TRAIT AGGRESSION AND ITS IMPACT ON MEMORY FOR VIOLENT INFORMATION

MICHELLE REANNE REININK
Bachelor of Arts, University of Lethbridge, 2021

A thesis submitted
in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

in

PSYCHOLOGY

Department of Psychology

University of Lethbridge

LETHBRIDGE, ALBERTA, CANADA

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MICHELLE REANNE REININK

Date of Defense: July 25th, 2025

Dr. J. Mansour Thesis Supervisor	Associate Professor	Ph.D.
Dr. K. Ito Thesis Examination Committee Member	Assistant Professor	Ph.D.
Dr. D. Logue Thesis Examination Committee Member	Associate Professor	Ph.D.
Dr. Louise Barrett Chair, Thesis Examination Committee	Professor	Ph.D.

ABSTRACT

I investigated whether an individual difference, specifically trait aggression, affects how violent information is remembered. My main hypothesis was that participants with higher trait aggression would better remember details of violence and be more accurate in identifying the perpetrators of violent actions than those with lower scores, while memory for non-violent events would not differ based on trait aggression. To test this, I used an eyewitness memory paradigm wherein participants watched a violent or non-violent video and indicated how aggressive they perceived the content and the person who committed the violent/non-violent act to be. Memory for the videos was measured with recall and recognition questions for the people in the videos. During the delay between the video and the lineups, participants completed the Buss-Perry Aggression Questionnaire (Buss & Perry, 1992). Next, participants completed a target-present or target-absent lineup for each of the two individuals from the video. Contrary to my hypothesis, increased trait aggression was not associated with increased memory for violent events, though it was associated with biased perceptions. Participants high in trait aggression perceived more aggression in non-violent videos and less aggression in violent ones than participants low in trait aggression. An implication of this research is that if an eyewitness perceives relatively neutral information as aggressive, this could affect how administrators of justice perceive the suspect, in turn potentially affecting investigations and subsequent sentencing.

ETHICS STATEMENT

Work described in this thesis received research ethics approval from the University of Alberta Research Ethics Board, Project Name “Impacts of Trait Aggression on Memory for Violence,” Pro00135949, January 29th, 2024

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Chapter 1 : Introduction

Eyewitnesses play a pivotal role in the administration of justice. An eyewitness's responsibility is to provide evidence as to whether a suspect is guilty or innocent. Sometimes, the only evidence available comes from an eyewitness's testimony. However, eyewitnesses can make mistakes (Wells et al., 2006). Memory is fallible and there are many factors that can affect an individual's ability to recall information about the crime accurately (Loftus, 2005). In Canada, eyewitness identification errors have been implicated in a third of wrongful convictions that were later exonerated (Schuller et al. 2021). A wrongful conviction has life-altering consequences for those involved. Even if a person is exonerated, they may struggle to fully reintegrate into society due to psychological issues, financial difficulties, trouble finding employment, and challenges in relationships (Russell et al., 2022). Therefore, it is important to study what factors affect eyewitness accuracy so that the criminal justice system can better safeguard innocent people from being wrongfully convicted while ensuring criminals are not free to commit more crimes.

Often, researchers break such factors into system and estimator variables (Wells, 1978). System variables are factors that are within the control of the criminal justice system while estimator variables are not. Estimator variables include situational variables such as the time of day the crime took place, the length of time the witness was able to observe the perpetrator, whether a weapon was present, and the level of stress experienced by the witness during the event (Cutler et al., 1987). They can affect how information is encoded, stored, and later retrieved.

For example, research has shown that attention and arousal at the time of the event can enhance (Hoscheidt et al., 2014) or impair memory (Guez et al., 2015). Attention is a critical component for encoding; it determines which elements of an experience are prioritized for

processing and storage (Chun et al., 2011). The relationship between emotional arousal and encoding is complex and cannot be assumed to solely influence memory processes one way or the other (Christianson, 1992). One study found that higher levels of emotional arousal led to better memory for the central details of a mock crime (Echterhoff & Wolf, 2012; Mittal, 2013). Central details include memory that an event occurred and the general knowledge of what that event entailed, like what type of crime occurred. They can be contrasted with peripheral memory which includes memory for details of the event that are less critical, such as the color of a car parked nearby but not involved in the crime (Lanciano & Curci, 2011). However, other studies have found that increased arousal can impair memory for both types of details (Deffenbacher et al., 2004). These inconsistent findings suggest a complex relationship between arousal and memory. Violent crimes in which feelings of fear and threat are more likely to be present are known to produce intense emotional arousal (Christianson, 1992). Violent crime, therefore, provides an important avenue of study for eyewitness memory.

Crimes are sometimes violent in nature. Statistics Canada's Crime Severity Index provides data about reported crimes according to their severity and over time. According to Statistics Canada (2024), in 2023, "there was a 4% increase in the rate, or total volume of violent crime, including higher rates of crimes such as assault, robbery, and extortion" (p.3). Youth violent crime severity rose by 3.59% in 2023. Because eyewitnesses may be exposed to violent crimes, it is important to understand how violence impacts memory.

Previous research on memory for violent crime is conflicting. One study found that witnessing physical violence had little effect on memory (Pajon & Walsh, 2017). An archival study by Wagstaff et al (2003) found that memory for specific details of a crime, such as perpetrator hair color, improved in violent conditions, specifically rape cases. Another study

found that when viewing a violent video, memory was significantly better in participants with high executive functioning than low (Battista et al., 2020). Conversely, several studies have found a negative effect of violence on memory, where participants who watched a staged violent (cf. non-violent) event less accurately recalled details of the crime including the perpetrator's appearance (Clifford & Hollins, 1981; Clifford & Scott, 1978). These inconsistent results indicate the importance of determining how the type of crime may impact an eyewitness's memory for violence.

Although there has been little and conflicting research on violence and eyewitness memory, there has been quite a bit of research on the related variables of stress and the presence of a weapon during a crime. The weapon focus effect posits that the presence of a weapon draws attention away from central details like a perpetrator leading to reduced memory for the perpetrator (Fawcett et al., 2013). Theories suggest that the threat of a weapon draw focus towards it and posit that this may be due to emotional arousal (Kocab & Sporer, 2016). One study found that when a weapon was fully visible to participants watching a mock-crime, self reported arousal ratings increased and accuracy of the target descriptions decreased compared to participants who viewed a mock crime where the weapon was concealed and therefore less visible. (Kramer et al., 1990). Weapons capture attention and signal potential for violence and are therefore useful for examining how individual differences might influence memory in violent situations.

Besides arousal and violence, researchers have studied a variety of estimator variables (Wells, 1978). Other factors like lighting, distance, and exposure duration during the crime can affect the quality of encoding, where poorer conditions usually lead to less accurate memories

(Wells & Olson, 2003). Indeed, the focus of research on estimator variables has tended to be on situational variables. Thus, despite the extensive research contributions to the field of eyewitness memory, significant gaps remain in literature. One area in the eyewitness literature that has been infrequently studied (but c.f. Andersen et al., 2014) is individual differences.

Individual differences are consistent character dispositions that are stable over time. These traits can impact how we react to and interact with the world around us. In the eyewitness field, individual differences have been studied in relation to working memory, where findings indicate differences in memory performance based on specific traits (Andersen et al., 2014). Some studies on personality and eyewitness memory have found that traits like openness impact eyewitness identification accuracy (Curley et al., 2017), but there is limited research on traits like aggression and how they might influence an eyewitness's cognitive processes.

