# Perception Over Personality in Lethal Force: Aggression, Impulsivity, and Big Five Traits in Threat Assessments and Behavioral Responses due to Weapon Presence and Posture

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The use of lethal force is a combination of threat perception and individual judgment that sometimes warrants a behavioral response. This simplified description implicates perceptual factors and individual differences in lethal force decision making, which ongoing research continues to address. However, personality-based factors have been less explored as to how they might affect either threat perception or behavioral responses in a lethal force decision. The current investigation examined multiple personality traits with the potential to influence lethal force decision making, including aggression, impulsivity, and the Big Five traits. These measures were compared to threat perception and behavioral responses made to a variety of lethal force stimuli broadly categorized as clear threats, ambiguous threats, and clear nonthreats. Samples were recruited from combat-trained infantry, military recruits, and the civilian community to control for prior lethal force training. Although there was a strong omnibus relationship between threat perception and the likelihood of a behavioral response, neither military training nor personality differences had any impact on threat perception or a binary (e.g., shoot/don't-shoot) behavioral response. Therefore, we conclude that perception dominates personality in lethal force decision making when the threat assessment decision is limited to factors such as weapon presence or posture rather than emotion.

KEYWORDS: lethal force decision making, aggression, impulsivity, personality, threat perception

Every lethal force decision depends on a complex combination of factors, including the environment, weapons, rules of engagement, briefings, and more. Still, the shooter bears responsibility for pressing the trigger, so the decision literally rests in his or her hands. This accountability highlights additional factors about the individual ranging from personality predispositions to training experience, which in turn may affect any perception-based threat assessment or subsequent behavioral-based threat response. However, there is surprisingly little evidence about the relationship between various trait-based factors and how they might alter a lethal force decision. For example, a person may generally exhibit more aggressive tendencies, but do those tendencies affect the perception of threat, the behavioral response to identify someone as a threat, or both? There is a critical difference between these two approaches. Specifically, threat perception represents a range of possibilities influencing how threatening someone appears, whereas behavioral response represents the critical threshold of whether a threat response is warranted—akin to the critical difference in shoot/don't-shoot identification. Put simply, one component addresses perception and one component addresses action, yet it is unclear whether personality influences perception, action, or both. The current investigation explored multiple personality factors in predicting both threat perception and a threat response.

Identifying threats remains a straightforward process when the threat is clearly visible as a dangerous weapon (cf. Suss & Raushel, 2019), yet some threat assessments require subjective interpretation. The most well-studied subjective component of threat assessment is emotion, where anger is often used as a corollary for threat (Brosch, Pourtois, & Sander, 2010; Hansen & Hansen, 1988; Yiend, 2010). Emotions are open to some interpretation as different individuals both express and perceive emotions differently from one another; that is, one person might identify a face as angry while another might identify the same face as not angry. Similarly, two people might construe the same expression as representing different degrees of anger. This ambiguity opens the opportunity for individual differences in threat assessment. More importantly, the combination of emotion, phylogenetic threats, and ontogenetic threats underscores the importance of context and addi-

tional information when making a threat assessment (Fox, Griggs, & Mouchlianitis, 2007; Zsido, Deak, & Bernath, 2019). Specifically, a small snake might represent an evolutionary threat to a lay observer, but a herpetologist might identify the snake as dangerous only if it is poisonous.

Subjective interpretation must be considered especially important in the context of lethal force, where a threat assessment may or may not warrant a lethal force response. For example, identifying a face as angry might raise the relative potential threat, yet detecting anger alone is not generally enough to warrant a lethal force response. Additional factors influence a threat assessment, including rules of engagement, weapon presence, and posture. These combined factors indicate that threat perception in lethal force situations involve holistic image processing that takes into account multiple components of the stimulus and the situation. However, there is a critical difference between the cognitive factors underlying threat assessment during subjective interpretation and the discrete behavioral outcome often associated with a threat response, namely the shoot/don't-shoot response. Presumably some threshold is associated with the accumulation of threat-relevant evidence (Pleskac, Cesario, & Johnson, 2018), and upon reaching said threshold, the individual decides to engage in a lethal force response. Attentional bias methods may differentiate between the relative priority of threats or whether different threats are detected by automatic attentional processes, but they do not as readily address the subjective nature of threat assessment or the underlying relationship between a threat assessment and a threat response.

Another factor to consider is the role of individual biases in a threat response. Some of the most well-known empirical results involve the role of racial biases in the decision to shoot (Correll, Hudson, Guillermo, & Ma, 2014; Correll et al., 2007; James, 2018; James, Klinger, & Vila, 2014; James, Vila, & Daratha, 2013; Plant & Peruche, 2005). These effects can be detected in both the degree of racial differentiation and the subsequent behavioral biases elicited in a shooting paradigm (Correll, Urland, & Ito, 2006). In addition to the cognitive factors associated with lethal force decisions, these findings seem to suggest that individual contributions should be considered as potential mediating factors in a threat assessment.

For example, previous evidence has explored the relationship between anger and aggressive behavior (Denson, Pedersen, Ronquillo, & Nandy, 2009). Regarding lethal force, an important question is whether aggressive traits likewise predispose someone to perceive a possible target as more threatening or to make a threat (i.e., shoot) response more often. The former would indicate a difference in threat interpretation, whereas the latter indicate a difference in response bias—although both could contribute to likely behavioral outcomes. Similarly, would other personality traits mediate lethal force decisions as they mediate the regulation of anger and aggression (e.g., the Big Five; Jensen-Campbell, Knack, Waldrip, & Campbell, 2007)?

The current investigation explored how the personality traits of aggression, impulsivity, and the Big Five might influence threat perception or a behavioral response. These three personality areas were selected to represent several factors with apparent relationships to either violence or shooting decisions. The clearest potential link is between aggression and threat responses, as aggressive tendencies have been linked to violence (DeWall, Anderson, & Bushman, 2011; Tedeschi & Felson, 1994). Poor inhibitory skills have previously been linked to the shooting error of inflicting unintended casualties (Biggs, Cain, & Mitroff, 2015; Hamilton, Lambert, Suss, & Biggs, 2019; Wilson, Head, De Joux, Finkbeiner, & Helton, 2015; Wilson, Head, & Helton, 2013), and poor inhibitory skills have been linked to greater impulsivity (Logan, Schachar, & Tannock, 1997). This connection creates the potential that the behavioral response, if not threat perception, will be linked to individual differences in impulsivity. Finally, general personality differences were captured by the Big Five traits (John & Srivastava, 1999). The purpose of this general personality assessment is to capture whether broad individual differences might influence either threat perception or behavioral responses in a threat-based response paradigm. To further explore individual differences existing before the lethal force scenario (cf. Jackson, Thoemmes, Jonkmann, Lüdtke, & Trautwein, 2012; Landman, Nieuwnhuys, & Oudejans, 2016; Scribner, 2016), three different groups were recruited based on military experience: combat-trained infantry, military recruits, and a community sample of nonmilitary personnel. These different populations provide impor-

tant training-related differences between participants as well as ensuring that the sample tested in the study includes the relevant personnel whose job involves making lethal force decisions.

During the study, participants completed several self-report personality measures via survey. Threat perception and behavioral threat response were recorded in separate computer-based tasks. Participants identified the degree of threat by rating threatening images on a continuous scale. Participants made threat responses in a go/no-go task as the best proxy available to isolate the decision-making component of a shoot/don't-shoot decision in lethal force. For example, marksmanship (i.e., accuracy and precision) and lethal force decision-making performance are largely uncorrelated variables (Blacker, Pettijohn, Roush, & Biggs, 2021), indicating that there is reason to measure them separately.

Perception and personality could interact in numerous ways throughout this experiment. Specifically, there are at least four primary outcomes to explore:

> *Personality influences both perception and behavior.* This outcome would suggest that personality factors have a cascading influence on lethal force decisions, beginning with the threat perception and translating into a different behavioral response. For example, highly aggressive people might perceive someone as more threatening, which in turn increases the likelihood of the person determining the threat warrants action.

> *Personality influences perception but not behavioral response.* This outcome would suggest that personality factors influence how threatening a person appears, but this perception does not translate into changed action when the person makes a behavioral response. For example, a highly aggressive person rates a potential threat as subjectively more threatening, but this increased threat perception does not translate to increased likelihood of a behavioral response.

> *Personality influences behavioral response but not perception.* This outcome would suggest that personality factors do not directly alter the perception, but they can affect behavior in other ways. For example, an impulsive person does not rate a threat as more subjectively threatening, but impulsivity (e.g., motor impulsivity)

indicates an increased likelihood of accidental threat response in a go/no-go or shoot/don't-shoot paradigm.

*Personality has no significant impact on perception or behavioral response.* This outcome would suggest that differences in personality do not directly affect either aspect of threat assessment. It would be supported by many different nonsignificant outcomes when personality factors are compared to threat perception and behavioral response.

## EXPERIMENT

### METHOD

*Participants*

There were 65 participants in this investigation, divided into three categories based on military experience. The most experienced participants were active duty military who had completed infantry training ($N$ = 24, 24 male, mean age = 26.42 years, $SD$ = 6.06 years). The next most experienced participants had recently completed recruit training, but had not attended their advanced training school ($N$ = 21, 21 men, mean age = 19.15 years, $SD$ = 0.93 years). The least experienced were nonmilitary personnel recruited as part of a community sample in the Wright–Patterson Air Force Base local area ($N$ = 20, 13 men, mean age = 28.20, $SD$ = 6.13 years). None of the community sample participants were known to have participated in any combat training. All participants reported normal or corrected-to-normal vision.

