Multiple Perpetrator Crime: Examining the Impact of Cognitive Load during Memory Retrieval on Eyewitness Testimony during Multiple Perpetrator Crimes

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Abstract

Eyewitnesses are a very important part of police investigations and they play a prominent role in the criminal justice system. Judges and jurors hold what eyewitnesses say in high regard and, for this reason, eyewitness identifications have a large impact on who gets charged with a crime. There are, however, several factors that can hinder the eyewitness’ ability to make an accurate identification. Psychological research shows that eyewitness identifications are often erroneous and problematic. Most of the current research investigating facial recognition and identification, addresses only the recognition of a single person. This is problematic because most real-world crime situations involve multiple perpetrators. Furthermore, the effects of cognitive load during memory retrieval during multiple perpetrator crimes are understudied. It is known that cognitive load effects the encoding of memories of multiple perpetrators, but such effects on memory retrieval are unknown. Thus, this study sought to examine the effects of cognitive load during memory retrieval on eyewitness testimony during multiple perpetrator crime. Further, it hoped to determine if the human brain becomes overloaded when there are too many factors impacting memory retrieval. Participants were recruited from introductory psychology classes, where they watched a brief video containing four target faces. Following a twenty-minute delay, participants were given a lineup identification task, with cognitive load manipulated throughout each condition. Results demonstrated that cognitive load did not influence lineup selection, however target presence was unsurprisingly an impactful factor. In target present lineups, the suspect was more likely to be selected, and in target absent lineups, the lineup was more likely to be rejected.
Acknowledgements

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Multiple Perpetrator Crime: Examining the Impact of Cognitive Load during Memory Retrieval on Eyewitness Testimony during Multiple Perpetrator Crimes

Identification lineups are commonly used by police and have a strong influence on the future direction of an investigation (Hobson & Wilcock, 2011). This being said though, research suggests that mistaken identifications are a major source of miscarriages of justice, such as wrongful convictions (Innocence Project, 2009). According to the Innocence Project (2009), misidentifications have played a role in over 70% of the 333 wrongful convictions that have been overturned by DNA evidence in the United States since 1982. For this reason, generating accurate eyewitness identification evidence is of the greatest importance to protect against such miscarriages (Valentine et al., 2007). Given the prominence of eyewitness identification within police investigations, the factors affecting its accuracy have been largely researched in laboratory settings (Hobson & Wilcock, 2011). However, one noteworthy factor that has received a dearth of attention is the effect of witnessing multiple perpetrators in a single crime, and how this affects eyewitness memory (Hobson & Wilcock, 2011). The minimal research that has been done indicates that cognitive load plays a role when people are encoding memories of multiple faces (Paas & Ayres, 2014). What is unknown, but of utmost importance, is how cognitive load plays a role during memory retrieval on eyewitness testimony during multiple perpetrator crime. The present study will therefore explore such effects.

Eyewitness Identification

An eyewitness identification is evidence derived from an individual who has seen the crime take place (Brewer & Wells, 2011). These individuals are often called upon by police to first describe the individual that they saw (Sauerland et al., 2008) and then to identify a suspected perpetrator from a lineup (Wixted et al., 2016). Once they have made their identification, this is
known as their eyewitness testimony (Wixted et al., 2016). A conventional lineup consists of the simultaneous presentation of a number of people, via photograph (Wixted et al., 2016). One of these people is the suspect and the others are fillers who resemble the suspect but are known to be innocent (Wixted et al., 2016). Eyewitnesses can identify either the suspect, one of the fillers, or can reject the lineup altogether (Wixted et al., 2016).

Eyewitness evidence is an important piece of evidence used by jurors when considering the outcome of a trial. Research has consistently shown that eyewitness evidence is perceived to be reliable by jurors and other legal decision makers (Brewer & Wells, 2011). This contradicts, psychological research that frequently finds that eyewitness identification evidence can be unreliable, and that the accuracy (or inaccuracy) of an eyewitness is shaped by several cognitive factors (Brewer & Wells, 2011). Research using basic face recognition paradigms demonstrates that there are multiple memory processes engaged when we encode and retrieve memories of a face, and that these memory capacities for facial recognition are limited (Megreya & Burton, 2006). Investigating how these cognitive factors impact face memory in applied, eyewitness contexts is vital.

**Person Recall versus Person Recognition**

Person recall and person recognition are two key aspects of eyewitness identifications. Person recall refers to the memory retrieval process of details such as age, race, height, etc., related to the individual that was seen (Budiu, 2014). Person recognition on the other hand, refers to the ability to recognize a person as familiar (Budiu, 2014). Person recognition is the memory process that is used when an eyewitness is making an identification from a lineup (Budiu, 2014). Any eyewitness task is usually preceded by a description of the perpetrator that is provided by the eyewitness (Sauerland et al., 2008). The person recall process is arguably the most important
part of making an accurate identification, because accuracy of this recall has strong influence on the witnesses’ ability to correctly identify the perpetrator from a lineup (Yarmey et al., 2002). Numerous studies have shown that this process of describing a target face can have negative effects on identification performance (Sauerland et al., 2008). These negative effects are likely caused by the verbal overshadowing effect. The verbal overshadowing effect refers to the phenomenon by which a verbal description of a face impairs recognition of the same face (Sauerland et al., 2008). The increase in cognitive load that is associated with attempting to recall and describe faces could be another reason for the inaccuracy of identifications and this must be explored further.

**Multiple Perpetrator Crime**

Multiple perpetrator crime involves several people (two or more) working together to carry out the desired crime (Morgan et al., 2012). This differs from single perpetrator crime in the way that only one person has the idea to carry out the crime and does so alone, in this type of offense (Morgan et al., 2012). In Canada and the United States, a substantial amount of violent crimes can be attributed to multiple perpetrators working together (Hobson & Wilcock, 2011). For instance, in Canada, one in six homicides have been linked to groups of people (Hobson & Wilcock, 2011). Furthermore, multiple perpetrator rapes account for 33 to 50 percent of all sexual assaults in South Africa and a large proportion of gun and knife crimes in the United Kingdom are committed by multiple perpetrators (Hobson & Wilcock, 2011). These statistics provide evidence that multiple perpetrator crime is a significant and ever-growing issue (Hobson & Wilcock, 2011).

