ORIGINAL PAPER

Are we Revealing Hidden Aspects of our Personality When we Walk?

Brittany Blaskovits[1] [iD] · **Craig Bennell[1]**

Abstract

Research suggests that certain individuals exhibit vulnerability through their gait, and that observers select such individuals as those most likely to experience victimization. It is currently assumed that the vulnerable gait pattern is an expression of one's submissiveness. To isolate gait movement, Study 1 utilized kinematic point-light display to record 28 individuals walking. The findings suggested that victimization history was related to gait vulnerability. The results also indicated that, contrary to expectation, individuals with more vulnerable features in their gait were more likely to self-report dominant personality characteristics, rather than submissive characteristics. In Study 2, a sample of 129 observers watched the point-light recordings and rated the walkers on their vulnerability to victimization. The results suggested that observers agreed on which walkers were easy targets; they were also accurate in that the walkers they rated as most likely to experience victimization tended to exhibit vulnerable gait cues. The current research is one of the few to explore the relationship between internal dispositions and non-verbal behavior in a sample of self-reported victims. The findings provide exciting insights related to the communicative function of gait, and the characteristics that may put some individuals at a greater risk to be criminally targeted.

Keywords Victim · Vulnerability · Submissive · Dominance · Point-light display

Introduction

It has been argued that personality traits are not actually directly observable, but rather inferred from behaviors such as leg movements, facial expressions, and patterns of touch (Mischel 1999; Simpson et al. 1993). As these behaviors are visible and thus easily detected by others, they can be used to assess an individual's state and intention(s); inferences are made regarding one's mood, attitude, interpersonal role, personality, and severity of pathology, from nonverbal behavior (Ekman and Friesen 1969; Simpson et al. 1993). For instance, Richards et al. (1991) found that observers could accurately differentiate

✉ Brittany Blaskovits
  brittanyblaskovits@cmail.carleton.ca

1 Department of Psychology, Carleton University, 1125 Colonel By Drive, Ottawa, ON K1S 5B6,
   Canada

dominant women from submissive women by the body movements they exhibited during conversation (e.g., submissive women appeared to use less expansive movements and gestured more often with their hands and feet). Interestingly, those who had been rated as submissive were also subsequently judged as more likely to be a victim of sexual assault.

Indeed, nonverbal behaviors do not only signal various traits and emotions to others, but also inspire action (e.g., approach or avoidance behavior) in the observer. Simpson et al. (1993) explored personality and nonverbal behavior during relationship initiation. They found that women with an unrestricted socio-sexual orientation (i.e., those who engage in sexual relationships quickly, without concern of commitment or partner familiarity) were significantly more likely to lean forward and cant their heads, relative to women with restricted socio-sexuality. The nonverbal behavior of the female has relevance for the male in that she is communicating her interest level, which simultaneously indicates whether he should initiate an approach (or vice versa). Certain behavioral displays of affiliation, such as head cants, appear to communicate "contact-readiness" and are aimed at facilitating intimacy (Eibl-Eibesfeldt 1989). Burgoon (1985) argues that, similar to flirting behavior, some submissive behaviors signal sexual interest and are postulated to induce approach behavior in others; these same behaviors may also suggest vulnerability. It is hence possible that nonverbal cues of submissiveness may unintentionally instigate approach behavior in offenders during target selection.

Nonverbal Cues of Vulnerability for Offenders

The rational choice approach to crime argues that offenders decide to commit offences based on available, albeit limited information (i.e., rationality is "bounded" by time, information, knowledge, and mental resources; Beauregard and Leclerc 2007; Cornish and Clark 1986; Snook and Cullen 2009). Offenders may decide their course of action by weighing the costs and benefits associated with the various methods available to them. Research indicates that cues of vulnerability are particularly important in the selection of victims for interpersonal crimes (e.g., mugging and sexual assault; Book et al. 2013; Stevens 1994; Wheeler et al. 2009). Targeting vulnerable individuals is likely to increase the chances of successful goal acquisition (i.e., sexual gratification, money, power, etc.), and thus becomes a crucial factor in the offender's decision-making framework.

Early work by Myers et al. (1984) suggested that individuals who report previous victimization tend to exhibit low dominance, low assertiveness, and less social presence, relative to individuals without histories of assault. In stranger-observer studies, individuals can reliably report which targets display such characteristics and also tend to report these same individuals as those most likely to be re-victimized in the future (e.g., Book et al. 2013; Richards et al. 1991; Wheeler et al. 2009). In other words, victims of crime who exhibit submissive behaviors (the 180° opposite of dominance in the interpersonal circumplex model of personality; Markey and Markey 2009; Trapnell and Wiggins 1990; Wiggins 1995), tend to be identified as those most likely to experience future victimization. In fact, past victimization appears to be highly predictive of future victimization. For example, the risk of new assault for a previously assaulted individual is more than four times higher compared to someone without a history of assault (Kilpatrick and Acierno 2003). Thus, a small proportion of the population experiences disproportionate amounts of criminal victimization (Kilpatrick et al. 1997).

Past victimization may predict future risk because: (1) being victimized alters the individual in some way (e.g., individuals who are victimized may experience anxiety, and

research suggests that highly anxious individuals are at an increased risk for experiencing victimization; Lauritsen and Quinet 1995), or (2) because there is an unmeasured aspect of the victim that fosters their repeated selection by offenders (e.g., they exhibit risk-taking tendencies and/or work in a dangerous profession; Lauritsen and Quinet 1995; Sparks 1981). It has been argued that the delineation of gait behavior in particular, is a key component in nonverbal communication between individuals (Thoresen et al. 2012) and could act as an important cue for offenders (e.g., Grayson and Stein 1981).

An individual's gait is one of the first behaviors that an observer has access to that can help them form impressions about another person, and is thus useful for making judgments of others (e.g., Ikeda and Watanabe 2009; Schneider et al. 2014).

Interestingly, research has demonstrated that certain gait patterns may indicate significantly more vulnerability relative to others (Book et al. 2013; Grayson and Stein 1981; Wheeler et al. 2009). A keystone study by Grayson and Stein (1981) examined differences in movement by video-taping individuals walking down the street and then asking offenders to rate their likelihood of assault. The findings revealed that five gait movement categories differentiated victims from non-victims. Victims, it seems, tend to have long or short strides, a lateral (i.e., weight shifts side to side), diagonal, or up/down shift movement, a gestural walk (i.e., movement activates only a part of the body [e.g., the legs]), unilateral arm/leg movements (i.e., anti-synchronous movement; only one side of the body moves at a time), and lifted foot movements. A later study using college students and police officers as judges, replicated these findings (Murzynski and Degelman 1996).

Moreover, those who report actual victimization experiences appear more likely to exhibit the "victim" walk compared to individuals without histories of victimization (Wheeler et al. 2009). Therefore, it has been suggested that offenders may use gait as a cue for vulnerability, enabling target selection. For example, extending prior research, Wheeler et al. (2009) explored the relationship between ratings of vulnerability, gait, psychopathy, and one's victimization history. Because psychopaths are characterized by their ability to manipulate and charm others (Hare 2003; Hare and Neumann 2006), they have been argued to be "successful opportunists" that are skilled in recognizing cues of vulnerability, ultimately increasingly the chances of successful goal acquisition (Gunns et al. 2002).

Wheeler et al. (2009) filmed students walking before asking if they had ever been victimized. The recorded walks were coded according to Grayson and Stein's (1981) movement categories and a total vulnerability score was assigned to each target. A separate sample was asked to imagine themselves as a mugger, rate the targets on their vulnerability to victimization, and complete a psychopathy scale. The results revealed that individuals who had been given high vulnerability scores on the movement categories were more likely to have self-reported previous victimization. Moreover, those with higher psychopathy scores were more likely to select individuals who had been previously victimized as those most vulnerable to future victimization. These findings were later replicated when the same set of "walkers" were shown to a sample of offenders (Book et al. 2013); supporting the argument that gait may, to some extent, explain certain cases of victim recidivism.

Assessing Gait Using Kinematic Point-Light Display

Given that there are confounds related to studying gait patterns, which make it unclear if observers are making judgments based on gait alone, or other, related features such as age or attractiveness, some studies have utilized kinematic point-light display technology to record individuals walking (e.g., Gunns et al. 2002; Sakaguchi and Hasegawa 2006).

Point-light display captures light-reflected body movement. The recording that is produced shows a moving lighted skeleton (with extraneous cues such as hair and weight, removed). Point-light display has been used mainly to infer personality and demographic information from gait patterns. It has been shown, for example, based on short observations of point-light figures, that individuals can reliably identify themselves (Beardsworth and Buckner 1981) and their friends (Cutting 1977), age in strangers (Montepare and Zebrowitz-McArthur 1988), and dominance (Montepare and Zebrowitz 1993).

Point-light display is based on the principle of kinematic specification of dynamics (KSD). KSD maintains that an organism's "dispositions" constrain and determine its kinematic (i.e., movement) pattern (Gunns et al. 2002; Runeson and Frykholm 1983). In humans, such dispositions include both mechanical properties (i.e., anatomical makeup), as well as internal states such as emotions and intentions (Runeson and Frykholm 1983). Species-specific information (actions, emotions, intentions, sex, identity, etc.) are therefore available to observers via movement patterns (Runeson and Frykholm 1983). In accordance with the KSD principle, it seems that through gait, individuals may communicate genuine characteristics of themselves to others. Satchell et al. (2017), for instance, used point-light display to investigate how personality traits manifest in gait. They found that the magnitude of upper and lower body movement, as well as walking speed, were associated with the Big Five personality traits and aggression.

However, it remains unclear whether or not one's submissiveness "leaks" into gait, thereby cueing their vulnerability to potential victimization. In one of the few studies to examine the kinematic gait movement of previously vctimized individuals, Sakaguchi and Hasegawa (2006) found that, similar to Grayson and Stein's (1981) "victim" walk prototype, females with shorter strides and slower gaits, were rated as most vulnerable to sexual exploitation. In terms of personality, these walkers (who were rated as likely victims by the observers) rated themselves as neurotic, shy, and introverted—correlates of submissiveness (Melchior 1990). However, the women who reported actual past sexual exploitation were not the same individuals exhibiting the "victim" walk, nor those chosen by the raters as future victims. Therefore, the association between the walkers' self-reported personality traits, victimization history, and the accuracy of observers' ratings was only partially supported.