Sample size was determined largely based on the combat-trained infantry participants. Data were collected from as many subjects as possible to create a representative sample of this population, and additional samples for military recruits and community personnel were sampled to be approximate in size to the combat-trained infantry sample. Additional measures were collected on various participants as part of their efforts in other studies. For example, the combat-trained infantry participants completed more surveys and cognitive tasks than are reported here; however, these additional tasks were not relevant to the outcomes of this study, nor did all participants complete the additional tasks.

Based on group differences, two participants were more than three standard deviations above either the group or total sample mean on response rate for clear nonthreat stimuli. All data from these participants

(both in the recruit training group) were excluded for noncompliance. These limitations produced a final sample of 63 participants who completed all or part of the experimental activities: 24 participants from a combat-trained infantry sample, 19 participants from a recently trained military recruit sample, and 20 participants from a random community sample. Three military participants did not complete the aggression survey due to time restrictions. Their data are included for all findings except aggression-specific analyses.

*Apparatus*

Experimental stimuli were displayed and timing controlled in the MATLAB program (The MathWorks, Natick, MA) with assistance from the Psychophysics Toolbox extensions (Brainard, 1997; Pelli, 1997). All participants remained seated through the experimental trials, approximately 60 cm from a 15-inch screen on a laptop computer. Participants did not have their head movements restricted during the experiments. Personality metrics were collected via paper-and-pencil measures. Data were stored on government systems and will not be uploaded to a public repository without consent from the organization.

*Stimuli*

Threat assessments were conducted with photorealistic stimuli that depicted people in various postures displaying either a gun, a cell phone, or nothing (Figure 1). Stimuli were create before the study based on three a priori conditions designed by the experimenters to manipulate the severity of threat and subjectivity in the threat assessment. The three image categories were clear threat, depicting people who unquestionably represented a threat target; ambiguous threat, depicting people who may or may not be in a position to offer threat based on subjective interpretations; and clear nonthreat, depicting people who did not present any threat. Clear threat positions included an actor pointing a gun at the camera when the picture was taken, with his finger on the trigger; a pointed weapon is the clearest possible indication of the immediate potential for violence (cf. Liao, Price-Sharps, & Sharps, 2018), and therefore the potential to be threatening. The gun was a BlueFire M9 Beretta normally used with the Meggitt Indoor Simulated Marksmanship Trainer for U.S. Marine Corps training. Thus, the weapon fully replicated the form, weight, size, and functionality of a live gun but could not fire a projectile. Six different clear threat positions

(e.g., weapon held in right or left hand, weapon held at hip or chest height) were adopted to prevent the posture and weapon location from becoming predictable during the experiment. Ambiguous threats included three different postures, which also manipulated weapon presence. Two positions depicted an actor with hands held near the waist, neither in clear surrender nor clearly reaching for the object holstered at the hip. The object at the hip was also either a holstered weapon or a holstered cell phone to created uncertainty about what would be carried by the actor. The third ambiguous threat image had the actor with one hand reaching behind his back. The hand was completely obscured, and the participants could not tell whether the actor was reaching for a weapon, a wallet, or some other object—making the perception of threat in this instance truly ambiguous. The final threat category, clear nonthreat, depicted people clearly showing a cell phone to the camera or maintaining a classic position of surrender (e.g., hands behind head with fingers interlaced, both hands raised above head).

There were 15 total stimuli across the three categories: six clear threat images, three ambiguous threat images, and six clear nonthreat images. For each of the 15 possible positions, there were also three different actors used to create a total of 45 unique photographs designed to mimic the threat conditions. These different actor and posture combinations were included to prevent actor identity or weapon location from becoming a predictable cue that could influence lethal force decision making (Biggs, Pistone, Riggenbach, Hamilton, & Blacker, 2021). The three actors were all white men of approximately the same age. Race in particular was controlled among the actors in the stimuli to prevent any biases due to racial influences (Correll, Park, Judd, & Wittenbrink, 2002; but see also James, James, & Vila, 2016; Ma & Correll, 2011). Detailed analyses of threat rating differences for these different individual stimuli have been reported elsewhere (Biggs, Pettijohn, & Gardony, 2021); those analyses represent and describe distinct outcomes from the work presented here.

### Threat Rating Task

Participants completed a subjective threat rating task by viewing the images and rating each image on a Likert-type scale from 1 (*least possible threat*) to 9 (*highest possible threat*). Each participant made the response via keyboard. Participants were also asked to make their threat rating as quickly as possible, although no timeout was set for rating the threat level.
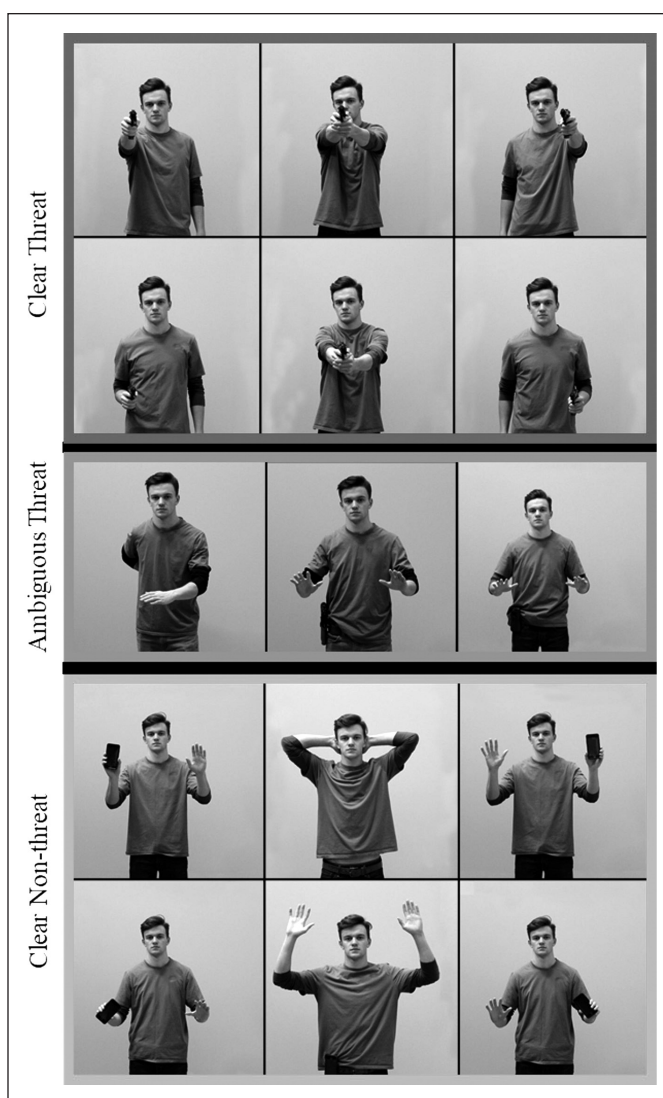


**FIGURE 1.** Average identity distress ratings by sex and avatar usage

This approach produced some trials with much longer response times (RTs) to determine the threat assessment, where any number of factors could have distracted the participant from that particular trial. To avoid undue influences on the threat rating, distracted trials were removed from the analyses. Distracted trials were defined here as threat rating trials with RTs more than three standard deviations beyond the overall mean RT for the task. The mean RT was 616.15 ms, with a standard deviation of 153.79 ms, and the data trimming procedure removed 2.42% of trials from the threat rating analyses. Each participant made 225 total threat ratings throughout the experiment by viewing each unique stimulus five

times. Trials were not blocked by stimulus type, nor were they blocked by actor in the image. All stimulus presentations were randomized to present a unique order to all participants. No participant was given any priming condition or instructions, other than to use whatever criteria they saw fit to determine how threatening an image was or should be considered.

*Response Rate Task*

To provide a better corollary to a shoot/don't-shoot decision with a discrete option, a go/no-go task was also completed by participants where they made a threat/nonthreat response via button press to mimic the shoot/don't-shoot response of squeezing the trigger. If a participant pressed the spacebar, the image was identified as a threat, whereas withholding a response identified the image as a nonthreat or at least not sufficiently threatening to warrant a threat response. All trials began with a fixation screen displaying a small, white cross on a black background. The fixation cross remained on screen for a randomized interval between 500 ms and 1,500 ms to prevent participants from engaging in a reliable response pattern. After the fixation interval, the fixation display was replaced with a photo stimulus to elicit a reaction from participants. The recorded dependent variables were RT and response rate. Response rate was calculated as the percentage of trials where the participant hit the key to identify the image as a threat. These responses were averaged across images within each of the three categories, and response rate was calculated separately for each of the threat categories. Response rate for the ambiguous threat images would not affect response rate for the clear threat images because these outcomes were calculated separately. Response rate is used in lieu of accuracy because whereas clear threat targets and clear nonthreat targets have a clear corresponding correct response (i.e., make a response to threat, withhold a response to nonthreat), there is no "correct" response in the ambiguous threat conditions because the combined stimuli were intended to create an uncertain lethal force assessment. Participants never discovered what the actor held in his hand behind his back, and the two remaining ambiguous images presented hands halfway between surrender and reaching for an object that could be either a gun or phone.