This research focused on trait aggression as a specific individual difference that might impact an eyewitness's memory for violence. Aggression can be defined as an inclination to cause harm to another person with violent behaviour, demeanor, and attitudes (Allen & Anderson, 2017). Trait aggression is defined as the tendency to behave aggressively and this behaviour is consistent and stable over time (Chester & DeWall, 2015; Chester & West, 2020). Research has shown that people with higher levels of trait aggression exhibit stronger cognitive connections to aggressive thoughts and behaviours, which makes them more likely to process and respond to violent stimuli (Bushman, 1996). This increased sensitivity relates to Bushman's (1996) theory on cognitive associative networks which function as mental frameworks where aggressive concepts are integrated and primed making it easier for individuals to respond to these associations.

As posited by Bushman (1996), a cognitive associative network is made up of links and nodes. Each node represents a construct, and the links connect these constructs to each other.

When we are exposed to aggressive information, the nodes are activated across the network. Individuals higher in trait aggression have stronger networks for these types of concepts. This means that they are primed for aggressive information and are more readily able to react, process and remember it. Therefore, when exposed to certain thoughts, emotions and behaviours, individuals with higher trait aggression may more quickly access aggression-related information than those that have low trait aggression. For example, if someone who is highly aggressive encounters violence, this information is likely to activate other aggressive associations, making them more predisposed to interpret situations with this type of lens (Bushman, 1996). This priming influences how people react and process violent information which may in turn lead to differences in memory for violent crime. Because violent content would fit the pre-existing aggressive schemas of trait-aggressive individuals, they might be more likely to allocate greater attentional resources to violent details during encoding, leading to stronger memory. Additionally, when retrieving information, violent concepts within the associative networks could facilitate recalling violent information leading to greater confidence in the recalled events, while neutral or peripheral aspects of an event may be less well remembered. This bias would have implications for eyewitness testimony as trait-aggressive individuals might give more detailed accounts of violent actions but misremember less emotionally valanced information.

Previous research has found evidence of this bias. For example, Van den Stock et al (2015) found that participants with higher levels of aggression responded more quickly when the focus of the task was on an aggressor in a conflict rather than the victim. This research suggests that cognitive associative networks in aggressive people are more likely to be activated when viewing aggressive information with increased focus on this type of information. Using this theory, I wanted to determine whether increased trait aggression influences eyewitness memory for violent information and whether more highly aggressive people encode and remember the

details for violent events better, including the perpetrators of said violence compared to those low on trait aggression. Furthermore, do highly trait aggressive people perceive violence differently than low trait aggressive people? Understanding the mechanisms associated with these networks and how individual differences might influence eyewitness testimony is crucial for criminal justice because it highlights strengths and risks associated with relying on eyewitness accounts from individuals with different degrees of trait aggression.

This research will add to the body of literature on internal factors that affect eyewitness memory. It is particularly relevant to criminal justice because it may assist in the development of better identification procedures, the determination of eyewitness credibility, and the development of specific interviewing strategies. Outside of the field of eyewitness memory, this research will be informative for those studying the relationship between aggression, violence, and memory. Understanding how these factors relate to each other can help us better understand the underlying mechanisms that contribute to effective or ineffective encoding and retrieval of memory for different information. Overall, this research makes an essential contribution to the field of psychology, and its findings have important implications for the criminal justice system and our understanding of memory, violence, and aggression.

To examine the relationship between trait aggression, violence, and memory, I used an eyewitness memory paradigm where participants watched either a violent or a non-violent video containing either an assault or a conversation. After this, they completed questions that measured their memory for the videos. They then completed the trait aggression questionnaire and made lineup decisions for the two targets in the videos. After completing the lineups, participants gave their perceptions for how aggressive they thought the targets in the videos were, how aggressive they thought the content was, and how aggressive it was compared to what they would watch on

television. This design allowed me to investigate how an individual difference impacts eyewitness memory for violent crime.

I had several hypotheses based on prior literature. The first hypothesis was that participants who scored higher on a trait aggression measure would have better memory overall for the details of a violent video (including the aggressors) than those who scored lower on these measures, but that there would be no difference in memory for non-violent conditions. My second hypothesis was that participants who scored higher on a trait aggression measure would be more accurate overall and with target-present lineups after witnessing a violent event than those who scored lower on trait aggression. In contrast, I did not expect those low versus high on trait aggression to differ in their performance after witnessing a non-violent event. These first two hypotheses derive primarily from the work of Bushman (1996) discussed above. Finally, the third hypothesis was that participants with higher trait aggression would report the video depicting violence to be less threatening than those with lower scores, based primarily on the work of Chester & Dewall (2015) and Bushman (1996) also discussed above.

Chapter 2: Method

This study, including the hypotheses, method, and planned analyses was pre-registered on the Open Science Framework.

2.1 Participants

We aimed to collect 400 usable participants. Because there is limited literature on memory capacity for violence being influenced by trait aggression, I considered the size of the effects on memory for violent versus non-violent crimes. Prior research (Clifford, & Scott, 1978; Pajon, & Walsh, 2017; Wagstaff et al., 2003) suggested a medium effect on recall/recognition. A power-analysis was conducted using G*Power 3 (Faul et al., 2007) for a logistic regression. I determined that with an odds ratio of 2, with 90% power at an alpha level of 0.05 I would need 200 participants. This number was doubled because I used target-present and target-absent lineups, so the total number of participants needed was 400. Typically, lineup effects are small (e.g., Fawcett et al., 2013) while recall and recognition tend to show medium effects. Due to constraints with resources and time to complete the project, I powered for a medium effect.

I collected participants (N = 405) via MechanicalTurk on the CloudResearch platform. Only participants able to view a computer screen and who accessed the study via a desktop or laptop computer were able to begin the study (to ensure they could see the video well enough to process the displayed faces). We sequentially excluded from our analysed sample any cases of duplicate IP addresses (n = 3), those who did not consent to have their data used in the analysis (n = 2), those who stated that they responded randomly-that is, selecting a random answer or typing random words instead of thinking about the response (n = 3), and those who provided five or more “not applicable” responses to the statements in the trait aggression questionnaire as the analysis required these scores to determine a relationship between this trait and memory (n = 3).

Also, participants were removed if they failed both attention check questions (n = 3). Thus, the total number of participants included for analysis was 391.

Participants' ages ranged from 19 to 81 years old (M = 45.6, SD = 13.5). Of our participants, 75% were White, roughly 7% were Black, and 6% were Latin American. Approximately 50% of participants were female and 48% were male; the remainder identified as "other" or preferred not to disclose their gender.

2.2 Design

This study utilized a mixed 2 (Video: violent or non-violent) x 2 (Lineup: target-present or target-absent) x 2 (Actor: 1, 2) x 2 (Stimulus Video: Video 1, Video 2) design. Video and Stimulus Video were manipulated between-subjects such that participants were randomly assigned to watch one of four videos (two violent, two non-violent) with each pair of videos containing two distinct actors. This allowed me to control any effects specific to an actor. Lineup and Actor were manipulated within-subjects as each video depicted two Actors. I randomly assigned participants to view either a target-present or target-absent lineup for each Actor. A target-present lineup is one which includes a person shown in the video, whereas a target-absent lineup does not contain anyone from the video. This mimics real-world conditions where police cannot know for certain if they have a guilty or innocent suspect.

2.3 Materials

2.3.1 Apparatus.

This study was conducted online using Qualtrics, version 2025.4 (Provo, UT).