Similarly, Gunns et al. (2002) found observers agreed that individuals with more vulnerable features present in their walk [coded according to Grayson and Stein's (1981) findings] would be easiest to attack, simply by observing brief clips of their degraded gait movement; in other words, observers selected the same targets to exploit. Gunns et al. (2002) did not, however, attempt to determine the accuracy of such ratings, nor did they measure the walkers' personality traits. Because the walkers were not asked about their victimization history, it was not possible to determine if individuals with prior victimization experiences were those exhibiting the characteristic "victim walk," if these individuals were highly submissive, and/or if observers selected such individuals as those most likely to experience victimization in the future.

The Current Studies

Although advances have been made in understanding how individuals detect cues of nonverbal vulnerability (e.g., Burgoon 1985; Richards et al. 1991), and the extent to which detection ability depends on observer personality (e.g., Book et al. 2013; Wheeler et al.

2009), significantly less attention has been paid to the traits of the walkers. Given the underlying link between vulnerability and submissiveness (Richards and Mcalister 1994; Hareli et al. 2009; Prabaharan 2015), such as the fact that submissiveness can be defined as the tendency to behave in helpless, appeasing, and fearful ways (Carli et al. 1995), the existing literature has largely assumed that the "victim" walk is an expression of submissiveness. However, there has yet to be an examination of whether previously victimized individuals who score high on submissive personality traits actually exhibit more vulnerable gait features. If they do, it would be important to determine the extent to which highly submissive individuals are at risk of being targeted (simply because of their body language). Furthermore, considering that claims regarding observer detection ability relies, in large part, on the association between genuine characteristics of the walkers (e.g., personality traits, victimization history) and the observers' ratings, examination of this relationship is overdue.

Additional research exploring the communicative function of isolated gait movements is also required. Clarification of the type of information exhibited through gait, when confounds have been eliminated, may contribute to a greater understanding of the role of nonverbal behavior in personality expression. The ability of non-psychopathic observers to then detect information (such as submissiveness and/or vulnerability) from gait, also requires study. It remains unclear if only "social predators" (e.g., psychopaths) are able to detect vulnerability from gait, or if this is a more universal phenomenon. Finally, a greater distinction between accuracy (achieved through "self-other agreement," whereby one questions the targets on their own personality traits and/or victimization history, and subsequently correlates these self-reports with the observers' ratings; Yeagley et al. 2007), and consensus (simply defined as the rate of agreement among observers), is required if one wants to determine if observers are truly detecting individuals who have submissive personalities from gait cues, and/or if they select past victims as future victims.

Study 1

The purpose of Study 1 was to explore whether the association between victimization history and the "victim" walk gait pattern (Grayson and Stein 1981) could be explained by personality. Male victims have often been ignored in the literature, and yet account for nearly half (48.8%) of all victims of violent crime (Truman 2011). Thus, the current study included male, as well as female walkers. Furthermore, a control group of individuals who indicated that they had never been victimized were included so that comparisons with self-reported victims could be conducted. In order to examine the communicative function of gait movement specifically, participants were recorded using kinematic point-light display technology. The use of kinematic point-light display may help to both: (1) validate notions that variations in biological gait patterns affect vulnerability ratings, and (2) explore the type of internal dispositional states that observers detect in order to infer vulnerability from gait cues.

Hypotheses

Research indicates that past victims are more likely to display a vulnerable gait pattern relative to others without victimization histories (e.g., Book et al. 2013). Thus, it was hypothesized that individuals who had been victimized would be significantly more likely to exhibit vulnerable features in their gait. Furthermore, to date, the literature has suggested

that individuals with vulnerable movement patterns are inherently more submissive and thus more likely to experience victim recidivism (i.e., an individual's submissiveness is expressed through their gait; e.g., Richards et al. 1991; Richards and Mcalister 1994; Prabaharan 2015). Therefore, it was also hypothesized that individuals who exhibited vulnerable gait cues would be more likely to report submissive personality traits. Lastly, consistent with Myers et al. (1984), it was expected that individuals who had been victimized would be more likely to report submissive personality characteristics. Personality was thought to (partially) explain why those who have been victimized appear to exhibit vulnerable gait cues.

Study 1: The Walkers

Method

Participants

The sample for Study 1 consisted of 28 students from Carleton University in Ottawa Ontario, Canada. Approximately 64.3% ($n=18$) of the sample was female, and 35.7% ($n=10$) was male. Participants ranged in age from 18 to 32 years ($M=20.03$, $SD=2.89$). There were no significant differences in age between males ($M=20.60$, $SD=2.07$) and females ($M=19.76$, $SD=3.22$), t (29)$=-.75$, $p=.46$, $d=.31$. The majority of participants were Caucasian (71%, $n=22$), 12.9% ($n=4$) were Asian, 6.5% ($n=2$) were African Canadian/Black, 3.2% ($n=1$) were First Nations/Aboriginal Canadian/Native Canadian, and 6.5% ($n=2$) designated themselves as from another unspecified ethnic background. Approximately 57.1% ($n=16$)[1] of the sample indicated that they had been violently and/or sexually victimized.[2] There was an equal ratio of individuals who reported a history

---

[1] Although the seemingly high number of victimized walkers could have implications for the observer's judgments of vulnerability in Study 2 (such that they might have expected only one or two walkers to be vulnerable to victimization, unduly contributing to lower ratings of the others), the relatively equal divide of victimized versus non-victimized walkers is actually reflective of the university from which they were sampled: A mass call was sent to all incoming first and second year undergraduate psychology students. $N=1397$ responded, and 51.8% ($n=720$) reported that they had been victimized. While the rate of victimization tends to be lower in the general population (e.g., approximately one quarter of all Canadians report that they have been *criminally* victimized in preceding years [Perreault and Brennan 2010]), similar percentages have been reported in other studies investigating victimization in student populations (e.g., Fass et al. 2008).

[2] Preliminary research exploring the type of victimization that individuals have experienced has found that observers may be more proficient at identifying those with violent and sexual victimization histories, relative to those who have been violated less interpersonally (e.g., Selkin 1975; Stevens 1994; Wheeler et al. 2009). However, the definition of victimization has remained arguably quite broad in gait vulnerability studies. For example, in Wheeler et al.'s (2009) study, victimization was simply defined as being equal to or greater than bullying. Therefore, the present study attempted to focus on sexual and violent victimization specifically. Sexual victimization was defined as, "sexual abuse, any non-consensual sexual activity (e.g., sexual assault, rape, etc.), threat of unwanted sexual contact, sexual trafficking, sexual defamation (e.g., sending of nude photos), sexual coercion, etc." Violent victimization was defined as, "physical bullying, in addition to any of the following crimes: Robbery, mugging, assault, physical abuse, neglect, harassment, battery (e.g., intimate partner violence), kidnapping, gang violence, threats, etc."

of violent victimization (39.3%, $n=11$) and sexual victimization (39.3%, $n=11$).[3] The remaining 42.9% ($n=12$) of individuals had not been victimized; this set acted as the control group. No other identifying information was collected from the participants. The protocol was approved by the Carleton University Ethics Committee for Psychological Research (REB #15-057).

Measures and Equipment

Study 1 took place in Carleton University's Motion Capture Laboratory, which is located in The School of Information Technology. The laboratory itself is a large $27' \times 38'$ rectangular room (Joslin 2010). The oversized area allows for optimal recording of moving targets and ensures that the reflective markers on the suits of the moving targets, are detected. The space was darkened in order to prevent the images from being obscured from outside infrared light. All reflective surfaces were removed so that the cameras captured only target-specific information.

The motion capture system consists of 10 mounted Vicon MX40 cameras (Joslin 2010). The specialized cameras are designed such that they only illuminate the reflective markers on the suit of the walking targets. The recording that is produced appears as grayscale light. Participants in the current study were asked to wear a black Vicon suit. The Vicon suit used in the Motion Capture Laboratory has adhesive properties (it is made of Velcro-hoop material), which allow retro-reflective globe-shaped markers to be attached using Velcro-hook pads (Joslin 2010). For the purposes of the current experiment, 18 mm markers were used; this size is ideal for body tracking because the markers are soft, flexible, and can be easily detected by the cameras. The placement of the markers and all calibration was conducted according to the Vicon 512 Instruction Manual (Woolard 1999), by an independent party trained in Motion Capture technology.

The video footage was edited in order to ensure that each walker appeared clearly as a point-light figure (a screen capture of one of the walkers viewed from the back is presented in Fig. 1); each video was also reduced to an approximately 10 s clip (consistent with Book et al. 2013; Wheeler et al. 2009). Studies often ascribe to using non-veridical point-light display, wherein the markers are used as points to estimate joint centers which then give rise to an approximated figure (e.g., Cutting and Kozlowski 1977; Troje et al. 2005; Vanrie et al. 2004). However, because the present study was concerned with eliminating confounds thought to have an effect on perceptions of vulnerability (e.g., clothing, attractiveness), the veridical versions were used. As such, the point-light figures show the true location of all reflective markers, providing observers with a potentially more precise indication of each walker's gait movement, while concealing other cues. The figures may thus have provided observers more information than in related studies (e.g., Gunns et al. 2002; Sakaguchi and Hasegawa 2006), but not so much as to potentially confound the findings in full-light conditions (e.g., Book et al. 2013).

Each participant received an experimental package to be completed in addition to the point-light recording session. The package contained several measures including a demographic survey (comprised of three questions that asked participants to indicate their age, gender, and racial/ethnic background), a victimization history questionnaire (Book et al.

---

[3] Several of the walkers indicated that they had been both violently and sexually victimized; these walkers contributed to both the violent victimization count and the sexual victimization count.