These dependent variables were recorded by the computer, and then the experimental software would automatically proceed to the next trial upon a response. Trial distribution and stimulus presen-

tation paralleled the threat rating task, with trials divided between clear threats (40%), ambiguous threats (20%), and clear nonthreats (40%). There were 225 trials (45 unique stimuli, each presented five times) throughout the experiment, and trials were not blocked by stimulus type or by actor appearing in the stimuli. All images were randomized to present a unique order to each participant. No participant was given any priming condition or instructions other than to use whatever criteria they saw fit to determine whether a target represented a sufficient threat to warrant the threat response.

*Personality Measures*

Aggression was measured via the Buss–Perry Aggression Questionnaire (Buss & Perry, 1992). Each question uses a 5-point scale to measure aggressive traits with a total of 29 questions; scores could range from 29 to 145. An overall aggression score is provided as well as individual scores on four subscales: physical aggression, verbal aggression, anger, and hostility. It should be noted there are well-documented sex differences in aggression (Archer, 2004). The current study included only men in both the combat-trained infantry sample and the recently trained military sample; only the community sample included female participants, but it remained predominantly male (65%). Impulsivity was measured via the Barratt Impulsiveness Scale (Patton, Stanford, & Barratt, 1995; Stanford et al., 2009). The Barratt Impulsiveness Scale consists of 30 questions and can be divided into three components used here to address various aspects of impulsivity: attentional impulsivity (the inability to concentrate or focus attention), motor impulsivity (the tendency to act without thinking), and nonplanning impulsivity (the lack of future planning and forethought). The Big Five were assessed via the Big Five Inventory (Benet-Martinez & John, 1998; John, Donahue, & Kentle, 1991; John, Naumann, & Soto, 2008; John & Srivastava, 1999), which consists of 44 questions evaluating five primary personality factors (neuroticism, extraversion, openness, agreeableness, and conscientiousness).

## RESULTS

*Military Experience and Personality Metrics*
Although the primary goal is to explore the influence of personality on threat perception and behavioral responses, this data collection provided the opportunity to also assess individual differences in per-

sonality metrics between military service members and a community sample. Furthermore, we could distinguish between experienced military service members trained for direct conflict (combat-trained infantry), new recruits who only completed their initial military training (recruit trainees), and our general community sample. There are several known population-based differences that could produce differences in a military-to-community comparison. For example, size and strength affect aggression (Archer & Thanzami, 2007; 2009), as well as age (Crawford et al., 2006; Toldos, 2005) and gender (Björkqvist, Österman, & Lagerspetz, 1994). Many of these issues parallel population differences among a military sample that tends to skew younger, male, and stronger. Although the current evidence can only provide a cross-sectional sample, it will be intriguing to determine whether the predispositions of a younger, male military recruit become exacerbated or reduced by further military experience. Therefore, the primary

differences of interest are whether aggressive tendencies among military recruits become exacerbated or reduced by combat training in this cross-sectional sample. These differences will be assessed independent of the threat perception and behavior issues first to determine whether there are existing group differences between these samples.

### Aggression

See Tables 1 and 2 for descriptive statistics and statistical analyses, respectively. Multiple significant differences observed between the groups because all one-way ANOVAs were significant for the dependent variables of total aggression score and the aggression subscales. The common trend was for recruit trainees to self-report being the most aggressive, with combat-trained infantry being the next most aggressive and the community sample being the least aggressive. Notably, the combat-trained infantry sample reported significantly more aggression

**TABLE 1.** Descriptive Statistics With Means for Aggression, Impulsivity, and the Big Five Traits as Divided by Military Experience

| Personality measure | Military experience | | |
| --- | --- | --- | --- |
| | Combat-trained infantry | Recruit trainees | Community sample |
| Aggression | | | |
| Total score | 78.75 (17.38) | 93.73 (19.85) | 66.60 (15.65) |
| Physical | 3.18 (0.63) | 3.46 (0.77) | 2.16 (0.52) |
| Verbal | 3.07 (0.71) | 3.43 (0.78) | 2.76 (0.64) |
| Anger | 2.34 (0.74) | 2.79 (0.89) | 2.12 (0.73) |
| Hostility | 2.31 (0.73) | 3.24 (0.84) | 2.32 (0.80) |
| Impulsivity | | | |
| Attentional | 2.00 (0.35) | 2.28 (0.37) | 2.27 (0.60) |
| Motor | 2.09 (0.38) | 2.30 (0.42) | 2.01 (0.42) |
| Nonplanning | 2.14 (0.32) | 2.25 (0.44) | 2.06 (0.45) |
| Big Five traits | | | |
| Neuroticism | 2.39 (0.51) | 2.98 (0.79) | 2.83 (0.80) |
| Extraversion | 3.17 (0.75) | 3.11 (0.55) | 3.20 (0.83) |
| Openness | 3.24 (0.43) | 3.58 (0.51) | 3.60 (0.58) |
| Agreeableness | 3.66 (0.48) | 3.54 (0.45) | 3.71 (0.55) |
| Conscientiousness | 3.63 (0.47) | 3.52 (0.55) | 3.53 (0.13) |

*Note.* Aggression was measured through the Buss–Perry Aggression Questionnaire, with 1 representing *extremely uncharacteristic of me* and 5 representing *extremely characteristic of me*. Impulsivity was measured on the Barratt Impulsiveness Scale, with 1 indicating *rarely/never* associated with the trait and 4 representing *almost/always*. The Big Five traits were measured via the Big Five Inventory, with 1 indicating that the quality is not characteristic of the individual (*disagree strongly*) and 5 indicating that the quality is characteristic of the individual (*agree strongly*).

**TABLE 2.** Summary of Statistical Tests as Conducted From One-Way ANOVAs and Post Hoc Testing

| Personality measure | Omnibus test | Tukey honestly significant difference post hoc tests | | |
| --- | --- | --- | --- | --- |
| | $F$ test results | Infantry to recruits | Infantry to community | Recruits to community |
| Aggression | | | | |
| Total score | $F(2, 56) = 10.33$, $p < .001$, $\eta_p^2 = .27$ | $p = .03$, $d = -0.80$ | $p = .07$, $d = 0.73$ | $p < .001$, $d = 1.52$ |
| Physical | $F(2, 56) = 21.74$, $p < .001$, $\eta_p^2 = .44$ | $p = .37$, $d = -0.40$ | $p < .001$, $d = 1.76$ | $p < .001$, $d = 1.97$ |
| Verbal | $F(2, 56) = 3.86$, $p = .03$, $\eta_p^2 = .12$ | $p = .27$, $d = -0.48$ | $p = .33$, $d = 0.46$ | $p = .02$, $d = 0.94$ |
| Anger | $F(2, 56) = 3.23$, $p = .05$, $\eta_p^2 = .10$ | $p = .20$, $d = -0.54$ | $p = .61$, $d = 0.30$ | $p = .04$, $d = 0.82$ |
| Hostility | $F(2, 56) = 7.90$, $p < .001$, $\eta_p^2 = .22$ | $p < .01$, $d = -1.19$ | $p > .99$, $d = -0.02$ | $p < .01$, $d = 1.13$ |
| Impulsivity | | | | |
| Attentional | $F(2, 59) = 2.75$, $p = .07$, $\eta_p^2 = .09$ | $p = .12$, $d = -0.79$ | $p = .13$, $d = -0.54$ | $p = .99$, $d = 0.03$ |
| Motor | $F(2, 59) = 2.63$, $p = .08$, $\eta_p^2 = .08$ | $p = .23$, $d = -0.52$ | $p = .77$, $d = 0.21$ | $p = .07$, $d = 0.70$ |
| Nonplanning | $F(2, 59) = 1.03$, $p = .36$, $\eta_p^2 = .03$ | $p = .67$, $d = -0.28$ | $p = .79$, $d = 0.21$ | $p = .33$, $d = 0.42$ |
| Big Five traits | | | | |
| Neuroticism | $F(2, 59) = 4.09$, $p = .02$, $\eta_p^2 = .12$ | $p = .03$, $d = -0.88$ | $p = .10$, $d = -0.66$ | $p = .80$, $d = 0.18$ |
| Extraversion | $F(2, 59) = 0.08$, $p = .92$, $\eta_p^2 < .01$ | $p = .96$, $d = 0.10$ | $p = .99$, $d = -0.04$ | $p = .92$, $d = -0.13$ |
| Openness | $F(2, 59) = 3.55$, $p = .04$, $\eta_p^2 = .11$ | $p = .09$, $d = -0.72$ | $p = .06$, $d = -0.70$ | $p = .99$, $d = -0.03$ |
| Agreeableness | $F(2, 59) = 0.58$, $p = .56$, $\eta_p^2 = .02$ | $p = .72$, $d = 0.26$ | $p = .95$, $d = -0.09$ | $p = .55$, $d = -0.34$ |
| Conscientiousness | $F(2, 59) = 0.29$, $p = .75$, $\eta_p^2 = .01$ | $p = .77$, $d = 0.22$ | $p = .82$, $d = 0.18$ | $p = .99$, $d = -0.03$ |

than the community sample through total score and physical aggression, although there were no significant differences between combat-trained infantry and the community sample on verbal aggression, anger, or hostility. Thus, the difference seems to be driven largely by the physical aggression subscale. Recruit trainees seem responsible for driving the other significant effects, although it should be noted that this sample represented a younger population than either the combat-trained infantry or the community sample. For the community sample, there were no observed differences between men and women on any measure of aggression ($p$s > .50). This lack of differences might be due to the small sample size. There were no women in the military samples, so no gender comparisons were possible.