In some jurisdictions, there is legislation or policies for conducting eyewitness identifications (e.g., UK identification practices are governed by the Police and Criminal
Evidence act; Hobson, et al., 2013). Unfortunately, such regulations or standards of practice often lack guidance for multiple suspect showings (Hobson et al., 2013). There does appear, however, to be a standard practice in some jurisdictions to conduct separate lineups for each suspect in a multiple perpetrator crime (Hobson et al., 2013). For example, in the UK, policy dictates that ‘when all members of a similar group are possible suspects, separate identification parades [lineups] shall be held for each’ (PACE Code D, 2011, p. 181). Only one suspect is shown in an identification at a time, and a witness makes their identification before moving onto the next suspect’s parade (Hobson et al., 2013). Therefore, as the number of perpetrators in a crime increases, this likely results in an increase of the cognitive demand placed on a single witness. However, the effects of increasing the number of identifications, and thereby likely increasing cognitive load on identification decisions has yet to be explored in the literature.

**Current Literature: The Effects of Witnessing Multiple Perpetrators in a Single Crime**

Clifford and Hollin (1981) investigated the way that the type of crime and number of perpetrators impacted eyewitness identifications. To do so, participants were shown a video depicting either a violent robbery or a non-violent interaction (Clifford & Hollin, 1981). The main target (who played both the thief in the violent crime video and the average individual in the other video) was shown alone or with two to four accomplices (Clifford & Hollin, 1981). After participants were shown the video, they were given an unexpected ten person identification lineup test (Clifford & Hollin, 1981). This test revealed poor accuracy in identifying the main protagonist, when he was accompanied by accomplices (Clifford et al., 1981). Clifford and Hollin (1981) concluded that the number of perpetrators has detrimental effects on the accuracy of an eyewitness testimony.
Megreya and Burton (2006) were interested in the way that people’s recognition for a face would be impacted by the presence of a second face. The researchers highlight the fact that humans are very commonly involved in situations where simultaneous identification is necessary and that in real-world eye-witnessing situations, there are often several protagonists (Megreya et al., 2006). To study this, they showed participants either a single target face or two target faces presented simultaneously (Megreya & Burton, 2006). Following this, participants were shown a simultaneous lineup and asked to identify the target (Megreya & Burton, 2006). Results showed that performance declined from 70 percent to 54 percent when participants viewed more than one face (Megreya & Burton, 2006). The multiple face disadvantage was greatest when the two faces were near each other when participants viewed them (Megreya & Burton, 2006). This indicates that eyewitnesses may find it difficult to adequately separate the characteristics of each face to make an accurate identification when they are included in the same lineup.

Hobson and Wilcock (2011) were also fascinated with the way that the number of perpetrators has an impact on the identification process. To research this, they recruited seventy-two participants who watched a video of a mock crime involving three individuals (Hobson & Wilcock, 2011). After watching the video, there was a thirty minute delay before participants were asked to identify the individuals from the video (Hobson & Wilcock, 2011). Both perpetrator present and perpetrator absent lineups were used in this study and they were counterbalanced across the study (Hobson & Wilcock, 2011). Results revealed that it is likely easier for eyewitnesses to be correct on perpetrator present lineups than perpetrator absent ones, because it is a case of recognition (Hobson & Wilcock, 2011). Furthermore, they concluded that eyewitnesses have a difficult time differentiating between the different faces involved in the
crime they saw, and thus, eliciting an accurate identification is difficult (Hobson & Wilcock, 2011).

What these studies suggest, is that memory performance is typically lower during the identification process in multiple perpetrator crime. This reduction in performance could be explained by an increase in cognitive load that was associated with witnessing and recognizing multiple perpetrators in a single crime.

**Cognitive Load**

Selective attention is what allows us to focus on what is important and ignore what is unimportant and potentially distracting information (Murphy & Greene, 2016). This includes the ability to recall essential details after witnessing a crime (i.e., eyewitness memory). Cognitive load refers to a person’s used amount of working memory resources at any given time (Murphy & Greene, 2016). Load theory states that the level of perceptual load (i.e., cognitive load) in a task determines the efficiency of selective attention (Murphy & Greene, 2016). Perceptual load is defined as the amount of information involved in processing task-relevant stimuli (Macdonald & Lavie, 2011). There is evidence that suggests that high load can cause inattentional blindness, the phenomenon whereby people fail to notice easily visible stimuli, and that it affects distractor processing (Murphy & Greene, 2016). Given that high cognitive load can result in individuals failing to report seeing certain objects, it is possible that load may also impair memory for a scene, such as a crime scene (Murphy & Greene, 2016). This has clear implications for eyewitness memory, suggesting that memories for events that invoke high cognitive load (i.e., multiple perpetrator crime) may be less accurate due to early inattentional filtering (Murphy & Greene, 2016). There is also some evidence that suggests that perceptual load impacts recognition memory. For instance, in a study by Lavie et al., (2009), participants performed a
low or high load letter search task while attempting to ignore salient but task-irrelevant
distractors at fixation, such as a spider or a car. In the high load task, participants were presented
with more distractors at once (Lavie et al., 2009). Recognition for the task-irrelevant object in a
surprise test was significantly worse in the high load condition. Murphy and Greene (2016)
therefore wanted to investigate if eyewitness reports for high load events are less accurate than
for low load events and if high load induces spatial narrowing, such that peripheral details are
especially affected by load. Participants in their study were randomly assigned to watch either a
high/low cognitive load video of a robbery (Murphy & Greene 2016). Perceptual load in the
videos was manipulated via the number of objects that were in the scene (Murphy & Greene
2016). They found that participants were significantly less accurate in the high load condition
(Murphy & Greene, 2016). These studies demonstrate that increasing cognitive load during the
encoding of memories of a crime, can negatively influence later memory performance. However,
no research has looked at such effects increasing cognitive load during the memory retrieval
process. Thus, a study involving the manipulation of cognitive load during memory retrieval on
eyewitness testimony during multiple perpetrator crime is required to advance our understanding
of the effects of cognitive load.