Fig. 1 Back view screen capture of one of the walkers
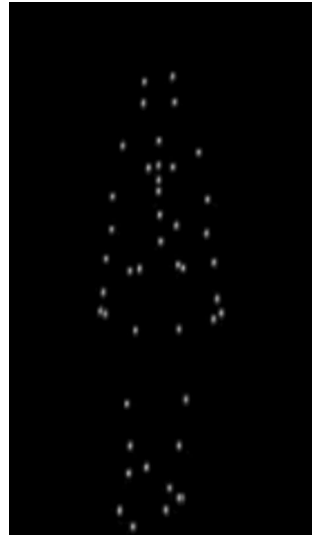
2013; Wheeler et al. 2009), and a personality assessment (the Revised Interpersonal Adjective Scales—Big Five [IASR-B5]; Trapnell and Wiggins 1990).

Victimization History Questionnaire Extended

The Victimization History Questionnaire is a short, self-report survey that was originally developed and piloted with an undergraduate student population at Brock University in Ontario, Canada (Wheeler et al. 2009). It asked students to report whether or not they had ever been victimized (yes/no), and if they had been victimized, the number of times. The survey was revised for the current study to ask participants if they had ever experienced violent victimization, sexual victimization, or any type of victimization in a yes/no format. Such ratings were dichotomously coded such that individuals who indicated that they had been victimized received a rating of one; those without victimization histories received a rating of zero. A short glossary was included in the Victimization History Questionnaire Extended version to help participants discriminate between sexual and violent victimization, if necessary.[4]

Revised Interpersonal Adjective Scales-Big Five

The IAS-R consists of eight scales, one for each interpersonal trait: Warm-Agreeable, Gregarious-Extraverted, Assured-Dominant, Arrogant-Calculating, Cold-Hearted, Aloof-Introverted, Unassured-Submissive, and Unassuming-Ingenuous. Each of the eight scales

---

[4] If a participant responded positively to any of the victimization questions, then they were directed to answer 11 additional questions. One question asked about the frequency with which they had experienced victimization (e.g., once versus 5 + times), another question asked them to report how long ago the victimization event had occurred (e.g., very recently versus very long ago [5 + years ago]), and nine of the questions pertained to the subjective impact/influence that the experience had on them. These questions are not explored in the current paper.

in the IASR-B5 consist of eight personal adjectives (Trapnell and Wiggins 1990). For example, items 7 and 9 on the warm-agreeable scale are "soft-hearted" and "kind," respectively. The Five-Factor dimensions also have their own scales, each of which are comprised of 20 adjectives. Individuals are required to self-report on the adjectives (ranging from 1 = *extremely inaccurate* to 8 = *extremely accurate*), the degree to which they describe their own characteristics. Each scale is scored by obtaining the mean of the relevant adjective ratings that comprise it. The measures contained in each package were ordered randomly to control for potential order effects.

Procedure

A mass call went out to all incoming first year (and various second year) undergraduate psychology students at Carleton University. Students with a violent and/or sexual victimization history, who provided their contact information, were invited to participate in a study examining the association between memory and movement. A random cohort of students without victimization histories were also invited in order to obtain a control group. Interested individuals could sign-up for an available time-slot through the university's research participation network.

Upon arrival, participants were presented with a consent form outlining the possible risks and benefits of taking part in the study. All participants consented and were asked to change into a black Vicon suit. They were then calibrated to the cameras, and told that recording had begun. They were asked to watch one of the researchers walk in a zig-zag pattern (which they were told to remember as a faux memory exercise). They were then told to retrace the pattern themselves, and to walk off the set once they were done. The memory task was included in order to elicit the most natural gait possible from the participants (i.e., to distract them from focusing on their movement).

Once the technician confirmed that an acceptable gait sequence had been captured, participants were told that the recording had finished and they were invited to change back into their regular clothing. Participants were then asked to complete the study package (which included a set of instructions, as well as the various questionnaires). Upon completion, participants were debriefed about the full purpose of the study. The entire study took each participant approximately 1 h to complete and participants were compensated for their time by receiving one study credit (1%), which could be allocated to one of their introductory psychology courses.[5]

Results

The edited point-light videos were used to code the walkers' movements. Two independent raters coded all 28 walkers; both were blind to the victimization history of the walkers. The movement code used was adopted from Ritchie (2014), and based on the significant findings in the original research by Grayson and Stein (1981). Inter-judge agreement was reasonably high for all of the movement categories (Cohen's kappa ranged from .75 to 1.00). In line with previous studies, the ratings were tallied across categories, and each walker was provided a total vulnerability score (e.g., Wheeler et al. 2009). Low vulnerability

---

[5] Several participants had already fulfilled their study credit maximum and/or simply requested to volunteer their time.

scores (e.g., 0, 1, 2) indicated that the walker had little or no vulnerability cues present in their gait pattern. Higher scores, up to a possible total score of five, indicated that the walker had most, or all of the vulnerability features present in their gait pattern.

Approximately 53.5% ($n = 15$) of the walkers had a low total vulnerability score (i.e., they scored between 0 and 2). On the other hand, 46.4% ($n = 13$) of the walkers had a high total vulnerability score (i.e., they scored between 3 and 5). On average, the majority of walkers were perceived by the coders as having a gait style with low to average vulnerability (i.e., $M = 2.39$, $SD = 1.57$). There was no significant difference in vulnerability between male ($M = 2.40$, $SD = 1.65$) and female walkers ($M = 2.39$, $SD = 1.58$), $t(26) = -.02$, $p = .99$; $d = .01$.

Gait Pattern Vulnerability

The present study sought to replicate the relationship between victimization history and the exhibition of vulnerable gait characteristics. As expected, gait pattern and victimization history were significantly correlated, $r_{rb} = .55$, $p < .01$. Therefore, individuals who had been victimized were significantly more likely to exhibit vulnerable features in their gait.

Victimization History, Gait, and Personality

It was predicted that individuals who exhibited vulnerable gait cues would be more likely to report submissive personality traits. However, contrary to expectation, a significant positive correlation was observed between gait and the Assured-Dominant scale in the IASR-B5, $r_s[25] = .46$, $p = .02$. The correlation between gait and the Unassured-Submissive scale, on the other hand, was negative, and did not reach statistical significance, $r_s[25] = -.34$, $p = .08$. These findings suggest that individuals with more vulnerable features present in their gait are significantly more likely to self-report dominant personality characteristics. None of the other correlations conducted between gait and the personality scales reached significance.

It was further predicted that individuals who had been victimized would be more likely to self-report submissive personality characteristics. Again, contrary to expectation, no relationship was observed between the Unassured-Submissive scale and self-reported victimization history, $r_{pb} = .03$, $p = .88$. Interestingly, however, although not significant, the relationship between the Assured-Dominant scale and victimization history was positive ($r_{pb} = .16$, $p = .39$). None of the correlations conducted between victimization history and the personality scales reached significance (Table 1).

Lastly, recall that it was expected that personality would (partially) explain why those who have been victimized appear to exhibit vulnerable gait cues. In an attempt to compensate for the low power characteristic of small samples, a bootstrapped mediated ordinal regression was conducted to examine whether personality (dominance specifically in this case because it was the one scale that correlated significantly with gait) could account for the relationship between victimization history and the vulnerable gait pattern observed in participants (Hayes 2013; see Fig. 2 for a pictorial representation of these analyses).

Victimization history was entered as the predictor, the walker's self-reported score for the Assured-Dominance scale was entered as the mediator, and gait pattern was entered as the outcome variable. The total effect was statistically significant (path c; b = 1.71, $p < .01$, 95% CI [.67, 2.75]). Therefore, victimization history significantly predicted the vulnerability level of one's gait pattern. More specifically, on average, those who self-reported

**Table 1** Correlations between personality, victimization history, and gait

IASR-B5 scale variables	Gait pattern[a]		Victimization history[b]	
	r_s	p	r_{pb}	p
Unassured-submissive	−.34	.083	.03	.881
Assured-dominant	.46	.016*	.16	.390
Gregarious-extraverted	.05	.813	−.27	.149
Warm-agreeable	.30	.126	−.02	.933
Unassuming-ingenuous	.07	.739	−.03	.857
Aloof-introverted	−.10	.609	.09	.648
Cold-hearted	−.28	.152	.10	.615
Arrogant-calculating	−.21	.290	.02	.933
Conscientiousness	−.01	.945	−.09	.657
Neuroticism	−.13	.524	−.09	.622
Openness to experience	.26	.197	.21	.270

IASR-B5 = Revised interpersonal adjective scales big five. Higher scores on the IASR-B5 are indicative of greater participant agreement on the items in that scale, whereas lower scores are indicative of less agreement

[a]$N = 27$; three videos were not useable and a gait vulnerability score could not be computed for them. They were removed from the present analyses. One participant scored highly on both the Unassured-Submissive scale *and* on a general negative affect scale. They were also removed from the analyses so that affect did not confound the results. r_s = Spearman's Rank-Order Correlation. *$p < .05$. The gait pattern scale variable ranged from 0 = no vulnerable cues present, to 5 = all vulnerable cues present

[b]$N = 30$; one participant scored highly on the unassured-submissive scale *and* on a general negative affect scale. They were removed from the present analyses so that affect did not confound the results. r_{pb} = Point-Biserial correlation. Victimization history was coded as 1 = they reported sexual and/or violent victimization; the control group was coded as 0

Fig. 2 Mediation model examining the relationship between victimization history, gait pattern, and personality
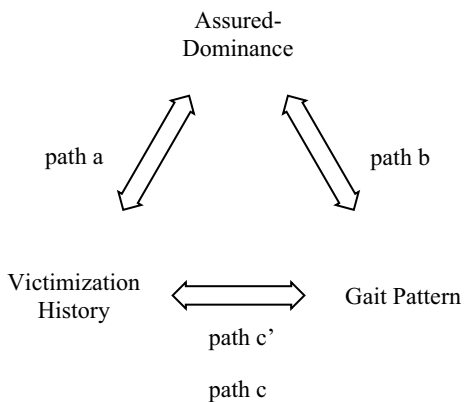
that they had been violently and/or sexually victimized received higher gait vulnerability scores. Indeed, victimization history explained 30% of the variance in gait pattern scores. There was also a significant relationship observed between victimization history and gait pattern when Assured-Dominance was explicitly controlled for (path c'; $b = 1.41$, $p = .01$, 95% CI [.34, 2.48]).