*Impulsivity*
See Tables 1 and 2 for descriptive statistics and statistical analyses, respectively. The one-way ANOVAs

did not produce a significant difference on either the attentional impulsivity subscale, the motor impulsivity subscale, or the nonplanning impulsivity subscale.

### Big Five Traits

See Tables 1 and 2 for descriptive statistics and statistical analyses, respectively. There were significant differences between the groups on neuroticism and openness. Regarding neuroticism, combat-trained infantry reported less neuroticism than either the recruit trainees or the community sample. Regarding openness, combat-trained infantry reported significantly less openness than either the recruit trainees or the community sample. The omnibus tests for extraversion, agreeableness, and conscientiousness did not produce any group differences.

### Military Training and Threat Perception

To assess whether military training influenced threat perception, the first analysis was done for the dependent variable of threat assessment on the 1–9 Likert-type scale during the threat rating task. A $3 \times 3$ mixed model ANOVA was conducted with the between-subjects dimension of military training (combat-trained infantry, recently trained military service members, community sample) and the within-subject dimension of threat rating by category in the threat assessment task (clear threat, ambiguous threat, clear nonthreat). See Table 3 for descriptive statistics.

There was no significant main effect of military training on threat perception ratings, $F(2, 58) = 1.18$, $p = .32$, $\eta_p^2 = .04$. There was a significant main effect of threat category, $F(2, 116) = 1,313.77$, $p < .001$, $\eta_p^2 = .96$. Clear threats (mean = 8.65, $SD = 0.46$) were rated as more threatening than ambiguous threats (mean = 3.79, $SD = 1.26$), $t(60) = 30.89$, $p < .001$, Cohen's $d = 5.14$, and ambiguous threats were rated as more threatening than clear nonthreats (mean = 1.55, $SD = 0.59$), $t(60) = 14.74$, $p < .001$, Cohen's $d = 2.28$. The interaction between military training and threat responses by category was nonsignificant, $F(4, 116) = 0.41$, $p = .80$, $\eta_p^2 = .01$.

### Military Training and Threat Response

To assess whether military training influenced a behavioral response after a threat assessment, another analysis was done for the dependent variable of response rate, as collected from responses in the threat response task (i.e., go/no-go, or threat/nonthreat). A $3 \times 3$ mixed model ANOVA was conducted with the between-subject dimension of military training (combat-trained infantry, recently trained military service members, community sample) and the within-subject dimension of threat responses by category in the threat/nonthreat task (clear threat, ambiguous threat, clear nonthreat). There was no significant main effect of military training on response rate, $F(2, 58) = 1.11$, $p = .34$, $\eta_p^2 = .04$. There was a significant

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**TABLE 3.** Average Response Rate to Identify an Image as a Threat and Subjective Threat Rating

| Image type | Sample | | |
| --- | --- | --- | --- |
| | **Combat infantry** | **Recruit trainees** | **Civilian community** |
| Clear threat | | | |
|     Response rate | 98.38% (2.58%) | 96.93% (4.33%) | 96.78% (4.37%) |
|     Threat rating | 8.69 (0.38) | 8.73 (0.27) | 8.54 (0.65) |
| Ambiguous threat | | | |
|     Response rate | 39.81% (23.17%) | 29.54% (21.80%) | 34.44% (21.41%) |
|     Threat rating | 3.99 (1.19) | 3.75 (1.39) | 3.59 (1.23) |
| Clear nonthreat | | | |
|     Response rate | 2.45% (2.87%) | 3.01% (2.99%) | 2.94% (4.02%) |
|     Threat rating | 1.71 (0.54) | 1.40 (0.55) | 1.49 (0.67) |

*Note.* Threat ratings range from 1 (*least threatening*) to 9 (*most threatening*). Standard deviations in parentheses.

main effect of threat category, $F(2, 116) = 851.73$, $p < .001$, $\eta_p^2 = .94$. Clear threats (mean = 97.45%, $SD$ = 3.76%) were responded to as threats more often than ambiguous threats (mean = 35.19%, $SD$ = 22.26%), $t(60) = 22.39$, $p < .001$, Cohen's $d$ = 3.90, and ambiguous threats were responded to as threats more often than clear nonthreats (mean = 2.77%, $SD$ = 3.27%), $t(60) = 11.62$, $p < .001$, Cohen's $d$ = 2.04. The interaction between military training and threat responses by category was nonsignificant, $F(4, 116) = 1.04$, $p = .39$, $\eta_p^2 = .04$.

Even when we conducted another $3 \times 3$ mixed model ANOVA for behavioral response with the between-subject dimension of military training (combat-trained infantry, recently training military service members, community sample) and the within-subject dimension of specific ambiguous threat (one hand behind back, hands low near holstered gun, hands low near holstered cell phone), the results were nearly identical. There was no significant main effect of military training on response rate, $F(2, 58) = 1.08$, $p = .35$, $\eta_p^2 = .04$. There was a significant main effect of ambiguous stimulus type, $F(2, 116) = 91.72$, $p < .001$, $\eta_p^2 = .61$. One-hand-behind-the-back images were responded to as threats most often (mean = 68.31%, $SD$ = 37.80%) and significantly more often than images with hands low near a holstered gun (mean = 30.16%, $SD$ = 33.88%), $t(60) = 7.31$, $p < .001$, Cohen's $d$ = 1.06. Also, the images with an actor's hands low near a holstered gun were responded to as threats more often than the images with an actor's hands low near a holstered cell phone (mean = 7.10%, $SD$ = 11.41%), $t(60) = 6.47$, $p < .001$, Cohen's $d$ = 0.91. The interaction between military training and threat responses by category was nonsignificant, $F(4, 116) = 0.78$, $p = .54$, $\eta_p^2 = .03$.

### Predicting Behavioral Responses with Personality and Perception

The critical outcome for any lethal force decision is the behavioral response, which is why response rate—or the percentage of trials where the participant identified the image as a threat—was the key dependent variable. To examine the influence of personality on threat response, hierarchical linear regressions were conducted with personality variables as possible predictors. Each model analyzed the data with the following two steps: Step 1 included the personality metrics, and Step 2 included threat perception (average individual rating for the given image category) as well as stimulus category (clear threat, ambiguous, clear nonthreat). The purpose of this analysis is to explore the relative influence of perceptual factors when controlling for personality traits. The first step will identify the role of personality-based factors in determining whether the participant responded to the stimulus as a threat, and the second step will identify the role of perceptual factors in determining threat above and beyond the influence of personality.

### Aggression

Measures from the four aggression subscales (physical, verbal, anger, and hostility) were entered first, followed by the perception-related variables (threat rating and stimulus category). Aggression-based indicators did not significantly explain the variance in threat response, Step 1 (aggression) $\Delta$ Adj. $R^2$ = .004, $F(4, 160) = 0.164$, $p = .956$, although perception-based indicators did explain a significant portion of the variance, Step 2 (rating and category) $\Delta$ Adj. $R^2$ = .911, $F(2, 158) = 850.79$, $p < .001$.

### Impulsivity

Measures from the three impulsivity subscales (attentional, motor, and nonplanning) were entered first, followed by the perception-related variables (threat rating and stimulus category). Impulsivity-based indicators did not significantly explain the variance in threat response, Step 1 (impulsivity) $\Delta$ Adj. $R^2$ = .001, $F(3, 170) = 0.084$, $p = .969$, although perception-based indicators did explain a significant portion of the variance, Step 2 (rating and category) $\Delta$ Adj. $R^2$ = .92, $F(2, 168) = 937.83$, $p < .001$.

### Big Five Traits

Measures from the five personality subscales (neuroticism, extraversion, openness, agreeableness, and conscientiousness) were entered first, followed by the perception-related variables (threat rating and stimulus category). Trait-based indicators did not significantly explain the variance in threat response, Step 1 (personality) $\Delta$ Adj. $R^2$ = .003, $F(5, 168) = 0.095$, $p = .993$, although perception-based indicators did explain a significant portion of the variance, Step 2 (rating and category) $\Delta$ Adj. $R^2$ = .913, $F(2, 166) = 895.83$, $p < .001$.

*Bayes Factor Analyses*

The preliminary personality analyses did not identify any significant relationship between personality traits and threat response. Given the small sample size for personality analyses, Bayes factor (BF) analyses were conducted with a Bayes factor calculator (http://pcl.missouri.edu/bayesfactor; Liang, Paulo, Molina, Clyde, & Berger, 2008; Rouder & Morey, 2012) (Table 4). Analyses were conducted with a combination of short-form and long-form data. Short-form data analyses conducted regressions with only stimuli from the particular stimulus set (clear threat, ambiguous, or clear nonthreat) with the set of personality predictors. Individual predictor variables were measured for their relative contribution to the variance explained with and without the factor in the model. For example, variance explained was compared between a full impulsivity model (attentional, motor, and nonplanning) and a model without attentional components (motor and nonplanning only). BFs were calculated from the resulting change in variance

explained. These analyses were also conducted in long form, where all stimuli were used in the analyses and each participant contributed three measures to the dataset (clear threat, ambiguous, and clear nonthreat).