**Present Study**

Despite the importance of theoretically understanding how perceptual load impacts the
encoding of eyewitness memory during multiple perpetrator crime, there is another important
element that needs to be considered: how cognitive load during the retrieval tasks impacts
eyewitness memory for multiple perpetrator crime. No research, to the best of our knowledge,
has manipulated cognitive load during the retrieval tasks with multiple perpetrators. This study
did that, and therefore, the purpose of this research was to examine the impact of cognitive load
during memory retrieval on eyewitness testimony during multiple perpetrator crime. I hoped to
determine what becomes important in ensuring accurate identifications are made, when a witness
sees a crime with multiple perpetrators. There is a limited body of research available on this
subject, and therefore, this research is important for several reasons. For instance, a witness may
see several people commit a crime, but police may not necessarily have a suspect for all of the
perpetrators. This, combined with the fact that police most commonly use only one lineup per
perpetrator (Hobson et al., 2013), presents situations in which it is conceivable that a witness will
be asked to identify only a subset of those they saw committing the crime. These two cases will
differently strain the witness’s memory. This research, therefore, sought to understand how the
different cognitive load of these cases will impact the accuracy of eyewitness identifications.

To investigate this, participants in this study were asked to identify either two or four
suspects from a multiple perpetrator event. Additionally, the goal of this research was to request
that if the witness engaged in person recall prior to making an identification (as is typically done
in applied settings), had an impact on the accuracy of identifications. Engaging in a person recall
task enhances cognitive load, thereby potentially decreasing accuracy. Understanding these
effects is important.

Hypothesis

Based on the previous research available, we hypothesized that increasing cognitive load
during the memory retrieval stage, by manipulating the amount of identifications participants
were making, would decrease identification accuracy for multiple perpetrator crimes. We
anticipated that the inaccuracy of these identifications would not wholly be due to memory
constraints, but also because the presence of other faces made it more difficult to accurately
encode these familiar faces, and later recognize them (Megreya et al., 2006). Furthermore, we
predicted that identification accuracy would also be decreased when participants were asked to
describe the targets before identifying them, because of the increase in cognitive load.
Additionally, we anticipated that because memories of multiple perpetrators have the same origin
and task demands at the time of encoding, this would cause confusion and overloading at the
retrieval stage (Hobson et al., 2011). This overloading phenomenon can make it difficult to
differentiate between the target faces, and for this reason we hypothesized that participants
would be able to make more accurate identifications when they were asked to identify only two
of the four target faces.

Methods

Participants

A total of 267 participants participated in the study, although 88 participants were
excluded from various analyses because they identified as knowing at least one of the targets in
the videos (see below for additional details). Thus, the data from 179 participants was analyzed.
Participants were recruited from first- and second- year Psychology courses at the University of
Regina. They were awarded one course credit towards their final grade for taking part in the
study. Most of the participants were female (67%), while a small portion did not identify with
being male or female (1.1%). The mean age of participants was $M = 21.62$ ($SD= 8.00$). Most of
the participants were Canadian citizens (84.6 and Caucasian 61.3%)

Design

The study followed a two (target presence: present or absent) by two (number of
identifications: four identifications or two identifications) by two (person recall: present or
absent) between subject design. Participants were randomly assigned to make either two or four
identifications. Participants were also randomly assigned to either complete a person recall task or not complete the task before making the identification decisions. For each identification that was made, lineups were randomly assigned as either target-present (the correct target person was one of the faces in the array) or target-absent (the correct target is absent and replaced by a similar looking replacement) lineup.

**Materials**

*Demographics Questionnaire*

Participants were asked to fill out a demographics questionnaire (see Appendix A) prior to commencing the study. The questionnaire asked participants what their gender, age, ethnicity, and nationality were. It also asked participants if English was their first language. We also asked participants if they knew any of the individuals from the target video, and if they indicated that they did, participants were asked to briefly explain how they knew them.

*Target Video*

Participants were shown one of two videos. In one video, that was 44 seconds in length, participants watched two males and two females read four word lists aloud. The second video that was two minutes and 21 seconds in length, contained the same four individuals reading 12 word lists aloud. Due to power, we did not explore how these different levels of exposures influenced participant responding but it should be considered while reading the results and when considering future research.

*Lineups*
All lineups contained eight lineup members that were presented simultaneously in a 2 x 4 array on paper. The location of the target or target-replacement was counterbalanced throughout the lineup in every condition. All lineups were done in greyscale in order to minimize the likelihood that any image stood out due to a variation in colour (e.g., choosing based on hair colour or eye colour). The females in the lineups also had their hair cropped in their corresponding image to avoid any selections based on hair length. It is important to note that there were specific instructions on each lineup indicating that the target may or may not be present. Furthermore, it was made clear that participants may choose “NOT HERE” if they do not believe that the target is present. The fillers and four target replacements (one for each target face) for these lineups were selected from the Glasgow Unfamiliar Face Database (Burton, et al., 2010). To select the pictures, 100 photographs that matched the two targets’ sex and race were pre-selected (100 females and 100 males). Eighteen independent adult judges were asked to provide pairwise similarity ratings between photographs of each target with its associated 100 potential fillers on a 10-point Likert-type scale (1= not at all similar, 10= highly similar). Each target replacement (for target absent lineups) was chosen as the most similarly rated filler to the target. On average, ratings of similarity were low and, as such, fillers were selected by randomly choosing fillers within one standard deviation of the average scores. For the first male target (“Mike”), similarity ratings ranged from 1.07 to 2.67, with the target replacement rating at 5.67. For the second male target (“Ben”), similarity ratings ranged from 1.56 through 3.50, with the target replacement rating at 6.61. For the first female target (“Alyssa”), similarity ratings ranged from 1.67 to 2.80, with the target replacement rating at 3.93. For the second female target (“Mackenzie”), similarity ratings ranged from 2.00 through 3.72, with the target replacement rating at 5.44.
**Target Presence Condition**

For the target present condition, the target-present lineups (see Appendix B) contained the targets from the videos, and seven fillers. In the target-present condition, the only correct decision was to select the target individual from the video. In the target-absent condition, the targets from the video were replaced in the lineups, with a similar-looking individual, known as the target replacement. The idea behind a target-absent lineup (see Appendix C) is to see if eyewitnesses wrongfully identify the individual deemed to be similar in appearance to the target. In target-absent lineups, the only correct decision was to reject the lineup and indicate that the perpetrator was not present.