2.3.2 Videos.

Several sets of videos were piloted for this study using the University of Lethbridge psychology participant pool. The first set of videos were filmed by myself and a fellow graduate

student using volunteer actors. The videos depicted a non-violent or a violent robbery and a non-violent or a violent argument. However, pilot testing indicated that participants did not find them to be violent and did not find the actors in the videos to be aggressive. Therefore, videos clips depicting Russian bare-knuckle boxing were pilot tested. The violent videos showed one opponent clearly assault the other, resulting in a knock-out. The non-violent videos contained face-offs between the two targets. There were up to three people in the boxing ring and several people surrounding the ring in the background in each of these videos. These videos were also piloted using the University's participant pool. Participants did not find these videos to be very violent or aggressive, though they were rated as slightly more aggressive than the first videos depicting mock crimes. Because of this, I decided to use clips from the movie "Borgman" (Midnight Picture Show, 2023) that depict high levels of violence including assaults and strangulation. The violent condition included two different clips; one contained a single aggressor and a victim while the other depicted two aggressors assaulting a victim. The actors from the first clip were both male, Caucasian, and were both middle aged. The actors from the second clips were females, Caucasian, and roughly middle aged. In contrast, the non-violent condition included videos with the same target actors but showed neutral conversations instead of assaults. The Borgman videos contained up to five people, however participants had greater exposure to the actors that they were later asked to identify from the lineups. Both studies used clips that were approximately 20-30 seconds long.

2.3.3 Lineups.

Lineups were constructed by having at least three people watch a video clip and then give a description of the victim and perpetrator of violence. Faces were then added to a folder for each target matching the description given. These faces were taken from formal, freely available

databases, such as the Chicago Face Database, and the lab's database of faces. After selecting all faces that matched the description from amongst the databases maintained by our lab (10-15 faces each), I used the iterative match-to-description approach to select lineup members (e.g., Mansour et al., 2020). That is, I compared the photos that matched the target's description to the target to determine the closest match. Then I selected the face that best matched the closest match; this process was repeated until there were eight photographs including the target. The closest match to the target was discarded and the remaining photos were used to construct the target-present and target-absent lineups for that target. This process was done for each target. All photos except that of the target comprised the target-absent lineup while five of the six nontarget photos were randomly chosen (for each participant) to comprise the target-present lineup. The photos were then superimposed onto the same blue background and presented simultaneously in a 2 x 3 configuration. All participants completed two lineups, each containing a target from the video. For the first violent video, participants identified one aggressor and one victim. For the second violent video, participants identified two aggressors. This ensured that participants always completed two lineup tasks.

Prior to being shown the lineup, participants were given the following instructions,

> We will now show you a lineup for each of the opponents from the video. Please read the following instructions carefully.
> 1. You will view a set of photographs.
> 2. You will be viewing all the photographs at the same time.
> 3. Please look at all the photographs carefully and take your time before making a decision.
> 4. The person you saw may or may not be in the set of photographs you are about to view.

Participants could identify a lineup member or select, "not there" if they believed that the target from the video was not present in the lineup. As soon as the participant selected a face, the

page advanced, and participants were shown the face they selected previously along with the full lineup, though they could not change their response. On this page, participants were also asked to give their confidence in their decision. Confidence was rated using a 101-incrememnt slider scale from 0 = *not at all confident* -100 = *completely confident*.

2.4 Procedure

Participants completed a consent form prior to starting the study. Next, they were told:

> You are about to watch a short video. Please pay attention, because we will be asking you about your perceptions of the event later. The video will play automatically and after it ends, will advance automatically to the next screen. There may be a short delay between when the video ends and the screen advances, though. The video does contain sound so please ensure that your volume is at a reasonable level before advancing. The speech is not in English, but you will not be asked questions about what was said.

After watching the video, participants completed two attention check questions and then memory questions. They first freely recalled, then answered cued recall questions, and finally answered recognition questions about their memory for the contents and actors in the video they saw. After answering the questions, participants completed a trait aggression questionnaire.

Following the questionnaire, participants made two lineup decisions, one for each target in the video they watched. Next, participants rated their perceptions of how violent they found the content of the video and how aggressive they found the target in the videos. They also rated how violent they found the contents of the videos in comparison to what they would normally watch on television. Finally, participants answered demographic and data quality questions, were debriefed, and were asked if they would like to submit or withdraw their data.

2.5 Measures

2.5.1 Memory Measures.

Participants answered three types of memory measures. First, they were given two free recall questions: “Please describe the people in the video in as much detail as possible,” and “Please describe the events in the video in as much detail as possible.” Responses were coded for correct details, with one point awarded for each accurate detail. Coding was completed by fellow graduate students or independent study students in the Psychology department. The maximum number of correct details varied across each video. For the violent and non-violent videos containing targets 1 and 2, participants could receive a maximum score of 33 and 21 respectively for correctly recalled details. For both versions of the videos containing targets 3 and 4, participants could receive a maximum score of 26. These variations in maximum possible scores were due to the varying details within each scene.

Second, participants responded to nine cued recall questions. For example, they were asked, “What were the ethnicities of the people in the video?” and “What kinds of tattoos did the people have?” For the violent and non-violent videos containing targets 1 and 2, participants could score a maximum of 15 and 22 respectively. For the violent and non-violent videos containing targets 3 and 4, participants could score a maximum of 13 and 24. A third person determined the appropriate score for both the free and cued recall questions if the two raters disagreed. Proportions correct for each participant on the free and cued recall questions were calculated because the total score that participants could receive for each video was different.

Participants also answered six multiple choice recognition questions for the violent condition and five for the non-violent condition. For example, “What color shirt was person 1 wearing?” with possible answers being red, blue, black, and white. Two people coded the free

and cued recall questions. Each question answered correctly received a score of 1. Due to differences in the number of recognition questions asked for each condition, proportions for these questions were also calculated for each participant.

2.5.2 Trait Aggression Questionnaire.

To measure participants' trait aggression levels, we used the Buss-Perry Aggression Questionnaire (Buss & Perry, 1992). The Buss-Perry Aggression Questionnaire is commonly used to measure trait aggression and includes four scales that assess different types of aggressive behaviour, such as physical, verbal, anger, and hostility. This questionnaire was chosen because it is a valid and reliable measure (Anderson, & Bushman, 1997; Bernstein, & Gesn, 1997; Gerevich et al., 2007; Harris, 1995, 1997; Webster et al., 2014). The questionnaire comprises 29 statements which participants responded to on a Likert-style slider scale where 1 = *Uncharacteristic of me* and 7 = *Extremely characteristic of me*. Participants could also answer with "not applicable." Participants were given the following instructions: "We are now going to ask you some questions about yourself that relate to individual differences. Please answer as honestly as possible. Your answers will not be paired with any identifying data so for all intents and purposes, they will be anonymous. Use the slider to indicate your responses." Scores were summed across all questions for each participant. Participants who gave less than five "not applicable" responses were given a 1 for each NA statement as this is the minimum score, they would have received had they not selected it. As noted earlier, if a participant gave more than five such responses, they were excluded from our analyses.

For comparison, Buss and Perry (1992) reported means of approximately 77.8 for men and 68.2 for women out of a possible score of 145. While the original Buss-Perry Aggression Questionnaire (1992) utilizes a 1-5 Likert-style scale, I adjusted the scale to range from 1-7 to

allow for greater response variability and increased sensitivity to measure aggression. The scale's original content was preserved during my research and the scaling adjustment was applied across all participants; these types of adjustments have been shown to not significantly change the reliability of the measure (Dawes, 2008; Preston & Colman, 2000). To compare against the reported mean scores from Buss and Perry's (1992) study, I adjusted what their means would be on a 7-point scale (M = 109 for men and M = 95 for women).