BFs can be broadly interpreted as providing variable evidence for the null hypothesis when the value is less than 1.00, variable evidence for the alternative hypothesis when the value is greater than 1.00, and no evidence for either when equal to 1.00 (Wetzels et al., 2011). For the null hypothesis, anything between one third and one would be considered anecdotal evidence with the strength of evidence increasing below a BF value of 0.33. One factor emerged as anecdotal evidence for the influence of personality on threat response (verbal aggression for ambiguous stimuli; BF = 1.73), and one factor emerged with arguably no evidence for either the null or alternative hypotheses (nonplanning for clear threat stimuli, BF = 1.03). For the remaining factors, 58% (28 factors) provided at least moderate support for the null hypothesis with

**TABLE 4.** Bayes Factors for the Relationship Between Various Personality Indices and Threat Response Rate for the Given Stimuli

| Image type | Stimulus set | | | |
|---|---|---|---|---|
| | All images | Clear threat | Ambiguous | Clear nonthreat |
| Aggression | | | | |
| Physical | 0.17 | 0.34 | 0.28 | 0.50 |
| Verbal | 0.21 | 0.29 | 1.73 | 0.63 |
| Anger | 0.20 | 0.35 | 0.68 | 0.27 |
| Hostility | 0.17 | 0.29 | 0.28 | 0.27 |
| Impulsivity | | | | |
| Attentional | 0.17 | 0.27 | 0.27 | 0.27 |
| Motor | 0.18 | 0.32 | 0.63 | 0.27 |
| Nonplanning | 0.17 | 1.03 | 0.35 | 0.98 |
| Big Five traits | | | | |
| Neuroticism | 0.17 | 0.27 | 0.30 | 0.71 |
| Extraversion | 0.17 | 0.34 | 0.47 | 0.60 |
| Openness | 0.18 | 0.34 | 0.38 | 0.89 |
| Agreeableness | 0.18 | 0.29 | 0.53 | 0.43 |
| Conscientiousness | 0.17 | 0.47 | 0.27 | 0.31 |

*Note.* Results were analyzed with short-form data for individual stimulus types (one per participant) and long-form data for all images (data included an entry from each participant for clear threat images, ambiguous images, and clear nonthreat images). Bayes factors were determined based on the contribution of the relative factor to the regression model by comparison of the $R^2$ value with and without the variable in question.

BF values less than 0.33, and 38% (18 factors) provided anecdotal support for the null hypothesis with BF values between 0.33 and 1.00. These data suggest that the majority of evidence moderately supports no influence on threat responses due to personality, and the remaining evidence largely supports anecdotal evidence of no influence. The combined evidence thus offers varying degrees of support for the null hypothesis. However, across all 48 analyses, there was no support for the alternative hypothesis, which in this case is that personality had an influence on threat response.

It should be noted that the most relevant stimuli for this analysis are the ambiguous stimuli. Other nonambiguous images provided a clear threat or clear nonthreat interpretation that leaves little room for subjective influence due to individual differences. Limiting the scope of BF analyses only to the ambiguous stimuli would shift the interpretation slightly. For the ambiguous stimuli, six of the 12 factors provide only anecdotal evidence in favor of the null hypothesis, and five factors provide moderate evidence for the null hypothesis. Although they are primarily anecdotal evidence, these findings are notable in that the evidence supporting the null hypothesis (i.e., no influence of personality on threat response) was stronger for clear threat and clear nonthreat stimuli than for ambiguous stimuli.

*Predicting Threat Perception with Personality*

Additional analyses were conducted to confirm the apparent lack of influence for any of the personality variables sampled here. Correlations were conducted between the Likert-type threat rating and the 12 different subscales measured here for aggression, impulsivity, and Big Five traits. Analyses were conducted with both short-form data, where the correlation was limited to specific category (clearly threatening, ambiguous, clearly nonthreatening), and long-form data, where each participant could contribute up to 15 data points (one average subjective rating for each stimulus posture) to the analysis as a correlation between personality and Likert-type rating for the category. The short-form data provided a controlled relationship for threat perception within a categorical range of stimuli, whereas the long-form data provided some insight into the omnibus effect with higher statistical power.

For the short-form analyses, two of the 36 correlations were statistically significant. Higher openness scores were related to higher threat ratings for ambiguous stimuli, $r(56) = .26$, $p = .05$, and higher verbal aggression scores were related to higher threat ratings for ambiguous stimuli, $r(53) = .27$, $p = .05$. However, neither outcome would be significant once we accounted for multiple comparisons with the Bonferroni method, as the adjusted alpha level for significance would be .0014 ($\alpha = .05/36 = .0014$). This result was confirmed for the omnibus analyses averaged across all image types and for those conducted by stimulus category (clear threat, ambiguous, or clear nonthreat).

For the long-form analyses, none of the 12 correlations between Likert-type threat rating and personality subscales were significant—even before Bonferroni correction. It is possible this lack of correlation is due to the postures themselves: 12 of the 15 postures fell into either the clearly threatening or clearly nonthreatening categories. This approach could limit variability in threat ratings by anchoring the data too heavily at both ends of the Likert-type scale. To address this possibility, an additional long-form analysis was conducted solely on the ambiguous stimuli, for which threat ratings varied more. Participant threat ratings for each of the three ambiguous postures (one hand behind back, hands low near gun, hands low near cell phone) were entered into a correlational analysis with the 12 personality variables. Three correlations were initially significant with this analysis: Higher verbal aggression correlated with higher threat ratings, $r(171) = .15$, $p = .04$; higher extraversion scores correlated with higher threat ratings, $r(180) = .15$, $p = .05$; and higher openness scores correlated with higher threat ratings, $r(180) = .18$, $p = .01$. Once again, however, these initially significant correlations would not be significant after a Bonferroni correction for multiple correlations, as the adjusted alpha level would be .0042 ($\alpha = .05/12 = .0042$).

Additional analyses were conducted on the RTs to make either a behavioral response or a threat rating. As with the Likert-type threat ratings, none of the correlational analyses would be significant after Bonferroni corrections for multiple comparisons. Several were significant before correction if the analyses were limited only to ambiguous stimuli, which again paral-

lels the findings observed from the Likert-type threat ratings.

*Exploring an Indirect Relationship Between Personality, Threat Rating, and Threat Response*

It is possible that the relationship between personality, threat perception, and threat response is not a direct relationship but rather a mediated one where personality indirectly affects behavioral response. Mediation analyses were conducted separately for all personality subscales with the personality variable in question, threat perception, and the behavioral response. These analyses were limited to the ambiguous threat images, which provided inherent ambiguity in the threat perception and the only suggestion of a relationship between personality and threat rating in the correlational analyses. Twelve mediator models were analyzed for the relationship between personality and behavioral response with the indirect relationship of threat rating. Even in this context, none of the personality metrics produced a significant relationship with behavioral threat response, either directly or indirectly. Results from the mediation analyses with overall Buss–Perry Aggression Questionnaire aggression score are provided for illustration of the consistent null outcome.

Mediation analyses were used to evaluate the direct and indirect role of overall aggression on threat perception and behavioral response. Results indicated that aggression was not a significant predictor of threat rating ($B$ = .004, $t$ = 0.50, $p$ = .62, 95% confidence interval [CI] = [−.013, .021]), but that threat rating was a significant predictor of response rate ($B$ = .107, $t$ = 4.89, $p$ < .001, CI = [.063, .151]). Aggression was not a significant predictor of response rate after we controlled for the mediator, threat rating ($B$ = −.000, $t$ = 0.16, $p$ = .88, CI = [−.003, .003]). Ap-

proximately 32% of the variance in response rate was accounted for by the predictors ($R^2$ = .32, $p$ < .001). The indirect effect was tested via a percentile bootstrap estimation, although the results indicated that the indirect coefficient was not significant ($B$ = .001, SE = .001, CI = [−.001, .002]). The combined results indicate that neither threat rating nor the eventual threat response was influenced by aggression (Figure 2).

## DISCUSSION

The current study compared perception-based and personality-based factors as influences on a threat response in a lethal force decision. Threat rating, a cognitive and quantifiable metric for holistic threat assessment, was highly related to a threat response across all stimuli. However, there was no evidence that personality metrics had any influence on the threat response, nor was personality related to the threat perception; military experience, aggression, impulsivity, and the Big Five traits were all unrelated to threat metrics. The combined evidence thus suggests that perception-based factors strongly dominate personality-based differences in lethal force decisions.