Next, a significant relationship was observed between personality (i.e., Assured-Dominance) and gait pattern when victimization history was controlled for (path b; $b = .55$, $p = .04$, 95% CI [.02, 1.09]); the regression coefficient indicated that as dominance ratings increased, so did the vulnerability score of one's gait pattern. However, victimization history did not significantly predict dominance (i.e., path a; $b = .54$, $p = .10$, 95% CI [−.12, 1.20]), and victimization history only accounted for 10.4% of the variance in Assured-Dominance scores. Interestingly, however, given the positive regression coefficient, it appeared that individuals with sexual and/or violent victimization histories had more dominant personalities relative to those who had not been victimized.

The 95% CI for the indirect effect (a*b) included zero (and $b = 0$ refers to no effect). Therefore, mediation could not be established ($ab = .30$, 95% CI [−.04, .96]); dominance could not explain the relationship between victimization history and gait pattern. Indeed, the mediator only accounted for 17% (percent mediation [P_M] = .17) of the total effect. The completely standardized indirect effect (ab_{cs}) was approximately 10%. Thus, it appears that while individuals with victimization histories tend to have a more vulnerable gait pattern, this elevated tendency cannot be attributed to their personality features (at least, as these personality features were measured in the current sample of participants).

Discussion

Study 1 consisted of four major hypotheses. The first hypothesis predicted that individuals with prior victimization experiences would be more likely to exhibit vulnerable gait cues. As expected, individuals with a victimization history were more likely to display vulnerable gait cues compared to individuals without a victimization history. The large effect (Cohen 1992) is consistent with previous literature (e.g., Book et al. 2013; Wheeler et al. 2009), and suggests that gait may be a valid indicator of vulnerability. Importantly, the current study removed extraneous cues such as clothing, age, and attractiveness by filming the targets in point-light conditions. Therefore, the coding of each walker's gait was based exclusively on their movement pattern. Together with other, similar research (e.g., Gunns et al. 2002; Sakaguchi and Hasegawa 2006), the results provide convincing evidence that individuals who have been victimized exhibit a considerably different movement pattern compared to those who have not experienced victimization.

The second, third, and fourth hypotheses in Study 1 pertained to the personality of the walkers. Given how submissiveness can be defined (e.g., as behaving helplessly; Carli et al. 1995), as well as prior literature in the areas of nonverbal behavior and personality (e.g., regarding how personality is expressed in behavior; Murzynski and Degelman 1996; Myers et al. 1984; Richards et al. 1991), it was predicted that individuals who had been victimized and/or who exhibited vulnerable gait features would be more likely to report submissive personality traits, and that personality would (at least partially) explain the relationship between victimization history and gait. The hypotheses were not supported; the relationship observed between submissiveness and gait was not significant, nor was there a significant association between submissiveness and victimization history. The findings could

simply be indicative of a power issue since several of the correlations would typically be considered a medium effect (Cohen 1992), but failed to reach significance (perhaps as a result of the small sample). Interestingly, however, the results did reveal that individuals who exhibited the "victim" walk pattern were significantly more likely to report dominant personality characteristics. More fine-grained analyses would likely confirm whether dominance is actually expressed in the features noted by Grayson and Stein (1981).

An exploratory mediated regression analysis was then conducted to examine whether or not dominance could account for the relationship between victimization history and gait. The results suggested that both previous victimization and dominance could independently predict the vulnerability of one's gait. However, dominance could not explain the association between victimization history and gait. In other words, dominant individuals and those who have been victimized are more likely to display the "victim" walk pattern. However, dominant individuals in the present sample were no more likely (than anyone else) to have a victimization history (there was no relationship between any of the personality traits and reported victimization history).

Collectively, the findings from Study 1 suggest that while much of the current literature assumes individuals who are submissive are at an increased risk of experiencing victimization, this may not be the case. It is possible that individuals who are submissive actually design their lives in a way that lessens their chances of experiencing victimization. For example, Beauregard et al. (2007) outline how an individual's recreational habits, occupational choices, and even transportation patterns, can impact an offender's choice of victim. If submissive individuals are less likely to party on a regular basis, for instance, or if they reside in professions that are generally considered safe and/or those which do not put them in regular contact with the public, then offenders may have fewer opportunities to target them. In other words, while submissive individuals may be "easy victims" to exploit, they may not be opportune victims because they are less likely to engage in "risky" routine activities. The availability and/or access to "easy (i.e., submissive) victims" may need to be examined as this could influence target selection criteria.

In an effort to disentangle the reasons why previously victimized individuals walk differently relative to others, Study 1 examined walker personality. However, it remained unclear if observers could detect personality characteristics from gait, and if said traits could be used to help make decisions about an individual's vulnerability. Therefore, Study 2 explored observer perceptions of walker personality and their apparent vulnerability to victimization.

Study 2

Study 2 utilized the recorded point-light displays to investigate the extent to which gait is a reliable indicator of victim vulnerability ratings. As noted, kinematic point-light display technology has rarely been used to investigate gait as a victim selection cue. Gunns et al. (2002) demonstrated that vulnerability ratings continue to correspond to the prototypical "victim" walk gait pattern (Grayson and Stein 1981), even when gait is isolated through the use of point-light display. However, Sakaguchi and Hasegawa's (2006) results indicated rater consensus, but not accuracy. Therefore, Study 2 aimed to confirm that individuals agree with one another regarding which target(s) will be chosen for future victimization, and that their ratings are accurate to the extent that those chosen as future victims do in fact report a victimization history and/or exhibit a vulnerable gait pattern. It is the first known study to examine zero-acquaintance detection ability of personality traits and victimization

history from gait cues, in a sample of individuals who self-reported experiencing either violent and/or sexual victimization.

Hypotheses

It was expected that the observers would agree (i.e., reach consensus) on which walkers were most likely to be victimized (e.g., similar to the findings reported by Gunns et al. 2002). It was further hypothesized that observers would agree on which walkers were submissive. Relatedly, since prior research has indicated that observers appear to select past victims as future victims based on "thin-slices" of gait information (e.g., Wheeler et al. 2009), it was hypothesized that relatively strong self-other agreement correlations (i.e., accuracy) would be observed between observer ratings of walker vulnerability to various types of victimization and walker self-reports of their own victimization history. As such, it was expected that the observer's ratings of vulnerability would be associated with the walker's gait patterns (i.e., a "victim" walk pattern would be associated with higher ratings of vulnerability by observers).

Study 2: The Observers

Method

Participants

The sample for Study 2 consisted of 129 Canadian citizens, who could understand English and who were at least 18 years of age. Approximately 55.3% ($n=52$) of the sample was female and 44.7% ($n=42$) was male. Participants ranged in age from 24 to 81 years ($M=49.14$, $SD=13.93$). There were no significant differences in age between males ($M=46.83$, $SD=12.73$), and females ($M=46.31$, $SD=13.99$), $t(92)=-.19$, $p=.85$, $d=.04$. The majority of participants were Caucasian (90.6%, $n=116$); approximately 5.5% ($n=7$) were Asian, one individual (.8%) was African Canadian/Black, one individual (.8%) was First Nations/Aboriginal Canadian/Native Canadian, and 2.3% ($n=3$) designated themselves as from another unspecified ethnic background. The protocol was approved by the Carleton University Ethics Committee for Psychological Research (REB #15-057).

Measures

Participants were required to complete a two-part online questionnaire. Part 1 consisted of the same demographic questionnaire used in Study 1. Part 2 consisted of a 28-item Victim Vulnerability Rating Questionnaire.

Victim Vulnerability Rating Questionnaire

The Victim Vulnerability Rating Questionnaire is a measure designed to assess participant perceptions of target vulnerability. It asks participants to rate walker vulnerability on a 10-point rating scale (1 = *not at all vulnerable*, 10 = *completely vulnerable*). It also includes a set of questions which ask about observer perceptions of the target's independence, exploitability, and capability, among others. Participants are asked to judge statements such

as "this person is strong" on a scale ranging from 1 (*not at all true*) to 10 (*completely true*). For the purposes of the current study, an additional subset of 4 statements were added to the questionnaire in order to obtain an indication of the observers' perceptions of the walkers' personality. Two of the questions related to the perception of dominance and asked the observer's to rate the walker's apparent assertiveness and self-confidence. The remaining two questions related to the perception of submissiveness and asked the observer's to rate how timid and unaggressive the walkers appeared.[6]

Procedure

Individuals who met the inclusion criteria (i.e., were Canadian citizens, at least 18 years of age, and could understand English) were recruited via an online survey panel. Those who were interested in participating could click on a link which directed them to a consent form. If they chose to consent, the system then redirected them to the study. The online survey began with a set of instructions which informed participants that following a short demographic questionnaire, 14 videos[7] of individuals walking would be shown. Although the videos were randomized in an attempt to control for order effects, the number of times that each video was shown across participants was controlled to ensure that each video was seen by approximately the same number of observers.[8] Therefore, genuine (complete) randomization was not met.

Consistent with Book et al. (2013), Ritchie (2014), and Wheeler et al. (2009), the videos lasted approximately 10 s each and the targets were shown walking away from the observers (i.e., with their backs to the camera). After each video, the Victim Vulnerability Rating Questionnaire appeared and asked participants to rate the last seen walker on their vulnerability to sexual, violent, and general (any) victimization. In accordance with Wheeler et al.'s (2009) study, participants were not made aware of any vulnerability cues prior to rating, and were provided as much time as necessary to provide their ratings before moving on to the next video. Upon completion (or withdrawal), all participants viewed the debriefing page. It took participants, on average, 35 min to complete the entire study, and everyone was financially compensated (earning between $.80 and $1.20, depending on where they were recruited from) for their time.