**Number of Identifications Condition**

This study explored the impact of cognitive load on the accuracy of identifications during multiple perpetrator crimes. As such, participants were asked to either identify two of the four targets from the video (lower cognitive load) or all four of the targets (higher cognitive load).

**Person Recall Condition**

Cognitive load was further manipulated by randomly assigning participants to either a person recall condition (higher cognitive load) (see Appendix D) or a no person recall condition (lower cognitive load). Those who were in the person recall condition were asked to describe all four of the individuals from the video (regardless of how many lineup decisions were made), prior to completing the lineups. Those who were assigned to the no person recall condition filled out the lineup sheets with no prior mention of the targets.

**Procedure**
The students in selected psychology courses were instructed to watch one of two videos, containing four individuals reading word lists aloud. To ensure that students noticed the faces of the individuals in the video, students were advised to pay attention to the video so that they could recall the words that were read. Following a twenty-minute break, participants were asked to complete a consent form (see Appendix E) and a demographic questionnaire. Next, depending on their assigned condition, those who were assigned to the person recall condition were asked to briefly describe the people that they saw in the video, before all participants were asked to make either two identifications or four identifications (depending on which condition they were assigned to). If participants were assigned to the no person recall condition they instead began the identification process immediately. The presentation order and location of the targets in the lineups was counterbalanced throughout the study. Once the lineup decision was made, participants were asked to rate their confidence in their decision on a scale of one to ten (one being least confident and ten being most confident).

**Results**

**The Impact of Target Presence, Number of Identifications, and Person Recall on Lineup Selection**

To understand the influence of multiple perpetrator lineups and the effects of person recall on identification decisions, a series of 2 (target presence: present or absent) x 2 (number of identifications: two or four) x 2 (person recall: present or absent x 3 (selection: suspect, filler or rejection) hierarchical log-linear analyses (HILOG) were conducted for each target individually, with line-up response (filler, suspect or reject) as the dependent variable. Given that each participant was asked to conduct multiple identifications, we explored performance on each of the four targets separately.
**Male Target One**

The HILOG revealed that the highest order interaction (i.e., a four-way interaction between all variables) was nonsignificant, $\chi^2(2) = 3.21, p = .201$, indicating that the model containing all four variables did not provide adequate fit with the data, and therefore, the association between all four variables together was not explored further. The highest order effect was a two-way interaction, $\chi^2(18) = 41.84, p = .001$. Partial association revealed a significant relationship between target presence and line-up selection, $\chi^2(4) = 22.09, p < .001$. Participants were more likely to select the suspect in target-present lineups (35%) compared to target-absent lineups (7%; $z = 491, p = <.001$). There was also a higher likelihood that participants rejected the lineup in target-absent conditions (57%) compared to target-present conditions (39%; $z = 2.46, p = .007$). There was no significant relationship between number of identifications and line-up selection, $\chi^2(4) = 0.33, p = .847$, nor between whether the participants completed the person recall task and line-up selection, $\chi^2(4) = 3.20, p = .203$.

**Female Target One**

The HILOG again revealed that the highest order interaction (i.e., a four-way interaction between all variables) was nonsignificant, $\chi^2(2) = 3.84, p = .147$. The highest order effect was a two-way interaction, $\chi^2(18) = 66.01, p < .001$. Partial association revealed a nearly significant relationship between the number of identifications and line-up selection, $\chi^2(4) = 5.82, p = .054$. Participants were more likely to select the suspect when they were asked to make only two identifications (54%) compared to when they were asked to make four identifications (39%; $z = 2.08, p = .038$). Furthermore, a significant relationship between target presence and line-up selection, $\chi^2(4) = 59.36, p < .001$, was revealed. Participants tended to select the suspect in target-present lineups (67%) compared to target-absent lineups (16%; $z = 8.30, p < .001$).
Participants were also more likely to reject the lineup in target-absent conditions (66%) compared to target-present conditions (21%; $z = 6.86, p < .001$). Additionally, a significant relationship was found between the person recall task and lineup selection, $\chi^2(4) = 9.40, p = .009$. Participants selected the suspect more when they were not given the person recall task (50%) compared to when they were (40%; $z = 1.22, p = .221$). Lastly, rejection rates were higher when participants were asked to complete the person recall task (48%; $z = 1.85, p = .064$), although not significant, this trend suggests that person recall did effect rejection rates with this target.

**Male Target Two**

The HILOG again revealed that the highest order interaction (i.e., a four-way interaction between all variables) was nonsignificant, $\chi^2(2) = 0.74, p = .691$. The highest order effect was a two-way interaction, $\chi^2(18) = 64.32, p < .001$. Partial association revealed a significant relationship between target presence and line-up selection, $\chi^2(4) = 46.44, p < .001$. Participants selected the suspect more frequently in target-present lineups (56%) compared to target-absent lineups (11%, $z = 7.62, p < .001$). Participants also rejected the lineup more often in target-absent conditions (70%) compared to target-present conditions (28%; $z = 6.34, p < .001$). There was no significant relationship between number of identifications and lineup selection, $\chi^2(4) = 0.17, p = .918$, nor between whether the participants completed the person recall task and lineup selection, $\chi^2(4) = 1.14, p = .486$.