One important issue is that our dependent variables addressed threat perception and a go/no-go proxy for a shoot/don't-shoot response. However, we may have found a different influence if our outcome measures were more nuanced than a simple binary threat/nonthreat outcome. For example, use-of-force continuums teach different intervention strategies based on the scenario and include nonlethal options (Terrill & Paoline, 2013). It is possible that certain personality factors do not affect perception of threat or threat identification procedures but might affect
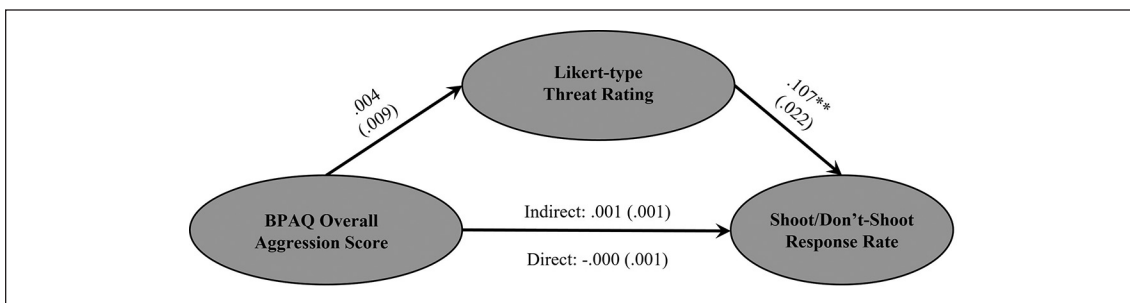


**FIGURE 2.** Average identity development by sex and avatar usage

the behavioral response. This possibility would be demonstrated by an aggressive person showing no difference in their relative threat assessment yet selecting a more extreme option along a use-of-force continuum than a less aggressive person. Nuanced behavioral responses represent an important extension of this work that might demonstrate a role for personality factors in lethal force even if they do not alter threat perception, although this possibility remains speculative and warrants future research.

The most obvious weakness of this study is the sample size and associated statistical power concerns. Some effects would have been statistically significant if given a larger sample size. For example, the correlation between physical aggression and threat perception was statistically nonsignificant for all participant ratings of all individual image postures, $r(867) = .03, p = .44$, and for aggregated scores across images within the categories of clearly threatening, $r(53) = .20, p = .14$; ambiguous, $r(53) = .17, p = .23$; and clearly nonthreatening, $r(53) = .17, p = .23$. The largest effects could become statistically significant with twice the sample size, indicating a relationship between physical aggression and threat ratings for clearly threatening or ambiguous stimulus. However, this example also highlights the problem in focusing on statistical significance for an applied effect. A larger sample size would produce this statistically significant outcome, but there would still be no relationship between physical aggression and behavioral response in a shoot/don't-shoot (go/no-go) equivalent task (effect size observed here, $r(53) = .06, p = .66$) without a sample 16 times larger. The problem becomes further compounded if the analyses in question were a partial correlation between physical aggression and threat response while controlling for threat rating with ambiguous stimuli. Given the effect size observed here, $r(53) = -.003, p = .98$, the effect would not be significant without many tens of thousands of participants contributing to the results.

When we consider sample size and statistical power, there is a related concern about the value of a "significant" effect (cf. Funder & Ozer, 2019). That is, does a statistically significant effect have any practical significance? A significant correlation between threat perception and aggressive personality traits has limited value if those traits do not cause the person to make a lethal force error in a scenario of

ambiguous decision making. A separate possibility would be whether an aggressive personality becomes predisposed to excessive use of force after identifying someone as a threat, but this possibility would distinguish between the identification of a threat and the actual application of force on an identified threat. The underlying problem here is the debate about whether to assign a causal attribution based on the evidence, accept the null hypothesis, or dismiss the finding as statistically underpowered. All three options focus on the statistical significance of an effect without questioning the practical value of the finding.

Instead, consider a selection and assessment scenario where instructors are trying to identify the best military or law enforcement candidates based on personality surveys. The interpretations here suggest three possible outcomes: Aggression can lead candidates to rate people as more threatening, aggression has no impact on behavioral response to threat in a binary threat/nonthreat or shoot/don't-shoot classification, or aggression leads to an overuse of force after identifying a threat. The first possibility could lead to candidates being dismissed from service if they are perceived as seeing threats where there are none. This outcome could be possible if the sample size in this study is doubled, resulting in a statistically significant relationship between threat ratings and physical aggression. However, it would be a poor practical choice given the second possibility: that aggression has no impact on the behavioral threat/nonthreat classification that would prompt someone to action. In this case, aggressive people might rate or perceive someone as threatening, but this perception would not produce a change in the threat/nonthreat classification and therefore should not affect selection, assessment, or training. These very different interpretations should also be contrasted with the third possibility: Aggressive people might be predisposed to using excessive force. Although this possibility is merely speculation requiring future research, it would again warrant using personality indices of aggression in selection and assessment. All three interpretations would alter how to best use the findings here to a practical purpose. Moreover, they fail to ask the most critical question: Is the effect size large enough to even warrant a "select out" decision? Eliminating candidates based on survey results that might explain less than 1% of the variance would not

be a practical solution and would probably not be a legally defensible practice.

An alternative course of action would be to consider the results from the viewpoint of clinical or practical significance rather than statistical significance. One such approach asks three questions of any finding to identify practical significance (Biggs & Littlejohn, 2022). First, is the effect real? Second, is the effect robust? Third, is the effect relevant? Optimal practical applications should answer all three questions in turn, and a failure to address any issue should highlight a weakness of the proposed application. For example, a statistically significant effect ($p$ = .001) might explain a relationship between use of force and personality indices, making it both real and relevant. Still, if the effect is not robust ($R^2$ = .02), then there is a question as to how the finding should be implemented in practice. The potential application might be considered a tie-breaker if all other effects were considered equal. A larger concern would be overapplication of the results simply because the effect is "statistically significant." It is often simpler to use statistical significance as a separating factor because there is often a significant/nonsignificant determination. Identifying the practical consequences of these findings generally requires more qualitative description and discussion that allows subjective interpretations to play a disproportionately large role. For the purposes of this discussion, the takeaway is that practical significance must supersede statistical significance for any law enforcement or military application. Although we acknowledge the limitations due to low statistical power, we would argue that the findings of this study provide sufficient evidence demonstrating that personality indices do not have a robust impact on threat perception or threat response when the main manipulations involve weapon presence and posture.

Still, the issue of practical significance raises multiple concerns about differentiating statistical significance from a "meaningful" effect. Small effects could still have practical, albeit short-lived value when appropriately consistent (Funder & Ozer, 2019). One challenge thus becomes differentiating an effect with limited practical value given a small effect size and a truly null outcome that has no impact on the situation. This challenge can be addressed via the BF analyses as demonstrated here and elsewhere (Jarosz

& Wiley, 2014; Lee & Wagenmakers, 2014; Raftery, 1995). These approaches provide the opportunity to determine whether statistically nonsignificant data are truly representative of supporting the null hypothesis or whether the data analysis simply has insufficient statistical power. BFs provide one method to explore the strength of these null results, but there are other methods that could provide further insight. For example, a region of practical significance (Kruschke, 2018) can be measured as the range of values accepted as a null effect. The parameters can be estimated within a 95% high-density interval on posterior parameter estimates. Its relative value is in dissociating a small but meaningful effect with practical significance and a truly null outcome. Although the data presented here provided varying levels of anecdotal or moderate support for the null hypothesis, these additional methods could be useful in similar situations to determine whether a small effect is truly a small but meaningful outcome or a truly null outcome.

There is a critical point to discuss about why personality did not interact with threat assessments or behavioral responses in this paradigm, especially because other findings suggest there should be some relationship. Prior evidence has demonstrated a relationship between aggressive personalities and related factors such as anger perception (Brennan & Baskin-Sommers, 2020) but no link between factors such as lifetime aggression and gun enthusiasm (Matson, Russell, & King, 2019). For these analyses, the stimuli themselves may have been responsible for failing to find any effect. Actors held either a weapon or cell phone in positions of clear threat or surrender, respectively, for the majority of stimuli. There is little room for interpretation of threat among these stimuli, although there is ample opportunity to explore decision speed and errant threat decisions for nonthreatening stimuli. Instead, ambiguous stimuli provided the best opportunity to see individual differences in threat perception, but these stimuli were ambiguous primarily because of posture. None of the actors displayed emotion, which might be the key to finding a relationship between threat perception and personality. Specifically, different personality factors such as aggression might predispose a person to perceive threats because they process emotions such as anger differently than nonaggressive people, but these dif-

ferences would not be readily apparent with stimuli that evoke threat perception through weapon presence and posture. Alternatively, rules of engagement are likely to play a larger role in threat assessment under these circumstances, and those individual differences would be affected more by experience than personality. This interpretation also aligns with other evidence in specialized police units that experience is more important than personality at determining effective performance under pressure (Landman et al., 2016).

Several limitations should be noted with this study, largely because of the paradigm. Foremost, participants did not hold or use a weapon during their threat ratings or threat responses. Although marksmanship would obfuscate any relationship between cognitive factors and the eventual threat response, holding a firearm could affect the process in other ways. For example, holding a gun creates a bias to see a gun in the hands of others (Witt & Brockmole, 2012; Witt, Parnes, & Tenhundfeld, 2020), pointing a weapon alters attentional biases in scene viewing (Biggs, Brockmole & Witt, 2013), the weapon type interacts with cognitive abilities (Biggs, 2017), and anger could lead to neutral objects being misidentified as weapons (Baumann & DeSteno, 2010). Any similar finding could affect the decision and bias a response, such as biasing the person to perceive a gun when one is not present and make a threat response. Another issue concerns general attentional biases. Trained warfighters may deploy cognitive resources differently than others by focusing on targets with greater threat potential (Paulus et al., 2010), but the present paradigm specifically reduced the potential for biases in threat processing by limiting stimuli to a single actor displayed one at a time. Any realistic lethal force event will integrate myriad complex factors, not the least of which is multiple stimuli competing for attention that would depend on relative attentional biases to determine processing priority. In turn, a threat assessment could be altered by the order in which stimuli were attended or the relative time spent on them, but this possibility could not be explored here. The combined limitations are a by-product of isolating the threat assessment and threat response components to explore the influence of cognitive factors and personality in the absence of these competing factors. Additional work is needed

to explore these additional influences in greater detail.