Results

To gain a better understanding of the ability of observers to detect nonverbal cues of vulnerability and/or of expressed personality, consensus (i.e., agreement among observers) and self-other agreement (i.e., agreement between observer ratings and walker ratings) was assessed. Recall that it was expected that the observers would reach consensus on which

---

[6] To maintain a level of consistency across studies, Study 2 utilized the same adjectives comprising the Unassured-Submissiveness and Assured-Dominance scales (Trapnell and Wiggins 1990) in Study 1. However, only four items from the two scales were included (chosen at random); this limited the power to find an effect, but was done to reduce rating fatigue and maintain internal validity.

[7] Although 28 videos were recorded altogether, each participant in Study 2 viewed only *half* of the videos (randomly selected); this was done in an attempt to reduce participant attrition and/or fatigue, and maintain internal validity.

[8] Between 56 and 65 participants viewed each video and completed each accompanying questionnaire.

Table 2 Consensus Correlations

Items rated by observers	Observer consensus	
	r	*p*
Vulnerability items		
Easy target	.32	.048*
Sexual vulnerability	.45	.008*
Violent vulnerability	.30	.061
Walker personality items		
Dominance		
Self-confident	.38	.024*
Assertive	− .20	.160
Submissiveness		
Timid	.28	.071
Unaggressive	− .19	.163
Descriptive items		
Capable	− .11	.294
Exploitable	.26	.089
Independent	− .22	.134
Protection	.14	.246
Weak	.17	.192

Due to issues with reflection and calibration, only 28 of the 31 videos were useable. Therefore, $N = 28$ videos. $N = 129$ observers. $r =$ Pearson correlation. * $p < .05$

walkers were most likely to be victimized, and that relatively strong self-other agreement accuracy would be obtained. It was further hypothesized that observers would agree on which walkers were submissive. However, given the lack of prior research regarding the detection of personality traits from gait specifically, observer ratings of walker submissiveness were not hypothesized to necessarily correlate with the walkers' self-reports of their own submissiveness.

Consensus

A method conducted in Yeagley et al.'s (2007) study, and Lippa and Dietz's (2000) study, which obtains agreement correlations when there are multiple raters, was used in the present study. Consistent with Yeagley et al. (2007), six observers (male and female) were chosen at random. The ratings of the group of six were averaged and subsequently correlated with the average of the remaining observer's ratings; this process (whereby new randomly selected raters were chosen) was repeated for each item examined. Table 2 provides a summary of the consensus correlations.

The bivariate correlation for "Easy Target" was significant, $r = .32$, $p = .05$, and indicated that observers agreed on which walkers were easy targets. Observers also agreed on which walkers were most vulnerable to sexual victimization, $r = .45$, $p = .01$. The Pearson correlation for violent vulnerability, however, only demonstrated a possible trend toward significance, $r = .30$, $p = .06$. These findings suggest that while observers may not agree on which walkers are most vulnerable to violent victimization, they do tend to agree on which

individuals are easy targets overall, as well as which individuals are vulnerable to sexual victimization in particular.

In terms of observer perceptions of the walkers' personalities, the consensus correlations indicated that the observers agreed on which walkers appeared the most self-confident, $r = .38$, $p = .02$. However, the correlation between the observers on the assertiveness item did not reach significance, $r = -.20$, $p = .16$. The observers' ratings of how timid and unaggressive the walkers appeared were also both non-significant ($r = .28$, $p = .07$ and $r = -.19$, $p = .16$, respectively).

Accuracy of Perceived Vulnerability and Actual Victimization

Recall that it was expected that self-other agreement would be observed whereby walkers who had experienced victimization would receive higher ratings of perceived vulnerability by the observers. Consistent with Book et al. (2013), observers were "…considered to be accurate in their judgments if they gave 'non-victims' a vulnerability score between 1 and 5, and if they gave 'victims' a vulnerability score between 6 and 10. The midpoint of the scale was used because the values from 1 to 5 described the person as not being vulnerable to victimization, while values from 6 to 10 described the targets as vulnerable to victimization" (p. 2375). The number of observers (for each walker) that were accurate in their ratings were then tallied.

As outlined in Tables 3 and 4, the majority of participants were relatively accurate in their judgments of the walkers' vulnerability to both violent (ratings were accurate for 18 out of the 28 walkers) and sexual victimization (ratings were accurate for 15 out of the 28 walkers). In other words, the observers were accurate in their ratings of the walkers' vulnerability to violent victimization 64% of the time. The observers were also accurate in their ratings of the walkers' vulnerability to sexual victimization 54% of the time. Note that although Book and colleagues' (2013) method of determining accuracy is reported, given potential issues with: (1) the base rate of victims to non-victims in the sample, and (2) the threshold used to determine when a walker is considered "vulnerable" (i.e., using a cutoff score of 5), an alternative analysis is reported in the Supplemental Material (available online).

Accuracy Between Perceived Vulnerability and Gait

Next it was hypothesized that the observer's ratings of vulnerability would be related to the walker's gait patterns.

Correlational Accuracy

Spearman correlations were calculated between the observers' (averaged) ratings of the walkers' vulnerability, and the coded gait patterns. The correlation between the averaged observers' ratings of the walkers' vulnerability to violent victimization and gait pattern was significant, $r_s = .37$, $p = .02$. Similarly, the correlation between the averaged observers' ratings of the walkers' vulnerability to sexual victimization and gait pattern was significant, $r_s = .33$, $p = .05$. The results suggested that, on average, observers provided higher vulnerability ratings to the walkers with more vulnerable features present in their gait. Given that

Table 3 Accuracy of observer ratings of the walkers' vulnerability to violent victimization

Walker	Observer ratings of violent victimization				Walker violent victimization history	Accuracy of the observers[b]
	Mode	Median	*M*	*SD*	Yes/no	Accurate/inaccurate
001	6[a]	6.00	6.03	2.54	No	Inaccurate
002	7	5.00	5.22	2.74	No	Accurate
003	10	5.50	5.53	2.99	No	Accurate
004	3	5.00	4.90	2.75	No	Accurate
005	7	5.00	4.72	2.66	No	Accurate
006	4	5.00	5.08	2.51	No	Accurate
007	7	5.00	5.18	2.83	No	Accurate
008	1	3.00	3.97	2.60	Yes	Inaccurate
009	7	7.00	6.40	2.74	No	Inaccurate
010	1	4.00	4.09	2.64	Yes	Inaccurate
011	1	3.50	4.09	2.60	No	Accurate
014	1	5.00	5.08	2.91	Yes	Inaccurate
015	1	4.00	4.23	2.51	No	Accurate
016	3	3.00	4.12	2.73	Yes	Inaccurate
017	3	4.00	4.28	2.32	No	Accurate
018	1	5.00	5.03	2.79	Yes	Inaccurate
020	5[a]	6.00	5.75	2.77	Yes	Accurate
021	1	5.00	4.44	2.82	No	Accurate
022	1	4.00	3.92	2.40	No	Accurate
023	5	5.00	5.09	2.79	Yes	Inaccurate
024	7	6.00	5.33	2.46	Yes	Accurate
025	1	3.50	3.97	2.58	No	Accurate
026	5	6.00	5.63	2.79	Yes	Accurate
027	1	3.00	3.41	2.44	Yes	Inaccurate
028	2	3.00	4.21	2.77	No	Accurate
029	1	3.50	3.80	2.55	Yes	Inaccurate
030	5	5.00	5.09	2.67	No	Accurate
031	1	5.00	4.71	2.86	No	Accurate

N = 28 videos. *N* = 129 observers

[a]Multiple modes were present; the lowest value is presented

[b]The raw observer responses were recoded for every observers' score on every walker. If an observer scored a victimized walker as a 6 or above, then they received a "1" (i.e., accurate); if an observer scored a non-victimized walker between 1 and 5, they also received a "1" for accurate. Accurate ratings (i.e., "1's") were tallied for each walker (i.e., the number of "1's" present for each walker were summed), and then divided by the total number of observers who rated that walker. If the majority of observers were accurate (i.e., over 50%) then they received a designation of "accurate" in the last column

Table 4 Accuracy of observer ratings of the walkers' vulnerability to sexual victimization

Walker	Observer ratings of sexual victimization				Walker sexual victimization history	Accuracy of the observers[b]
	Mode	Median	M	SD	Yes/no	Accurate/inaccurate
001	8	6.00	5.85	2.64	No	Inaccurate
002	5	5.00	5.14	2.84	No	Accurate
003	1[a]	5.00	5.03	2.99	No	Accurate
004	1	4.00	4.55	2.76	No	Accurate
005	5	5.00	4.38	2.68	No	Accurate
006	5	5.00	4.46	2.47	Yes	Inaccurate
007	1	4.50	4.80	2.81	Yes	Inaccurate
008	1	3.00	3.92	2.72	No	Accurate
009	5	6.00	5.92	2.82	No	Inaccurate
010	1	3.00	3.69	2.65	Yes	Inaccurate
011	1	3.00	3.92	2.52	No	Accurate
014	1	6.00	5.12	2.90	Yes	Accurate
015	1[a]	4.00	4.02	2.55	No	Accurate
016	1	3.00	4.06	2.68	Yes	Inaccurate
017	1	4.00	4.23	2.36	No	Accurate
018	1	4.50	4.64	2.96	No	Accurate
020	5	5.00	5.52	2.80	No	Accurate
021	1	4.50	4.36	2.88	No	Accurate
022	1	3.00	3.71	2.50	Yes	Inaccurate
023	1	4.50	4.64	2.83	Yes	Inaccurate
024	5	5.00	4.81	2.31	Yes	Inaccurate
025	1	3.00	3.73	2.61	Yes	Inaccurate
026	7	6.00	5.66	2.77	No	Inaccurate
027	1	3.00	3.80	2.57	Yes	Inaccurate
028	2	3.00	4.21	2.67	Yes	Inaccurate
029	1	3.00	3.45	2.43	No	Accurate
030	1[a]	4.00	4.70	2.75	No	Accurate
031	1[a]	4.00	4.44	2.75	No	Accurate

the observers were able to differentiate between vulnerable and non-vulnerable gait movement, the ratings were considered accurate.