**Female Target Two**

The HILOG again revealed that the highest order interaction (i.e., a four-way interaction between all variables) was nonsignificant, $\chi^2(2) = .018, p = .991$. The highest order effect was a
two-way interaction, $\chi^2(18) = 67.5$, $p = .001$. Partial association revealed a significant relationship between target presence and line-up selection, $\chi^2(4) = 63.95$, $p = .001$. Participants were more likely to select the suspect in target-present lineups (57%) compared to target-absent lineups (6%; $z = 9.29$, $p = .001$). Participants were also more likely to reject the lineup in target-absent conditions (73%) compared to target-present conditions (30%; $z = 6.44$, $p = .001$). There was no significant relationship between number of identifications and lineup selection, $\chi^2(4) = 3.082$, $p = .214$, nor between whether the participants completed the person recall task and lineup selection, $\chi^2(4) = 2.84$, $p = .241$.

**Confidence in Identifications**

Next, we explored the effects of accuracy on participant’s confidence in their identifications. To do so, we ran a one way analysis of variance (ANOVA), with confidence as the dependent variable. For this section, we collapsed across targets to explore for overall effects. The data suggests that participants who were accurate in their identification reported higher mean confidence ratings ($M = 6.59$, $SD = 2.45$) than those who were inaccurate ($M = 5.27$, $SD = 2.35$), $F(1, 591) = 40.7$, $p = .000$. Additionally, asking participants to complete a person recall task impacted confidence in their lineup decisions, such that those who were asked to complete the task reported significantly lower confidence ratings ($M = 5.78$, $SD = 2.49$) compared to those who did not complete a person recall task ($M = 6.23$, $SD = 2.47$), $F(1, 591) = 3.83$, $p = .051$.

Participants also reported higher confidence ratings when they completed two identifications ($M = 6.21$, $SD = 2.34$) compared to when they completed four identifications ($M = 5.84$, $SD = 2.59$), $F(1, 591) = 4.37$, $p = .037$). Furthermore, there was a trend towards an interaction of accuracy and the number of identifications on confidence, $F(1, 591) = 3.60$, $p = .058$. When participants were incorrect, they reported higher confidence with two identifications ($M = 5.71$, $SD = 2.24$)
compared to four ($M = 4.92, SD = 2.39$). This was not the case when participants were correct, participants reported similar confidence when they were completing two identifications ($M = 6.62, SD = 2.34$) as when they were completing four identifications ($M = 6.67, SD = 2.53$). All other effects were non-significant. For the effects of identification accuracy on confidence scores, see table 1. The effects of the person recall condition on confidence ratings are as described in table 2. For the mean confidence scores with the number of identifications, see table 3. The effects of identification accuracy and the number of identifications on confidence ratings are as listed in table 4.

Table 1

Identification Accuracy and Confidence Ratings

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>Incorrect</th>
<th>Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confidence</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td></td>
<td>5.27</td>
<td>2.35</td>
</tr>
</tbody>
</table>

Note. N represents the number of individual identifications made (not total participants) but excludes any responses where the participant indicated knowing a target.

Table 2

Person Recall and Confidence Ratings

<table>
<thead>
<tr>
<th>Person Recall</th>
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<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>SD</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3

*The Number of Identifications and Confidence Ratings*

<table>
<thead>
<tr>
<th></th>
<th>Two</th>
<th></th>
<th>Four</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>6.21</td>
<td>SD</td>
<td>2.34</td>
<td>N</td>
</tr>
<tr>
<td>N</td>
<td>258</td>
<td>M</td>
<td>5.84</td>
<td>SD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.59</td>
<td>N</td>
</tr>
<tr>
<td>Confidence</td>
<td></td>
<td></td>
<td>348</td>
<td></td>
</tr>
</tbody>
</table>

Note. N represents the number of individual identifications made (not total participants) but excludes any responses where the participant indicated knowing a target.

Table 4

*Identification Accuracy, the Number of Identifications, and Confidence Ratings*

<table>
<thead>
<tr>
<th>Number of Identifications</th>
<th>Incorrect</th>
<th>Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Two</td>
<td>Confidence</td>
<td>5.71</td>
</tr>
<tr>
<td>Four</td>
<td>Confidence</td>
<td>4.92</td>
</tr>
</tbody>
</table>

Note. N represents the number of individual identifications made (not total participants) but excludes any responses where the participant indicated knowing a target.
Person Recall Descriptions

The person recall descriptions that were given by participants were coded in two steps. First, by counting the number of descriptions that were given by participants for each target, and then by counting the number descriptions that were correct for each target. Separate scores were given for both of these categories on each target, and then analyzed. Thus, we explored the effects of the number of identifications and identification accuracy on: (1) the number of descriptors reported for each target on the person recall task and (2) the proportion of correct descriptors given. Again, for this section, we collapsed across targets to explore for overall effects. We found no impact of the number of identifications completed on the descriptors provided, nor on the accuracy of those descriptors, reported two t-tests. Similarly, the number of descriptors reported, nor the proportion of accurate descriptors reported varied by identification accuracy, reported two t-tests. For the mean number of descriptors given for each target and the proportion of correct descriptors, see table 5. For the effects of identification accuracy on descriptors given, see table 6.