2.5.4 Perception Measures.

To determine if the violent videos were perceived as aggressive, participants were asked about their perceptions of them. Participants rated how aggressive they found the perpetrators of the violence in the video to be (i.e., the aggressor); how aggressive they found the contents of the video and how aggressive they found the contents of the video in comparison to what they would normally watch on television. Perceptions were rated on a scale from 1 = *not very aggressive* to 7 = *very aggressive*.

2.5.5 Attention Checks and Data Quality.

Participants were asked two questions to determine if they paid attention to the contents of the video and therefore could be expected to remember the contents. The first question was, "What was happening in the video?" with possible answers being "Boxing," "A brisk walk," "A conversation," or "An assault." The second question asked, "What kind of weapons were seen?" with possible answers being, "Gun," "Rope," "Bat," "None." If participants got both questions wrong their data were excluded from analysis.

Participants were also asked questions related to their data quality. This included asking if they responded randomly; if they stated that they did, their data was excluded from analysis.

Participants were asked if they cheated in any way and depending on the nature of their response, their data may have been excluded. For instance, if a participant stated that they took a screenshot of the video to determine who the targets were, their data was excluded. The next question asked was if they experienced any technical difficulties. If the technical difficulty resulted in them being unable to properly see the video, then that participant's data was excluded. Participants were also asked if they recognized the people or location of the videos. Because the study was specifically testing participants' memory for a video, if a participant stated that they recognized the targets they were excluded because this would indicate they had prior exposure, which would affect their responses. Participants were also asked how they would rate the honesty of their responses on a scale of 1-7 with 1 = *not honest* and 7 = *completely honest*. This allowed participants to indicate how useful their data was without explicitly stating that they cheated. We did not exclude based on this but were interested in how honest people were.

2.5.6 Demographics.

Participants were asked to provide their gender identity, ethnicity, and age. They could choose not to provide this information.

Chapter 3: Results

Analyses were completed using R (R Core Team, 2025).

3.1 Trait Aggression

Trait aggression is a continuous variable and there is no agreed cutoff for high versus low trait aggression (e.g. Buss & Perry, 1992). To calculate total trait aggression scores, participants' responses on each scale were summed. The mean trait aggression score was 85.52 (SD = 30.95, Md = 82, $Range$ = 30 - 164) out of a possible 203. I used an ANOVA to determine if trait aggression scores differed between participants who watched a violent or non-violent video. There was no significant effect of condition on aggression scores, $F(1, 389) = 0.02$, $p = .90$. This indicated that trait aggression levels were comparable between both the violent and non-violent conditions.

3. 2 Hypothesis 1: How Violence and Trait Aggression Relate to Memory Questions

To test my hypothesis that there is a relationship between trait aggression and memory for violent videos but not for non-violent videos, I constructed linear regression models, one for each type of memory questions. I reported standardized regression coefficients (β) for comparability:

memory ~ trait_aggression + Video + trait_aggression*Video

For free recall, the overall model was significant, $r^2 = 0.06$, $F(3, 387) = 8.13$, $p < .001$. The interaction between trait aggression and Video was not significant ($p = .42$), contrary to my hypothesis. Video also did not predict free recall ($p = .39$). However, a higher trait aggression score was associated with a decrease in free recall accuracy, $\beta = -0.24$, $t(387) = 3.92$, $p < .001$. To determine if free recall accuracy differed by which targets appeared in the videos that participants watched, I used a linear regression with a four-level predictor (targets 1&2 violent, targets 1&2 non-violent, targets 3&4 violent, targets 3&4 non-violent). The model was statistically

significant, r^2 = 0.03, $F(3, 387) = 3.51$, $p = .01$. Compared to the non-violent video containing targets 1 and 2, participants that watched the non-violent video containing targets 3 and 4 (β = -0.32, $t(387) = 2.25$, $p = .02$), and the violent video containing targets 3 and 4 (β = -0.34, $t(387) = 2.43$, $p = .02$), demonstrated significantly lower free recall scores. There was no significant difference between the non-violent video containing targets 1 and 2 and the violent video containing the same targets ($p = .93$).

For cued recall, again my overall model was significant, $r^2 = 0.03$, $F(3, 387) = 4.31$, $p = .005$ The interaction between Video and trait aggression was not significant ($p = .40$). Neither the main effect of Video, ($p = .07$) nor the main effect of trait aggression ($p = .08$), reached significance. Again, a linear regression was used to determine if cued recall accuracy differed by which targets appeared in the video that participants watched. The model was statistically significant, r^2 = 0.08, $F(3, 387) = 11.92$, $p < .001$. Compared to the non-violent video containing targets 1 and 2, participants that watched the non-violent video containing targets 3 and 4, β = -0.53, $t(387) = 3.88$, $p = .009$, the violent video containing targets 3 and 4, β = -0.36, $t(387) = 2.64$, $p < .001$, and the violent video containing targets 1 and 2, β = -0.81, $t(387) = 5.82$, $p < .001$, demonstrated significantly lower cued recall scores.

In terms of recognition, the overall model was significant, $r^2 = 0.3$ $F(3, 387) = 57.87$, $p < .001$. Consistent with hypothesis one, the interaction between Video and trait aggression scores was significant, β = -0.14, $t(387) = 3.31$, $p = .001$. To examine whether the association between trait aggression and recognition differed by Video condition, I ran separate regression models for participants who viewed a violent video and those who viewed a non-violent video. In the violent condition, higher trait aggression was associated with lower recognition accuracy, β =-0.19, $t(195) = 2.77$, $p = .006$. In contrast, in the non-violent condition, higher trait aggression was associated with greater recognition accuracy, $\beta = 0.14$, $t(192) = 2.02$, $p = .04$. The main effect of

Video was significant, $\beta = 0.54$, $t(387) = 7.41$, $p < .001$, with higher recognition associated with violent ($M = .64$, $SD = .13$) than non-violent Videos ($M = .45$, $SD = .17$). The main effect of trait aggression was also significant, $\beta = -0.002$, $t(387) = 2.25$, $p = .03$, which indicated better recognition performance in participants with higher trait aggression scores. I used a linear regression to determine if recognition accuracy differed by which targets appeared in the video that participants watched. The model was statistically significant, $r^2 = 0.30$, $F(3, 387) = 54$, $p < .001$. Compared to the non-violent video containing targets 1 and 2, participants that watched the violent video containing targets 3 and 4, $\beta = 1.15$, $t(387) = 9.66$, $p < .001$, and the non-violent video containing targets 1 and 2, $\beta = 1.20$, $t(387) = 9.80$, $p < .001$, demonstrated significantly better recognition accuracy. There was no significant difference between the non-violent video containing targets 1 and 2 and the non-violent video containing targets 3 and 4 ($p = .11$).

3.3 Hypothesis 2: How Violence and Trait Aggression Relate to Lineup Performance

To test whether participants who score higher on the trait aggression measure would make more accurate lineup decisions in violent than the non-violent Video condition, I used logistic regression models. I first analysed performance on target-present and target-absent lineups combined (overall accuracy: correct, incorrect) and then responses to target-present lineups (target-present identification accuracy: correct, incorrect) as a function of Video and trait aggression score. The trait aggression score was scaled using z-scores to meaningfully compare it to the binary variable of Video violence. I reported standardized regression coefficients (β) for comparability. For each of the two analyses, the model used was:

lineup ~ trait_aggression + Video + trait_aggression*Video Both models included a random intercept for participant, to account for repeatedmeasures design as each participant gave two lineup decisions. Participants had an overall identification accuracy rate of approximately 26%. For these lineups, I found a significant main effect for Video, $\beta = -0.36$,

SE = 0.26, *z* = 2.78, *p* = .005, indicating that participants in the violent Video condition were less accurate (40%) than those in the non-violent condition (47%). Neither the interaction (*p* = .39), nor the main effect of trait aggression (*p* = .55) was significant. Thus, my hypothesis was not supported.