Accuracy Between Perceived and Actual Personality Features

Lastly, the accuracy of the observers' ratings of the walkers' personality was examined. Given the lack of prior research in this area, no formal hypotheses were made. Self-other agreement correlations were calculated between the observers' perceptions of the walkers' personality and the walkers' self-reports of their own personality. Self-other agreement accuracy was not obtained for any of the items (all correlations were $p > .05$; see Table 5). Thus, it appears that the way one perceives them self may not be how a stranger perceives them (when judgments are made based only on degraded gait movement).

Table 5 Self-other agreement correlations

Items rated by observers	Self-other agreement	
	r_s	p
Walker personality items		
Assertive	.19	.171
Timid	− .24	.105
Self-confident	− .24	.113
Unaggressive	− .14	.234

$N = 28$ videos. $N = 129$ observers. In order to reduce fatigue of the observers, they were asked to rate only certain personality features of the walkers (i.e., they did not rate the walkers on the entire IASR-B5). The adjectives chosen are argued to represent those traits most pertinent to the current investigation (i.e., of dominance and submissiveness). r_s = Spearman correlation. *$p < .05$. **$p < .01$

Discussion

Study 2 consisted of two major research questions. The first question aimed to determine the extent to which observers collectively agreed on which walkers were most vulnerable, and which exhibited submissiveness. As expected, the consensus correlations suggested that the observers agreed with one another on which walkers were most vulnerable to experience sexual victimization, as well as which walkers appeared to be "easy targets." However, the observers did not agree on which walkers were most vulnerable to experience violent victimization, though the result approached significance.

The current findings regarding consensus are consistent with previous literature on the topic suggesting that zero-acquaintance observers tend to select the same targets to victimize; and this appears to be true for offenders, and among the general population (as they were measured in the current study; e.g., Gunns et al. 2002). However, it is unclear why observers are more apt to agree on which individuals were vulnerable to sexual victimization, as opposed to violent victimization. It is possible that different and/or additional movement cues are considered when individuals make decisions regarding one's vulnerability to sexual crime, relative to violent crime.

Notably though, like the consensus correlation for sexual victimization, the correlation for violent victimization was within the medium effect size range (Cohen 1992), but marginally failed to reach significance. With a larger sample, a similar finding across the two types of victimization might be observed. Moreover, because several of the walkers with violent victimization experiences had also been sexually victimized, any findings that differ by type of victimization must be interpreted carefully. The collection of additional point-light walkers is necessary in order to ensure that similar results are obtained when individuals who have been victimized both violently and sexually are isolated.

In terms of personality, the consensus correlations indicated that the observers agreed on which walkers appeared the most self-confident, but not on which walkers appeared assertive. Given that both self-confidence and assertiveness are components of the Assured-Dominance scale in the IASR-B5 (Trapnell and Wiggins 1990), it is unclear the extent to which observers agree on the apparent dominance of others. The observers did not agree on which walkers appeared submissive (i.e., the consensus correlations for both items [timid and unaggressive] that comprise the Unassured-Submissive scale

in the IASR-B5 were non-significant). Therefore, the hypothesis stating that observers would agree on which walkers were submissive was not supported.

Point-light conditions were employed in order to eliminate confounds unrelated to gait movement such that stronger conclusions could be drawn about the communicative function of an isolated behavior. However, while it was the intention of the researchers to capture the walkers' most natural gait, it is difficult, if not impossible, to film individuals without their knowledge in point-light conditions. Some research has suggested that individuals may alter (e.g., exaggerate or constrain) their body movements when they believe they are being watched. For example, Johnston et al. (2004) found that spontaneous differences in walking behavior occurred when participants were told to imagine themselves walking in a park (where they might be seen by others) compared to when they were instructed to simply walk naturally. That being said, Johnston et al.'s (2004) results may be better explained by the perceived safety of the imagined park and/or by participant confidence in their perceived safety, and not necessarily because the park is a public space where they would be observed by others. Indeed, the current research, consistent with Gunns et al. (2002), found that individuals who had been previously victimized exhibited more vulnerable gait cues, regardless of their vigilance.

The present study averted the walker's attention away from their movement by employing a memory task. Cognitive research attests to the difficulty that the brain has attending to multiple pieces of information simultaneously (e.g., Marois and Ivanoff 2005). Thus, it is likely that one's ability to focus on their movement while also attempting to achieve a memory task, would be limited (i.e., individuals would be forced to attend to the memory task, and consequently, would have less cognitive capacity to worry about how they are walking). However, the memory exercise that the walkers completed may have affected how strong and self-confident they appeared. Because participants focused on where to walk, some of the walkers may have exhibited a stride that appeared purposeful (e.g., they may have walked with their head up as they concentrated on where to go); this type of a walk may have also been perceived as self-confident and/or strong to observers. In the future, researchers may wish to examine how gait changes as a function of the situation an individual is in, or the task they are provided.

The second research question examined in Study 2 pertained to the accuracy of the observers (i.e., did the observers tend to rate those with a previous victimization history as those most vulnerable to experience victimization in the future?). Consistent with prior research (e.g., Book et al. 2013), observer ratings were tallied and percentages were calculated, with the results suggesting that the majority of the observers were accurate. However, the apparent accuracy from the percentage calculations is likely the result of the observers providing low ratings of vulnerability to walkers without victimization histories, and less to do with observers identifying walkers who had previous victimization experiences as those most vulnerable to future victimization. Although not the main focus of the current paper, future research to help establish more reliable methods of analysis for understanding gait vulnerability is crucial (see the Supplemental Material for one possible strategy).

While the observers in the current sample may not have been truly accurate in terms of providing higher vulnerability ratings to those who had been previous victims of crime, they did provide higher ratings of vulnerability to those who exhibited more vulnerable gait cues. Moreover, observers appear able to distinguish between vulnerable and non-vulnerable gait movement, even when provided with substantially degraded information (i.e., only 10 s of point-light footage). This result is consistent with previous literature (Gunns et al. 2002; Wheeler et al. 2009) and provides additional evidence suggesting that

zero-acquaintance observers can perceive subtle differences in gait movement (and use such differences to make decisions regarding vulnerability).

Accuracy correlations were also calculated between the observers' perceptions of the walkers' personality and the walkers' self-reports of their own personality. Despite some prior research suggesting that individuals are quite skilled at making personality judgments about others from nonverbal behavior (e.g., Ambady et al. 1999; Fowler et al. 2009; Stillman et al. 2010), self-other agreement accuracy was not obtained for any of the items. It is unclear why the walkers' perceptions of themselves were incongruent with the way observers perceived them. One possibility though is that the walkers perceived themselves differently from how they actually are.

Individuals often engage in self-serving biases wherein they attribute more positive states and traits to themselves: "…far from being balanced between the positive and the negative, the perception of self that most individuals hold is heavily weighted toward the positive end of the scale…individuals judge positive personality attributes to be more descriptive of themselves than of the average person…" (Kruglanski and Higgins 2003, p. 26). Thus, it is possible that the walkers reported their personality to be different than how it appeared to the observers, perhaps because they perceived themselves more positively. Alternatively, it is possible that the observers simply had difficulty ascertaining personality from the point-light footage. For example, Thoresen et al. (2012) found that observers "… make reliable, albeit inaccurate, trait judgments, and these [are] linked to a small number of motion components derived from Principal Component Analysis of…motion data" (p. 261).

General Discussion

Research has suggested that both situational and environmental factors, as well as the inherent attributes of individuals, contribute to perceptions of vulnerability (e.g., Beauregard et al. 2007; Myers et al. 1984); offenders appear to use a combination of "victim-centric" cues during the process of target selection. The current research aimed to advance the literature regarding gait as a cue of vulnerability. Zero-acquaintance observers made decisions regarding vulnerability to victimization based on a "thin slice" of information (i.e., a silent 10-s video clip of an individual walking).

The findings indicated that certain gait features are indeed perceived as more vulnerable than others, even when extraneous features (e.g., clothing, sex, weight, attractiveness) have been removed. More specifically, individuals who exhibit long or short strides, a lateral, diagonal, or up/down shift movement, a gestural walk, unilateral arm/leg movements, and lifted foot movements, tend to be perceived as those most vulnerable to experience future victimization. The findings lend credence to prior research investigating gait as a nonverbal cue of vulnerability (e.g., Book et al. 2013; Wheeler et al. 2009).

Interestingly, individuals who had been victimized in the past were more likely to exhibit said gait features. To understand why some previously victimized individual's exhibit gait movements that increases their likelihood of being perceived as a target, their personality was examined. It was argued that certain personality traits (namely submissiveness) might be expressed via gait (consistent with literature in the areas of personality; e.g., Fowler et al. 2009; Simpson et al. 1993; Wolff 1943; victim selection; e.g., Murzynski and Degelman 1996; Myers et al. 1984; Sakaguchi and Hasegawa 2006; nonverbal behavior; e.g., Ekman 1964; Ekman and Friesen 1965, 1968; and in line with

the KSD principle; Gunns et al. 2002; Runeson and Frykholm 1983), and could explain outsider perceptions of vulnerability.

However, submissiveness (when measured as a personality trait using the IASR-B5) was not related to gait, nor to prior victimization, and it could not account for the relationship between victimization history and the exhibition of vulnerable gait cues. Surprisingly though, there was a significant association observed between dominance and gait; walkers who rated themselves higher on dominance were more likely to exhibit the "victim" walk (Grayson and Stein 1981). Thus, although dominant individuals may be less likely to experience victimization, it appears that they do exhibit a noticeably vulnerable gait pattern. Additional research is required to ensure the association between dominance and gait is not spurious, as it remains possible that while vulnerability may be evidenced by gait (as demonstrated in the current study, Gunns et al. (2002) and Wheeler et al.'s (2009) studies, among others), certain personality traits, may simply be absent from the kinematic pattern.