Table 5

The Number of Identifications on Descriptors Given

<table>
<thead>
<tr>
<th></th>
<th>Number of Identifications</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Two</td>
<td>Four</td>
<td>Two</td>
<td>Four</td>
<td>Two</td>
<td>Four</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>N</td>
<td>M</td>
<td>SD</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Mike’s Number of Descriptors</td>
<td>2.09</td>
<td>1.17</td>
<td>68</td>
<td>2.24</td>
<td>1.26</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>Mike’s Proportion Correct</td>
<td>.460</td>
<td>.409</td>
<td>68</td>
<td>.490</td>
<td>.409</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>Alyssa’s Number of Descriptors</td>
<td>1.18</td>
<td>1.13</td>
<td>68</td>
<td>2.14</td>
<td>1.18</td>
<td>51</td>
<td></td>
</tr>
</tbody>
</table>
Alyssa’s Proportion Correct | .284 | .387 | 63 | .299 | .362 | 50
--- | --- | --- | --- | --- | --- | ---
Ben’s Number of Descriptors | 1.90 | 1.05 | 68 | 2.00 | 1.18 | 51
--- | --- | --- | --- | --- | --- | ---
Ben’s Proportion Correct | .406 | .381 | 65 | .482 | .420 | 48
--- | --- | --- | --- | --- | --- | ---
Mackenzie’s Number of Descriptors | 2.06 | 1.22 | 68 | 2.04 | 1.22 | 51
--- | --- | --- | --- | --- | --- | ---
Mackenzie’s Proportion Correct | .450 | .376 | 63 | .386 | .387 | 46

---

Table 6

Identification Accuracy on Descriptors Given

<table>
<thead>
<tr>
<th></th>
<th>Accuracy</th>
<th>Incorrect</th>
<th>Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Number of Descriptors Given</td>
<td>1.96</td>
<td>1.207</td>
<td>128</td>
</tr>
<tr>
<td>Proportion of Correct Descriptors</td>
<td>.374</td>
<td>.395</td>
<td>117</td>
</tr>
</tbody>
</table>

Discussion

This study attempted to understand how cognitive load during memory retrieval impacted eyewitness testimonies during multiple perpetrator crime. We anticipated that the presence of more than one perpetrator increases the cognitive demand on a single witness. Within this context, we manipulated cognitive load in two ways. First, cognitive load was manipulated by asking certain participants to make four identifications, while others made only two. The four identifications condition required more mental effort to complete the task, thereby increasing
cognitive load. Second, cognitive load was manipulated by randomly assigning a group of participants to complete a person recall task before beginning the identification procedure. Asking these participants to describe the targets from the video prior to making their identifications increased cognitive load. It was hypothesized than an increase in cognitive load would decrease the accuracy of identifications. The findings demonstrate that overall, cognitive load did not impact the accuracy of identifications in any way. This could be the result of the small sample size that was obtained, because cognitive load was not manipulated enough, or that the effects of cognitive load are negligible regarding eyewitness testimonies.

Studies that have previously looked at the reliability of eyewitness identifications during multiple perpetrator crimes have concluded that an increase in the number of perpetrators has detrimental effects on the witness’s ability to accurately recount information (Clifford & Hollin, 1981). It has also been determined that high cognitive load can result in the failure to see certain objects and may also impair an individual’s memory (Murphy & Greene, 2016). While research indicates that cognitive load during the encoding of memories impacts the accuracy of the memories that were formed, no research has looked at such effects during the memory retrieval process. For this reason, cognitive load during memory retrieval was explored.

It was hypothesized that increasing cognitive load during the memory retrieval stage would decrease eyewitness identification accuracy during multiple perpetrator crime. We anticipated that when participants were asked to make four identifications their accuracy rates would be lower than those of the participants who made only two identifications. Furthermore, we predicted that when participants engaged in a person recall task prior to making their identifications, their accuracy rates would be lower than those participants who did not engage in the task. The present study likely did not have enough power to determine if cognitive load
during memory retrieval had an impact on the eyewitness identifications (due to COVID-19) as the results of this study did not support our hypotheses. We did not find any significant effects to indicate that an increase in the number of identifications being made (higher cognitive load) or engaging in a person recall task before making the identifications (higher cognitive load) had an impact on the accuracy of these identifications. However, for one of the female targets, some significant effects were found. Participants were more likely to select the suspect when making only two identifications (lower cognitive load) compared to four. Furthermore, participants selected the suspect more when they did not have to complete the person recall task before making their identifications (lower cognitive load). Although the effects of these findings are minimal because they were found with only one of the targets, they do suggest that cognitive load could have been a factor and that it is worth further exploration.

Overall, the selections participants made when viewing the lineups were also found to be dependent on whether the target was present or absent in the lineups for all the targets. This indicates that participants were able to differentiate between the correct suspect (the target), the fillers, and the innocent suspect (the target replacement). Although unsurprising, this suggests that the material creation did what it intended. When creating the lineup materials, fillers and target replacements were chosen based on their similar, but not too similar, appearance to the targets. Research has indicated that fillers seen as highly similar to the suspect could impede identifications and having low similarity fillers and replacements is considered to be better for the witness (Fitzgerald et al., 2013). Thus, this study supports the findings that lower similarity ratings thereby help the witness to make accurate identifications.

**Limitations**
The present research is not without limitations. In most instances, when an individual is a witness to a crime it is traumatic and therefore stressful. The conditions involved in this study were likely not reflective of the stress a real witness would experience. For instance, participants in this study did not witness a crime and had a clear uninterrupted view of the faces. Furthermore, there was no stress placed on the participants to stimulate a real-world criminal environment. These factors may have decreased the validity of the results. Furthermore, while participants were encouraged to pay close attention to the video, it is likely that the classroom environment was distracting. Moreover, because the targets were observed using a video and not a live event, it is probable that participants were inclined to pay less attention that they would have during a live event.

Another limitation to this study would be the small sample size and the unbalanced number of participants in each condition (due to ending data collection early; COVID-19). It is possible that the sample size (or power) was too small to determine if our manipulations of cognitive load impacted the identifications and may have contributed to the lack of effects that were found.

Lastly, it is possible that our manipulations did not sufficiently increase cognitive load to determine effects. For instance, because the targets were only seen one at a time in the videos, and never all together, it is possible that the videos used were not suitable to mimic the level of cognitive load involved in witnessing a multiple perpetrator crime. There is also a chance that our manipulations of cognitive load were not strong enough. Perhaps increasing the number of identifications to four in the higher cognitive load condition, instead of two, was not sufficient enough. It is also possible that the person recall task did not increase cognitive load enough to impact the identification process. Overall, it is a possibility that the levels of cognitive load did
not differ enough between the lower cognitive load conditions and higher cognitive load conditions to determine effects.