Participants had a target-present identification accuracy rate of approximately 43%. My results showed a significant main effect for Video, suggesting that participants who watched the violent video were less accurate in their decisions (21%) compared to those who watched a non-violent video (31%), β = -0.30, *SE* = 0.28, *z* = 2.16, *p* = .03. Neither the interaction (*p* = .96) nor the effect of trait aggression (*p* = .38) was significant. Thus, my hypothesis was again, not supported.

To determine if participant's lineup accuracy differed by which targets appeared in the video they watched I used a logistic regression. The overall model was not significant (*p* = .60). Lineup accuracy did not differ for the non-violent video containing targets 1 and 2, did not differ for the violent (*p* = .85) nor the non-violent (*p* = .31) videos containing targets 3 and 4, as well as the violent video containing targets 1 and 2 (*p* = .53).

3.4 Hypotheses 3: Trait Aggression and Perceptions of Violence

Next, I examined how trait aggression related to perceptions of violence. I hypothesized a negative relationship between trait aggression and perceptions of violence for the content of the videos as well as the aggressors, where higher trait aggression would be associated with lower perceptions of aggression for violent videos. To test this hypothesis, I used two linear regression models (one predicting perceptions of violence in the video and one predicting perceptions of the aggressor's violence), and again, I reported standardized regression coefficients (β) for comparability:

perceptions ~trait_aggression +Video + trait_aggression*Video

Hypothesis three was partially supported. The overall model concerning the content of the video was significant, $r^2 = 0.70$, $F(3, 387) = 306.6$, $p < .001$. There was a significant interaction between trait aggression and Video, $\beta = -0.14$, $t(387) = 5.11$, $p < .001$. To make sense of the interaction, I performed separate regression models for the violent and non-violent Video conditions, with trait aggression as a predictor of perceptions of the content of the video.

Higher trait aggression was associated with lower perceived aggression for the content in the violent condition, $\beta = -0.25$, $t(195) = 3.62$, $p < .001$. Unexpectedly, higher trait aggression was associated with greater perceptions of aggression in the non-violent condition, $\beta = 0.25$, $t(192) = 3.64$, $p < .001$. Figure 1 illustrates this interaction. Additionally, I found significant main effects of both trait aggression, $\beta = 0.02$, $t(387) = 4.11$, $p < .001$, and Video, $\beta = 0.83$, $t(387) = 14.91$, $p < .001$. Higher trait aggression scores were associated with greater perceptions of violence. Participants perceived the content of a violent Video, ($M = 5.98$, $SD = 1.05$), to be more aggressive than a non-violent Video, ($M = 2.38$, $SD = 1.38$).

Figure 1: Perceptions of violence in videos as a function of whether the video contained violence and trait aggression.

The overall model for perception of the aggressors was also significant, $r^2 = 0.67$, $F(3, 387) = 256.9$, $p < .001$. The interaction between trait aggression and Video was significant, $\beta = 0.11$, $t(387) = 3.78$, $p < .001$. Again, I ran separate regression models for violent and non-violent Video conditions, with trait aggression as a predictor of perceptions of the aggressor in the video.

Higher trait aggression was again associated with lower perceived aggression for the aggressor in the violent Video condition, $\beta = -0.22$, $t(195) = -3.22$, $p = .002$, but greater perceived aggression in the non-violent condition $\beta = 0.17$, $t(192) = 2.38$, $p = 0.02$ (see Figure 2). The main effects of trait aggression, $\beta = 0.008$, $t(387) = 2.79$, $p = .005$, and Video, $\beta = 0.81$, $t(387) = 12.85$, $p < .001$, were also significant. Participants with greater trait aggression were more likely to perceive the aggressor as violent. Participants in the violent condition ($M = 6.08$, $SD = 1.01$) perceived the aggressor in the video as more aggressive than those in the non-violent condition, ($M = 2.61$, $SD = 1.48$).

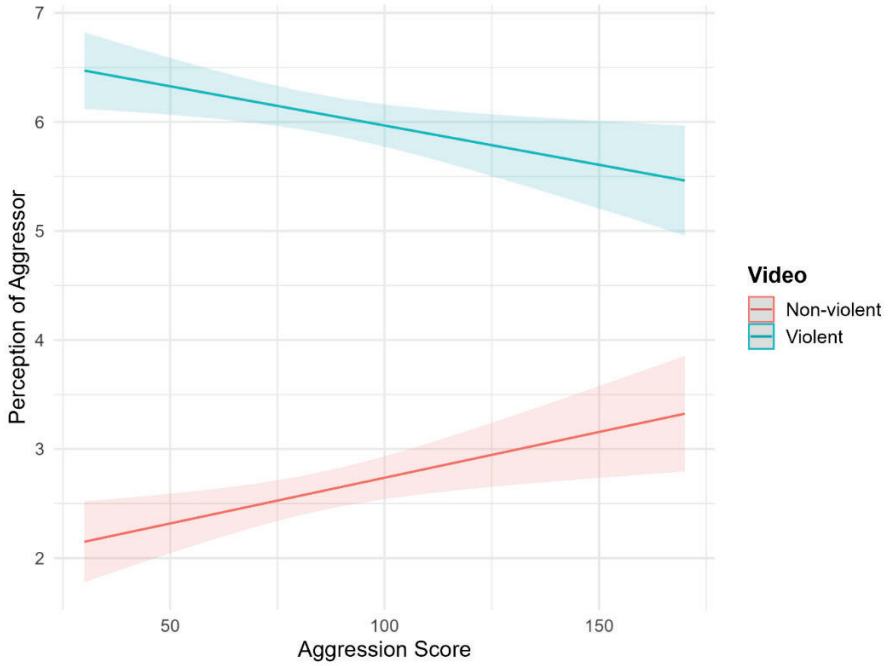

Figure 2: Perceptions of aggressors in videos as a function of whether the video contained violence and trait aggression.

To determine if perceptions of the aggressor(s) varied by which targets appeared in the video participants watched, I used a linear regression. The overall model was significant, r^2 = 0.67, $F(3, 387) = 263$, $p < .001$. Compared to the non-violent video containing targets 1 and 2, participants who watched both the violent videos containing targets 1 and 2, $\beta = 1.39$, $t(387) = 16.72$, $p < .001$, and targets 3 and 4, $\beta = 1.46$, $t(387) = 17.94$, $p < .001$, found the aggressor to be significantly more aggressive. Participants who watched the non-violent video containing targets 3 and 4, found the aggressor(s) to be significantly less aggressive, $\beta = -0.37$, $t(387) = 4.47$, $p < .001$.

The same relationships were true when comparing perceptions of content by the video participants watched. The overall model was significant, $r^2 = 0.69$, $F(3, 387) = 296.3$, $p < .001$. Again, compared to the non-violent video containing targets 1 and 2, participants who

watched both the violent videos containing targets 1 and 2, $\beta = 1.45$, $t(387) = 18.13$, $p < .001$, and targets 3 and 4, $\beta = 1.54$, $t(387) = 19.63$, $p < .001$, found the content to be significantly more aggressive. As well, participants who watched the non-violent video containing targets 3 and 4, found the content to be significantly less aggressive, $\beta = -0.31$, $t(387) = 3.93$, $p < .001$.