Despite literature suggesting that zero-acquaintance observers are fairly skilled at judging personality traits in others from degraded information (e.g., Fowler et al. 2009; Richards et al. 1991; Simpson et al. 1993), the observers in the current sample were not able to accurately detect any of the walkers' personality traits. Interestingly, however, while unbeknownst to the observers (given that they did not rate self-reportedly dominant individuals as "dominant"), they actually selected self-reportedly dominant individuals as those most vulnerable to victimization. Indeed, walkers who reported that they were particularly dominant tended to exhibit the "victim" walk features, and observers selected individuals who exhibited such cues as those most vulnerable to experience victimization in the future. Observers clearly perceive a difference across gait patterns, and make decisions regarding vulnerability based on the presence or absence of certain movements. However, it becomes difficult to disentangle the influence of the walkers' personality on gait vulnerability.

It is possible that the walkers were attempting to appear more dominant than they are in reality, and the observers actually detected their "leaked" submissiveness. Recall that the KSD principle maintains that an individual's "dispositions" (i.e., anatomical makeup, as well as emotions and intentions) constrain and determine their movement pattern (Gunns et al. 2002; Runeson and Frykholm 1983). One's movement thus provides genuine information (e.g., regarding their personality, emotions, intentions). Similarly, Ekman and Friesen's (1969) argument that nonverbal behavior(s) may "escape[s] efforts to deceive" by "leaking" withheld information (p. 52) implies that even "hidden" properties related to personality (such as submissiveness) are present in the kinematic pattern and detectable from point-light images (Runeson and Frykholm 1983).

Although some research (e.g., Book et al. 2013; Wheeler et al. 2009) suggests that observers may select past victims as future victims based on gait cues, the observers in the current study did not necessarily select individuals with past victimization histories as those most likely to experience future victimization (i.e., the observers' apparent accuracy appeared to be the result of them providing low ratings of vulnerability to walkers without victimization histories). The differential results may have been a consequence of the point-light display technology. Because only biological movement was observable from the recordings (i.e., gait was isolated from any other cues), the raters could only make decisions regarding vulnerability from movement. Ratings of vulnerability in previous studies (e.g., Wheeler et al. 2009) may have been based on gait movement cues *in addition* to other cues (e.g., clothing). Therefore, results which indicated that prior victims of crime may be at risk of experiencing victim recidivism, may have occurred because observers were making decisions based on a myriad of features suggesting that someone had been a prior

victim of crime. Similar results have been observed in other studies investigating gait using kinematic point-light technology (e.g., Sakaguchi and Hasegawa 2006).

Limitations and Future Directions

Various factors pertaining to the observers remain untested and may have contributed to the current results. For example, some research suggests that certain clusters of personality traits, such as those related to psychopathy (Book et al. 2013; Wheeler et al. 2009), impacts the observers' conferred ratings.[9] Given that the current research was interested in the potential reasons why individuals with victimization histories exhibit differential gait patterns, the background of the observers was not examined. However, it would be valuable in future research to examine how observer personality (over and above the features inherent to psychopathy; see Hare 2003; Hare and Neumann 2008; Neumann et al. 2007) influences ratings of vulnerability.

Notably, because the current research was largely correlational in design, the findings require replication before firm conclusions can be made. Replication with a larger sample of walkers would also help ensure the reliability of the results—particularly the regression analyses, wherein 40–50 participants per predictor are often recommended (Cohen and Cohen 1983; Tabachnick and Fidell 2013). The sample size limited the type of tests and number of analyses that could be conducted. Nevertheless, both studies exceeded the sample sizes reported in other, related literature (e.g., it contained nearly triple the number of observers and double the number of walkers that Book et al. (2013) and Wheeler et al. (2009) had).

Furthermore, the cross-sectional nature of research limits the findings. A sample of the population was surveyed at a particular moment in time, and self-reports of personality are limited in that the constructs examined can fluctuate and adapt. Personality may change as a result of an individual's circumstances and relationships, or it can simply evolve over time (e.g., Hampson and Goldberg 2006). For example, it is possible that an individual may experience a shift in their personality following a significant life event (e.g., trauma; e.g., Beltran and Silove 1999); if gait is tied to one's personality, then this relationship may change accordingly. Therefore, the reports provided by participants are only true to the extent that they reflect their present personality traits, and that the IASR-B5 (Trapnell and Wiggins 1990) reliably measured them.

Given the current findings suggesting that certain individuals exhibit considerably different gait patterns, relative to others, and that such movement cues appear to impact one's vulnerability (regardless of self-reported personality), it is important to establish ways that individuals can reduce their outward vulnerability. Preliminary findings suggest that gait patterns may respond adaptively when in a potentially dangerous situation (e.g., individuals walk with more energy, produce greater arm swings, and display longer stride lengths; Johnston et al. 2004), and that it may be possible to train individuals to walk with different features than they normally would (in day-to-day life), thereby mitigating their overall vulnerability (see Johnston et al. 2004 for their findings on gait-specific training). Although

---

[9] Some research suggests that a small percentage of the general (non-offender) population possess psychopathic traits (e.g., "subclinical psychopathy;" Levenson et al. 1995; Williams et al. 2007). Given that the present sample consisted of community members, it is possible that those possessing more psychopathic characteristics may have displayed greater accuracy in their ratings.

replication of these results is required, particularly with larger samples, empirically-driven intervention/prevention strategies aimed at targeting nonverbal cues of vulnerability are an encouraging step toward reducing victimization.[10]

Conclusion

The current research aimed to expand the extremely novel literature regarding gait as a victim selection cue, and was one of the few to investigate both observer choice and victim cueing using kinematic point-light display. Should one adhere to the argument that biological movement is non-sporadic and constrained by one's emotions and intentions (i.e., consistent with the KSD principle; Gunns et al. 2002; Runeson and Frykholm 1983), then it would appear that the walkers who were exhibiting the noticeably different gait pattern were communicating a specific message (through their gait). Examination of the victim selection process is important theoretically in terms of advancing understanding of nonverbal behavior, personality expression, and cognitive appraisal processes (e.g., such as the ability to detect internal states from external behavior). More practically, understanding how non-criminal populations use body language cues to detect vulnerability is likely to provide some understanding as to how predatory offenders (who *seek* vulnerability) would be able to use them as well. Greater consideration of nonverbal cues of vulnerability may lead to the design and implementation of proactive and targeted strategies (e.g., body awareness training) that may help to prevent future incidences of victimization (Johnston et al. 2004).

References

Ambady, N., Conner, B., & Hallahan, M. (1999). Accuracy of judgements of sexual orientation from thin slices of behavior. *Journal of Personality and Social Psychology, 77*(3), 538–547.

Beardsworth, T., & Buckner, T. (1981). The ability to recognize oneself from a video recording of one's movements without seeing one's body. *Bulletin of the Psychonomic Society, 18,* 19–22.

Beauregard, E., & Leclerc, B. (2007). An application of the rational choice approach to the offending process of sex offenders: A closer look at the decision-making. *Sex Abuse, 19,* 115–133. https://doi.org/10.1007/s11194-007-9043-6.

Beauregard, E., Rossmo, K. D., & Proulx, J. (2007). A descriptive model of the hunting process of serial sex offenders: a rational choice perspective. *Journal of Family Violence, 22,* 449–463. https://doi.org/10.1007/s10896-007-9101-3.

Beltran, R. O., & Silove, D. (1999). Expert opinions about the ICD-10 category of enduring personality change after catastrophic experience. *Comprehensive Psychiatry, 40*(5), 396–403.

---

[10] The study of characteristics that are theorized to increase one's vulnerability to experience victimization does not excuse the offender from his/her exclusive responsibility. A comprehensive study of both the characteristics that make one vulnerable to an attack, as well as the elements that result in an offender perpetrating a crime, are necessary in order to fully understand the interactions involved in victimization. Similarly, techniques or tactics aimed at reducing one's vulnerability does not supersede interventions instituted to prevent offenders from perpetrating the act in the first place.

Book, A., Costello, K., & Camilleri, J. A. (2013). Psychopathy and victim selection: The use of gait as a cue to vulnerability. *Journal of Interpersonal Violence, 28*(11), 2368–2383. https://doi.org/10.1177/0886260512475315.

Burgoon, J. K. (1985). Nonverbal signals. In M. L. Knapp & G. R. Miller (Eds.), *Handbook of interpersonal communication* (pp. 344–390). Beverly Hills, CA: Sage.

Carli, L. L., LaFleur, S. J., & Loeber, C. C. (1995). Nonverbal behavior, gender, and influence. *Journal of Personality and Social Psychology, 68*(6), 1030–1041.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–159.

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.

Cornish, D. B., & Clark, R. V. (1986). *The reasoning criminal: Rational choice perspectives on offending*. New York, NY: Springer-Verlag.

Cutting, J. E. (1977). Recognizing friends by their walk: Gait perception without familiarity cues. *Bulletin of the Psychonomic Society, 9,* 353–356.

Cutting, J. E., & Kozlowski, L. T. (1977). Recognizing friends by their walk: Gait perception without familiarity cues. *Bulletin of the Psychonomic Society, 9*(5), 353–356.

Eibl-Eibesfeldt, I. (1989). *Human ethology*. New York, NY: Aldine de Gruyter.

Ekman, P. (1964). Body position, facial expression, and verbal behavior during interviews. *Journal of Abnormal and Social Psychology, 68*(3), 295–301.

Ekman, P., & Friesen, W. V. (1965). *Personality, pathology, affect, and nonverbal behavior*. Hawaii: Paper presented at the Western Psychological Association Convention.

Ekman, P., & Friesen, W. V. (1968). Nonverbal behavior in psychotherapy research. In J. Shlien (Ed.), *Research in psychotherapy* (Vol. III, pp. 179–216). Washington, DC: American Psychological Association.

Ekman, P., & Friesen, W. V. (1969). The repertoire of nonverbal behavior: Categories, origins, usage, and coding. *Semiotica, 11,* 49–98.

Fass, D. F., Benson, R. I., & Leggett, D. G. (2008). Assessing prevalence and awareness of violent behaviors in the intimate partner relationships of college students using internet sampling. *Journal of College Student Psychotherapy, 22*(4), 66–75.

Fowler, K. A., Lilienfeld, S. O., & Patrick, C. J. (2009). Detecting psychopathy from thin slices of behavior. *Psychological Assessment, 21*(1), 68–78. https://doi.org/10.1037/a0014938.