**Future Directions**

Although our manipulations of cognitive load were not found to have an effect on the accuracy of eyewitness identifications during multiple perpetrator crime, this phenomenon should be explored further. Cognitive load is very likely a consideration and should be understood and accounted for during multiple perpetrator crimes. More participants should be recruited in attempt to increase the power of this study, since it is believed that a small sample size contributed to the lack of effects found. Because it is possible that cognitive load was not increased enough, future directions should also aim to further manipulate cognitive load by placing a higher demand on participants. This could be done by including a distractor task (for participants assigned to the higher cognitive load condition) that will cognitively exhaust the participants (i.e. mathematical problems) to see if this impacts identification accuracy. It would also be beneficial to add in a measure to determine how much cognitive load participants are experiencing, to ensure that the higher cognitive load condition is sufficiently different than the lower cognitive load condition. This could perhaps be done by asking participants to rate how difficult they felt the tasks were, in the conditions they were assigned to. Overall, the sample size needs to be increased and the participants should be balanced throughout each condition, while an increase in cognitive load should also be considered.

**Conclusion**

Identification lineups are commonly used by police and therefore largely impact the developments of an investigation (Hobson & Wilcock, 2011). For this reason, eyewitness
identifications have been largely researched (Hobson & Wilcock, 2011). Studies suggest that as the number of perpetrators in a crime increases, the accuracy of eyewitness identifications for those crimes, decreases (Clifford & Hollin, 1981). It has also been discovered that an increased cognitive load during the encoding of memories thereby decreases the accuracy of the memories that were formed (Murphy & Greene, 2016). This provides evidence to the fact that the increase of cognitive load associated with witnessing multiple perpetrators in a single crime contributes to the inaccuracy of identifications. It is also important to consider how cognitive load impacts the memory retrieval process during multiple perpetrator crime, and these effects are largely understudied. This study attempted to understand how cognitive load plays a role during memory retrieval on eyewitness testimony during multiple perpetrator crime. Although significant effects were not found in this study, the impacts of cognitive load should be explored further. The small sample size combined with only minor manipulations of cognitive load creates a need for continued research. Because of the influence eyewitnesses have on an identification, it is beneficial to continue researching their weaknesses. Moreover, this research combined with the evidence suggesting that increased cognitive load during multiple perpetrator crime impacts the encoding of memories, may motivate police to create better procedures for when they are dealing with eyewitnesses to such crimes.
References


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https://doi.org/10.1037/a0016454

https://doi.org/10.3758/s13414-011-0144-4

https://doi.org/10.1002/acp.1243


https://doi.org/10.3389/fpsyg.2016.01322


Appendices

Appendix A

Demographic Information

1. Gender? ______________________

2. What is your age? ______________

3. Is English your first language? Yes No
   If not, how many years have you been speaking English? ______

4. Ethnicity (optional): Please indicate which ethnic group you would consider yourself to belong to:
   □ White (e.g., European)
   □ Aboriginal (e.g., First Nations, Métis, Inuit)
   □ Black (e.g. African, African American, African Canadian, Caribbean)
   □ East Asian (e.g. Chinese, Japanese, Korean, Polynesian)
   □ South Asian (e.g. Indian, Pakistani, Sri Lankan, Bangladeshi)
   □ Southeast Asian (e.g. Burmese, Cambodian, Filipino, Laotian, Malaysian, Thai, Vietnamese)
   □ West Asian (e.g. Arabian, Armenian, Iranian, Israeli, Lebanese, Palestinian, Syrian, Turkish)
   □ Latin American (e.g. Mexican, Indigenous Central and South American)
   □ Mixed origin, please specify: ____________________________

5. Nationality (please check one)
   □ Canadian citizen _________
   □ Permanent resident __________
   □ Student Visa ________________
   □ Other (please specify) __________

6. Which is your dominant hand? (Please circle) Left Right

7. Have you seen either of the men or either of the woman in the video (the people wearing the hats) before? (Please circle your response)
   Mike? YES / NO
   Ben? YES / NO
   Mackenzie? YES / NO
   Alyssa? YES / NO

8. If you do know one of the people from the video, please indicate where you have seen them before:
   ______________________________________.
Appendix B

Examine the pictures below. The person from the video you watched in class MAY OR MAY NOT be here. If you see the person from the video, circle their picture. If you do not see the person, circle "NOT HERE".  

Please indicate how confident you are in your decision by circling a number (10 being most confident, 1 being least confident)  

1  2  3  4  5  6  7  8  9  10

Examine the pictures below. The person from the video you watched in class MAY OR MAY NOT be here. If you see the person from the video, circle their picture. If you do not see the person, circle "NOT HERE".  

Please indicate how confident you are in your decision by circling a number (10 being most confident, 1 being least confident)  

1  2  3  4  5  6  7  8  9  10
Examine the pictures below. The person from the video you watched in class MAY OR MAY NOT be here. If you see the person from the video, circle their picture. If you do not see the person, circle "NOT HERE".

Please indicate how confident you are in your decision by circling a number (10 being most confident, 1 being least confident)

1  2  3  4  5  6  7  8  9  10

Examine the pictures below. The person from the video you watched in class MAY OR MAY NOT be here. If you see the person from the video, circle their picture. If you do not see the person, circle "NOT HERE".

Please indicate how confident you are in your decision by circling a number (10 being most confident, 1 being least confident)

1  2  3  4  5  6  7  8  9  10
Appendix C

Examine the pictures below. The person from the video you watched in class MAY OR MAY NOT be here. If you see the person from the video, circle their picture. If you do not see the person, circle "NOT HERE".

Please indicate how confident you are in your decision by circling a number (10 being most confident, 1 being least confident)

1  2  3  4  5  6  7  9  10

Examine the pictures below. The person from the video you watched in class MAY OR MAY NOT be here. If you see the person from the video, circle their picture. If you do not see the person, circle "NOT HERE".