Chapter 4: Discussion

This study investigated how trait aggression relates to eyewitness memory and perception in violent versus non-violent conditions based on Bushman's (1996) cognitive associative network theory. I predicted that aggressive individuals would be better and more accurate at recalling violent information, but my findings indicate a more nuanced relationship. While not all of my hypotheses were supported, my results suggest that individuals high in trait aggression process violent and non-violent content differently, specifically relating to recognition memory and perceptions of aggression, suggesting that higher trait aggression may bias attention and perception of incoming information and may distort memory rather than improve it. In only one of my five analyses of memory performance (memory questions, lineups) did I find a significant interaction between trait aggression and video type (violent vs. non-violent). The effect of trait aggression varied by video type for recognition memory questions, but not in the direction I expected. Participants with higher trait aggression had lower recognition performance for the violent videos, and increased recognition performance for the non-violent videos. These results suggest that increased trait aggression may *interfere* with memory for violent events.

One reason a significant interaction was found for recognition and not the other memory measures may be the nature of the questions. Recognition is often considered easier because it requires participants to only identify details they have previously seen rather than generate them by interrogating their memory. During the recognition task, even when participants were unsure, they could still select the correct response by guessing which could lead to a greater range of scores, increasing variability.

Although the interaction for free recall was not significant, a main effect showed that higher trait aggression predicted poorer recall performance across both violent and non-violent

videos. This suggests that trait aggression may have a general negative impact on memory when the task requires a certain level of cognitive effort. Together, these results suggest that trait aggression does not enhance memory for violence as I had hypothesized. Rather, it may influence attention allocation and encoding which may impair memory instead of improving it which contradicts the assumption that highly trait aggressive individuals are likely to be more attuned to violent information.

Similarly, my second hypothesis, that aggressive individuals would be more accurate in identifying witnessed individuals from a lineup, was not supported. I found no significant effects for trait aggression and no significant interaction between aggression and the type of video participants watched. However, both models showed a significant main effect of video in that participants who viewed a violent video were less accurate in their lineup identifications than those in the non-violent condition. These findings support the broader pattern seen in the free recall data where violence appeared to impair memory accuracy regardless of individual differences in trait aggression.

One explanation for this impairment in memory is that when viewing violence, participants' attention may have been drawn away from the aggressor's face and towards more dynamic, threatening elements. That is, participants may have focused on physical interactions or contact points between individuals because dynamic threat cues may capture attention more strongly than facial features that remain static. Consistent with this notion, Scrivner and colleagues (2019) measured participant's gaze when viewing a violent scenario versus a non-violent scenario and found that participants spent less time looking at target faces in the violent than the non-violent scenario and instead focused on contact points between the targets for longer durations. This attentional shift may explain why participants in the present study were less likely

to make an accurate identification in the violent than non-violent condition; if their attention was allocated to the contact points when viewing violence then they would be less likely to encode the faces of the targets in that situation. Additionally, the targets in the violent conditions both used an object at some point in the video to assault the victim. This could have led to a weapon focus effect (Fawcett et al., 2013; Kocab & Sporer, 2016) in that participants were focused on the objects rather than the targets. The use of objects as weapons in violent conditions could have drawn attention away from the target's faces and towards the objects themselves if participants found these objects to be threatening or unusual in nature.

My final hypothesis examined the relationship between trait aggression and participant's perceptions of violence; specifically, how aggressive they rated the overall content of the videos and how aggressive they perceived the aggressors to be. This hypothesis was partially supported. Overall, the violent videos were rated as significantly more aggressive than the non-violent videos in terms of perceptions of content and the aggressor. However, there were also significant interactions between trait aggression and the type of video in both models.

Participants in the violent condition had higher perceptions of aggression in general, however, those with higher trait aggression scores rated the content and aggressor as less violent than those with lower trait aggression scores, whereas in the non-violent condition, higher trait aggression scores were associated with increased perceptions of aggression despite a lack of violence. This interaction indicates that more trait aggressive participants relative to less trait aggressive participants may underestimate aggression when it is present but overestimate aggression when it is not. Another possibility is that the overt violence depicted in the violent videos was a strong enough cue that most participants perceived the violent videos as aggressive, which leveled the ratings. Alternatively, more trait aggressive individuals may have been more

likely to interpret neutral or ambiguous behaviour in the non-violent condition as threatening or hostile due to predispositions in cognition, compared to less trait aggressive individuals.

Bushman's (1996) cognitive associative network for aggression indicates that aggressive individuals have more accessible schemas for aggression and that this could lead them to perceive aggression even when it is absent. This is consistent with other research showing that when aggressive concepts are easily accessible, trait-aggressive individuals are more prone to interpret ambiguous situations as violent or hostile (Dodge, 1980; Wilkowski & Robinson, 2012). My results add to this literature because they suggest that high trait aggression may not just affect what is being attended to and encoded, but how this information is being interpreted as well. According to Bushman's (1996) theory on cognitive associative networks, individuals high in trait aggression have schemas that are more readily activated by aggressive information which could possibly bias their perceptions of neutral events. This may explain why participants with high trait aggression perceived the non-violent video clips as more aggressive. The non-violent and violent clips that I used came from the same movie such that the non-violent clips immediately preceded the violent clips. This highlights how individuals high in trait aggression may be interpreting neutral social cues as threatening, aggressive, or even as predictive of violence which would be consistent with the idea that these individuals have associative networks that are primed to detect aggression even if it is not overt.

This interpretation also aligns with the idea that individuals high in trait aggression may have a lower threshold for aggressive cues and therefore interpret neutral content as more aggressive. For example, a slight expression of anger in a target's tone may have been perceived more readily as aggression to highly trait aggressive (cf. less aggressive) participants.

Alternatively, highly trait aggressive participants may have been more likely to perceive aggression in everyday interactions despite a lack of violence present. They may overestimate the presence of aggression in others, perceiving things as more violent or hostile than they are, or they may expect aggression more frequently. My findings suggest that individuals with higher trait aggression may be more susceptible to perceptual biases when interpreting ambiguous or non-violent situations and therefore, in relation to real-world practice. If aggression-related concepts are highly accessible, trait aggressive individuals may be more likely to encode ambiguous or non-violent information as aggressive and therefore distort recall, exaggerating the violence associated with an event.

The results of this study has implications for legal and forensic contexts in that eyewitness testimony may be shaped by perceptions which are influenced by traits. If highly trait aggressive individuals perceive events as more or less aggressive than they are, then their testimony may be skewed. In terms of memory, if highly trait aggressive individuals focus on cues that indicate threat or violence (hand gestures, stance), then they may miss other important information about the event, such as physical details of the perpetrator. Such knowledge is particularly relevant to criminal justice because it may assist in the development of better identification procedures, the determination of eyewitness credibility, and the development of specific interviewing strategies. This could include assigning eyewitnesses a "reliability score" based on the type of crime witnessed and their score on an individual difference measure or developing specific interviewing strategies that are tailored to the type of crime. These approaches could improve how eyewitness credibility is assessed in legal settings. Gaining insight into individual differences that predict memory performance could improve evaluations

of identifications and therefore could decrease wrongful convictions resulting from the identifications of innocent suspects.

There were several limitations to this study. One limitation was the use of crime videos for my violent condition but only using videos depicting conversations for my non-violent condition. This choice may have made it easier for participants to identify and remember information from the non-violent videos because they may have been less distracted by a crime occurring which would likely draw attention because it is unexpected. As seen from my exploratory analyses of the variations in accuracy and perceptions across all four videos, there are significant differences in how each video itself impacts participants' responding. Therefore, this highlights a true lack of comparability across each video. Future research will aim to address these differences by using videos containing the same actors committing both a violent and non-violent crime. Another limitation is the nature of the trait aggression scores. The highest trait aggression score in my data was 164 out of a possible 203. This represents roughly 81% of the maximum range which covers a broad range of the scale. However, it is possible that the absence of extreme scores may have limited the ability to detect effects that may occur within those higher scores.

