-race faces the same way (Anzures et al., 2013). Additionally, infants' scanning patterns and the features they focus on, also differ when viewing other-race faces (Wheeler et al., 2011). Therefore it may be necessary for individuals to view faces simultaneously when attempting to recognize other-race faces, in order to facilitate processing and recognition of other-race faces. Simply put, if individuals already have difficulty recognizing and discriminating between other-race faces, then a simultaneous presentation of photographs may help facilitate the recognition of diagnostic features.

The findings from the perceptual learning literature and face processing literature, along with the hypothesis proposed by Wixted and Mickes (2014), suggest that an effective lineup is likely one that facilitates the identification of diagnostic features. This can be done directly by presenting photographs simultaneously or indirectly by placing the suspect towards the end of a sequential procedure. However, presenting photographs simultaneously is likely the best way to facilitate the direct comparison of faces and detection of diagnostic features. Anecdotally it should be noted that during collection of data for Pascal (2013), participants would occasionally ask if they could pick up photographs and rearrange the order in order to better compare the different photographs side-by-side. Additionally, Lindsay and Bellinger (1999) reported that some participants compared photographs even though they were supposed to be self-administering a sequential lineup via a photo album or stack of photographs. These observations suggest that people are inclined to compare photographs and may believe it is easier to make an identification when able to do so.

Number of Faces that should be Viewed Simultaneously

Given the support for a simultaneous presentation, another factor that needs to be considered is how many photographs should be presented at a time. Research suggests that humans may be limited to processing a single face at one time, possibly due to the depletion of cognitive resources that occurs when viewing a face (Bindemann, Burton, & Jenkins, 2005). Furthermore, within the cross-race context, research examining event-related potentials (ERPs) has found that both encoding and retrieval of other-race faces from memory is more effortful than encoding or retrieving same-race faces (Herzmann, Willenbockel, Tanaka, & Curran, 2011). Consequently, these findings suggest that it may be helpful for a smaller number of faces to be presented simultaneously in order to reduce the cognitive demands. Indeed, E.C. Wells and Pozzulo (2006) found a trend for a higher number of correct rejections for target-absent lineups when participants were presented with a two-person serial lineup (i.e., two photographs presented simultaneously at a time), than when six photographs were presented simultaneously. Additionally, within the other-race identification context, people's ability to identify other-race faces decreased as the size of the simultaneous lineup increased (Marcon, Meissner, Frueh, Susa, & MacLin, 2010). Presenting fewer faces may also allow for more cognitive resources to be devoted towards individuating faces, as a failure to attend to individuating facial features is a factor that is hypothesized to play a role in the occurrence of the cross-race effect (Hugenberg, Young, Bernstein, & Sacco, 2010). Therefore, taken together these findings suggest that it would be useful for same-race, and particularly beneficial for other-race identifications, to view fewer photographs at one time.

Placement of Photographs

Another issue that has largely been ignored in the literature is the placement of photographs and the impact that order and placement may have on recognition and accuracy. In the traditional simultaneous lineup, photographs are arranged in a 2x3 (vertical by horizontal) matrix. Recent research suggests that the arrangement of the photographs may have an impact on accuracy. The fusiform facial area, which is located in the fusiform gyrus in the brain and largely lateralized to the right hemisphere, is the primary area in which faces are recognized or processed (Kanwisher, McDermott, & Chun, 1997). As a result, research has documented that people give more attention to the left side of a face than to the right side, and that faces in the left visual field receive more processing than faces in the right visual field (Megreya & Havard, 2011). Further, people tend to scan faces located on the left before they scan faces on the right; partly due to left-right scanning habits seen in English readers, but primarily due to the lateralization of facial processing in the right hemisphere (Megreya, Bindemann, Havard, & Burton, 2011).

These findings become problematic for simultaneous presentation of photographs because people are differentially scanning and dividing their attention depending on the location of the photograph. In the eyewitness lineup context, Megreya et al. (2011) found that in a 1x5 array of photographs, more time was spent scanning faces located on the left than faces on the right. The difference in time spent scanning photographs on the left from photographs on the right tended to increase the further apart the photographs were placed. Moreover, faces located on the left were more likely to be misidentified than faces on the right (Megreya et al., 2011). Other research has also found biases in visual scanning patterns of simultaneous lineups such that participants spent more time looking at faces in the upper middle of the lineup than at other locations (Mansour, Lindsay, Brewer, & Munhall, 2009). Similarly, there appears to be position effects in simultaneous lineups in which lineup members in the centre are chosen more often than lineup members on the sides (Palmer, Sauer, & Holt, 2017). This position bias can be eliminated by placing the photographs in a tilted circle (Palmer et al., 2017). Overall, these findings suggest that protecting the innocent may be problematic if an innocent person is positioned on the left-hand side or middle of a lineup. Although these findings are relatively new and have not been widely replicated, they nevertheless are sufficiently compelling that they should be considered in the creation of a new procedure.

Bracket Lineup: A New Procedure

Given the above research findings the proposed new lineup involves asking the witness to make a series of judgements that involve selecting or eliminating (determined during the pilot phase) photographs that are presented in pairs until a final photograph remains. At that point, the witness is asked whether the photograph is actually the culprit or not. In general, the new procedure is as follows: participants see two photos simultaneously and are asked to select the person that either resembles the culprit the least (or the most). They continue to do this for four sets of two photographs, which will be referred to as Round 1. During Round 2, participants view two more sets of photographs that are composed of photographs from the first round that were not eliminated (or were deemed to be most similar). They then make a judgment about the similarity of the lineup members to the culprit and eliminate one member from each pair, with the remaining photographs moving onto the third round. In Round 3, the participants are asked once again to make a decision about the similarity of the two remaining members to the culprit, at which point they would eliminate or select one photograph that would move onto the final round. With one member remaining, the participants are then asked whether the final photograph is or is not the culprit. This is done to elicit an absolute decision and consequently induce a conservative response bias. See Appendix A for an infographic depicting the procedure. It should be noted that participants were required to make a response at each step of the procedure and to continue to the end regardless of whether they believed neither of the members were the culprit or were certain that one of the members was the culprit. Allowing participants to make an identification or reject both members in a pair before the final round would defeat the purpose and design of the proposed procedure. It would also essentially reduce the procedure to that of the sequential lineup in which some participants make an incorrect identification early on, only to change their minds and make a second, and often correct, decision later on.

During the pilot phase of the study, there were some aspects of the procedure that were actively explored prior to finalizing the new procedure as it was initially unclear which details of the procedure may have needed to be modified or which factors appeared to be the most beneficial. During the pilot phase the following factors were assessed: (a) placement of the photographs, either horizontally or vertically, to account for research that suggests photographs on the left may be processed biasedly; (b) lineup instructions regarding whether participants should be asked to pick the most similar member to the culprit, or to eliminate the most dissimilar lineup member; and (c) participants' ability to complete the procedure without getting stuck or having comprehension problems, along with whether they had any feedback on aspects that might improve the procedure that may have been overlooked.

With the exception of the initial study that created the elimination lineup (Pozzulo & Lindsay, 1999), asking participants to select the most similar or eliminate the most dissimilar lineup member has not been a factor in previous lineup procedures. In their original elimination lineup study, Pozzulo and Lindsay created a fast elimination procedure and a slow elimination procedure for the purposes of improving children's identification accuracy. In the fast elimination lineup, children were shown six photographs and first asked to select which member looked most like the culprit. After selecting the most similar looking member, the participants were asked to make a second judgment about whether the selected photograph was actually the culprit. In the slow elimination procedure, children were shown six lineup members simultaneously and asked to eliminate the least similar looking member one at a time until one lineup member remained. When one lineup member remained, participants were asked if the remaining member was the culprit or someone else. Results showed that both versions of the elimination lineup resulted in comparable correct identification accuracy to the simultaneous lineup, and fewer false identifications than the simultaneous lineup. Furthermore, the fast elimination lineup was slightly, but not statistically, more effective than the slow elimination lineup at reducing false identifications, possibly because participants became confused or their memory for the culprit changed after making multiple judgments. Although for adults, Pozzulo and Lindsay found that both types of elimination lineup resulted in poorer accuracy than the simultaneous lineup, more recent research has found the fast elimination lineup to be as effective as or more effective with adults than the simultaneous and sequential lineups (Humphries, Holliday, & Flowe, 2012; Pozzulo & Balfour, 2006; Pozzulo et al., 2008; Pozzulo, Reed, Pettalia, & Dempsey, 2016).

Given the current design of the procedure, along with research on the fast and slow elimination lineup procedures, a small change in the wording and decision process may have an impact on accuracy. False memory and suggestibility research has demonstrated that small changes in the wording of a question can influence a person’s response to a question and their memory of an event (Loftus & Palmer, 1974). Asking participants to continuously select the most similar photograph may bias participants to make an identification during the final stage by implicitly suggesting the culprit is present in the lineup or by priming the participant to make an identification. For example, theories of the misattribution of cognitive fluency suggest that repeated choosing of a face may lead to an accrual of processing fluency (Whittlesea, Jacoby, & Girard, 1990). The resulting sense of familiarity when viewing the face at a later time may result in the individual being misidentified as the culprit. Alternatively, by having participants eliminate the most dissimilar looking members, they are not primed to make an identification nor are they making implicit judgments about the guilt of the members that remain from each pair. Additionally, emphasizing the dissimilarities may induce a more conservative criterion threshold, which would be particularly beneficial in the target-absent context, in which conservative responding is beneficial, and in the cross-race context as previous research has shown that people tend to have a liberal criterion threshold when recognizing other-race faces (Marcon et al., 2009).

The proposed benefits of this new procedure were thought to be as follows: (a) presenting photos simultaneously would help facilitate the identification of distinctive features needed to make a correct identification, thereby increasing discriminability; (b) showing a smaller number of photographs at a time, would reduce the cognitive load and slow-down the decision process so that a more careful analysis of all the faces could take place; in other words, this would help ensure that all photos were considered, not just the ones on the left; (c) the general procedure would help avoid position effects and discourage witnesses from picking a similar other, prior to the culprit being shown (which is a potential limitation of the sequential lineup); and (d) the final decision requires an absolute judgment which would help reduce mistaken identifications. It should be noted that commitment effects (i.e., when a witness is committed to a previously selected lineup member) were not likely to be a confound because participants were selecting multiple photographs, and in the case of asking them to eliminate the most dissimilar photograph, they would not actually select or reject the final lineup member until the final round. Additionally, research on the elimination lineup, which requires people to first make a relative judgment by comparing all the photographs simultaneously and select the most similar looking member, and then make an absolute judgment regarding whether the chosen member is actually the culprit, has found that the elimination lineup is at least as effective if not more effective than the simultaneous lineup (Humphries et al., 2012; Pozzulo & Balfour, 2006; Pozzulo et al., 2008; Pozzulo et al., 2016). These findings further suggest that having participants compare photographs through a series of decisions and then require them to make an absolute decision about the remaining member are components that may help to increase accuracy.

In terms of the other-race identifications specifically, this procedure would likely be beneficial, beyond the arguments previously mentioned, because it is theorized to help facilitate the ability to detect diagnostic features. This is particularly important given that individuals are less sensitive to difference in facial features when viewing other-races faces and have poorer processing of other-race faces overall. Further, given that other-race face recognition relies more on familiarity than on recollection (Marcon et al., 2009), the repeated comparisons of faces may help the witness to recollect details that were not initially retrieved from memory. Finally, because individuals are poorer at discriminating between other-race faces, and tend to be more liberal in their judgments when deciding to identify an other-race face (Marcon et al., 2009), procedures that are designed to facilitate discrimination and promote a conservative response bias may increase accuracy for other-race identifications.

Finally, it was expected that the proposed benefits would likely be seen in both the target-present and target-absent conditions. In the target-present conditions, this procedure should help improve discriminability which will help maximize the correct identification rate. As participants continue to compare and contrast the different lineup members as they move through the procedure, they should be improving their ability to correctly recollect the diagnostic features and increase the total number of features they recollect. This will help them determine the quality of the match between the photograph and their memory, thereby increasing their ability to identify the culprit. In other words, as participants move through the procedure continually identifying diagnostic features, the strength of their recollection should increase as well as their confidence in the match between their memory and the photograph. Consequently, this should result in a correct identification due to their criterion threshold being surpassed. In comparison, in the target-absent condition, participants should be accruing confidence that none of the features they are detecting match their recollection of the culprit; further, having participants eliminate the most dissimilar culprit may help to reinforce this notion. It is possible that as they compare more photographs, they will be able to eliminate all lineup members as a viable option through a recall-to-reject strategy, which occurs when an individual recollects information that allows them to reject other (false) recollections (Rotello & Heit, 2000). Additionally, the final requirement of an absolute decision will help induce a conservative criterion which will work to reduce false identifications.

In conclusion, the current study created a new lineup procedure through a pilot study and then sought to validate the procedure within the context of same-race (Study 1; Caucasians viewing Caucasian faces) and one type of other-race (Study 2; Caucasians viewing Asian faces) identification, by comparing it to the simultaneous and sequential lineups. Caucasian participants were chosen because research has shown that the cross-race effect is strongest in Caucasian participants (Meissner et al., 2005), and East Asian faces were used because much of the research investigating cross-race facial recognition focuses on African American faces and Chinese are the second largest visible minority group in Canada (Statistics Canada, N.D.). It was hypothesized that compared to both the simultaneous and sequential lineups, the bracket lineup would increase correct identifications and reduce false identifications for both same-race and other-race identifications.

CHAPTER II

Lineup Construction Method

Stimuli collected and created during previous research (Minear & Park, 2004; Pascal, 2013) were used to construct four 8-person lineups for the present study. Additional photographs were also collected from Caucasian volunteers to use as additional lineup foils. Each photograph contained a male with a neutral facial expression wearing a black t-shirt. The match-to-description method (see Wells, Rydell, & Seelau, 1993) was used to select seven foils and one suspect replacement member to create 8-person lineups for each race. A modal description (see Lindsay et al., 2009) of each culprit obtained from previous research that involved the same mock-crime videos (Pascal, 2013) was used to guide the selection of foils. The descriptions that were used were: *Caucasian male, early 20s, short brown hair, brown eyes, slim to average build,* and *Asian male, early to mid-20s, short black hair, and medium build.* Based on these modal descriptions, along with visual inspection to ensure there were no obvious distinctive features, photographs containing males resembling each culprit were selected to create 8-person lineups (one for each race). Due to difficulties in obtaining photographs of faces that would be suitable to create a fair lineup, as well as finding suitable volunteers to act as the culprit, only one set of stimuli was used for each race. McQuiston-Surrett, Malpass, & Tredoux (2006) found that 88% of published studies reported using only one target face (e.g., one culprit) in their research. The potential limitations of using one stimuli set is mentioned in the general discussion section.

The mock witness paradigm (Doob & Kirshenbaum, 1973; Wells, Leippe, & Ostrom, 1979) was used to assess the fairness of the lineups. Volunteers and participants completing other studies through the psychology participant pool were approached to assist with the mock witness paradigm. Because of the short nature of the task per participant (i.e., 1 to 2 minutes), this procedure was added to the end of other studies that were running in the department at the time of administration. For the mock-witness paradigm, individuals were shown the preliminary lineups (displayed in a 4x2 matrix) with a form containing the modal description described previously. They were then asked to select the culprit based solely on the provided description. Theoretically, a lineup is considered to be fair if all members are selected based solely on a description, at a rate no difference than chance (Malpass, Tredoux, & McQuiston-Surrett, 2007). Although it is currently considered best practice to report measures of lineup fairness (e.g., effective size, Tredoux's *e*, functional size, binomial probability) recent research suggests that these commonly used measures are highly dependent on the characteristics of the mock-witness paradigm used and thus may not be as reliable or valid as previously thought (Mansour, Beaudry, Kalmet, Bertrand, & Lindsay, 2016). Nevertheless, measures for lineup bias and effective size were calculated for each lineup in line with current best practices. Lineup bias, which measures whether the suspect is chosen significantly more or less than chance (Malpass et al., 2007), was assessed by calculating binomial probabilities using software provided by Malpass (2004). Tredoux's *e* was used to calculate effective size (Malpass et al., 2007; Tredoux, 1998), which is a measure used to assess the number of plausible potential suspects in the lineup.

Thirty-one participants, self-identifying as Caucasian, viewed the target-present lineup containing East Asian males. The lineup bias measure indicated the suspect was not selected at a rate different than chance (proportion selecting culprit = 0.23; chance =

0.13; $\alpha = .05$; critical value = 1.96, obtained critical ratio = 1.34) and Tredoux's *e* indicated the East Asian lineup had 6.36 plausible members. Thirty-three participants (some of who were also mock witnesses for the Asian faces), self-identifying as Caucasian, also viewed the target-present lineup containing Caucasian males. The lineup bias measure indicated the suspect was not selected at a rate different than chance (proportion selecting culprit = 0.24; chance = 0.13; $\alpha = .05$; critical value = 1.96, obtained critical ratio = 1.57) and Tredoux's *e* indicated the Caucasian lineup had 4.97 plausible members. Target-absent lineups were created by replacing the culprit's photograph with an alternative photograph containing a male who matched the culprit's description.

Pilot Study: Developing the Bracket Procedure

The goal of the pilot phase of the research was to establish the specific parameters and structure of the proposed procedure, before testing and validating the procedure with a larger sample and under different conditions (i.e., same- versus other-race identifications). This approach is efficient, because validation of the procedure requires large samples of individuals. Although the general framework of the procedure was determined in advance, it was unknown how some of the details might affect participants' ability to complete the task. Additionally, a website needed to be developed to administer the lineup procedures and thus needed to be tested to ensure it worked properly. This research received clearance by the University of Windsor Research Ethics Board prior to data collection.