Please indicate how confident you are in your decision by circling a number (10 being most confident, 1 being least confident)

1  2  3  4  5  6  7  8  9  10
Examine the pictures below. The person from the video you watched in class MAY OR MAY NOT be here. If you see the person from the video, circle their picture. If you do not see the person, circle “NOT HERE”.

Please indicate how confident you are in your decision by circling a number (10 being most confident, 1 being least confident)

1  2  3  4  5  6  7  8  9  10

Examine the pictures below. The person from the video you watched in class MAY OR MAY NOT be here. If you see the person from the video, circle their picture. If you do not see the person, circle “NOT HERE”.

Please indicate how confident you are in your decision by circling a number (10 being most confident, 1 being least confident)

1  2  3  4  5  6  7  8  9  10
Appendix D

Please describe Mike from the video you watched in class:

Please describe Alyssa from the video you watched in class:

Please describe Ben from the video you watched in class:

Please describe Mackenzie from the video you watched in class:
Appendix E

Project Title: Memory for Faces and Words

REB Approval: This project was approved by the Research Ethics Board, University of Regina on (date).

Student Researcher(s): Tenielle Workman and Chavon Gonsalves

Faculty Supervisor(s): Dr. Kaila Bruer, Assistant Professor, 306-206-2104, kaila.bruer@uregina.ca
Dr. Tom Phenix, Dean and Associate Professor, 306-359-1264, tom.phenix@uregina.ca

Collaborator(s): Dr. Heather Price (Thompson Rivers University)

Purpose of the Research: This research is intended to learn more about the capabilities and limitations of human memory. The purpose of this study is two-fold. First, we hope to better understand how various circumstances can assist or hinder ability to remember experiences—such as retrieval-induced forgetting. We are also hoping to learn more about how young adults remember the faces of people they see.

Procedures: In class, you will be asked to complete a number of tasks in a group activity, as pertaining to memory. You will have watched a video of four people reading different words. Now, you will be asked to try to identify the faces of people you saw from the video and the words that they said. You will also be asked to provide some basic demographic information about yourself. Your participation in this study is expected to take about 45 minutes.

Potential Risks: We know of no risks associated with your participation in this study. But, if for any reason, you feel negatively affected in some way, please contact University of Regina Counselling Services at 251 Riddell Centre or by calling 306-585-4491. Please inform the researcher(s) if you do not wish to participate in any component of the study.

Potential Benefits: Your participation in this project helps us understand the limitations and capabilities of memory—particularly as it pertains to forgetting. In turn, this will help memory researchers improve theory and better understand how we can improve memory performance in real-world settings—such as when a witness is asked to report on a crime they saw.

Compensation: Without regard for your performance on the tasks, you will receive 1 course credit if you agree to participate in this study.

Confidentiality: As required by the law, your confidentiality will be maintained with strict standards if you wish to participate. Despite having participated in class in a group activity, your name will have no association with the data collected in the study. Your provided information will be confidential and you will be identified only by your participant number. Personal information, such as your identity and contact information, will be protected and stored in a secure location at the University of Regina and will only be provided to your course instructor in order to receive appropriate course credit. All information collected from this study will remain confidential and only group results will be reported. You are advised to not put any identifying information, such as your name, on the study materials. We intend to publish these group results in theses and academic journals, present them at conferences, and share them with granting agencies who supported or funded the research.

Storage of Data: This consent form is to be stored in a locked filing cabinet, isolated from any collected data. Following the completion of the study, data will be stored in a locked filing cabinet in Dr. Kaila Bruer’s office and all electronic information will be
password protected and will be kept for no less than five years. All electronic files will be permanently deleted and all paper materials will be shredded following this period.

**Right to Withdraw:** It is important to be mindful that your participation is voluntary. You may withdraw without penalty at any time should you decide to discontinue participation in the study, still after signing this form. Choosing to withdraw will result in no loss of accessibility to services provided by the University of Regina, nor will your academic status be affected in any facet. If a student decides they wish to withdraw from the study, they may raise their hand and one of the student researchers (Tenielle Workman or Chavon Gonsalves) will then approach the student and the student will give the researcher their study materials. The researcher will then take their materials and destroy them. The researcher will also ask the student if they have any questions, and remind them that they will not be penalized for withdrawing. Should you wish to withdraw from the study and have your responses removed, please let the researchers know prior to completing to study. After this time, we will not be able to identify your individual responses to remove. If you wish not to participate in research, course credit may be acquired by alternative methods. We encourage you to discuss this with your course instructor.

**Follow-up:** Please email the principal investigators Tenielle Workman (workmant@uregina.ca) and Chavon Gonsalves (gonsalvc@uregina.ca) or faculty supervisors Dr. Kaila Bruer (kaila.bruer@uregina.ca) and Dr. Tom Phenix (tom.phenix@uregina.ca) to obtain summary results from the study.

**Questions or Concerns:** This project has been approved on ethical grounds by the UofR Research Ethics Board on (_____). Inquiries related to your rights as a participant may be addressed to the committee at (306-585-4775 or research.ethics@uregina.ca). Participants out of town may call collect. Questions about this research may also be directed to principal investigators Tenielle Workman (306-540-9442, workmant@uregina.ca) and Chavon Gonsalves (306-737-0435; gonsalvc@uregina.ca) or faculty supervisors Dr. Kaila Bruer (306-585-4772; kaila.bruer@uregina.ca) and Dr. Tom Phenix (306-359-1264; tom.phenix@uregina.ca).

**Consent:** By providing your signature below, you have indicated that you have read and understand the provided description; you have had an opportunity to ask about the study. I provide my consent to participate in this research project. For documentation, I have received a copy of this consent form.

<table>
<thead>
<tr>
<th>Name of Participant</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>____________________</td>
<td>__________</td>
<td>_____</td>
</tr>
</tbody>
</table>

Researcher’s Signature  
Date