Power may have also been a limitation, specifically in terms of the lineups. While my power analysis indicated that 400 participants would be sufficient to detect a medium effect, studies on eyewitness identification manipulating lineups often find small effects of manipulations on lineup performance (e.g., Fawcett et al., 2013). Thus, my study may have been underpowered to detect effects of violence and/or trait aggression on lineup performance. However, it is notable that effects on memory questions tend to be medium in size (e.g. Fawcett et al.) therefore my power for these questions was reasonably good.

The multiple-choice format of the recognition questions may have provided cues for participants to select the correct answer and therefore may lack ecological validity compared to cued and free recall which would be more likely to reflect how people are tasked with remembering and reporting information within an eyewitness context. If police were using best practices when taking a statement from an eyewitness, they would not give them a multiple-choice questionnaire about the details of the crime. However, if they do not use best practices then this research provides some insight into how trait aggression may affect memory. Therefore, it is important to consider both the type of memory measure and how cognitively demanding it is when determining how individual differences may interact with violence.

Future directions for this research could include the use of videos depicting crimes for the non-violent condition as well, to increase ecological validity and ensure that both violent and non-violent conditions are matched in terms of context. For example, having a violent robbery and a non-violent robbery would allow me to better determine if differences in perception and memory are due to levels of trait aggression or if the different contexts have a greater influence. This would allow for greater control and improve the ability to compare groups across conditions.

Additionally, it would be beneficial to use eye-tracking to determine where participants are focusing and if their attention is allocated to points of contact rather than target faces. This could provide evidence as to whether attentional biases are at fault for decreased identification accuracy and memory performance. Finally, future research could benefit from exploring how other individual differences might interact with violence to impact or improve memory for these types of events. This could include things like individual stress responses, reactivity or impulsiveness, and attentional capacity. Improving our understanding of the interactions between

individual differences and memory can allow for the determination of factors that mitigate and exacerbate perceptual biases that may affect how information is remembered.

Chapter 5: Conclusion

The results of this study provide evidence that trait aggression plays a role in perception of violent and non-violent events. While I hypothesized that aggressive individuals would recall violent information more accurately than lower trait aggressive individuals, my findings instead indicated that perceptual biases may influence how the events of a crime are interpreted and therefore recalled. Higher trait aggression was associated with misinterpreting ambiguous or neutral events as more aggressive which suggests perhaps a lower threshold for perceiving violence. These biases may influence encoding which may account for inaccurate eyewitness accounts and indeed, I found some evidence that violence directly affected memory performance. Though there was no relationship between identification accuracy and trait aggression, attention to peripheral information, such as the presence of a weapon or the contact points during physical altercations may have affected memory for faces. The findings from this study highlight the importance of considering individual differences in the perception of an event, specifically within the eyewitness context. Because this was a single study, future research should explore how individual differences shape attention allocation as well as perceptions of non-violent crime.

References

Allen, J. J., & Anderson, C. A. (2017). Aggression and violence: Definitions and distinctions. In *The Wiley Handbook of Violence and Aggression,* 1-14. https://doi.org/https://doi.org/10.1002/9781119057574.whbva001

Andersen, S. M., Carlson, C. A., Carlson, M. A., & Gronlund, S. D. (2014). Individual differences predict eyewitness identification performance. *Personality and Individual Differences, 60*, 36–40. https://doi.org/10.1016/j.paid.2013.12.011

Anderson, C. A., & Bushman, B. J. (1997). External validity of "trivial" experiments: The case of laboratory aggression. *Review of General Psychology, 1*(1), 19–41. https://doi.org/10.1037//1089-2680.1.1.19

Battista, F., Otgaar, H., Lanciano, T., & Curci, A. (2020). Individual differences impact memory for a crime: A study on executive functions resources. *Consciousness and cognition,* 84, 103000. https://doi.org/10.1016/j.concog.2020.103000

Bernstein, I. H., & Gesn, P. R. (1997). On the dimensionality of the Buss/Perry Aggression Questionnaire. *Behaviour Research and Therapy, 35(*6), 563–568. https://doi.org/10.1016/s0005-7967(97)00014-4

Bushman, B. J., & Anderson, C. A. (2002). Violent video games and hostile expectations: A test of the general aggression model. *Personality & Social Psychology Bulletin, 28*(12), 1679-1686. https://doi.org/10.1177/014616702237649

Bushman, B. J. (1996). Individual differences in the extent and development of aggressive cognitive-associative networks. *Personality and Social Psychology Bulletin, 22*(8), 811–819. https://doi.org/10.1177/0146167296228004

Buss, A. H., & Perry, M. (1992). The Aggression Questionnaire. *Journal of Personality and Social Psychology, 63*(3), 452–459. https://doi.org/10.1037/0022-3514.63.3.452

Chester, D. S., & DeWall, C. N. (2015). The pleasure of revenge: Retaliatory aggression arises from a neural imbalance toward reward. *Social Cognitive and Affective Neuroscience, 11*(7), 1173–1182. https://doi.org/10.1093/scan/nsv082

Chester, D. S., & West, S. J. (2020). Trait aggression is primarily a facet of antagonism: Evidence from dominance, latent correlational, and item-level analyses. *Journal of Research in Personality*, 89, 104042. https://doi.org/10.1016/j.jrp.2020.104042

Christianson, S. (1992). Emotional stress and eyewitness memory: A critical review. *Psychological Bulletin, 112*(2), 284-309. https://doi.org/10.1037/0033-2909.112.2.284

Chun, M. M., Golomb, J. D., & Turk-Browne, N. B. (2011). A taxonomy of external and internal attention. *Annual review of psychology,* 62, 73–101. https://doi.org/10.1146/annurev.psych.093008.100427

Clifford B. R., & Hollin C. R. (1981). Effects of the type of incident and the number of perpetrators on eyewitness memory. *Journal of Applied Psychology,* 66, 364–370. Https://doi.org/10.1037/0021-9010.66.3.364

Clifford B. R., & Scott J. (1978). Individual and situational factors in eyewitness testimony. *Journal of Applied Psychology,* 63, 352–359. https://doi.org/10.1037/0021-9010.63.3.352

Curley, L. J., MacLean, R., & Murray, J. (2017). The relationship between the big 5 personality traits and eyewitness recognition. *Journal of Articles in Support of the Null Hypothesis, 13*(2), 57.

Cutler, B. L., Penrod, S. D., & Martens, T. K. (1987). The reliability of eyewitness identification: The role of system and estimator variables. *Law and Human Behavior, 11*(3), 233-258. https://doi.org/10.1007/BF01044644

Dawes, J. (2008). Do data characteristics change according to the number of scale points used? An experiment using 5-point, 7-point and 10-point scales. *International Journal of Market Research, 50*(1), 61-104. https://doi.org/10.1177/147078530805000106

Deffenbacher, K. A., Bornstein, B. H., Penrod, S. D., & McGorty, E. K. (2004). A meta-analytic review of the effects of high stress on eyewitness memory. *Law and human behavior, 28*(6), 687–706. https://doi.org/10.1007/s10979-004-0565-x

Dobson, M., & Markham, R. (1992). Individual differences in anxiety level and eyewitness memory. *The Journal of General Psychology, 119*(4), 343-350. https://doi.org/10.1080/00221309.1992.9921177

Dodge, K. A. (1980). Social cognition and children's aggressive behavior. *Child Development, 51*(1), 162–170. https://doi.org/10.2307/1129603

Echterhoff, G., & Wolf, O. T. (2012). The stressed eyewitness: The interaction of thematic arousal and post-event stress in memory for central and peripheral event information. *Frontiers in Integrative Neuroscience*, 6, 57. https://doi.org/10.3389/fnint.2012.00057

Fanti, K. A., & Avraamides, M. N. (2011). Desensitization to media violence. In M. A. Paludi (Ed.), *The psychology of teen violence and victimization,* (Vols. 1–2, pp. 121–133). Praeger/ABC-CLIO.