Participants

Fifteen participants who self-identified as Caucasian (80% female, mean age = 19.33 years, *SD* = 2.13, range 17-25) were recruited through the Department of

Psychology's participant pool to partake in the pilot study. Participants who had prior participation in a research study that used the same stimuli were excluded. Participants received academic credit as a token of appreciation for their participation.

Materials

Video. A mock, non-violent theft video clip that showed a Caucasian or Asian culprit approaching an empty lemonade stand in a park during daylight was used to simulate witnessing a crime. The culprit cautiously looks around, drinks some lemonade, and steals some cash from a jar before running away. The video lasted approximately 55 seconds, contained both front and side profile views of the culprit, and focussed for 10 seconds in a close-up view of the culprit's face.

Lineups. Eight-person lineups obtained during the lineup construction phase of the study were used. Each lineup was composed of coloured, headshot images of males of a single race. In total there were two compositions of photographs; one for target-present lineups and one for target-absent lineups. The culprit or innocent target appeared in position four in the simultaneous and sequential lineup, and in the second position of the second pair of photographs presented in the bracket lineup. Lineups were presented using a computer.

Website. A website was developed in order to present the lineups and record the data online. After the experimenter logged participants onto the website and randomly assigned them to a condition, the site independently guided participants through the lineup procedure As such, participants viewed each lineup member and subsequently made identifications and rejections on the computer. The site recorded each participant's decisions. Although the majority of research has investigated eyewitness identification accuracy using physical photographs, a study by MacLin, Zimmerman, and Malpass (2005) found no difference between paper-and-pencil administration and computer administration.

Procedure

Developing the bracket procedure. Participants completed the pilot study in a computer laboratory in groups up to a maximum of three participants; participants' computer screens were not visible to other participants. After obtaining informed consent (see Appendix B for consent form), participants watched the mock crime video, containing either the East Asian or Caucasian culprit, and completed a 20 minute distractor task (i.e., a word search puzzle). Participants were then administered the bracket procedure, with the specific details (i.e., placement of photographs and wording of instructions) varying randomly across participants in order to determine the best parameters. In general, participants were shown pairs of lineup members and asked to select one that was either the most similar to or least like the culprit. Prior to viewing the photographs participants read the following instructions: "You will be seeing some photographs. To start off, think back to what the culprit looks like." Two photographs then appeared on the next screen. Participants were asked to make judgements for four unique pairs of photographs. After four pairs had been viewed, two new pairs comprised of lineup members that remained from the first four pairs was shown one pair at a time. Lineup members continued to be selected or eliminated in this manner until one lineup member remained. At that point the participant was provided the following directions and asked to either reject the lineup member or to identify him as a culprit:

> This may or may not be a picture of the culprit. Think back to what the culprit looked like. Now, compare your memory to this photograph. If this is a picture of the culprit, click "Yes, this is a picture of the culprit." If this is a picture of someone else, click "No, this is not a picture of the culprit."

After participants provide their response they were asked to rate their confidence in their decision on a scale of *0 (not at all confident)* to *100 (completely confident).* See Appendix C for screenshots of the preliminary bracket lineup website.

Following completion of the lineup procedure, participants were briefly interviewed regarding their experience of the lineup. Participants were asked to comment on their experience completing the procedure with emphasis placed on: (a) what it was like to complete the lineup, (b) what they wished was different, (c) what they liked about the procedure, (d) what they were thinking as they were going through it, (e) what they thought about the placement of the pictures and the instructions, and (f) if they have any suggestions. This entire procedure took between 30 and 45 minutes.

As the goal of the pilot study was to refine the procedure by gathering participant feedback, certain details within the bracket procedure were varied and administered to different participants. Namely, the position of the lineup members (either vertically or horizontally) was varied, along with the instructions to select the most similar or dissimilar looking lineup member to the culprit. In regards to the latter, some participants were asked "Which picture looks least like the culprit?", while others were asked "Which picture looks most similar to the culprit?" Modifications based on participant feedback regarding these factors and any unforeseen details were made as deemed appropriate.

Results and Discussion

A quantitative content analysis of participants' responses to the interview questions was conducted to identify common response themes and concerns. All participants' responses were read and themes were identified based on the frequency, similarity, and relevance of the content. Similar feedback that was provided by multiple participants was given more weight in the decision process for finalizing the bracket lineup procedure. Any concerns reported by participants that may impact the clarity of the procedure were taken into consideration when finalizing the bracket procedure. Overall, with the exception of one participant (who was in the "least similar" condition) who reported not understanding the purpose of the task, there was no feedback provided by participants that indicated the procedural instructions were confusing or challenging to manage. Although one of the main components of the bracket procedure is showing two photographs at a time, and a few (n = 3) participants reported that they preferred seeing fewer faces at a time, a few participants (n = 3) reported that they wanted to be able to compare all the faces at once. Several participants (n = 3) also noted they liked that the procedure narrowed down the options. There was also numerous references to analyzing and comparing facial features among lineup members. Notably, several participants (n = 2 in the "most" condition, n = 2 in the "least" condition) reported that their confidence decreased and that discriminating between the faces and their memory became more difficult as the procedure reached the end.

Position of photos. Given that previous research suggests there may be a visual field and spatial bias towards the left (Mansour et al., 2009; Megreya et al., 2011;

Megreya & Havard, 2011), the initial intent for the bracket procedure was to place the photographs vertically in order to mitigate any left-right gaze spatial biases. However, since this positioning could be considered unusual, and may violate participants' expectations, the positioning of the photographs was also varied in the pilot study to assess for unforeseen problems before validating the procedure with a larger sample. Nine participants viewed a lineup with vertically placed photographs, and six participants viewed a lineup with horizontally placed photographs. Participants who viewed the photographs horizontally often reported that this placement facilitated comparison of the lineup members. In contrast, a majority of participants viewing the photographs vertically often reported that they thought a horizontal placement would be better as it would allow for an easier comparison of features (e.g., height, face shape). Vertical placement also violated expectations of two participants who reported expecting to see the photographs side by side. See Table 1 for frequency counts for the content themes. Overall, participants reported a preference for photographs to be placed horizontally, but there were no reported problems or difficulties. Therefore, photographs were maintained in a vertical placement as originally intended to avoid visual and spatial biases that could occur with horizontal placement.

Lineup instructions. Six pilot participants viewed a lineup that required them to select the member most similar to the culprit and nine pilot participants were required to eliminate lineup members by selecting the member who looked least like the culprit. Participants who were asked to select the most similar looking member reported no concerns with the instructions. In contrast, about half of the participants who were asked to eliminate the least similar member reported potential concerns (see Table 1 for

Table 1

Frequency of Responses for Content Themes Regarding Position of Photographs and Selection Instructions

Bracket Procedure Characteristic	Content themes		Number of respondents mentioning theme
Position of photos	Horizontal placement		*N* = 6
		Horizontal placement facilitated comparison of the lineup members	4 (67%)
	Vertical placement		*N* = 9
		Spontaneously suggested a horizontal placement would allow for an easier comparison of facial features than vertical placement	6 (67%)
		Vertical placement violated expectations	2 (22%)
Selection Instructions	Select most similar		*N* = 6
		Instructions/procedure were confusing	0 (0%)
	Select least similar		*N* = 9
		Violated expectations	4 (44%)
		Made the task more difficult relative to being asked to select the most similar member	1 (11%)

frequency counts). Several participants reported that the instruction violated their expectation as they assumed they would be selecting the most similar looking member. Participants reported having to re-read the instructions carefully, and one participant reported picking the most similar culprit until part way through the lineup when he realized he was following the directions incorrectly. Some participants also reported that they believed that the “least-like instruction” made the task more difficult compared to selecting the most similar member. Overall, based on participants’ expectations, it appeared that an instruction to eliminate the least similar member could cause confusion or result in people responding opposite to the instructions (i.e., choosing the most similar member). Having participants eliminate least similar members could be one methodological change that could potentially improve identification accuracy. However, due to people’s expectations regarding instructions, it is likely some training and practice trials would need to occur before the real lineup is presented. To design and test instructions that would not result in confusion or failure to follow directions accurately was beyond the scope of this project. Therefore, it was decided that for the current studies participants would be asked to select the member most similar to the culprit.

Study 1

The purpose of Study 1 was to validate the new lineup procedure within the same-race identification context.

Participants

Three hundred seventy-two participants who self-identified as Caucasian completed Study 1. Participants were initially recruited through the Department of Psychology’s participant pool and completed the study in the laboratory. Participants were excluded if they had previously participated in a research study using the same stimuli, including the pilot study. However due to low participation using this recruitment strategy, efforts were made to expand recruitment to online samples. Additional participants were recruited via the participant pool to complete the study online and through Amazon's Mechanical Turk (MTurk). Mechanical Turk is a crowdsourcing platform where workers signup to complete tasks for pay. Although workers come from over 100 countries, workers are primarily from the United States and India (Mason & Suri, 2012). Recruitment via Mechanical Turk was open to all Turk workers, except individuals located in India according to the MTurk system. Each MTurk worker has a unique MTurk ID number that was used to prevent workers from completing the study more than once. It is difficult for workers to create more than one MTurk account (Mason & Suri, 2012) and it is therefore unlikely the same worker completed the study multiple times using different IDs. As an additional safeguard, participants were asked if they had previously completed the study to screen for duplicate participants. Participants who were recruited through the participant pool and completed the study in lab received 1 bonus credit, and participants who completed the study online received 0.5 bonus credit. Participants recruited via Mechanical Turk received $2.00 USD for their participation.

Participants were excluded from the final sample if they experienced technical difficulties during the video or had incomplete data (n = 5), failed the validity check question regarding the video content (n = 7), completed the study on a mobile device (n = 1), were unable to see all lineup members on their screen simultaneously when assigned to the simultaneous lineup (n = 8), reported they could not read English fluently (n = 1), or took more than 45 minutes to complete the study (n = 7; 97% of participants completed the study in under 45 minutes). Because there were no differences in the pattern of results when participants who had previously identified a suspect in a real police lineup (*n* = 14) were included or excluded from the sample, participants who reported previous experience were retained in the final sample. The final sample consisted of 343 participants (56.9% female; mean age = 29.56 years, *SD* = 11.9, range 17-77; 60.3% Mechanical Turk, 12% online participant pool, 27.7% lab participant pool). See Table 2 for the number of participants in each condition as a function of recruitment method. See Table 3 for demographic information for participants for each recruitment method.

Design

A 3 (Lineup Procedure: Simultaneous, Sequential, Bracket) x 2 (Lineup Type: Target-Present, Target-Absent) between-subjects design was used.

Materials

The video containing a Caucasian culprit as described in the pilot study was used as the mock crime for Study 1. Similarly, the 8-person lineups containing Caucasian males obtained during the lineup creation phase that were also used in the pilot study, were used for Study 1.

Procedure

General procedure. Participants completed the study in a computer lab in groups of a maximum of 10 participants; participants' computer screens were not visible to other participants. After providing informed consent (see Appendix D for consent form), participants were randomly assigned to one of six conditions, with the constraint that the number of participants be approximately evenly distributed across conditions. The

Table 2

Number of Participants per Condition for Each Recruitment Method for Study 1

	Recruitment source		
Target-present	Participant pool - lab	Participant Pool - online	MTurk
Simultaneous	17	4	34
Sequential	11	5	41
Bracket	15	9	39
Target-absent			
Simultaneous	19	5	30
Sequential	20	8	31
Bracket	13	10	32

Table 3

Demographic Information for Participants Recruited through the Participant Pool in Lab, Participant Pool Online, and Mechanical Turk for Study 1

	Participant pool - lab	Participant Pool - online	MTurk
Age in years			
Mean (SD)	20.35 (3.33)	21.34 (4.45)	35.38 (11.88)
Range	17-36	18-43	18-77
Gender *n* (%)			
Female	69 (72.60)	35 (85.40)	91 (44.00)
Male	26 (27.40)	6 (14.60)	116 (56.00)

participants were directed to a website where they watched the mock crime video containing the Caucasian culprit. Following a 20 minute delay, in which participants completed a word search, participants were presented with one of the three lineup procedures as described below. In other words, participants were shown either a simultaneous lineup, sequential lineup, or the bracket lineup procedure developed in the pilot study. Further, half the participants viewed a target-present lineup and half viewed a target-absent lineup. Instructions for the simultaneous and sequential lineup procedures were modeled closely off of the instructions used by Pozzulo and colleagues (2008). Minor changes to instructions included using the word culprit instead of criminal, and adapting the wording to fit computer administration rather than paper-and-pencil administration. Following completion of the lineup procedure, participants were asked to provide demographic information. See Appendix E for the demographic questionnaire. At the conclusion of the study, all participants were debriefed regarding the purpose of the research, asked not to discuss the study with others, and were awarded any bonus credit. The procedure took no longer than 30 minutes.

Efforts to collect data in the lab via the participant pool continued for 1 year. Over the year there was a considerable decline in participation in lab-based studies throughout the psychology department. Despite posting 60 to 100 participant time slots per week, there were many weeks with very few (i.e., less than 5) to no participants signing up. After 1 year of data collection, approximately 95 participants had completed Study 1, which was less than a third of the desired sample size. Brewer, Weber, and Semmler (2005) argued that low statistical power is “the most significant methodological issue in this field” (p. 181). Therefore, due to this slow recruitment and need for a sufficient sample size, the study was modified partway through data collection so that it could be completed independently online, thus allowing for increased recruitment via an online method only (i.e., through the participant pool or via an online recruitment source, Amazon Mechanical Turk).

Prior to modifying the study for online recruitment, an effort was made to consult with researchers in the field who had conducted similar studies online to obtain advice on conducting lineup studies online. K. Wade and M. Colloff (personal communications, November 23 and 24, 2016) provided a sample online lineup study and shared some of their ideas for addressing methodological and validity concerns (e.g., including validity check questions, automatically advancing webpages, asking what device was used to complete the study). Some of their ideas were used to guide the development of the online procedure for the present research. Methods from studies in which similar research was conducted using online recruitment sources were also reviewed to help guide development of the online procedure (e.g. Carlson & Carlson, 2014; Carlson, Carlson, Weatherford, Tucker, & Bednarz, 2016; Colloff, Wade, & Strange, 2016; Mansour et al., 2016).

Overall, the main changes that needed to be made included adding validity check questions, asking about technical difficulties, recording completion time, and asking about the device used to complete the study. Data collection through online methods, including Mechanical Turk, has become increasingly popular in psychology. Although there are some differences between MTurk participants and typical student participants, there are also many similarities, and lab-based (in-person) findings in psychology have been replicated with MTurk samples (Chandler & Shapiro, 2016; Goodman, Cryder, &

Cheema, 2013; Mason & Suri, 2012; Paolacci & Chandler, 2014) Once recruitment began via online methods, recruitment through the lab was stopped. Participants completing the study solely online were asked to complete it in one sitting at home, in private, using a laptop or desktop computer. Participants were asked not to use a mobile device. Validity check questions were added to the study to ensure participants were adequately paying attention, did not encounter technical difficulties, and were following the basic requirements of the study (i.e., not using a mobile device). See Appendix F for validity questions. Length of time to complete the study was also recorded.

Simultaneous lineup procedure. Participants assigned to view the simultaneous lineup were presented with eight photographs in two rows of four along with the following instructions placed above the photographs:

> Please look at these photographs. The culprit's picture may or may not be present. To start off, think back to what the culprit looks like. If you see the culprit, please click on the culprit's picture. If you do not see the culprit, please click the "not here" button.

After the participant selected a response he or she rated his or her confidence on a scale ranging from *not at all confident (0)* to *completely confident (100)*. See Appendix G for screenshot of the simultaneous lineup webpage.

Sequential lineup procedure. Participants viewing the sequential lineup were presented eight photographs one at a time. Participants were unaware of how many photographs they would be viewing and were not allowed to view the photographs more than once. As done in the original sequential lineup (Lindsay & Wells, 1985) and in subsequent research (e.g., Carlson et al., 2016; Horry, Palmer, & Brewer, 2012;

Humphries et al., 2012; Pozzulo et al., 2016), participants were informed that they would only see each photograph once. The following directions were presented on the screen:

> You will be seeing some photographs. The culprit's picture may or may not be present. You will see each picture once. You will not be able to move ahead or back in the sequence. You need to make an identification decision each time you view a picture. Once you have made an identification decision, you will not be able to see that picture again. To start off, think back to what the culprit looks like, and compare your memory of the culprit's face to each picture. If the picture shown is the culprit, please click "yes." If the picture shown is not the culprit, please click "no."

After the participant clicked on the "continue" button, a photograph was presented in the middle of the screen along with the question: "Is this a picture of the culprit?" After the participant made a decision, he or she was asked to rate his or her confidence on a scale ranging from *not at all confident (0)* to *completely confident (100)*. After providing a confidence rating, the next photograph was presented and the procedure was repeated. This continued until all eight photographs were shown, regardless of whether the participant made an identification. Participants were allowed to make an identification more than once if they choose to do so, however, if a participant made multiple identifications, the participant was automatically coded as making a false identification. See Appendix H for screenshots of the sequential lineup website.