Grayson, B., & Stein, M. I. (1981). Attracting assault: Victims' nonverbal cues. *Journal of Communication, 31,* 68–75.

Gunns, R. E., Johnston, L., & Hudson, S. M. (2002). Victim selection and kinematics: A point light investigation of vulnerability to attack. *Journal of Nonverbal Behavior, 26*(3), 129–158.

Hampson, S. E., & Goldberg, L. R. (2006). A first large cohort study of personality trait stability over the 40 years between elementary school and midlife. *Journal of Personality and Social Psychology, 91*(4), 763–779. https://doi.org/10.1037/0022-3514.91.4.763.

Hare, R. D. (2003). *The Hare Psychopathy Checklist-Revised* (2nd ed.). Toronto, Ontario: Multi-Health Systems.

Hare, R. D., & Neumann, C. S. (2006). The PCL-R assessment of psychopathy: Development, structural properties, and new directions. In C. J. Patrick (Ed.), *Handbook of psychopathy* (pp. 58–88). New York, NY: The Guilford Press.

Hare, R. D., & Neumann, C. S. (2008). Psychopathy as a clinical and empirical construct. *Annual Review of Clinical Psychology, 4,* 217–246. https://doi.org/10.1146/annurev.clinpsy.3.022806.091452.

Hareli, S., Shomrat, N., & Hess, U. (2009). Emotional versus neutral expressions and perceptions of social dominance and submissiveness. *Emotion, 9,* 378–384.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Press.

Ikeda, H., & Watanabe, K. (2009). Anger and happiness are linked differently to the explicit detection of biological motion. *Perception, 38,* 1002–1011.

Johnston, L., Hudson, S. M., Richardson, M. J., Gunns, R. E., & Garner, M. (2004). Changing kinematics as a means of reducing vulnerability to physical attack. *Journal of Applied Social Psychology, 34*(3), 514–537.

Joslin, C. (2010). *Motion capture.* Retrieved May 5, 2015 from http://mocap.csit. XXXXX.ca/index.php?Section=Overview&Item=Default&Page=Default.

Kilpatrick, D. G., & Acierno, R. (2003). Mental health needs of crime victims: epidemiology and outcomes. *Journal of Traumatic Stress, 16*(2), 119–132.

Kilpatrick, D. G., Acierno, R., Resnick, H. S., Saunders, B. E., & Best, C. L. (1997). A two year longitudinal analysis of the relationship between violent assault and alcohol and drug use in women. *Journal of Consulting and Clinical Psychology, 65*(5), 834–847.

Kruglanski, A. W., & Higgins, E. T. (2003). *Social psychology: A general reader*. New York, NY: Taylor and Francis Books Inc.

Lauritsen, J. L., & Quinet, K. F. D. (1995). Repeat victimization among adolescents and young adults. *Journal of Quantitative Criminology, 11*(2), 143–166.

Levenson, M. R., Kiehl, K. A., & Fitzpatrick, C. M. (1995). Assessing psychopathic attributes in a non-institutionalized population. *Journal of Personality and Social Psychology, 68*(1), 151–158.

Lippa, R., & Dietz, J. K. (2000). The relation of gender, personality, and intelligence to judges' accuracy in judging strangers' personality from brief video segments. *Journal of Nonverbal Behavior, 24,* 25–43.

Markey, P. M., & Markey, C. N. (2009). A brief assessment of the Interpersonal Circumplex: The IPIP-IPC. *Assessment, 16*(4), 352–361. https://doi.org/10.1177/1073191103940382.

Marois, R., & Ivanoff, J. (2005). Capacity limits of information processing in the brain. *Trends in Cognitive Sciences, 9*(6), 296–305.

Melchior, L. A. (1990). *Sampling the three components of shyness: The Shyness Syndrome Inventory* (Doctoral dissertation).

Mischel, W. (1999). Personality coherence and dispositions in a cognitive-affective personality system (CAPS) approach. In D. Cervone & Y. Shoda (Eds.), *The coherence of personality: Social-cognitive bases of consistency, variability, and organization* (pp. 37–60). New York, NY: The Guilford Press.

Montepare, J. M., & Zebrowitz, L. A. (1993). A cross-cultural comparison of impressions created by age-related variations in gait. *Journal of Nonverbal Behavior, 17,* 55–68.

Montepare, J. M., & Zebrowitz-McArthur, L. (1988). Impressions of people created by age-related qualities of their gaits. *Journal of Personality and Social Psychology, 55*(4), 547–556.

Murzynski, J., & Degelman, D. (1996). Body language of women and judgements of vulnerability to sexual assault. *Journal of Applied Social Psychology, 26*(18), 1617–1626.

Myers, M. B., Templer, D. I., & Brown, R. (1984). Coping ability in women who become victims of rape. *Journal of Consulting and Clinical Psychology, 52,* 73–78. https://doi.org/10.1037/0022-006X.52.1.73.

Neumann, C. S., Kosson, D. S., & Salekin, R. T. (2007). Exploratory and confirmatory factor analysis of the psychopathy construct: Methodological and conceptual issue. In H. Herve´ & J. C. Yuille (Eds.), *The psychopath: Theory, research, and practice* (pp. 79–104). Mahwah, NJ: Erlbaum.

Perreault, S., & Brennan, S. (2010). *Criminal victimization in Canada, 2009* (Vol. 30). Ottawa: Canadian Centre for Justice Statistics.

Prabaharan, N. (2015). Behavioural cues for the perceptions of victim vulnerability. *Inkblot, 4,* 7–11.

Richards, L., & Mcalister, L. (1994). Female submissiveness, nonverbal behavior, and body boundary definition. *The Journal of Psychology, 128*(4), 419–424.

Richards, L., Rollerson, B., & Phillips, J. (1991). Perceptions of submissiveness: Implications for victimization. *The Journal of Psychology, 125*(4), 407–411.

Ritchie, M. (2014). *Perceptions of victim vulnerability: The role of personality and psychopathy* (Unpublished undergraduate honour's thesis). Carleton University, Ottawa Ontario.

Runeson, S., & Frykholm, G. (1983). Kinematic specification of dynamics as an informational basis for person-and-action perception: Expectation, gender recognition, and deceptive intention. *Journal of Experimental Psychology: General, 112,* 585–615.

Sakaguchi, K., & Hasegawa, T. (2006). Person perception through gait information and target choice for sexual advances: Comparison of likely targets in experiments and real life. *Journal of Nonverbal Behavior, 30,* 63–85. https://doi.org/10.1007/s10919-006-0006-2.

Satchell, L., Morris, P., Mills, C., O'Reilly, L., Marshman, P., & Akehurst, L. (2017). Evidence of big five and aggressive personalities in gait biomechanics. *Journal of Nonverbal Behavior, 41*(1), 35–44.

Schneider, S., Christensen, A., Haubinger, F. B., & Fallgatter, A. J. (2014). Show me how you walk and I tell you how you feel—A functional near-infrared spectroscopy study on emotion perception based on human gait. *NeuroImage, 85,* 380–390.

Selkin, J. (1975). Rape: When to fight back. *Psychology Today, 8*(8), 71–76.

Simpson, J. A., Gangestad, S. W., & Biek, M. (1993). Personality and nonverbal social behavior: An ethological perspective of relationship initiation. *Journal of Experimental Social Psychology, 29,* 434–461.

Snook, B., & Cullen, R. M. (2009). Bounded rationality and criminal investigations: Has tunnel vision been wrongfully convicted? In D. K. Rossmo (Ed.), *Criminal investigative failures* (pp. 71–98). Boca Raton, FL: Taylor and Francis Group.

Sparks, R. (1981). Multiple victimization: Evidence, theory, and future research. *Journal of Criminal Law and Criminology, 72,* 762–778.

Stevens, D. J. (1994). Predatory rapists and victim selection techniques. *The Social Science Journal, 31*(4), 421–433.

Stillman, T. F., Maner, J. K., & Baumeister, R. F. (2010). A thin slice of violence: Distinguishing violent from nonviolent sex offenders at a glance. *Evolution and Human Behavior, 31*(4), 298–303.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson.

Thoresen, J. C., Vuong, Q. C., & Atkinson, A. P. (2012). First impressions: Gait cues drive reliable trait judgements. *Cognition, 124*(3), 261–271.

Trapnell, P. D., & Wiggins, J. S. (1990). Extension of the interpersonal adjective scales to include the big five dimensions of personality. *Journal of Personality and Social Psychology, 59*(4), 781–790.

Troje, N. F., Westhoff, C., & Lavrov, M. (2005). Person identification from biological motion: Effects of structural and kinematic cues. *Perception and Psychophysics, 67*(4), 667–675.

Truman, J. L. (2011). Criminal victimization, 2010. *National crime victimization survey, U.S. Department of Justice, office of justice programs, Bureau of Justice Statistics* (NCJ 235508) (pp. 1–20).

Vanrie, J., Dekeyser, M., & Verfaillie, K. (2004). Bistability and biasing effects in the perception of ambiguous point-light walkers. *Perception, 33*(5), 547–560.

Wheeler, S., Book, A., & Costello, K. (2009). Psychopathic traits and perceptions of victim vulnerability. *Criminal Justice and Behavior, 36*(6), 635–648. https://doi.org/10.1177/0093854809333958.

Wiggins, J. S. (1995). *Interpersonal adjective scales professional manual*. Odessa, FL: Psychological Assessment Resources.

Williams, K. M., Paulhus, D. L., & Hare, R. D. (2007). Capturing the four-factor structure of psychopathy in college students via self-report. *Journal of Personality Assessment, 88,* 205–219.

Wolff, W. (1943). *The expression of personality*. New York, NY: Harper.

Woolard, A. (1999). Vicon 512 manual. Retrieved May 5, 2015 from http://users.aber.ac.uk/hoh/CS390/512ViconSWManual.pdf.

Yeagley, E., Morling, B., & Nelson, M. (2007). Nonverbal zero-acquaintance accuracy of self-esteem, social dominance orientation, and satisfaction with life. *Journal of Research in Personality, 41,* 1099–1106. https://doi.org/10.1016/j.jrp.2006.12.002.