Fawcett, J. M., Russell, E. J., Peace, K. A., & Christie, J. (2013). Of guns and geese: A meta-analytic review of the 'weapon focus' literature. *Psychology, Crime & Law, 19*(1), 35-66. https://doi.org/10.1080/1068316X.2011.599325

Faul, F., Erdfelder, E., Lang, A., & Buchner, A. (2007). GPower 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-191. https://doi.org/10.3758/bf03193146

Gerevich, J., Bácskai, E., & Czobor, P. (2007). The generalizability of the buss–perry aggression questionnaire. *International Journal of Methods in Psychiatric Research, 16*(3), 124–136. https://doi.org/10.1002/mpr.221

Statistics Canada. (2024, August 21). Police-reported crime statistics in Canada, 2023. https://www150.statcan.gc.ca/n1/daily-quotidien/240821/dq240821b-eng.htm

Guez, J., Saar-Ashkenazy, R., Mualem, L., Efrati, M., & Keha, E. (2015). Negative emotional arousal impairs associative memory performance for emotionally neutral content in healthy participants. *PloS one, 10*(7), e0132405. https://doi.org/10.1371/journal.pone.0132405

Harris, J. A. (1995). Confirmatory factor analysis of the aggression questionnaire. *Behaviour Research and Therapy, 33*(8), 991–993. https://doi.org/10.1016/0005-7967(95)00038-y

Harris, J. A. (1997). A further evaluation of the Aggression Questionnaire: Issues of validity and Reliability. *Behaviour Research and Therapy, 35*(11), 1047–1053. https://doi.org/10.1016/s0005-7967(97)00064-8

Hoscheidt, S. M., LaBar, K. S., Ryan, L., Jacobs, W. J., & Nadel, L. (2014). Encoding negative events under stress: High subjective arousal is related to accurate emotional memory despite misinformation exposure. *Neurobiology of Learning and Memory,* 112, 237-247. https://doi.org/10.1016/j.nlm.2013.09.008

Kramer, T. H., Buckhout, R., & Eugenio, P. (1990). Weapon focus, arousal, and eyewitness memory: Attention must be paid. *Law and Human Behavior, 14*(2), 167-184. https://doi.org/10.1007/BF01062971

Kocab, K., & Sporer, S. L. (2016). The weapon focus effect for person identifications and descriptions: A meta-analysis. In M. Miller & B. Bornstein (Eds.), *Advances in psychology and law,* (Vol. 1). Springer. https://doi.org/10.1007/978-3-319-29406-3_3

Lanciano, T., & Curci, A. (2011). Memory for emotional events: The accuracy of central and peripheral details. *Europe's Journal of Psychology, 7*(2), 323-336. https://doi.org/10.5964/ejop.v7i2.132

Loftus, E. F. (2005). Planting misinformation in the human mind: A 30-year investigation of the malleability of memory. *Learning & Memory, 12*(4), 361–366. https://doi.org/10.1101/lm.94705

Midnight Picture Show. (2023, October 16). Borgman | FULL MOVIE | Midnite Picture Show. YouTube. https://www.youtube.com/watch?v=P4aroZsJsYs

Mittal, S., Singh, T., Arya, Y. K., & Tiwari, M. K. (2013). Effect of emotional arousal on eyewitness memory. *Indian Journal of Social Science Researchers, 10*(1), 24-30.

Pajón, L., & Walsh, D. (2017). Examining the effects of violence and personality on eyewitness memory. *Psychiatry, Psychology and Law, 24*(6), 923–935. https://doi.org/10.1080/13218719.2017.1327313

Preston, C. C., & Colman, A. M. (2000). Optimal number of response categories in rating scales: reliability, validity, discriminating power, and respondent preferences. *Acta psychologica, 104*(1), 1–15. https://doi.org/10.1016/s0001-6918(99)00050-5

Qualtrics, Provo, UT, USA. https://www.qualtrics.com

Russell, C., Pang, M., Nafeh, F., MacDonald, S. F., Derkzen, D., Rehm, J., & Fischer, B. (2022). Applying the socio-ecological model to understand community reintegration experiences among individuals on opioid agonist treatment (OAT) released from federal incarceration in Ontario, Canada. *SSM - Qualitative Research in Health, 2,* 100083. https://doi.org/10.1016/j.ssmqr.2022.100083

Schuller, R. A., Clow, K. A., & Erentzen, C. (2021). Twenty years for nothing: An exploration of wrongful conviction cases in Canada. *The Criminal Law Quarterly, 69*(1), 111-148.

Scrivner, C., Choe, K. W., Henry, J., Lyu, M., Maestripieri, D., & Berman, M. G. (2019). Violence reduces attention to faces and draws attention to points of contact. *Scientific reports, 9*(1), 17779. https://doi.org/10.1038/s41598-019-54327-3

Statistics Canada. (2024). *Table 35-10-0026-01: Crime severity index and weighted clearance rates, Canada, provinces, territories and Census Metropolitan Area*s. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3510002601

Van den Stock, J., Hortensius, R., Sinke, C., Goebel, R., & de Gelder, B. (2015). Personality traits predict brain activation and connectivity when witnessing a violent conflict. *Scientific Reports, 5*(1). https://doi.org/10.1038/srep13779

Wagstaff, G. F., MaCveigh, J., Boston, R., Scott, L., Brunas-Wagstaff, J., & Cole, J. (2003). Can laboratory findings on eyewitness testimony be generalized to the real world? An archival analysis of the influence of violence, weapon presence, and age on eyewitness accuracy. *The Journal of Psychology, 137(*1), 17-28. https://doi.org/10.1080/00223980309600596

Webster, G. D., DeWall, C. N., Pond, R. S., Deckman, T., Jonason, P. K., Le, B. M., Nichols, A. L., Schember, T. O., Crysel, L. C., Crosier, B. S., Smith, C. V., Paddock, E. L., Nezlek, J. B., Kirkpatrick, L. A., Bryan, A. D., & Bator, R. J. (2013). The brief aggression questionnaire: Psychometric and behavioral evidence for an efficient measure of trait aggression. *Aggressive Behavior, 40*(2), 120–139. https://doi.org/10.1002/ab.21507

Wells, G. L. (1978). Applied eyewitness-testimony research: System variables and estimator variables. *Journal of Personality and Social Psychology, 36*(12), 1546– 1557. https://doi.org/10.1037/0022-3514.36.12.1546

Wells, G. L., & Olson, E. A. (2003). Eyewitness testimony. *Annual Review of Psychology,* 54, 277–295. https://doi.org/10.1146/annurev.psych.54.101601.145028

Wells, G. L., Memon, A., & Penrod, S. D. (2006). Eyewitness Evidence: Improving Its Probative Value. *Psychological Science in the Public Interest, 7(*2), 45-75. https://doi.org/10.1111/j.1529-1006.2006.00027.x

Wilkowski, B. M., & Robinson, M. D. (2012). When aggressive individuals see the world more accurately: The case of perceptual sensitivity to subtle facial expressions of anger. *Personality and Social Psychology Bulletin, 38*(4), 540-553. https://doi.org/10.1177/0146167211430233