Bracket lineup procedure. For the bracket lineup condition, participants were presented pairs of photographs and were asked to select the photograph that looked most similar to the culprit. On the first screen participants saw the following directions: “You will be seeing some photographs. To start off, think back to what the culprit looks like.” Two photographs then appeared in a vertical orientation on the screen and the participant was asked to click on the photograph that looked most like the culprit. After a photograph was selected, another pair of photographs were presented for the participant to choose the member who most resembled the culprit. This continued until four pairs of photographs had been viewed. Following the fourth selection, the photographs selected from the first two pairs were presented as a pair, and the participant was asked to select the most similar looking member. This was repeated with the photographs that were selected from the third and fourth pairs presented. The photographs selected from the last two pairs shown were then presented, and again the participant was asked to select the most similar looking member. After the participant selected the most similar looking member, that lineup member remained on the screen and the participant read the following directions:

> This may or may not be a picture of the culprit. Think back to what the culprit looked like. Now, compare your memory to this photograph. If this is a picture of the culprit, click “Yes, this is a picture of the culprit.” If this is a picture of someone else, click “No, this is not a picture of the culprit.”

After a decision was made the participant rated his or her confidence in this decision on a scale ranging from *not at all confident (0)* to *completely confident (100).* See Appendix I for screenshots of the bracket procedure.

Results and Discussion

Data Analysis. Due to statistical disadvantages of analyzing the data separately for each recruitment method, which results in low numbers of participants for each condition, all participants were analyzed together regardless of recruitment method. Appendix L contains a table displaying the accuracy rates for each condition as a function of whether participants were recruited through the participant pool or Mechanical Turk. However, these data were not further analyzed to due low numbers of participants within cells, resulting in low statistical power and precision. Similarly, further fine-grained analyses based on participant demographics (e.g., age, gender) were also not conducted due to the low number of participants per cell that would result by splitting the data up.

Data was analyzed separately for target-present and target-absent lineups. The proportion of correct identifications was the primary dependent measure for target-present lineups, whereas correct rejections (i.e., not selecting anyone from the lineup) was the dependent measure for target-absent lineups. The proportion of foil identifications and false rejections were also examined for target-present lineups to provide a further analysis of the types of errors produced by each lineup. Appendix J, displays the number of people who identified each lineup member for each lineup procedure. Data were also analyzed for choosers and nonchoosers separately. Because in the real world it is unknown whether the suspect is actually the culprit, analyzing data of choosers and nonchoosers provides information about the reliability and accuracy of a decision independent of whether the culprit was present. Per Cumming (2012), differences in accuracy between the different conditions were examined by calculating proportions and comparing the differences between the proportions and the associated 95% confidence intervals.

Suspect identification diagnosticity ratios were calculated for each procedure as a measure of probative value. Diagnosticity ratios take into account both target-present and target-absent lineups, which is important for generalizing conclusions to the real world, because in reality it is unknown whether the culprit is present in the lineup. It is also helpful in drawing conclusions about the superiority of a procedure when the differences between procedures vary in opposite directions in terms of correct identifications and correct rejections. Conditional probability of diagnosticity was calculated, as recommended by other researchers, (e.g., Clark, Howell, & Davey, 2008; Wells & Lindsay, 1980), by dividing the proportion of correct identifications for target-present lineups, by the sum of the proportion of correct identifications for target-present lineups and the proportion of false identifications from target-absent lineups. The false identification rate for target-absent lineups was determined by dividing the total proportion of false identifications by lineup size, in order to estimate the true false identification rate that is independent from foil identifications. In other words, in lab-based research in which there is no designated innocent suspect for target-absent lineups, all identifications count as a false identification. However, in the field, some of these identifications would be known foil identifications and would not be considered a false identification in the sense that a known innocent person would be identified. Therefore, in lab based research, the false identification rate is estimated by dividing by lineup size (i.e., 8 for the present study). In summary, conditional probability indicates the likelihood that a lineup member is guilty if he has been selected from the lineup.

Target present lineups. To determine differences in accuracy amongst the three lineup procedures when the target was present, differences between proportions for each lineup were calculated for participants making same-race identifications. For same-race identifications when the target was present, there was no difference in the number of correct identifications between the simultaneous, P = 0.53 [0.40, 0.65], sequential, P = 0.37 [0.26, 0.50], and bracket, P = 0.49 [0.37, 0.61], lineup procedures (Simultaneous vs. Sequential, P_{diff} = 0.16 [-0.02, 0.33]; Simultaneous vs. Bracket, P_{diff} = 0.04 [-0.14, 0.21]; Sequential vs. Bracket, P_{diff} = 0.12 [-0.05, 0.29]). In other words, lineup procedure did not differentially affect accuracy rates for same-race identifications when the target was present.

Because there are three types of possible response outcomes (i.e., correct identification, foil identification, and false rejection) for participants viewing a target-present lineup, the differences in types of errors made between each lineup were also examined. With regards to the types of errors made, the sequential lineup, P = 0.47 [0.35, 0.60], resulted in 5.2 times more foil identifications than the simultaneous lineup, P = 0.09 [0.04, 0.20], P_{diff} = 0.38 [0.22, 0.52], and 2.1 times more foil identifications than the bracket lineup procedure, P = 0.22 [0.14, 0.34], P_{diff} = 0.25 [0.08, 0.40]. In other words, the sequential lineup resulted in statistically more foil identifications than the simultaneous or bracket lineup. Thirteen participants (23%) in the sequential lineup condition made more than one identification and were coded as making a foil identification. There was no difference in the foil identification rate between the simultaneous and bracket lineup procedures, P_{diff} = 0.13 [0.00, 0.26]. In contrast, the simultaneous lineup, P = 0.38 [0.27, 0.51], resulted in more false rejections than the sequential lineup, P = 0.16 [0.09, 0.27], P_{diff} = 0.22 [0.06, 0.38], such that a person making an identification was 2.4 times more likely to falsely reject the lineup when administered the simultaneous procedure compared to the sequential lineup procedure. However, the simultaneous lineup resulted in a comparable number of false rejections to the bracket lineup, P = 0.29 [0.19, 0.41], P_{diff} = 0.10 [-0.07, 0.26]. The sequential lineup and the bracket lineup also had comparable false rejection rates, P_{diff} = 0.13 [-0.02, 0.27]. Overall, all three lineups produced similar accuracy rates, however, the sequential lineup resulted in more foil identifications, whereas the simultaneous lineup resulted in more false rejections relative to the sequential lineup. Table 4 and Figure 1 displays the results for target-present lineups.

Target absent lineups. Differences between correct rejection rates were calculated for each target-absent lineup. For same-race identifications when the target was absent, there was no difference in the number of correct rejections between the simultaneous, P = 0.63 [0.50, 0.75], sequential, P = 0.53 [0.40, 0.65], and bracket, P = 0.51 [0.38, 0.64], lineup procedures (Simultaneous vs. Sequential, P_{diff} = 0.10 [-0.08, 0.28]; Simultaneous vs. Bracket, P_{diff} = 0.12 [-0.06, 0.29]; Sequential vs. Bracket, P_{diff} = 0.02 [-0.16, 0.19]; see Table 4 and Figure 2). Thus, lineup procedure did not differentially affect accuracy rates for same-race identifications when the target was absent. Additionally, 10 participants (17%) in the sequential lineup condition made more than one identification and were coded as making a false identification.

Choosers. Differences in choosing rates and accuracy rates between the three lineup procedures for participants who made an identification were also examined. Collapsed across target-present and target-absent lineups, participants were more likely to choose a lineup member when administered the sequential lineup, P=0.66 [0.56, 0.73], than when administered the simultaneous lineup, P=0.50 [0.40, 0.59], P_{diff} = 0.16 [0.03, 0.28]. The choosing rate for the bracket lineup was P=0.61 [0.52, 0.69], which did not differ from the choosing rate for the sequential lineup, P_{diff} = 0.05 [-0.08, 0. 17], or the

Table 4

Accuracy Rates as a Function of Lineup Procedure for Same-Race Identifications

	Lineup procedure		
Target-present	Simultaneous (*N* = 55)	Sequential (*N* = 57)	Bracket (*N* = 63)
Correct identifications	0.53 (29)	0.37 (21)	0.49 (31)
Foil identifications	0.09 (5)	0.47 (27)	0.22 (14)
False rejections	0.38 (21)	0.16 (9)	0.29 (18)
Target-absent	(*N* = 54)	(*N* = 59)	(*N* = 55)
Correct rejections	0.63 (34)	0.53 (31)	0.51 (28)
False identifications	0.37 (20)	0.47 (28)	0.49 (27)

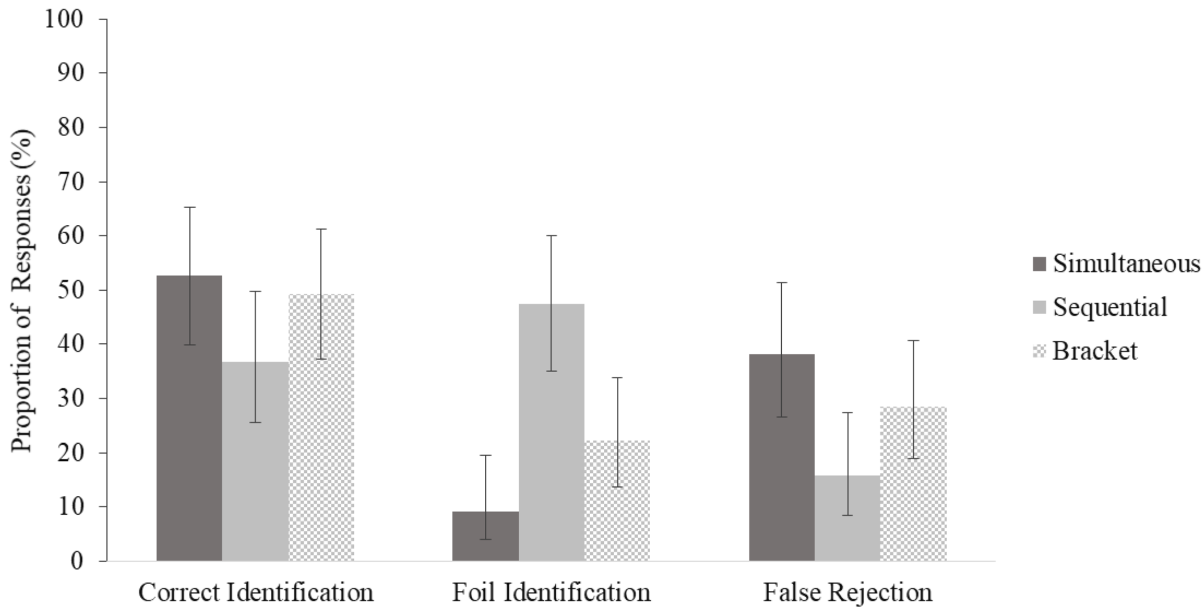

Figure 1. Proportion of responses for each lineup procedure as a function of response type for target-present lineups (same-race identifications). Error bars represent 95% confidence intervals on the proportions.

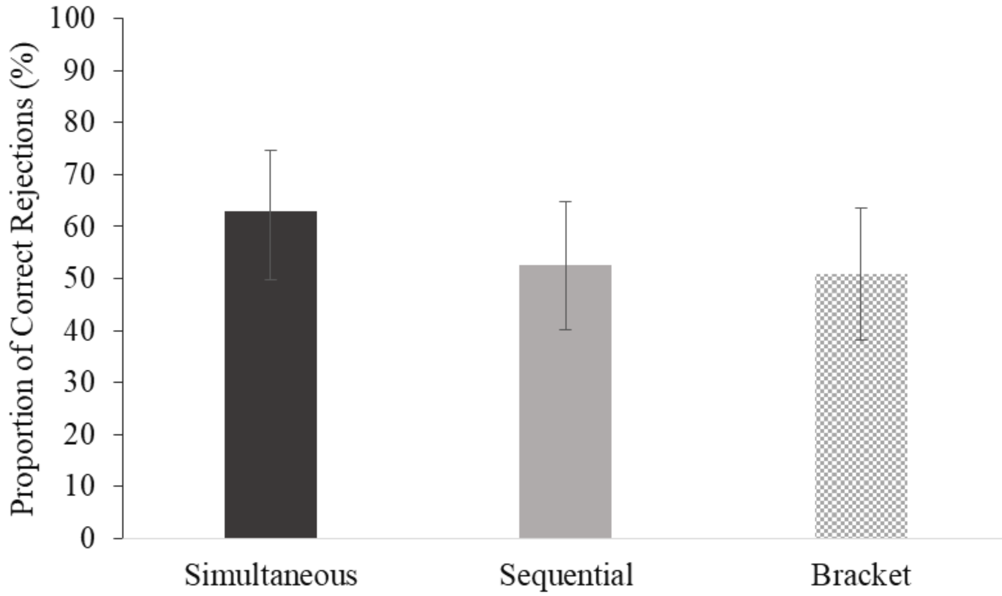

Figure 2. Proportion of correct rejections for each lineup procedure for target-absent lineups (same-race). Error bars represent 95% confidence intervals on the proportions.

simultaneous lineup, P_{diff} = 0.05 [-0.17, 0.08].

When participants did choose a lineup member as the culprit, they were 1.9 times more likely to be correct when administered the simultaneous lineup, P=0.53 [0.41, 0.66], P_{diff} = 0.26 [-0.09, -0. 41], and 1.6 times more likely to be correct when administered the bracket lineup, P=0.43 [0.32, 0.55], relative to the sequential lineup, P=0.28 [0.19, 0.39], P_{diff} = 0.15 [0.001, 0.30]. Participants were equally likely to be correct when they made an identification when administered the simultaneous or bracket lineups, P_{diff} = 0.11 [-0.07, 0.27]. Figure 3 and Table 5 displays the results for choosers for same-race identifications

Nonchoosers. Participants who rejected the lineup were classified as nonchoosers. Differences in accuracy (i.e., correctly rejecting the lineup when the target is absent) rates amongst nonchoosers for each lineup were calculated. Accuracy for participants who did not make an identification (i.e., rejected the lineup) did not differ across lineup procedures (Simultaneous vs. Sequential, P_{diff} = 0.1 [-0.03, 0.32]; Simultaneous vs. Bracket, P_{diff} = 0.01 [-0. 17, 0.20]; Sequential vs. Bracket, P_{diff} = 0.17 [-0.03, 0. 34]; see Figure 4, and Table 5). Therefore, participants who rejected a lineup had comparable accuracy regardless of the lineup procedure.

Diagnosticity. Conditional probability of diagnosticity was calculated for each lineup to provide an index of which lineup resulted in the highest overall accuracy. All lineup procedures had similar diagnosticity ratios, with the simultaneous lineup having the highest ratio. Conditional probability of diagnosticity ratio was 0.92 for the simultaneous lineup, 0.89 for the bracket lineup, and 0.86 for the sequential lineup.

Table 5

Accuracy Rates as a Function of Lineup Procedure for Choosers and Nonchoosers for Same-Race Identifications

	Lineup procedure		
Choosers	Simultaneous (*N* = 54)	Sequential (*N* = 76)	Bracket (*N* = 72)
Correct identifications	0.54 (29)	0.28 (21)	0.43 (31)
Nonchoosers	(*N* = 55)	(*N* = 40)	(*N* = 46)
Correct rejections	0.62 (34)	0.78 (31)	0.61 (28)

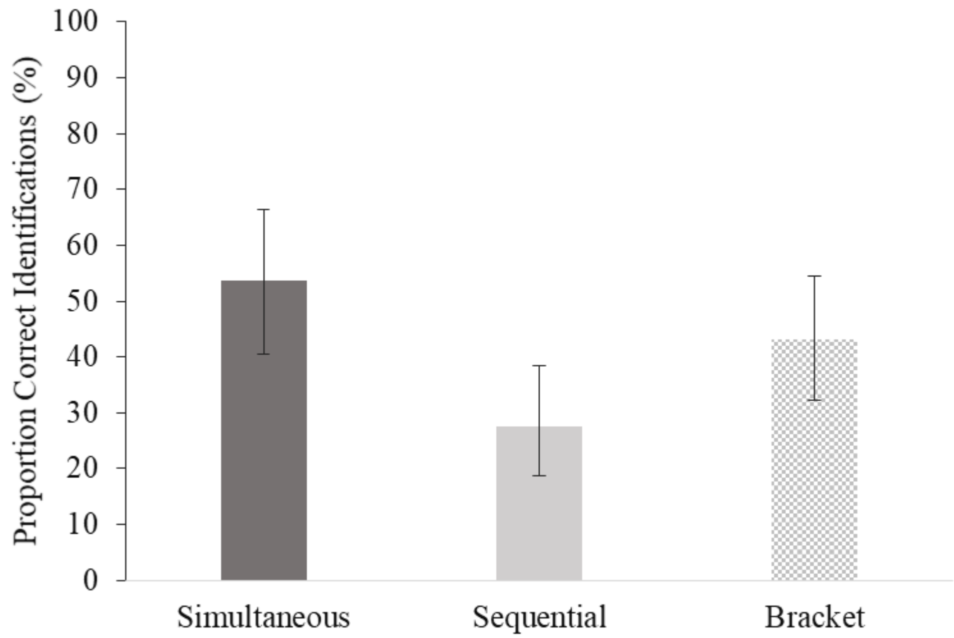

Figure 3. Proportion of correct identifications for choosers for same-race identifications for each lineup procedure. Error bars represent 95% confidence intervals on the proportions.