These findings need to be consolidated with existing evidence that attentional biases underscore cognitive processing for threatening stimuli. For example, attention is drawn automatically to fear-inducing stimuli or learned threats (Carlson, Fee, & Reinke, 2009; Fox et al., 2007; LoBue & DeLoache, 2008; Öhman, Flykt, & Esteves, 2001; Öhman & Mineka, 2003; Soares, Lindström, Esteves, & Öhman, 2014; Zsido et al., 2019), but these threat responses can develop as part of learned activities or associations requiring frontal lobe activity (Coelho & Purkis, 2009; Sakaki, Niki, & Mather, 2012). Attentional biases may tap into automatic cognitive processes, yet these processes stem from an inherent understanding that a given stimulus is threatening. If the relative threat is ambiguous, as with the one-hand-behind-the-back images, the relationship is not as clear-cut and allows potential postperceptual processing to guide threat assessments. Moreover, attentional biases provide a mechanism by which training could affect threat assessments. Attentional bias training has already been used as a successful treatment for anxiety (Bar-Haim, 2010; Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van Ijzendoorn, 2007; Hakamata et al., 2010), and anxiety is another factor known to influence attentional biases (Bar-Haim, Lamy, & Glickman, 2005; Shechner et al., 2012). Applying these same principles to lethal force training could provide a mechanism to instill rules of engagement, thereby facilitating faster and more accurate performance in lethal force decision making. Moreover, these novel training methods should apply universally, because personality does not seem to have a major impact on threat assessment beyond racial prejudices. Although different personality types might respond better or worse to a proposed training regimen, it seems likely that anyone would be able to take advantage of cognitive training methods for military or law enforcement applications (for further discussion, see Blacker, Hamilton, Roush, Pettijohn, & Biggs, 2019).

In summary, lethal force decisions require holistic image processing where aggregate information from multiple sources contributes to a threat assessment and ultimately a threat response. Cognitive factors seem to play an exceptionally large role in threat assessment, whereas personality metrics appear to play

a minor role. These differences speak to the malleability of a lethal force decision and the need for more complex training techniques that specifically alter the type of decision made in the field. Likewise, it is interesting that threat assessments and threat responses were nearly identical across all personnel, despite controlling for military experience. This latter finding suggests that current training methods, while addressing many factors, are not directly altering threat perception. Novel training methods will be needed to address threat perception training and all future—hopefully successful—interactions between the civilian population and military or law enforcement personnel.

*NOTES*

*REFERENCES*

Archer, J. (2004). Sex differences in aggression in real-world settings: A meta-analytic review. *Review of General Psychology, 8,* 291–322.

Archer, J., & Thanzami, V. (2007). The relation between physical aggression, size and strength, among a sample of young Indian men. *Personality and Individual Differences, 43,* 627–633.

Archer, J., & Thanzami, V. (2009). The relation between mate value, entitlement, physical aggression, size and strength among a sample of young Indian men. *Evolution and Human Behavior, 30,* 315–321.

Bar-Haim, Y. (2010). Research review: Attention bias modification (ABM): A novel treatment for anxiety disorders. *Journal of Child Psychology and Psychiatry, 51,* 859–870.

Bar-Haim, Y., Lamy, D., & Glickman, S. (2005). Attentional bias in anxiety: A behavioral and ERP study. *Brain and Cognition, 59,* 11–22.

Bar-Haim, Y., Lamy, D., Pergamin, L., Bakermans-Kranenburg, M. J., & Van Ijzendoorn, M. H. (2007). Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. *Psychological Bulletin, 133,* 1–24.

Baumann, J., & DeSteno, D. (2010). Emotion guided threat detection: Expecting guns where there are none. *Journal of Personality and Social Psychology, 99,* 595–610.

Benet-Martinez, V., & John, O. P. (1998). Los Cinco Grandes across cultures and ethnic groups: Multitrait multimethod analyses of the Big Five in Spanish and English. *Journal of Personality and Social Psychology, 75,* 729–750.

Biggs, A. T. (2017). How many bullets do you need? Contrasting and comparing behavioral outcomes and cognitive abilities when using a semiautomatic versus automatic firearm. *American Journal of Psychology, 130,* 439–453.

Biggs, A. T., Brockmole, J. R., & Witt, J. K. (2013). Armed and attentive: Holding a weapon can bias attentional priorities in scene viewing. *Attention, Perception, & Psychophysics, 75,* 1715–1724.

Biggs, A. T., Cain, M. S., & Mitroff, S. R. (2015). Cognitive training can reduce civilian casualties in a simulated shooting environment. *Psychological Science, 26,* 1164–1176.

Biggs, A. T., & Littlejohn, L. F. (2022). Looking for more than hot air: How experimental design can enhance clinical evidence for hyperbaric oxygen therapy. *Medical Gas Research.*

Biggs, A. T., Pettijohn, K. A., & Gardony, A. (2021). When the response does not match the threat: The relationship between threat assessment and behavioral response in ambiguous lethal force decision-making. *Quarterly Journal of Experimental Psychology,* 1747021820985819.

Biggs, A. T., Pistone, D., Riggenbach, M., Hamilton, J. A., & Blacker, K. J. (2021). How unintentional cues can bias threat assessments during shoot/don't-shoot simulations. *Applied Ergonomics, 95,* 103451.

Björkqvist, K., Österman, K., & Lagerspetz, K. M. (1994). Sex differences in covert aggression among adults. *Aggressive Behavior, 20,* 27–33.

Blacker, K. J., Hamilton, J., Roush, G., Pettijohn, K. A., & Biggs, A. T. (2019). Cognitive training for military application: A review of the literature and practical guide. *Journal of Cognitive Enhancement, 3,* 30–51.

Blacker, K. J., Pettijohn, K. A., Roush, G., & Biggs, A. T. (2021). Measuring lethal force performance in the lab: The effects of simulator realism and participant experience. *Human Factors, 63(7),* 1141–1155.

Brainard, D. H. (1997). The psychophysics toolbox. *Spat Vis, 10*(4), 433–436. http://www.ncbi.nlm.nih.gov/pubmed/9176952

Brennan, G. M., & Baskin-Sommers, A. R. (2020). Aggressive realism: More efficient processing of anger in physically aggressive individuals. *Psychological Science, 31,* 568–581.

Brosch, T., Pourtois, G., & Sander, D. (2010). The perception and categorisation of emotional stimuli: A review. *Cognition and Emotion, 24,* 377–400.

Buss, A. H., & Perry, M. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology, 63,* 452–459.

Carlson, J. M., Fee, A. L., & Reinke, K. S. (2009). Backward masked snakes and guns modulate spatial attention. *Evolutionary Psychology, 7,* 534–544.

Coelho, C. M., & Purkis, H. (2009). The origins of specific phobias: Influential theories and current perspectives. *Review of General Psychology, 13, 335–348.*

Correll, J., Hudson, S. M., Guillermo, S., & Ma, D. S. (2014). The police officer's dilemma: A decade of research on racial bias in the decision to shoot. *Social & Personality Psychology Compass, 8,* 201–213.

Correll, J., Park, B., Judd, C. M., & Wittenbrink, B. (2002). The police officer's dilemma: Using ethnicity to disambiguate potentially threatening individuals. *Journal of Personality and Social Psychology, 83,* 1314–1329.

Correll, J., Park, B., Judd, C. M., Wittenbrink, B., Sadler, M. S., & Keesee, T. (2007). Across the thin blue line: Police officers and racial bias in the decision to shoot. *Journal of Personality and Social Psychology, 92,* 1006–1023.

Correll, J., Urland, G. R., & Ito, T. A. (2006). Event-related potentials and the decision to shoot: The role of threat perception and cognitive control. *Journal of Experimental Social Psychology, 42,* 120–128.

Crawford, T. N., Shaver, P. R., Cohen, P., Pilkonis, P. A., Gillath, O., & Kasen, S. (2006). Self-reported attachment, interpersonal aggression, and personality disorder in a prospective community sample of adolescents and adults. *Journal of Personality Disorders, 20,* 331–351.

Denson, T. F., Pedersen, W. C., Ronquillo, J., & Nandy, A. S. (2009). The angry brain: Neural correlates of anger, angry rumination, and aggressive personality. *Journal of Cognitive Neuroscience, 21,* 734–744.

DeWall, C. N., Anderson, C. A., & Bushman, B. J. (2011). The general aggression model: Theoretical extensions to violence. *Psychology of Violence, 1,* 245.

Fox, E., Griggs, L., & Mouchlianitis, E. (2007). The detection of fear-relevant stimuli: Are guns noticed as quickly as snakes? *Emotion, 7,* 691–696.

Funder, D. C., & Ozer, D. J. (2019). Evaluating effect size in psychological research: Sense and nonsense. *Advances in Methods and Practices in Psychological Science, 2,* 156–168.