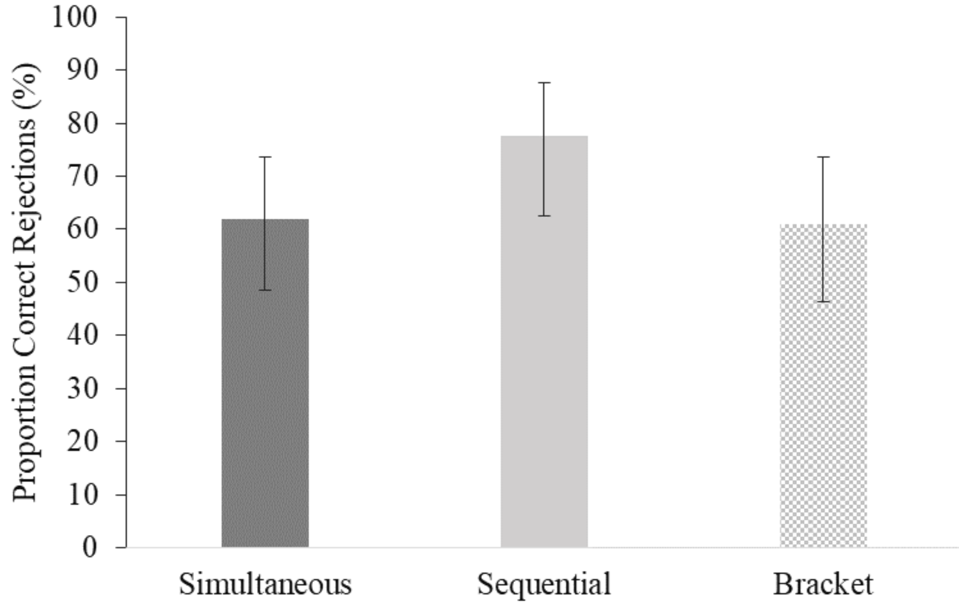

Figure 4. Proportion of correct rejections for nonchoosers for same-race identifications for each lineup procedure. Error bars represent 95% confidence intervals on the proportions.

Discussion. The goal of this study was to explore whether a novel lineup procedure would improve identification accuracy for same-race identifications. It was hypothesized that the bracket lineup would result in more correct identifications than the simultaneous and sequential lineups. The results did not support this hypothesis. Instead, correct identifications were comparable across all three procedures. This is consistent with other research that has found no differences in correct identification rates between simultaneous or sequential lineups (Humphries et al., 2012; Lindsay & Wells, 1985; Pica & Pozzulo, 2017; Pozzulo et al., 2016; E. C. Wells & Pozzulo, 2006), although some research has found that the simultaneous lineup results in higher correct identification rates than the sequential lineup (Steblay et al., 2011). It is also similar to research that has found no differences in correct identification rates between simultaneous or sequential lineups and other novel lineup procedures (Pica & Pozzulo, 2017; Pozzulo et al., 2008; Pozzulo et al., 2016; E. C. Wells & Pozzulo, 2006). In regards to correct rejections, it was predicted that the bracket lineup would result in more correct rejections than the sequential or simultaneous lineup. Again, results did not support this hypothesis as correct rejection rates were comparable across all three lineup procedures. This is in contrast to the majority of research that finds a sequential lineup advantage such that the sequential lineup results in more correct rejections than the simultaneous lineup (Steblay et al., 2011). Nevertheless, some studies have found no differences in correct rejection rates between the simultaneous and sequential lineup (Humphries et al., 2012; Pozzulo et al., 2016). Finally, in relation to the overall goal of the study, the bracket lineup failed to improve overall identification accuracy relative to the simultaneous and sequential lineups. Diagnosticity was comparable across all three lineup procedures, which is inconsistent with prior research that has found the sequential lineup to be more diagnostic than the simultaneous lineup (Steblay et al., 2011). Nonetheless, choosers (i.e., participants who made an identification), were more likely to be accurate with the bracket or simultaneous lineup than the sequential lineup, suggesting that there is a benefit to lineup procedures that allow for direct comparison of lineup members. This is consistent with the diagnostic feature-detection model proposed Wixted and Mickes (2014).

A failure to find a sequential lineup advantage could be the result of backloading the lineup using a nondisclosure method (i.e., not informing participants about how many lineup members they would see), rather than deceiving participants about how many members they would see. The more lineup members a participant believes they will see, the more conservative their responding (Horry et al., 2012). Thus it is possible that with no indication about the number of lineup members that would be shown, participants failed to adopt a more conservative response criterion. This is discussed further in the general discussion.

Study 2

The purpose of Study 2 was to validate the new lineup procedure within the other-race identification context. As a caveat upfront, it should be noted that a full crossover design (i.e., Caucasian participants viewing Caucasian and East Asian faces, and East Asian participants viewing Caucasian and East Asian faces was not used for several reasons. First, given the demographic characteristics of the participant pool and the sample size required to conduct a full crossover design, using a full crossover design was not feasible. Second, the main purpose of this research was to investigate how a new lineup procedure would perform in the context of making one type of other-race identification. Given the robustness of the cross-race effect, and the findings that the effect is strongest when a majority group (generally Caucasians) view a minority group (Meissner & Brigham, 2001), a full crossover design is not required to investigate this research question. Last, not using a full crossover design is not uncommon in the field of cross-race research and other researchers have used similar reasoning as discussed above when explaining their design choices (e.g., Bornstein, Laub, Meissner, & Susa, 2013; McDonnell, Bornstein, Laub, Mills, & Dodd, 2014; Meissner, Susa, & Ross, 2013; Pezdek et al., 2012; M. G. Rhodes, Sitzman, & Rowland, 2013). Nevertheless, findings are limited to one other-race situation, and designs using other culprit races will likely be needed before generalizations, if any, can be made.

Participants

Three hundred fifty-nine participants who self-identified as Caucasian completed Study 2. Participants were recruited in conjunction with participants from Study 1. The recruitment procedures were the same as in Study 1, and included participants from an undergraduate participant pool and from Mechanical Turk. As in Study 1, participants recruited through the participant pool received academic credit, and participants recruited via Mechanical Turk received $2.00 USD for their participation.

Participants were excluded from the final sample if they experienced technical difficulties during the study or had incomplete data (n = 7), failed the validity check question regarding the video content (n = 4), completed the study on a mobile device (n = 2), were unable to see all lineup members on their screen simultaneously when assigned to the simultaneous lineup (n = 4), or took more than 45 minutes to complete the study (n = 10; 96% of participants completed the study in under 45 minutes). As only 3 participants reported previous experience with a real police lineup, and because there were no differences in the pattern of results when participants who had previously identified a suspect in a police lineup were included or excluded from the sample, these participants were retained in the final sample. The final sample consisted of 332 participants (62% female; mean age = 30 years, SD = 11.3, range 17-65; 59.0% Mechanical Turk, 11.1% online participant pool, 29.8% lab participant pool). See Table 6 for the number of participants per condition for each recruitment method. See Table 7 for demographic information for participants for each recruitment method.

Design

A 3 (Lineup Procedure: Simultaneous, Sequential, Bracket) x 2 (Lineup Type: Target-Present, Target-Absent) between-subjects design was used.

Materials

A mock crime video containing an Asian culprit was used for Study 2. The content of the video was identical to the content in the video with the Caucasian culprit described in the pilot study and used in Study 1. The photographic lineups obtained during the lineup construction phase that contained Asian males were used.

Procedure

The same procedure used in the Study 1 was used for Study 2 with the exception that an East Asian culprit appeared in the video instead of a Caucasian culprit. Participants completed the study in a computer lab in groups up to a maximum of 10 participants. Participants' computer screens were not visible to others. After providing informed consent, participants were randomly assigned to one of the six conditions, with the constraint that the number of participants be evenly distributed across conditions.

Table 6

Number of Participants per Condition for Each Recruitment Method for Study 2

	Recruitment source		
Target-present	Participant pool - lab	Participant Pool - online	MTurk
Simultaneous	19	10	27
Sequential	20	9	27
Bracket	17	3	37
Target-absent			
Simultaneous	12	4	38
Sequential	16	4	34
Bracket	15	7	33

Table 7

Demographic Information for Participants Recruited through the Participant Pool in Lab, Participant Pool Online, and Mechanical Turk for Study 2

	Participant pool - lab	Participant Pool - online	MTurk
Age in years			
Mean (SD)	20.72 (4.47)	21.03 (4.70)	36.39 (10.21)
Range	17-53	18-40	20-65
Gender *n* (%)			
Female	70 (70.70)	29 (78.40)	107 (54.60)
Male	29 (29.30)	7 (18.90)	89 (45.40)
No response	-	1 (2.70)	-

Similar to Study 1, participants watched the mock crime video, and following a 20 minute delay, were presented via the computer one of the three lineup procedures (i.e., simultaneous, sequential, bracket). Following completion of the lineup procedure, participants provided demographic information. At the conclusion of the study all participants were debriefed regarding the purpose of the research, asked not to discuss the study with others, and awarded credit/paid.

As in Study 1, due to slow recruitment via the participant pool, which required participants to come into the laboratory, the study was modified partway through to allow for recruitment via an online method only (i.e., through Mechanical Turk and participant pool). The same modifications made during Study 1 were also made for Study 2.

Results and Discussion

Data Analysis. Data was analyzed in the same manner as in Study 1. For the same reasons as discussed in Study 1, data were collapsed across recruitment methods and sample size precluded further fine-grain analyses from being conducted. Appendix M contains accuracy rates for each condition as a function of recruitment sample. Data was analyzed separately for target-present and target-absent lineups, as well as for choosers and nonchoosers. Per Cumming (2012), differences in accuracy between the different conditions were examined by calculating proportions and comparing the differences between the proportions and the associated 95% confidence intervals. Conditional probability of diagnosticity for each lineup was also calculated. Appendix K displays the number of people who identified each lineup member for each lineup procedure.

Target present lineups. To determine differences in accuracy amongst the three lineup procedures when the target was present, differences between proportions for each lineup were calculated for participants making other-race identifications. For other-race identifications when the target was present, the bracket lineup, *P*=0.26 [0.17, 0.39], resulted in a higher proportion of correct identifications than the sequential lineup, *P*=0.11 [0.05, 0.22], P_{diff} = 0.15 [0.01, 0.30]. Participants who were administered the bracket lineup were 2.5 times more likely to correctly identify the culprit than participants who were administered the sequential lineup. In contrast, the proportion of correct identifications for the simultaneous lineup, *P*=0.20 [0.11, 0.32], did not differ from the proportion of correct identifications for the sequential lineups, P_{diff} = 0.09 [-0.05, 0. 22], or the bracket lineup, P_{diff} = 0.07 [-0.09, 0.22].

Differences between the lineups in regards to the two types of errors possible (i.e., foil identification and false rejections) when viewing a target-present lineup were also calculated. With regards to foil identification errors, the sequential lineup, *P*=0.63 [0.49, 0.74], resulted in 1.5 times more foil identifications than the simultaneous lineup, *P*=0.41 [0.29, 0.54], P_{diff} = 0.21 [0.03, 0.38], and 1.4 times more foil identifications than the bracket lineup procedure, *P*=0.44 [0.32, 0.57], P_{diff} = 0.19 [-0.01, -0. 35]. In other words, the sequential lineup resulted in more foil identifications than the simultaneous or bracket lineups. Fifteen participants (33%) in the sequential lineup condition made more than one identification and were coded as making a foil identification. There was no difference in the foil identification rate between the simultaneous and bracket lineup procedures, P_{diff} = 0.03 [-0.15, 0.20]. In terms of false rejections, all three lineups had comparable false rejections rates, Simultaneous vs. Sequential, P_{diff} = 0.13 [-0.05, 0. 29]; Simultaneous vs. Bracket, P_{diff} = 0.10 [-0.08, 0. 26]; Sequential vs. Bracket, P_{diff} = 0.03 [-0.13, 0.19].

Overall, participants were more likely to correctly identify the culprit when shown a bracket lineup than a sequential lineup. In comparison, correct identification rates observed with the simultaneous lineup were comparable with correct identification rates for both the sequential and bracket lineups. In regards to errors, the sequential lineup resulted in more foil identifications, whereas there was no difference between lineups in terms of false rejections. Table 8 and Figure 5 displays the results for target-present lineups for other-race identifications.

Target absent lineups. Differences between correct rejection rates were calculated for each lineup when the target was absent. For other-race identifications when the target was absent, participants who were administered a simultaneous lineup, P=0.57 [0.44, 0.70], were 1.9 times more likely to correctly reject the lineup than when administered the sequential lineup, P=0.30 [0.19, 0.43], P_{diff} = 0.28 [-0.09, -0. 44], and 2.3 times more likely to correctly reject the lineup than when administered the bracket lineup, P=0.25 [0.16, 0.38], P_{diff} = 0.32 [-0.14, -0. 48]. There was no statistical difference in the number of correct rejections between the sequential and bracket lineups, P_{diff} = 0.04 [-0.12, 0. 21]. Table 8 and Figure 6 displays the results for target-absent lineups for other-race identifications. Additionally, 9 participants (17%) in the sequential lineup condition made more than one identification and were coded as making a false identification.

Choosers. As with the same-race identifications in Study 1, differences in choosing rates and accuracy rates between the three lineup procedures for participants who made an identification were examined. Collapsed across target-present and target-absent lineups, participants were 1.4 times more likely to choose a lineup member when

Table 8

Accuracy Rates as a Function of Lineup Procedure for Other-Race Identifications

	Lineup procedure		
Target-present	Simultaneous (*N* = 56)	Sequential (*N* = 56)	Bracket (*N* = 57)
Correct identifications	0.20 (11)	0.11 (6)	0.26 (15)
Foil identifications	0.41 (23)	0.63 (35)	0.44 (25)
False rejections	0.39 (22)	0.27 (15)	0.30 (17)
Target-absent	(*N* = 54)	(*N* = 54)	(*N* = 55)
Correct rejections	0.57 (31)	0.30 (16)	0.25 (14)
False identifications	0.43 (23)	0.70 (38)	0.75 (41)

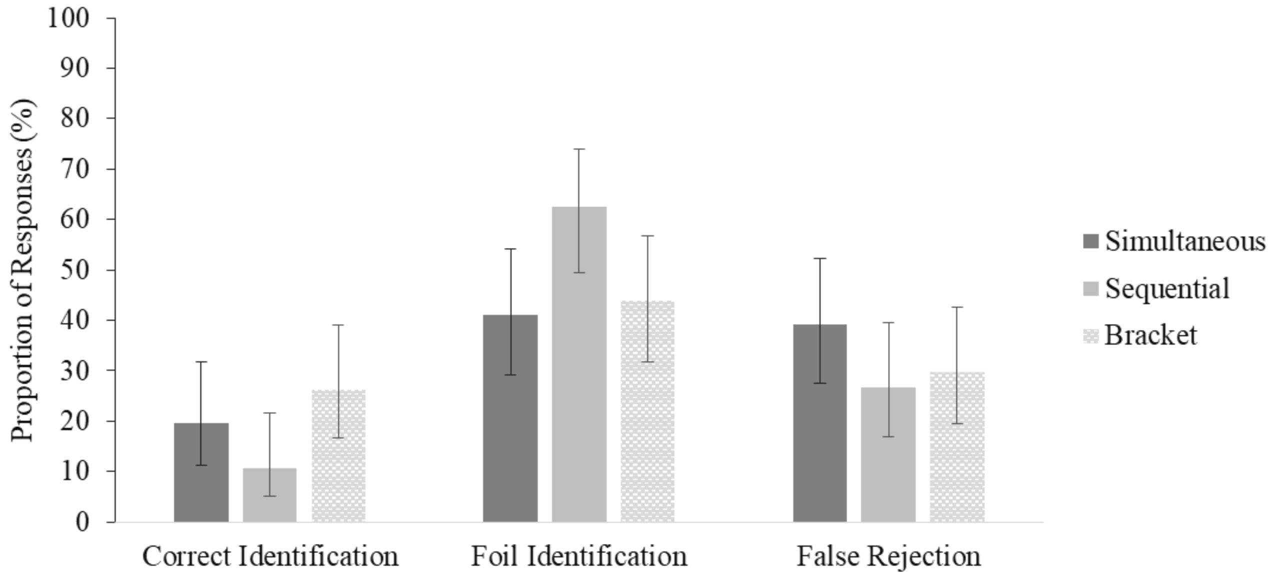

Figure 5. Proportion of responses for each lineup procedure as a function of response type for target-present lineups (other-race identifications). Error bars represent 95% confidence intervals on the proportions.

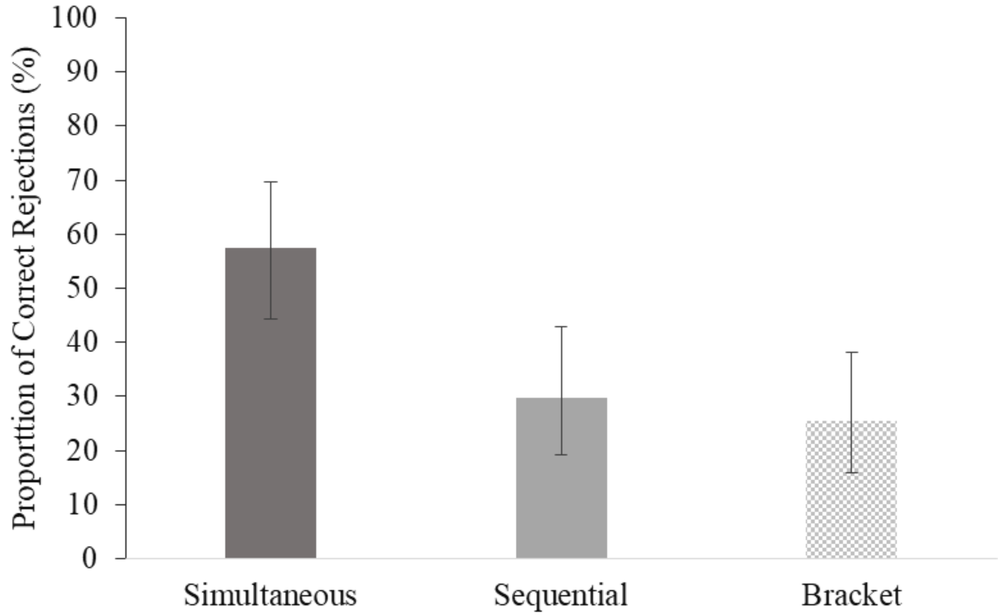

Figure 6. Proportion of correct rejections for each lineup procedure for other-race target-absent lineups. Error bars represent 95% confidence intervals on the proportions.

administered the sequential lineup, P=0.72 [0.63, 0.79], than when administered a simultaneous lineup, P=0.52 [0.43, 0.61], P_{diff} = 0.20 [0.07, 0.32]. Similarly, participants were 1.4 times more likely to choose a lineup member when administered the bracket lineup, P=0.72 [0.63, 0.80], than when administered a simultaneous lineup, P_{diff} =0.21 [0.08, 0.32]. Choosing rates did not differ between the sequential lineup and the bracket lineup, P_{diff} = 0.01 [-0.11, 0.12].

When participants did choose a lineup member as the culprit, they were 2.5 times more likely to be correct when administered the simultaneous lineup, P=0.19 [0.11, 0.31], than when administered the sequential lineup, P=0.08 [0.04, 0.08], P_{diff} = 0.12 [-0. 00, -0. 24].Similarly, participants who made an identification when shown the bracket lineup, P=0.19 [0.12, 0.28], were 2.4 times more likely to be correct than participants shown the sequential lineup, P_{diff} = 0.11 [0.00, 0.22]. Participants had comparable accuracy when they made an identification when administered the simultaneous or bracket lineups, P_{diff} = 0.01 [-0.12, 0.15].Table 9 and Figure 7 displays the results for choosers for other-race identifications.

Nonchoosers. Accuracy of lineup rejections, collapsed across target-present and –absent lineups, were also compared for participants for each lineup procedure. Accuracy for participants who did not make an identification (i.e., rejected the lineup) did not differ across lineup procedures (Simultaneous vs. Sequential, P_{diff} = 0.07 [-0.28, 0.14]; Simultaneous vs. Bracket, P_{diff} = 0.13 [-0.08, 0.34]; Sequential vs. Bracket, P_{diff} = 0.07 [-0.18, 0.29]; see Table 9 and Figure 8). As in Study 1, participants who rejected a lineup had comparable accuracy regardless of the lineup procedure.

Diagnosticity. Conditional probability of diagnosticity was calculated for each lineup to provide an assessment of overall lineup accuracy. The simultaneous lineup (0.79) and bracket lineup (0.74) had similar diagnosticity ratios. The sequential lineup had the lowest diagnosticity ratio (0.55). In other words, when a lineup member was selected using a simultaneous or bracket lineup, he was more likely to be guilty than a member selected using the sequential lineup.

Table 9

Accuracy Rates as a Function of Lineup Procedure for Choosers and Nonchoosers for Other-Race Identifications

	Lineup procedure		
Choosers	Simultaneous (*N* = 57)	Sequential (*N* = 79)	Bracket (*N* = 81)
Correct identifications	0.19 (11)	0.08 (6)	0.19 (15)
Nonchoosers	Simultaneous (*N* = 53)	Sequential (*N* = 31)	Bracket (*N* = 31)
Correct rejections	0.58 (31)	0.52 (16)	0.45 (14)

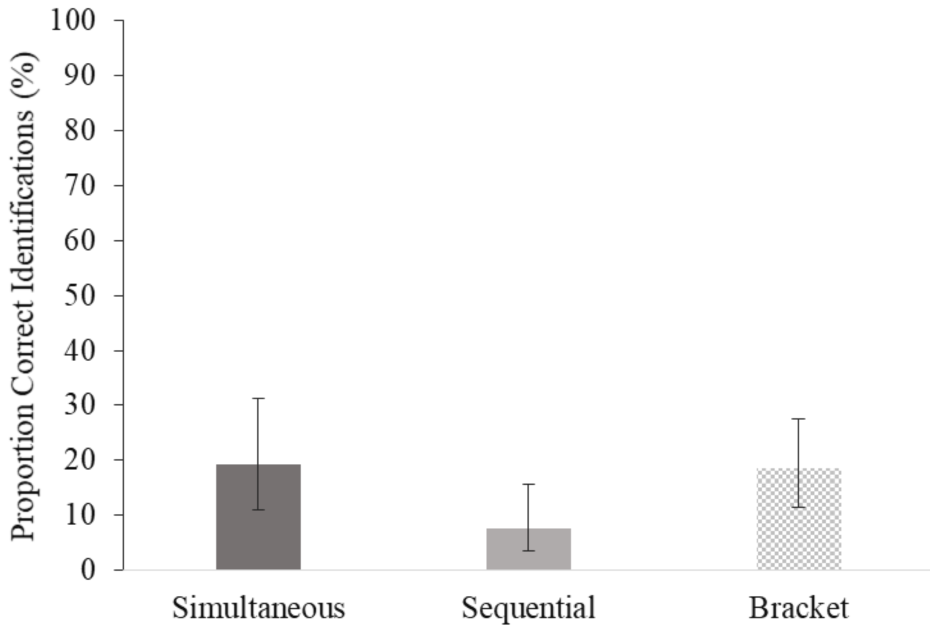

Figure 7. Proportion of correct identifications for choosers for other-race identifications for each lineup procedure. Error bars represent 95% confidence intervals on the proportions.

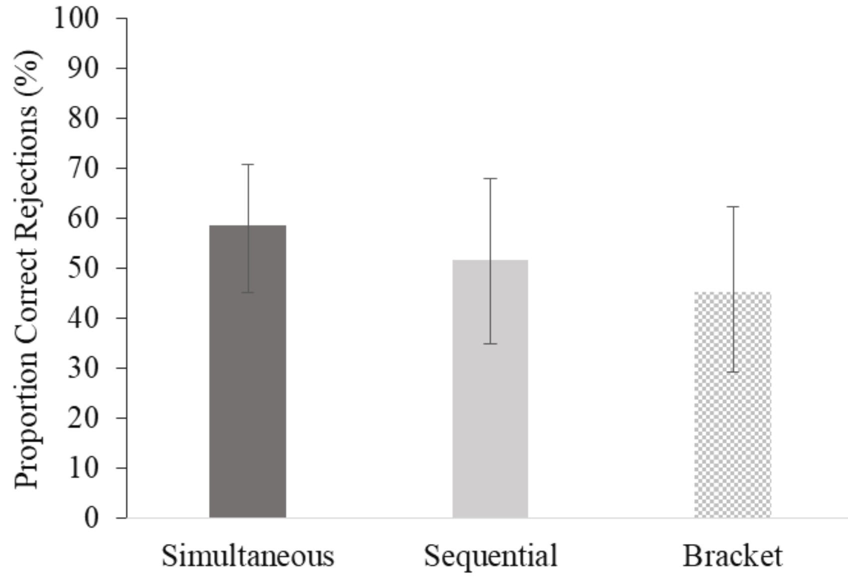

Figure 8. Proportion of correct rejections for nonchoosers for other-race identifications for each lineup procedure. Error bars represent 95% confidence intervals on the proportions.

Discussion. The goal of Study 2 was to explore whether other-race identification accuracy could be improved by using a novel lineup procedure. It was hypothesized that the bracket lineup would result in more correct identifications than the simultaneous and sequential lineups. Results partially supported this hypothesis; the bracket lineup resulted in more correct rejections than the sequential lineup, but comparable correct identifications to the simultaneous lineup. It was also hypothesized that the bracket lineup would result in more correct rejections than the simultaneous or sequential lineup. Contrary to this hypothesis, the bracket lineup resulted in fewer correct rejections (and more false identifications) than the simultaneous lineup, and comparable correct rejections to the sequential lineup. These results are inconsistent with prior research that found that the simultaneous lineup resulted in higher correct identifications than the sequential lineup for other-race identifications (Pascal, 2013). But they are consistent with research that found that the simultaneous and sequential lineups resulted in comparable correct rejection rates for other-race identifications (Pascal, 2013). However, to my knowledge, only one prior study has investigated other-race identifications using the simultaneous and sequential lineup, limiting direct comparisons to lineup research involving other-race identifications. Ignoring differences in race between witness and culprit, other research has also found no differences between correct identifications for simultaneous and sequential lineups (Humphries et al., 2012; Lindsay & Wells, 1985; Pica & Pozzulo, 2017; Pozzulo et al., 2016; E. C. Wells & Pozzulo, 2006), although the simultaneous lineup generally results in higher correct identification rates (Steblay et al., 2011). The current results are inconsistent with the wider body of research that finds the sequential lineup results in higher correct rejection rates (Steblay et al., 2011).

Finally, in regards to the bracket lineup improving accuracy overall, results only partially supported that the bracket lineup demonstrated benefits. The bracket lineup resulted in higher diagnosticity than the sequential lineup, but comparable diagnosticity to the simultaneous lineup. Further, as was seen in Study 1, choosers were more likely to be accurate with the bracket or simultaneous lineup than with the sequential lineup. Again, results appear to support the benefit of allowing participants to compare lineup members, however, the bracket procedure did not result in greater accuracy than the simultaneous lineup in the cross-race situation. Furthermore, the bracket lineup resulted in more false identifications than the simultaneous lineup when the target was absent, and an overall higher choosing rate. This higher choosing rate for the bracket lineup was not seen in Study 1. It is possible that the higher choosing rate in Study 2 resulted in increased correct identifications when the target was present but decreased correct rejections when the target was absent. However, the sequential lineup also had a higher choosing rate in both studies, and did not result in a similar pattern of results. Further, choosing rates between Study 1 and Study 2 were comparable, even though previous research has suggested that people making other-race identifications may be more liberal in their choosing (Meissner & Brigham, 2001). Additionally, the higher diagnosticity of the bracket lineup to the sequential lineup is likely not the result of higher choosing, but rather due to differences in accuracy rates between the target-present and target-absent lineups for each procedure (Steblay et al., 2011). It is possible that the combination of making an other-race identification and using the bracket lineup resulted in high false identification rates. One theory is that because people have poor memory for other-race faces, the bracket procedure made participants more susceptible to becoming confused or to having an increased sense of familiarity across decisions, thus resulting in a higher false identification rate for target-absent lineups.

Comparison across studies 1 and 2. Although the primary purpose of this research was to explore how a new lineup procedure would perform in two different contexts (i.e., same-race and other-race identifications), potential differences between same-race and other-race identifications were examined across the studies, including whether differences in accuracy between same- and other-race identification could be attenuated by different lineup procedures. Appendices J and L contain tables with the proportions for each condition. Overall, a cross-race effect was present. Regardless of lineup procedure or presence of target, participants viewing a same-race lineup, P = 0.51 [0.46, 0.56], were more accurate than participants viewing an other-race lineup, P = 0.28 [0.24, 0.33], P_{diff} = 0.23 [0.15, 0.30]. For target-present lineups, participants making a same-race identification had a higher proportion of correct identifications than participants making an other-race identification when the simultaneous, P_{diff} = 0.33 [0.15, 0.48], sequential, P_{diff} = 0.26 [0.11, 0.40], or bracket, P_{diff} = 0.23 [0.06, 0.38], lineup procedures were administered. For target-absent lineups, participants making a same-race identification were more likely to correctly reject the lineup than participants making an other-race identification when administered the sequential, P_{diff} = 0.23 [0.05, 0.39], or bracket, P_{diff} = 0.26 [0.07, 0.41], lineups. In contrast, when administered the simultaneous lineup, participants had comparable correct rejection rates when making a same-race or other-race identification, P_{diff} = 0.06 [-0.13, 0.23].

The cross-race effect was also evident for choosers. For choosers, participants were more likely to be accurate in their identification when making a same-race identification than when making an other-race identification when administered the simultaneous, P_{diff} = 0.34 [0.17, 0.49], sequential, P_{diff} = 0.20 [0.08, 0.32], or bracket, P_{diff} = 0.25 [0.10, 0.38], lineup procedure. Choosing rates cannot account for these findings. Choosing rates were comparable for same-race and other-race identifications for the simultaneous, P_{diff} = 0.02 [-0.11, 0.15], sequential, P_{diff} = 0.07 [-0.06, 0.18], and bracket, P_{diff} = 0.11 [-0.01 0.23], lineups. In contrast, for nonchoosers, participants making a same-race identification were more likely to make a correct rejection when administered the sequential lineup, P_{diff} = 0.26 [0.04, 0.46]. Participants making same-race identifications had comparable correct rejection rates to participants making an other-race identification when shown the simultaneous, P_{diff} = 0.03 [-0.15, 0.21], or bracket, P_{diff} = 0.16 [-0.07, 0.36], lineups.

CHAPTER III

Discussion

The purpose of the present research was to create and test a novel bracket lineup procedure that had the potential to improve eyewitness identification accuracy over the two existing lineup procedures that are typically used in current practice by police. Furthermore, a secondary goal of this research was to explore the effectiveness of the novel lineup procedure for same-race and other-race identifications. It was hypothesized that for both same- and other-race identifications, the correct identification rate and the correct rejection rate would be highest for participants who completed the bracket procedure. Results did not support the hypotheses for same-race identifications, as correct identification rates and correct rejection rates were comparable across all three lineup procedures. For other-race identifications, results partially supported the hypothesis for correct identifications, as the bracket lineup resulted in more correct identifications than the sequential lineup, but produced similar correct identification rates to the simultaneous lineup.

Further, contrary to hypotheses, the bracket lineup resulted in fewer correct rejections than the simultaneous lineup, and similar correct rejections to the sequential lineup for other-race identifications. Overall, these results suggest that for same-race identifications, the lineup procedures did not differentially affect a participant's ability to recognize the culprit when he was present, nor recognize when he was absent. In contrast for other-race identifications, the bracket lineup, relative to the sequential lineup, improved participants' ability to recognize the culprit when present, but hindered their ability to recognize the absence of the culprit relative to the simultaneous lineup.

Despite the finding that the bracket lineup had minimal impact on increasing a person's ability to recognize the culprit, and for other-race identifications may even increase false identifications, the bracket lineup resulted in better accuracy when a participant made an identification relative to the sequential lineup. Thus, in relation to the goal of the study, which was to improve eyewitness identification accuracy relative to the existing procedures, when participants made an identification, the bracket lineup resulted in better accuracy than the sequential lineup, and comparable accuracy to the simultaneous lineup. In other words, when participants made an identification, they were more likely to be correct when shown a bracket or simultaneous lineup than when shown a sequential lineup. Furthermore, for other-race identifications, the bracket lineup resulted in better diagnosticity than the sequential lineup. In contrast, diagnosticity was comparable across all lineup procedures for same-race identifications. In summary, the bracket lineup resulted in better accuracy than the sequential lineup, particularly for other-race identifications, but resulted in comparable accuracy to the simultaneous lineup.

The finding that the simultaneous and bracket lineup produced comparable accuracy and better accuracy than the sequential lineup would seem to support the notion that being able to directly compare photographs is one important factor for improving accuracy, especially for other-race identifications. Moreover, even with the sequential lineup having a higher choosing rate than the simultaneous lineup, participants were more likely to be wrong when they made an identification using the sequential lineup, further supporting the benefit of direct comparisons. This is consistent with research that finds the simultaneous lineup results in better discrimination than the sequential lineup (Mickes et al., 2012). According to the diagnostic feature-detection model proposed by Wixted and Mickes (2014), the simultaneous comparison of lineup members facilitates discrimination of the culprit from foil lineup members. Therefore, the simultaneous and bracket lineup should produce higher correct identification rates than the sequential lineup when the target is present and higher correct rejection rates when the target is absent. However, in the present studies, this pattern of results was not found for same-race identifications, and only partially found for other-race identifications. It is possible that differences in recognition accuracy between lineup procedures was masked by placing the culprit later in the sequential lineup (position 4), thus allowing participants to conduct relative comparisons in their mind, essentially resulting in the simultaneous, sequential, and bracket lineup being functionally similar. Previous research has found that the advantage in discrimination accuracy afforded by the simultaneous lineup relative to the sequential lineup, decreases when the culprit is placed later in the lineup (Gronlund et al., 2012). However, this explanation likely cannot account for the findings, as the sequential lineup did result in differential accuracy relative to the other lineups for other-race identifications, even though the culprit was placed in the same position. It could be possible that direct comparison of lineup members is only beneficial when the task is difficult due to poor memory, such as when making other-race identifications. Indeed, in the present study, allowing participants to compare faces appeared to be the most beneficial for other-race identifications. Thus it is possible that simultaneous comparison affords an increase in discriminability as suggested by the diagnostic feature-detection model, but the effects are only observed when participants need extra help to facilitate recognition.

Alternatively to the diagnostic feature-detection model, the benefit of simultaneous presentation of photographs could be due to an increase in discrimination along with a change in criterion threshold or confidence that could be attributed to making both relative and absolute decisions. Traditionally, the simultaneous lineup is thought to elicit a relative judgement which tends to lead to more false identifications (Lindsay & Wells, 1985). However, it is likely that participants viewing a simultaneous lineup are using both relative and absolute judgment strategies. For example, Mansour et al. (2009) found that the majority of participants viewing a simultaneous lineup reported using an absolute judgement strategy even though their visual behaviour indicated use of a relative judgment strategy. Comparison of photographs may help to increase recognition of the culprit, and then an absolute judgment, which results in a conservative criterion shift (Dobolyi & Dodson, 2013; Palmer & Brewer, 2012), helps to increase accuracy of output. This is supported by the present finding that when participants do make an identification, they are more likely to be correct when using the simultaneous or bracket lineup procedure (each of which require both a relative and an absolute judgment) than the sequential lineup (which requires only an absolute judgement, at least initially).