Hakamata, Y., Lissek, S., Bar-Haim, Y., Britton, J. C., Fox, N. A., Leibenluft, E., . . . Pine, D. S. (2010). Attention bias modification treatment: A meta-analysis toward the establishment of novel treatment for anxiety. *Biological Psychiatry, 68,* 982–990.

Hamilton, J. A., Lambert, G., Suss, J., & Biggs, A. T. (2019). Can cognitive training improve shoot/don't-shoot performance? Evidence from live fire exercises. *American Journal of Psychology, 132,* 179–194.

Hansen, C. H., & Hansen, R. D. (1988). Finding the face in the crowd: An anger superiority effect. *Journal of Personality and Social Psychology, 54,* 917–924.

Jackson, J. J., Thoemmes, F., Jonkmann, K., Lüdtke, O., & Trautwein, U. (2012). Military training and personality trait development: Does the military make the man, or does the man make the military? *Psychological Science, 23,* 270–277.

James, L. (2018). The stability of implicit racial bias in police officers. *Police Quarterly, 21,* 30–52.

James, L., James, S. M., & Vila, B. J. (2016). The reverse racism effect: Are cops more hesitant to shoot black than white suspects?. *Criminology & Public Policy, 15,* 457–479.

James, L., Klinger, D., & Vila, B. (2014). Racial and ethnic bias in decisions to shoot seen through a stronger lens: Experimental results from high-fidelity laboratory simulations. *Journal of Experimental Criminology, 10,* 323–340.

James, L., Vila, B., & Daratha, K. (2013). Results from experimental trials testing participant responses to White, Hispanic and Black suspects in high-fidelity deadly force judgment and decision-making simulations. *Journal of Experimental Criminology, 9,* 189–212.

Jarosz, A. F., & Wiley, J. (2014). What are the odds? A practical guide to computing and reporting Bayes factors. *Journal of Problem Solving, 7(1),* 2–9.

Jensen-Campbell, L. A., Knack, J. M., Waldrip, A. M., & Campbell, S. D. (2007). Do Big Five personality traits associated with self-control influence the regulation of anger and aggression? *Journal of Research in Personality, 41,* 403–424.

John, O. P., Donahue, E. M., & Kentle, R. L. (1991). *The Big Five Inventory: Versions 4a and 54.* University of California, Berkeley, Institute of Personality and Social Research.

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative Big-Five trait taxonomy: History, measurement, and conceptual issues. In O. P. John, R. W. Robins, & L.A. Pervin (Eds.), *Handbook of personality: Theory and research* (pp. 114–158). Guilford Press.

John, O. P., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. *Handbook of Personality: Theory and Research, 2,* 102–138.

Kruschke, J. K. (2018). Rejecting or accepting parameter values in Bayesian estimation. *Advances in Methods and Practices in Psychological Science, 1,* 270–280.

Landman, A., Nieuwenhuys, A., & Oudejans, R. R. (2016). The impact of personality traits and professional experience on police officers' shooting performance under pressure. *Ergonomics, 59,* 950–961.

Lee, M. D., & Wagenmakers, E. J. (2014). *Bayesian cognitive modeling: A practical course.* Cambridge University Press.

Liang, F., Paulo, R., Molina, G., Clyde, M. A., & Berger, J. O. (2008). Mixtures of g priors for Bayesian variable selection. *Journal of the American Statistical Association, 103,* 410–423.

Liao, S. W., Price-Sharps, J. L., & Sharps, M. J. (2018). Shoot/no-shoot decisions: Dissociation, judgment, and assailant/weapon characteristics. *Journal of Police and Criminal Psychology, 33,* 209–214.

LoBue, V., & DeLoache, J. S. (2008). Detecting the snake in the grass: Attention to fear-relevant stimuli by adults and young children. *Psychological Science, 19,* 284–289.

Logan, G. D., Schachar, R. J., & Tannock, R. (1997). Impulsivity and inhibitory control. *Psychological Science, 8,* 60–64.

Ma, D. S., & Correll, J. (2011). Target prototypicality moderates racial bias in the decision to shoot. *Journal of Experimental Social Psychology, 47,* 391–396.

Matson, K., Russell, T. D., & King, A. R. (2019). Gun enthusiasm, hypermasculinity, manhood honor, and lifetime aggression. *Journal of Aggression, Maltreatment & Trauma, 28,* 369–383.

Öhman, A., Flykt, A., & Esteves, F. (2001). Emotion drives attention: Detecting the snake in the grass. *Journal of Experimental Psychology: General, 130,* 466–478.

Öhman, A., & Mineka, S. (2003). The malicious serpent: Snakes as a prototypical stimulus for an evolved module of fear. *Current Directions in Psychological Science, 12,* 5–9.

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology, 51,* 768–774.

Paulus, M. P., Simmons, A. N., Fitzpatrick, S. N., Potterat, E. G., Van Orden, K. F., Bauman, J., & Swain, J. L. (2010). Differential brain activation to angry faces by elite warfighters: Neural processing evidence for enhanced threat detection. *PLOS ONE, 5*(4), e10096.

Pelli, D. G. (1997). The VideoToolbox software for visual psychophysics: Transforming numbers into movies. *Spatial Vision, 10,* 437–442. http://www.ncbi.nlm.nih.gov /pubmed/9176953

Plant, E. A., & Peruche, B. M. (2005). The consequences of race for police officers' responses to criminal suspects. *Psychological Science, 16,* 180–183.

Pleskac, T. J., Cesario, J., & Johnson, D. J. (2018). How race affects evidence accumulation during the decision to shoot. *Psychonomic Bulletin & Review, 25,* 1301–1330.

Raftery, A. E. (1995). Bayesian model selection in social research. In P. V. Marsden (Ed.), *Sociological methodology* (pp. 111–196). Blackwell.

Rouder, J. N., & Morey, R. D. (2012). Default Bayes factors for model selection in regression. *Multivariate Behavioral Research, 47,* 877–903.

Sakaki, M., Niki, K., & Mather, M. (2012). Beyond arousal and valence: The importance of the biological versus social relevance of emotional stimuli. *Cognitive, Affective, & Behavioral Neuroscience, 12,* 115–139.

Scribner, D. R. (2016). Predictors of shoot–don't shoot decision-making performance: An examination of cognitive and emotional factors. *Journal of Cognitive Engineering and Decision Making, 10,* 3–13.

Shechner, T., Britton, J. C., Pérez-Edgar, K., Bar-Haim, Y., Ernst, M., Fox, N. A., . . . Pine, D. S. (2012). Attention biases, anxiety, and development: Toward or away from threats or rewards?. *Depression and Anxiety, 29,* 282–294.

Soares, S. C., Lindström, B., Esteves, F., & Öhman, A. (2014). The hidden snake in the grass: superior detection of snakes in challenging attentional conditions. *PLOS ONE, 9*(12), e114724.

Stanford, M. S., Mathias, C. W., Dougherty, D. M., Lake, S. L., Anderson, N. E., & Patton, J. H. (2009). Fifty years of the Barratt Impulsiveness Scale: An update and review. *Personality and Individual Differences, 47,* 385–395.

Suss, J., & Raushel, A. (2019). Wallet or gun? Evaluating factors that affect anticipation ability in a use-of-force scenario. *Journal of Police and Criminal Psychology, 34,* 292–302.

Tedeschi, J. T., & Felson, R. B. (1994). *Violence, aggression, and coercive actions.* American Psychological Association.

Terrill, W., & Paoline, E. A. III. (2013). Examining less lethal force policy and the force continuum: Results from a national use-of-force study. *Police Quarterly, 16,* 38–65.

Toldos, M. P. (2005). Sex and age differences in self-estimated physical, verbal and indirect aggression in Spanish adolescents. *Aggressive Behavior, 31,* 13–23.

Wetzels, R., Matzke, D., Lee, M. D., Rouder, J. N., Iverson, G. J., & Wagenmakers, E. J. (2011). Statistical evidence in experimental psychology: An empirical comparison using 855 t tests. *Perspectives on Psychological Science, 6,* 291–298.

Wilson, K. M., Head, J., De Joux, N. R., Finkbeiner, K. M., & Helton, W. S. (2015). Friendly fire and the sustained attention to response task. *Human Factors, 57,* 1219–1234.

Wilson, K., Head, J., & Helton, W. S. (2013, September). Friendly fire in a simulated firearms task. In *Proceedings of the human factors and ergonomics society annual meeting* (Vol. 57, pp. 1244–1248). SAGE Publications.

Witt, J. K., & Brockmole, J. R. (2012). Action alters object identification: Wielding a gun increases the bias to see guns. *Journal of Experimental Psychology: Human Perception and Performance, 38,* 1159–1167.

Witt, J. K., Parnes, J. E., & Tenhundfeld, N. L. (2020). Wielding a gun increases judgments of others as holding guns: A randomized controlled trial. *Cognitive Research: Principles and Implications, 5*(1), 1–17.

Yiend, J. (2010). The effects of emotion on attention: A review of attentional processing of emotional information. *Cognition & Emotion, 24,* 3–47.

Zsido, A. N., Deak, A., & Bernath, L. (2019). Is a snake scarier than a gun? The ontogenetic–phylogenetic dispute from a new perspective: The role of arousal. *Emotion, 19,* 726–732.