In further support of the benefit of direct comparison of lineup members, especially for other-race identifications, is the present finding that the sequential lineup resulted in lower accuracy when participants made an identification, and that the sequential lineup resulted in lower diagnosticity for other-race identifications. While diagnosticity was relatively comparable across lineup procedures for same-race identifications, the sequential lineup resulted in the largest drop in diagnosticity relative to the other two lineup procedures when an other-race identification was made. The ineffectiveness of the sequential lineup for other-race identifications along with the observed benefit of simultaneous comparisons is consistent with expectations given research on the cross-race effect. Given that research finds that other-race faces are weakly or poorly encoded (Sporer, 2001), and that recognition of other-race faces relies more on familiarity (Marcon et al., 2009), it would make sense that being able to compare lineup members would be beneficial for other-race identifications. Further, because the sequential lineup requires the retrieval of specific memory content and theoretically relies on recollection more than familiarity (Gronlund, 2005; Lindsay & Wells, 1985), it would be less suitable for identifications where the culprit is poorly encoded, such as in the case with cross-race identifications. Due to a weak memory trace, people would not be able to identify a culprit on its own, but would need some other information, such as alternative lineup members, to enhance recognition (like the diagnostic feature-detection model suggests). This is also consistent with research that found a trend for increased accuracy for a two-culprit crime when foils that resembled the one culprit were included as the foils for the other culprit (E. C. Wells & Pozzulo, 2006), suggesting that the presence of cues can facilitate accuracy.

Although the bracket lineup resulted in comparable accuracy to the simultaneous lineup, the overarching goal of this research was to create a lineup that would improve accuracy beyond the levels obtained by the simultaneous and sequential lineup. There are several hypotheses as to why this did not occur. First, it is possible that the amount of variability in accuracy that can be accounted for by lineup procedure is maximized, and other factors (e.g., time, quality of memory, foil lineup members, differences in photograph quality, stress at encoding, personality factors) that cannot be controlled, creates a ceiling for the level of accuracy that can be achieved. Although accuracy rates vary and have been reported to be as high as the 80% range for the simultaneous lineup (e.g. Lindsay et al., 1997; Pica & Pozzulo, 2017), one meta-analysis reported that the average correct identification rate was 52% for the simultaneous lineup, and 38% for the sequential lineup (Steblay et al., 2011). Further, a review of several studies that attempted to create a novel lineup procedure to improve accuracy reveals accuracy rates that range from approximately 10% to 60% (e.g. Horry et al., 2015; Horry et al., 2012; Pica & Pozzulo, 2017; Pozzulo et al., 2016), suggesting that variations in lineup procedure methods may not be able to improve accuracy rates further. Therefore, it is possible that increasing accuracy through lineup procedures is restricted, and other methods are needed to help prevent misidentifications and wrongful convictions (e.g., considering decision time, using a blank lineup to eliminate witnesses prone to choosing, instructions to the jury about effectiveness of lineups).

Second, it does not appear that reducing the number of photographs that are shown at once helps to improve accuracy. This is similar to research that has found no differences in correct identification rates between a simultaneous lineup procedure and a lineup method that involves presenting 2 or 3 lineup members at time, (Dillon, McAllister, & Vernon, 2009; E. C. Wells & Pozzulo, 2006). However, this is in contrast to the same research that has also found increased correct rejections when 2 or 3 lineup members were presented at a time (Dillon et al., 2009). It was expected that reducing the number of photographs presented at once would help reduce cognitive load and facilitate identification of diagnostic features thereby increasing recognition. This could potentially be beneficial for other-race identifications, as research has shown that retrieving other-race faces is more effortful than same-race faces (Herzmann et al., 2011). It is possible that showing two lineup members at a time did decrease cognitive load, but this was not beneficial in the current studies because participants did not gain any extra information (e.g., were not able to recognize any additional diagnostic features), or the extra information they gained through additional available cognitive resources was not useful in recognizing the culprit. Alternatively, it is also possible that other novel aspects of the bracket procedure (e.g., making multiple selections), overrode any benefits that would occur by reducing the number of lineup members presented at once. Further research that examines visual behaviour through eye-tracking might help understand the underlying mechanisms and benefits, if any, of reducing the number of photographs presented at once.

Last, it is possible that the repeated selection of lineup members created confusion (due to increasing difficulties in discriminating between faces and memory for the culprit) or increased sense of familiarity, potentially through accrual of fluency, which resulted in increased false identifications. Some participants did note during the pilot phase that they became more confused or less certain as the procedure went on. This could result in more false identifications if people are confused or uncertain but are still willing to make an identification. However, the bracket lineup only resulted in more false identifications for other-race identifications. Alternatively, because participants are seeing the lineup members repeatedly, they may misattribute their familiarity with the lineup member as actually being the culprit and therefore may be more likely to make an identification. Similarly, they may have been reinforced to choose a lineup member that they had selected three times previously during the procedure. If the bracket lineup was increasing participants' confusion, familiarity, or reinforcing choosing, then a higher choosing rate would be expected. However, choosing rates were only higher for the bracket lineup relative to the simultaneous lineup in the other-race context. Taken together, this suggests that participants who are initially more likely to have a weak memory may be more susceptible to becoming confused, misremembering the culprit after repeated exposure, or choosing after repeated decisions. Approximately half of participants making a same-race identification made an identification of the final bracket lineup member, whereas almost three quarters of participants making an other-race identification made an identification of the final bracket lineup member. Commitment effects are not likely to account for the results as choosing rates with the bracket lineup were comparable to the sequential lineup, and previous research involving the elimination lineup (which requires first selecting a lineup member and then deciding if that lineup member is the culprit) has found decreased choosing at the second judgment (Pica & Pozzulo, 2017; Pozzulo et al., 2016), suggesting participants are not necessarily committed to making an identification after an initial selection. Nevertheless, future research should explore modifications to the bracket lineup such as eliminating the dissimilar lineup members rather than selecting the most similar. Research on the elimination lineup has shown that, at least for children, asking participants to eliminate lineup members one at a time, or asking participants to first select the most similar looking member before making a final judgment can have different effects on accuracy, but both can also increase accuracy over just having participants make an immediate identification from an array (Pozzulo et al., 2008) It is also possible that eliminating lineup members may have a different effect than selecting lineup members and may help to avoid some of the concerns or pitfalls of the current bracket procedure. For example, research has found that small wording changes can alter memory reports (Loftus & Palmer, 1974; Loftus & Zanni, 1975), and including options versus excluding options can lead to different results in decision making (Heller, Levin, & Goransson, 2001; Hugenberg, Bodenhausen, & McLain, 2006). Furthermore, people tend to have a natural preference for eliminating options when narrowing down choices (Heller et al., 2001). Finally, being asked to eliminate the least similar member may better facilitate a recall-to-reject strategy (e.g., I know the culprit had a big nose so this member cannot be him), which is a process that has been found to reduce false recollection (Gallo, 2004), that leads to less ambiguity or confusion by the end of the procedure than may be likely with selecting the most similar looking member (e.g., I know the culprit had a big nose, so this member could be him). Assessing the effects of having witnesses eliminate lineup members versus selecting lineup members is a novel direction for researchers to explore.

Several limitations regarding the present research should be noted. The online nature of data collection for more than half of the participants increases variability in the sample and limits the number of procedural factors that could be controlled such as the size of the presentation of the stimuli. Further, this variability and less control is only present for a portion of the sample due to a change in recruitment method partway through the research. Although researchers have generally found similarities between MTurk and student samples (Goodman et al., 2013), the current sample is more heterogeneous than has been typically used by researchers investigating eyewitness identification, as most previous research relies on undergraduates from one university.

Furthermore, researchers have found that as a whole, MTurk samples tend to be more diverse than student samples (Chandler & Shapiro, 2016; Goodman et al., 2013; Mason & Suri, 2012). Although a more heterogeneous sample helps to increase generalizability of results, it can make direct comparisons to prior research more challenging, and it could increase the chance that other factors could be influencing the results. For example, in the case of eyewitness identification research, including a sample containing older individuals when the stimuli is of males in their 20's could elicit an own-age bias (Anastasi & Rhodes, 2005) that would not typically be present in research involving an undergraduate student sample.

Another limitation is the use of only Caucasian participants and one culprit per race to examine cross-race identification, a critique that applies to many, if not most, studies of eyewitness identification. Without including East Asian participants, a full crossover design was not possible, and it is impossible to know if the stimuli for other-race identifications were more difficult or differed in some way compared to the stimuli used for same-race identifications, potentially limiting the conclusions that can be drawn when comparing Study 1 with Study 2. For example, it is possible that participants were more accurate in Study 1 than Study 2 because the stimuli were somehow easier to recognize in Study 1. However, the lineups for each stimuli were assessed to be reasonably fair and unbiased, and the cross-race effect is a reliable finding (Meissner & Brigham, 2001), indicating the cross-race effect obtained in the present research is not likely due to the difficulty of the stimuli. Furthermore, the goal of this research was not to establish the presence of the cross-race effect, or to manipulate race to determine the effect race has on recognition accuracy, but to explore the effectiveness of a new lineup procedure when making an other-race identification, thereby reducing the necessity of using a full 2x2 cross-over design or using multiple stimuli. Including different and multiple stimuli (i.e., more than one culprit per race), although perhaps ideal for increasing validity, was not feasible for the present research and would have required an even larger sample size, something that was difficult to obtain in the present research. Without the inclusion of multiple stimuli sets, it is possible that the findings in regards to any cross-race effect and comparisons made between Studies 1 and 2 are due to the stimuli rather than the lineup procedures. However, as stated previously, the main goal of this research was to explore the effects of a new lineup procedure under two different scenarios (i.e., making a same-race identification and making an other-race identification), and not to establish the presence of some more general cross-race effect, thus eliminating the need for multiple culprits or stimuli. Nevertheless, replication of the present research should be done using different stimuli to help ensure results are not a function of the stimuli used and to increase generalizability.

Additionally, the inclusion of only Caucasian participants and Caucasian and East Asian stimuli may limit the application of these results to other racial groups and matches between racial groups. Although research has found that the cross-race effect occurs in different countries, across numerous ethnic/racial groups, and between different combinations of groups (Brigham et al., 2007; Meissner & Brigham, 2001), it is possible that results may differ based on the inclusion of other racial groups, or if the identification is made between a racial minority witness and a racial majority culprit, or between a minority witness and minority culprit. Previous research on the cross-race effect (Meissner & Brigham, 2001) suggests that findings would be the strongest for

Caucasian participants viewing a minority group due to having less contact with the minority group, but that there would still be poorer accuracy for other-race identifications overall regardless of which two groups were studied. Stereotypes, which have been shown to affect who is more likely to be misidentified in a lineup (Osborne & Davies, 2012), may differ in type and strength across groups, however it is unknown how this may interact with lineup procedures or affect overall accuracy, if at all. Additionally, it is unknown how the current results would differ if a solely Canadian sample was used versus the current samples which included a number of Americans, given that data was primarily collected through MTurk. Any potential differences are likely to be small given the replication of the cross-race effect and lineup studies in both Canada and the USA, and given that the present research used an East Asian culprit, a group that may not be as marginalized as other groups (e.g., First Nations, African Americans; American Psychological Association, n.d.). Nevertheless, future research should explore the effectiveness of lineup procedures with different racial/ethnic groups. Very few studies have investigated the differences between same- and other-race identifications in an eyewitness context and much more research is needed as findings appear to differ between same- and other-race identifications. Furthermore, recommendations for which lineup should be used by police are being made without sufficient information regarding the limits of their effectiveness, particularly with regards to race. Although the sequential lineup has historically been recommended over the simultaneous lineup, and is the procedure most often used in Ontario (Beaudry & Lindsay, 2006) and parts of the United States (G. L. Wells, 2014), the current results do not support the use of the sequential lineup with witnesses making other-race identifications. It should not be assumed that what works for same-race identifications will work similarly for other-race identifications.

Another potential limitation that may account for the lower accuracy obtained with the sequential lineup is that the present research did not mislead participants in the sequential lineup about how many photographs they would be seeing. Although research has shown that backloading the sequential lineup (i.e., ensuring that participants are unaware of how many photographs they will be seeing) is critical to the sequential lineup advantage (Horry et al., 2012; Lindsay, Lea, & Fulford, 1991; McQuiston-Surrett et al., 2006; Steblay et al., 2011), participants are generally not only unaware of how many photographs they will be viewing, but are also led to believe they will be seeing more than they actually are shown. Research indicates that backloading lineups induces a conservative response criterion thereby decreasing choosing (Horry et al., 2012). However, in the present research, choosing rates were higher in the sequential lineup relative to the simultaneous lineup, suggesting that backloading via nondisclosure may not have been sufficient to result in a conservative criterion shift and thus did not result in reduced choosing. Two research studies that used a nondisclosure backloading method (rather than misleading participants about the number of lineup members to be shown) also did not find differences in accuracy between the simultaneous and sequential lineup procedures (Gronlund, Carlson, Dailey, & Goodsell, 2009; Humphries et al., 2012); but in contrast to the present research, the nondisclosure method still resulted in either reduced (Gronlund et al., 2009) or comparable choosing rates (Humphries et al., 2012). Although research indicates that the sequential lineup advantage is due to a shift towards conservative responding (Meissner et al., 2005; Palmer & Brewer, 2012), it is not solely a lower choosing rate that results in the sequential lineup having higher diagnosticity (Steblay et al., 2011). Thus it is not clear if the nondisclosure backloading method can fully account for the lack of sequential lineup advantage found in the present research. More research is needed to determine how different backloading methods (i.e., nondisclosure versus misleading) may affect accuracy with the sequential lineup.

Applied Implications

This research was conducted under ideal conditions for viewing the culprit with an attempt to mimic some of the factors seen in the field (e.g., time delay), but it was unable to realistically mimic factors that could be present during a real crime that could hinder accurate identification (e.g., stress experienced by the witness, potentially poor viewing conditions, changes in appearance, presence of a weapon, long delays). Despite the optimal conditions of lab research, accuracy overall is rather low and is abysmal for other-race identifications. Although lab-based research limits external validity, it is likely that accuracy in the 'real world' would be poorer than reported here as conditions for optimal accuracy (e.g., good lighting, good view of the culprit, low stress) would not necessarily be present. Indeed, field and archival research has found a low rate of suspect identifications and a high rate of false identifications (e.g. G. L. Wells et al., 2015). This is concerning given the weight that eyewitness identification can be given in legal decision making. Consequently, these findings highlight the need for more research that not only improves identification accuracy, but also investigates factors that limit accuracy, so that informed cautionary statements can be provided to people in the justice system when weighing the quality of eyewitness identification evidence. Given that increasing accuracy via changing identification procedures seems difficult to do, an emphasis needs to be made on educating police, lawyers, judges and juries on the reliability of eyewitness identification and making policy guidelines that highlight the limitations. The Canadian Department of Justice report on the miscarriage of justice (2004) recommends that juries be informed about the fallibility of eyewitness identification, however, there is no mention that cross-race identifications are even more fallible. Given the robust finding of the cross-race effect, and the heightened vulnerability faced by minority groups, it is critical that the legal system is informed about the current status of other-race identifications.

Canadian guidelines (Department of Justice Canada, 2004) currently recommend the use of the sequential lineup whereas American guidelines specify no preference (U.S. Department of Justice, 1999). Based on the current findings and state of the literature, recommending one procedure over the other is questionable, however it is possible that one lineup may be less effective for other-race identifications. Given the volume of research on eyewitness identification and the limited conclusions that can be drawn about which procedure is superior (if any), along with a lack of improvement in overall accuracy, it may be more beneficial to determine under which conditions the procedures are most effective. Presently the sequential lineup appears to be more ineffective for other-race identifications, but substantially more research involving other-race identifications is needed before firm conclusions or recommendations can be made.

In conclusion, improving eyewitness identification accuracy is a difficult task and more research is needed to determine how to reduce mistaken eyewitness identifications and subsequent wrongful convictions. The aim of this research was to improve eyewitness identification through a novel lineup procedure. Findings showed that for same-race identifications, the simultaneous, sequential, and bracket lineup resulted in comparable diagnosticity. In comparison, for other-race identifications, identifications made with the simultaneous and bracket lineup were more diagnostic than the sequential lineup. Choosers for both same- and other-race identifications were also more likely to be accurate with the simultaneous and bracket lineups than the sequential lineup. Overall, direct comparison of lineup members appears to facilitate accuracy over showing a single photograph sequentially, especially for other-race identifications. Although the bracket lineup did not facilitate accuracy above the existing procedures, the procedure did show some advantages relative to the sequential lineup for other-race identifications, and it may help avoid position effects that have previously been found to occur with the simultaneous lineup.

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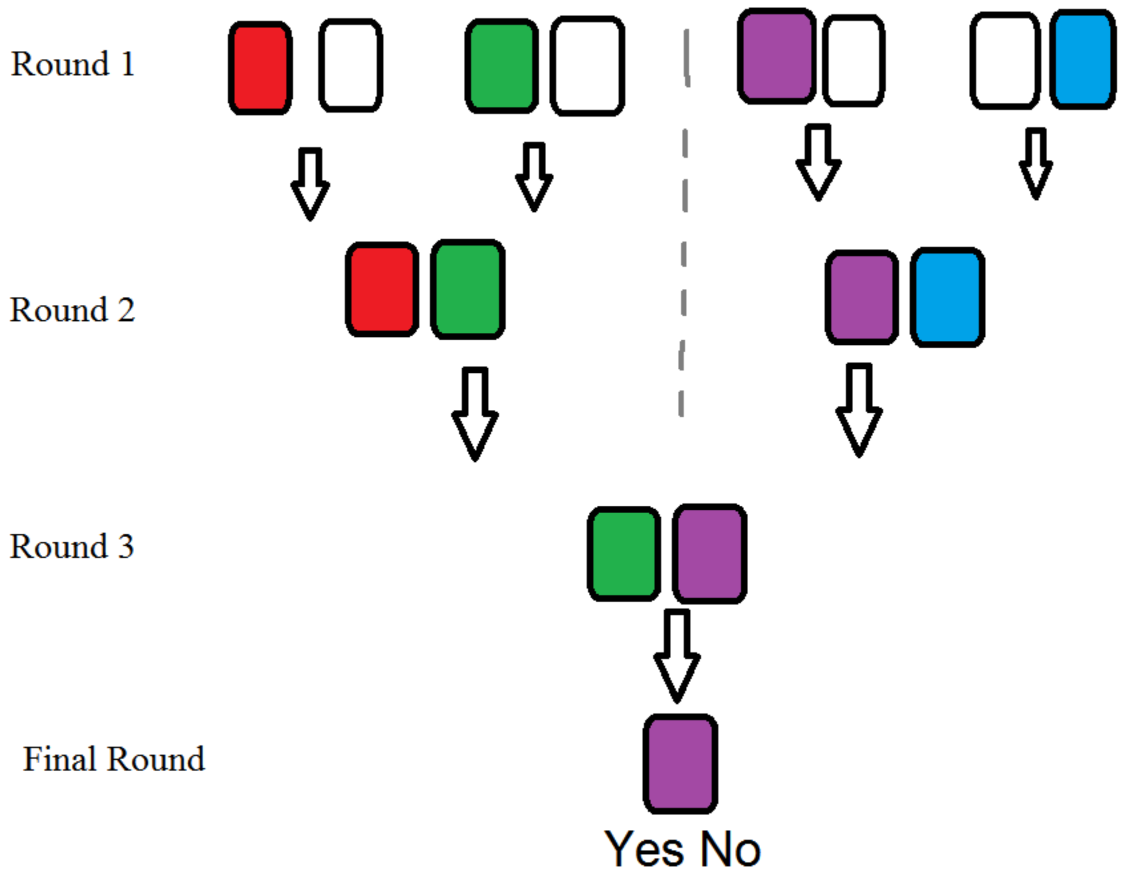
APPENDIX A

Infographic for the Bracket Lineup



This infographic illustrates the general flow of the procedure for the bracket lineup. Lineup members are presented in pairs and one member from each pair moves on to the next round.

APPENDIX B

CONSENT TO PARTICIPATE IN RESEARCH

Title of Study: **Questions about Perceptual Experiences 2a**

You are asked to participate in a research study conducted by Lisa Pascal (Doctoral Candidate) under the supervision of Dr. Alan Scoboria from the Psychology Department at the University of Windsor as part of the principal researcher's dissertation.
If you have any questions or concerns about the research, please feel to contact Lisa Pascal (pascall@uwindsor.ca) or Dr. Alan Scoboria (scoboria@uwindsor.ca; 519-253-3000, ext.4090).

PURPOSE OF THE STUDY
The purpose of this study is to examine people's recollection of perceptual experiences.

PROCEDURES

If you volunteer to participate in this study, you will be asked to watch a short video and answer some questions about it both in person and using an online survey program. A member of the research team will record your responses manually, in addition to the computer recording your responses. You will also be asked to complete an innocuous task and answer some questions about you and your experiences by the computer and verbally by a member of the research team. The session will take one hour to complete.

POTENTIAL RISKS AND DISCOMFORTS

There are no foreseeable risks or discomforts associated with this research.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

You may benefit from increased knowledge about research in psychology. This research will expand knowledge about how people remember information. This research may contribute to knowledge of psychological processes related to perception and remembering.

COMPENSATION FOR PARTICIPATION

Participants will receive 1 bonus point for 60 minutes of participation towards the psychology participant pool, if registered in the pool and enrolled in one or more eligible courses. If you choose to withdraw after you have begun the study you will receive credit proportional to your participation. If you begin the study but withdraw prior to 30 minutes you will receive 0.5 credit. If you continue past 30 minutes you will receive 1.0 credit.
CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Each participant will be given an identification number and therefore the information you provide will not be associated with your identity upon being credited on the Participant Pool and following the collection of your data. Data is stored securely and can only be accessed by the researcher and members of her research team. Electronic data collected on the website is stored on a server located in Canada. Data will be stored indefinitely.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so. If at any time you choose to withdraw from the study, any data that has been collected up until that point will be retained and cannot be withdrawn as your identity is not associated with the data.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE PARTICIPANTS

Results will be available on approximately November 30, 2017 at www.uwindsor.ca/reb

SUBSEQUENT USE OF DATA

These data may be used in subsequent studies, in publications and in presentations.

RIGHTS OF RESEARCH PARTICIPANTS

If you have questions regarding your rights as a research participant, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario, N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF INVESTIGATOR

These are the terms under which I will conduct research.

Lisa Pascal

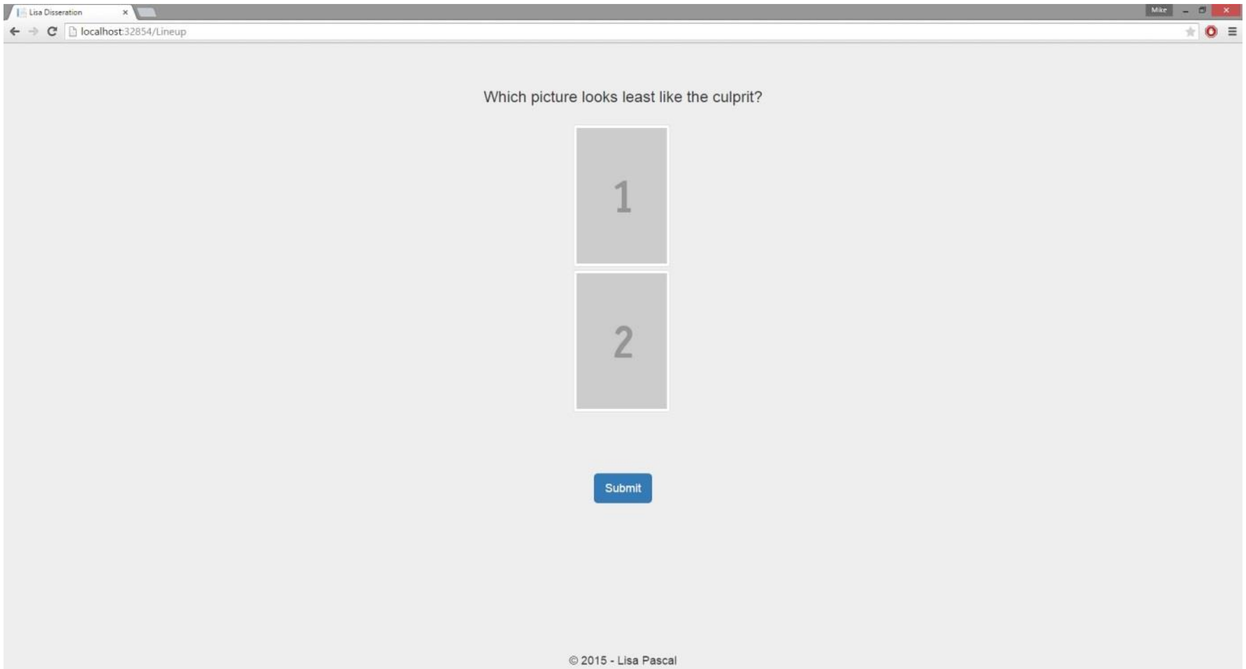
November 15 2015

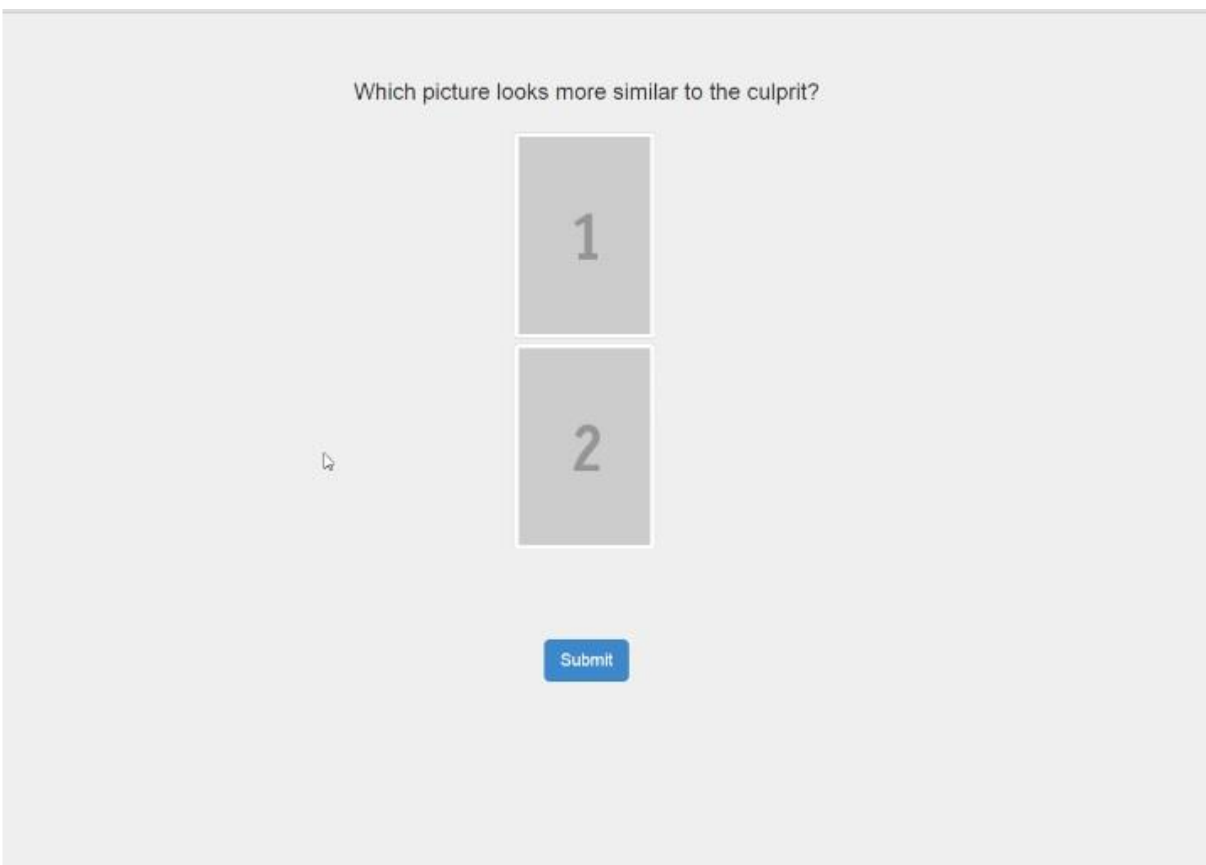
SIGNATURE OF RESEARCH PARTICIPANT/LEGAL REPRESENTATIVE

I understand the information provided for the study Questions about Perceptual Experiences 2a as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study

APPENDIX C

Screenshots of Bracket Lineup for the Pilot Study





APPENDIX D

CONSENT TO PARTICIPATE IN RESEARCH (Participant Pool in Lab)

CONSENT TO PARTICIPATE IN RESEARCH

Title of Study: **Questions about Perceptual Experiences 2b**

You are asked to participate in a research study conducted by Lisa Pascal (Doctoral Candidate) under the supervision of Dr. Alan Scoboria from the Psychology Department at the University of Windsor as part of the principal researcher's dissertation.
If you have any questions or concerns about the research, please feel to contact Lisa Pascal (pascall@uwindsor.ca) or Dr. Alan Scoboria (scoboria@uwindsor.ca; 519-253-3000, ext.4090).

PURPOSE OF THE STUDY
The purpose of this study is to examine people's recollection of perceptual experiences.

PROCEDURES

If you volunteer to participate in this study, you will be asked to watch a short video and answer some questions about it using an online program. You will also be asked to complete an innocuous task and answer some questions about you and your experiences. The session will take 30 minutes to complete.

POTENTIAL RISKS AND DISCOMFORTS

There are no foreseeable risks or discomforts associated with this research.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

You may benefit from increased knowledge about research in psychology. This research will expand knowledge about how people remember information. This research may contribute to knowledge of psychological processes related to perception and remembering.

COMPENSATION FOR PARTICIPATION

Participants will receive 0.5 bonus point for 30 minutes of participation towards the psychology participant pool, if registered in the pool and enrolled in one or more eligible courses. If you begin the study but withdraw prior to 30 minutes you will receive 0.5 credit.
CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Each participant will be given an identification number and therefore the information you provide will not be associated with your identity upon being credited on the Participant Pool and following the collection of your data. Data is stored securely and can only be accessed by the researcher and members of her research team. Electronic data collected on the website is stored on a server located in Canada. Data will be stored indefinitely.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so. If at any time you choose to withdraw from the study, any data that has been collected up until that point will be retained and cannot be withdrawn as your identity is not associated with the data.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE PARTICIPANTS

Results will be available on approximately November 30, 2017 at www.uwindsor.ca/reb

SUBSEQUENT USE OF DATA

These data may be used in subsequent studies, in publications and in presentations.

RIGHTS OF RESEARCH PARTICIPANTS

If you have questions regarding your rights as a research participant, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario, N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF INVESTIGATOR

These are the terms under which I will conduct research.

Lisa Pascal

November 15 2015

SIGNATURE OF RESEARCH PARTICIPANT/LEGAL REPRESENTATIVE

I understand the information provided for the study Questions about Perceptual Experiences 2a as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study

CONSENT TO PARTICIPATE IN RESEARCH (Participant Pool Online)

Title of Study: **Questions about Perceptual Experiences 2b - online**

You are asked to participate in a research study conducted by Lisa Pascal (Doctoral Candidate) under the supervision of Dr. Alan Scoboria from the Psychology Department at the University of Windsor as part of the principal researcher's dissertation.
If you have any questions or concerns about the research, please feel to contact Lisa Pascal (pascall@uwindsor.ca) or Dr. Alan Scoboria (scoboria@uwindsor.ca; 519-253-3000, ext.4090).

PURPOSE OF THE STUDY

The purpose of this study is to examine people's recollection of perceptual experiences.

PROCEDURES

If you volunteer to participate in this study, you will be asked to watch a short video and answer some questions about it online. You will also be asked to complete an innocuous task and answer some questions about you and your experiences.

This study must be completed on your own, and in a private location where you cannot be observed, and at a time that you can devote your full attention without interruption. It must be done using a laptop or desktop computer. This study cannot be completed on a mobile device. This study will take approximately 30 minutes to complete and must be done in one session.

POTENTIAL RISKS AND DISCOMFORTS

There are no foreseeable risks or discomforts associated with this research.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

You may benefit from increased knowledge about research in psychology. This research will expand knowledge about how people remember information. This research may contribute to knowledge of psychological processes related to perception and remembering.

COMPENSATION FOR PARTICIPATION

Participants will receive 0.5 bonus point for 30 minutes of participation towards the psychology participant pool, if registered in the pool and enrolled in one or more eligible courses. If you begin the study but withdraw prior to 30 minutes you will receive 0.5 credit.

CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Each participant will be given an identification number and therefore the information you provide will not be associated with your identity upon being credited on the Participant Pool and following the collection of your data. Data is stored securely and can only be accessed by the researcher and members of her research team. Electronic data collected on the website is stored on a server located in Canada. Data will be stored indefinitely.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time while completing the study without consequences of any kind by closing your browser and informing the researcher via email that you are withdrawing. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so. If at any time you choose to withdraw from the study, any data that has been collected up until that point will be retained and cannot be withdrawn. You cannot withdraw from the study after completing the study online.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE PARTICIPANTS

Results will be available on approximately November 30, 2017 at www.uwindsor.ca/reb

SUBSEQUENT USE OF DATA

These data may be used in subsequent studies, in publications and in presentations.

RIGHTS OF RESEARCH PARTICIPANTS

If you have questions regarding your rights as a research participant, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario, N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF INVESTIGATOR

These are the terms under which I will conduct research.

Lisa Pascal

January 28, 2017

SIGNATURE OF RESEARCH PARTICIPANT/LEGAL REPRESENTATIVE

Online Participants will click a box that says:

I understand the information provided for the study Questions about Perceptual Experiences 2b-online as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study

CONSENT TO PARTICIPATE IN RESEARCH (Consent for Mechanical Turk)

CONSENT TO PARTICIPATE IN RESEARCH

Title of Study: **Questions about Perceptual Experiences 2B - online**

You are asked to participate in a research study conducted by Lisa Pascal (Doctoral Candidate) under the supervision of Dr. Alan Scoboria from the Psychology Department at the University of Windsor as part of the principal researcher's dissertation.

If you have any questions or concerns about the research, please feel to contact Lisa Pascal (pascall@uwindsor.ca) or Dr. Alan Scoboria (scoboria@uwindsor.ca; 519-253-3000, ext.4090).

PURPOSE OF THE STUDY

The purpose of this study is to examine people's recollection of perceptual experiences.

PROCEDURES

If you volunteer to participate in this study, you will be asked to watch a short video and answer some questions about it online. You will also be asked to complete an innocuous task and answer some questions about you and your experiences.

This study must be completed on your own, and in a private location where you cannot be observed, and at a time that you can devote your full attention without interruption. It must be done using a laptop or desktop computer. This study cannot be completed on a mobile device. This study will take approximately 30 minutes to complete and must be done in one session.

POTENTIAL RISKS AND DISCOMFORTS

There are no foreseeable risks or discomforts associated with this research.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

You may benefit from increased knowledge about research in psychology. This research will expand knowledge about how people remember information. This research may contribute to knowledge of psychological processes related to perception and remembering.

COMPENSATION FOR PARTICIPATION

You will be compensated $2.00 (USD) as a token of appreciation for your participation in this research. You must complete at least 80% of the study to receive this compensation.

CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. You will participate using your Mechanical Turk ID so that we can provide you with the compensation after the study is completed. No further identifying information will be collected about you. Each participant will be assigned an identification number and therefore the information you provide will not be associated with your identity upon being compensated and following the collection of your data. Data is stored securely and can only be accessed by the researcher and members of her research team. Electronic data collected on the website is stored on a server located in Canada. Data will be stored indefinitely.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time while completing the study by closing your browser and returning to Turk to withdraw yourself from the HIT. If you choose to withdraw before completing 80% of the study (withdrawing before demographic questionnaire), you must return to Turk to withdraw yourself from the HIT. If at any time you choose to withdraw from the study, any data that has been collected up until that point will be retained and cannot be withdrawn. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so. You cannot withdraw from the study after completing the study online.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE PARTICIPANTS

Results will be available on approximately November 30, 2017 at www.uwindsor.ca/reb

SUBSEQUENT USE OF DATA

These data may be used in subsequent studies, in publications and in presentations.

RIGHTS OF RESEARCH PARTICIPANTS

If you have questions regarding your rights as a research participant, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario, N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF INVESTIGATOR

These are the terms under which I will conduct research.

Lisa Pascal

January 28, 2017

SIGNATURE OF RESEARCH PARTICIPANT/LEGAL REPRESENTATIVE

Online Participants will click a box that says:

I understand the information provided for the study Questions about Perceptual Experiences 2b-online as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study

APPENDIX E

Demographic Questionnaire

1. Age: ____________

2. Gender: ____________

3. Race (please select one):

   White
   Black
   Latin American
   Arab
   Chinese
   Korean
   Japanese
   Filipino
   South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)
   Southeast Asian (e.g., Vietnamese, Cambodian, Malaysian, Laotian, etc.)
   West Asian (e.g., Iranian, Afghan, etc.)
   Other – Specify

4. Are you able to read and answer questions in English fluently? YES/NO

5. Have you ever taken a psychology and law course or forensic psychology course?
   YES / NO

6. If yes, please explain: (e.g., which course and when)

7. Have you ever had to identify a suspect in a police lineup? YES / NO

APPENDIX F

Additional Validity Questions for Online Participants

Did you encounter any TECHNINCAL problems while viewing the video? (e.g., wouldn't load, slow buffering, frozen video, etc.)

YES_ NO_

If so, please briefly describe the issue below:

What happened in the video?

A. A laptop was stolen
B. A man drank lemonade
C. Three people went for a walk
D. Someone was mowing the lawn

What device did you use to complete this study

a. Laptop/computer
b. Tablet
c. Phone

Where did you complete this study:

a. In a public place with others around (e.g., classroom, coffee shop)
b. At home, in private

Where you able to see all lineup members on the screen at the same time (i.e., you did not need to scroll to see all the photos)?

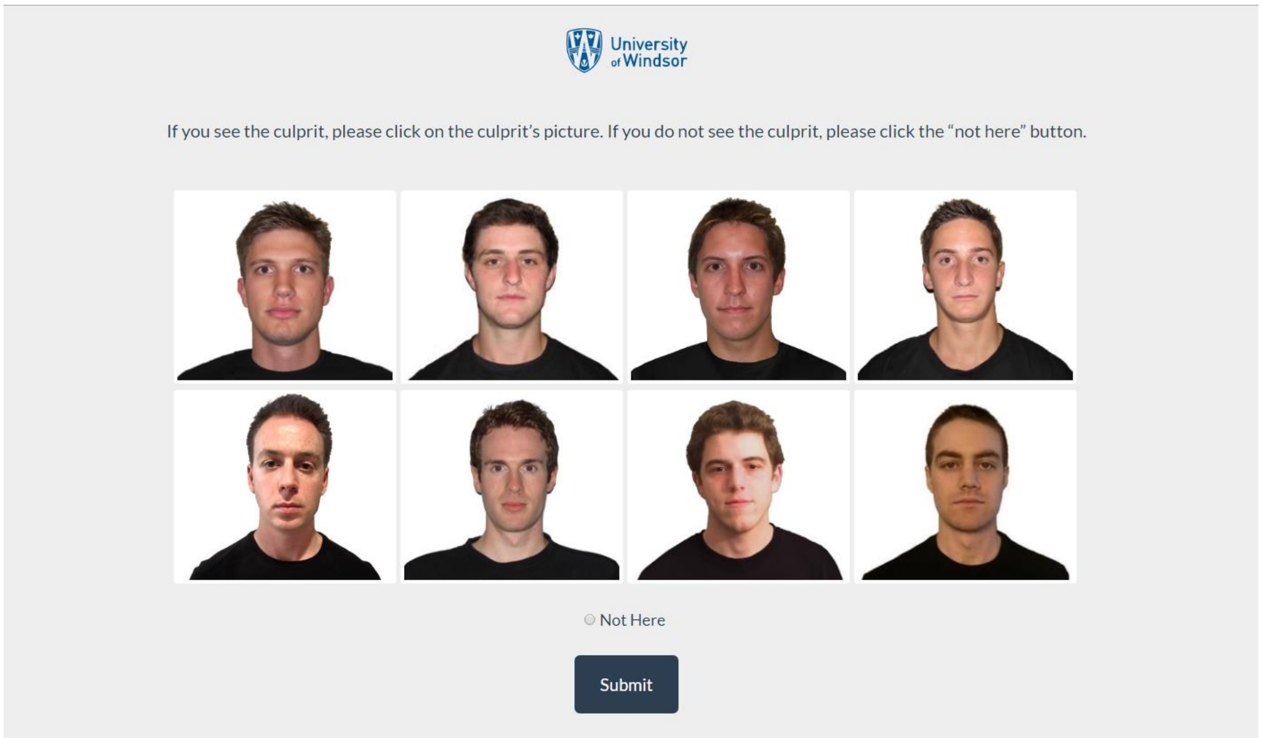
a. Yes, I could see all the photos on the screen at the same time
b. No, I needed to scroll to see all of the photos

Before completing this particular study, have you seen this video before or completed this study?

a. No, I have not previously seen the video or completed this study
b. Yes, I have seen the video before and have completed this study previously

APPENDIX G

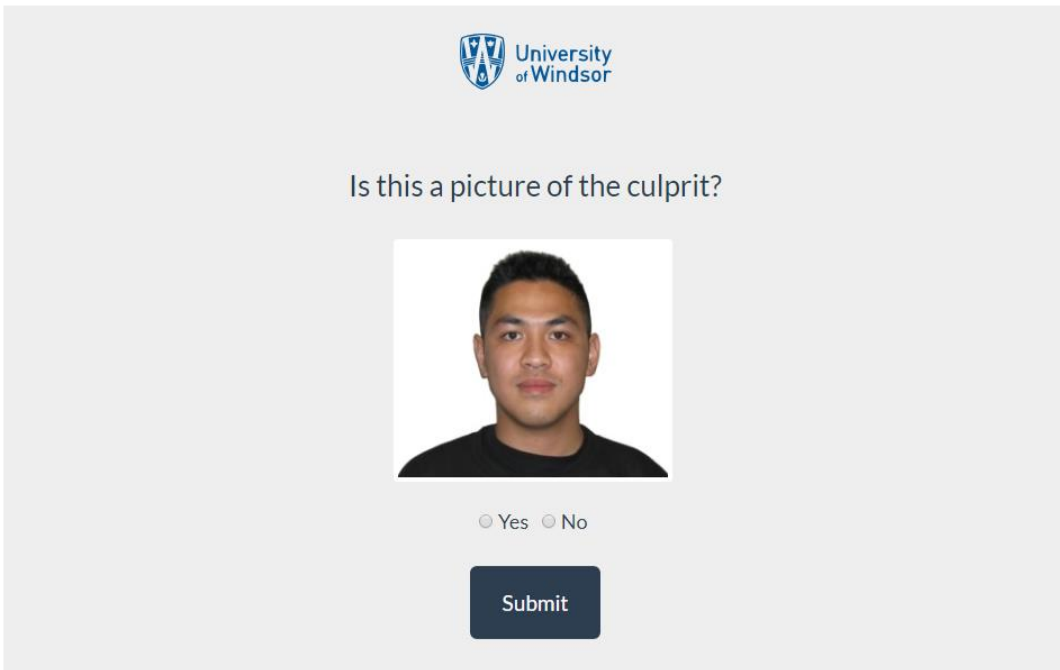
Screen Shot of Simultaneous Lineup



APPENDIX H

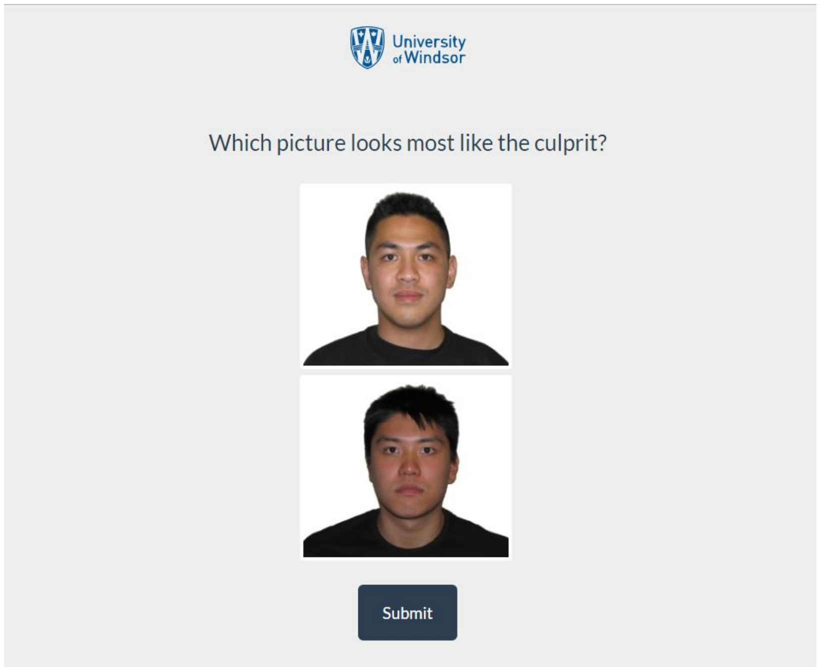
Screenshots of Sequential Lineup

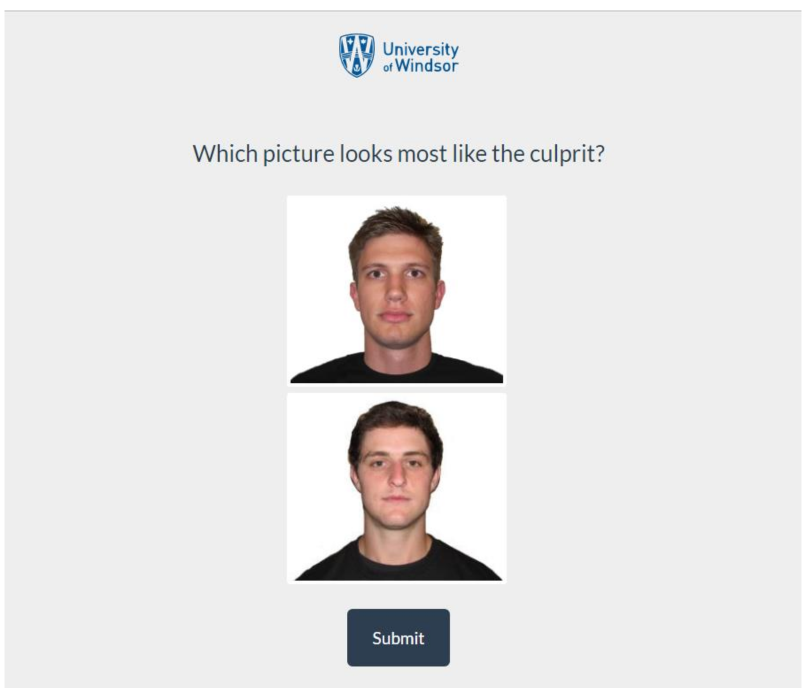
Below is a screen shot of the one lineup member page only. Similar pages are repeated until 8 lineup members have been shown.



APPENDIX I

Screenshots of Bracket Lineup





APPENDIX J

Table 10

Number of Participants Identifying Each Lineup Member for Same-Race Lineups

	Lineup Member								
Target-present	1	2	3	4	5	6	7	8	No One
Simultaneous	0	0	1	29	1	1	1	1	21
Sequential	4	5	12	24	0	1	2	0	9
Bracket – last member standing	6	14	1	35	1	0	2	4	-
Bracket-final decision	3	7	1	31	0	0	1	2	18
Target-absent									
Simultaneous	0	6	9	0	2	1	0	2	34
Sequential	5	8	7	3	3	0	1	1	31
Bracket – last member standing	3	19	8	1	10	2	5	7	-
Bracket-final decision	2	10	6	1	4	0	1	3	28

**Note. Includes participants who made more than one identification in the sequential lineup*

APPENDIX K

Table 11

Number of Participants Identifying Each Lineup Member for Other-Race Lineups

	Lineup Member								
Target-present	1	2	3	4	5	6	7	8	No One
Simultaneous	4	8	1	11	0	2	2	6	22
Sequential	25	2	1	9	0	2	0	2	15
Bracket – last member standing	13	16	0	17	2	7	0	2	-
Bracket-final decision	7	9	0	15	2	5	0	2	17
Target-absent									
Simultaneous	2	8	1	1	0	2	2	7	31
Sequential	17	7	1	1	3	4	3	2	16
Bracket – last member standing	15	19	2	1	3	2	3	10	-
Bracket-final decision	13	15	2	0	1	1	2	7	14

**Note*. Includes participants who made more than one identification in the sequential lineup*

APPENDIX L

Table 12

Accuracy Rates as a Function of Lineup Procedure for Same-Race Identifications for Each Recruitment Method

	Lineup procedure					
	Simultaneous		Sequential		Bracket	
	Participant pool	Mechanical turk	Participant pool	Mechanical turk	Participant pool	Mechanical turk
Target-present	*N* = 21	*N* = 34	*N* = 16	*N* = 41	*N* = 24	*N* = 39
Correct identifications	0.38 (8)	0.62 (21)	0.31 (5)	0.39 (16)	0.29 (7)	0.61 (24)
Foil identifications	0.10 (2)	0.09 (3)	0.44 (7)	0.49 (20)	0.29 (7)	0.18 (7)
False rejections	0.52 (11)	0.29 (10)	0.25 (4)	0.12 (5)	0.42 (10)	0.21 (8)
Target-absent	*N* = 24	*N* = 30	*N* = 28	*N* = 31	*N* = 23	*N* = 32
Correct rejections	0.75 (18)	0.53 (16)	0.57 (16)	0.48 (15)	0.57 (13)	0.47 (15)
False identifications	0.25 (6)	0.47 (14)	0.43 (12)	0.52 (16)	0.43 (10)	0.53 (17)

APPENDIX M

Table 13

Accuracy Rates as a Function of Lineup Procedure for Other-Race Identifications for Each Recruitment Method

	Lineup procedure					
	Simultaneous		Sequential		Bracket	
	Participant pool	Mechanical turk	Participant pool	Mechanical turk	Participant pool	Mechanical turk
Target-present	*N* = 29	*N* = 27	*N* = 29	*N* = 27	*N* = 20	*N* = 37
Correct identifications	0.14 (4)	0.26 (7)	0.03 (1)	0.18 (5)	0.35 (7)	0.22 (8)
Foil identifications	0.48 (14)	0.33 (9)	0.69 (20)	0.56 (15)	0.45 (9)	0.43 (16)
False rejections	0.38 (11)	0.41 (11)	0.28 (8)	0.26 (7)	0.20 (4)	0.35 (13)
Target-absent	*N* = 16	*N* = 38	*N* = 20	*N* = 34	*N* = 22	*N* = 33
Correct rejections	0.56 (9)	0.58 (22)	0.35 (7)	0.26 (9)	0.18 (4)	0.30 (10)
False identifications	0.44 (7)	0.42 (16)	0.65 (13)	0.74 (25)	0.82 (18)	0.70 (23)

VITA AUCTORIS

NAME:	Lisa Pascal
PLACE OF BIRTH:	Calgary, Canada
YEAR OF BIRTH:	1988
EDUCATION:	University of Calgary, B.Sc. (Hons.), Calgary, Alberta, 2006-2011
	University of Windsor, M.A., Windsor, Ontario, 2011-2013
	University of Windsor, Ph.D., Windsor, Ontario, 2013-2018