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# Emotional Reactivity and Police Expertise in Use-of-Force Decision-Making

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**Abstract**
Given the vast amount of evidence showing the substantial influence of emotion on decision-making, we examined emotionality—a person's emotional reactivity to a stimulus—in police use-of-force decision-making between a sample of expert ($n=42$) and novice ($n=36$) officers. Officers observed body-worn camera footage and described the course of action they would take, the kinds of information they paid attention to, and their assessment of the situation. Natural language processing techniques were used to detect measures of valence, arousal, and dominance from officer responses. Linear mixed-effects models indicated that responses from experts were more positively valenced, more dominant, and less arousing compared with responses from novices. In other words, the ability to react and assess situations calmly, with a greater sense of control, and less negatively seems to be linked with the production of accurate, effective, and efficient behaviors that mark expert policing. These results shed light on the ways in which expert and novice officers understand and experience stimuli involved in use-of-force decision-making. Practical implications for use-of-force training and future directions are discussed.

**Keywords** Emotional reactivity · Police · Expertise · Use-of-force · Decision-making

## Introduction

Expertise and expert performance have become important components in research assessing police use-of-force decision-making. The literature across a wide variety of domains—including law enforcement—indicates that judgment and decision-making from more experienced individuals tends to be more effective, efficient, and accurate than less experienced individuals in a given domain (Ericsson et al. 1993; Klein et al. 2017; Larrick and Feiler 2015). For instance, police officers with more experience select more appropriate courses of action than less experienced officers, evaluate scenarios differently, and attend to different information (Andersen and Gustafsberg 2016; Di Nota and Huhta 2019; Johnson et al. 2014; Suss and Ward 2018; Vickers and Lewinski 2012; Ward et al. 2011). As such, researchers have sought to understand the specific skills involved in the selection of appropriate use-of-force to produce interventions that facilitate the development of such skills and expertise in law enforcement (e.g., Boulton and Cole 2016; Mangels et al. 2020; Suss and Ward 2018; Ward et al. 2011; Zimmerman 2008).

However, no study to date has examined emotionality—a person's emotional reactivity to a stimulus—in expert use-of-force decision-making despite the large body of research showing the central role of emotion on cognition and behavior (Estes et al. 2012; Forgas 1995; George and Dane 2016; Rowe et al. 2007; Van Kleef 2009; Wray 2020; Zheng et al. 2017), including judgments and decision-making (Schwarz 2000). An individual's emotional reactivity to a particular stimulus provides information regarding *how* they are understanding and thinking about the stimulus (Tausczik and Pennebaker 2010), which can influence their subsequent decisions and behaviors (e.g., Damasio 1994; Greene and Haidt 2002; Kalvin et al. 2016). This is an important addition to the police decision-making literature for several reasons. Previous studies have typically focused on the contents of officer cognition in use-of-force decision-making, rather than how officers are

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construing such contents in use-of-force decision-making. Put another way, previous literature has focused on *what* officers think about rather than *how* they think about (e.g., evaluate) those things. However, individuals who experience the same stimulus can interpret it in very different manners (Paluck and Shafir 2017). A group of officers may notice the exact same cues and stimuli in a given situation, but their subjective evaluation about them may vary. Only assessing the contents of officer cognition disregards the manner by which officers interpret and associate meaning to their environment—factors that shape one's reality and ultimately guide judgment and behavior. How officers react to stimuli provides valuable information about their decision-making process that is often difficult to capture given that such processes can occur without awareness (Keltner and Lerner 2010). Even with awareness, such information would need to be elicited and articulated accurately. As such, emotionality can also provide further insight into the specific skills and cognitive processes that are involved in expert policing.

Most importantly, more research on police use-of-force is clearly needed (e.g., Foster 2020; United States Department of Justice 2020; Wood et al. 2020). Despite the intense scrutiny and the considerable amount of resources that have been directed toward police training in appropriate uses-of-force (Andersen and Gustafsberg 2016), incidents involving questionable use-of-force by police continue to occur. Such incidents can result in death (such as the death of George Floyd in Minneapolis in May 2020) and have "potentially devastating consequences for the police organization, the public, and the relationship between the police and the community" (Brandl et al. 2001, p. 521). Thus, in the current study, we sought to explore emotional reactivity in officer use-of-force decision-making and how it varies as a function of expertise.

In the following sections, we begin with a brief review of the background literature on the cognitive processes involved in expert performance. We then review the ways in which emotions have been found to impact decision-making in general, as well as in law enforcement specifically (pp. 6–7). Next, we describe the current research starting with the hypotheses, followed by the method and results. We then evaluate our overall findings and end with a discussion on the practical implications of use-of-force training and future directions.

## Background Literature

Studies have identified several cognitive processes that are marked by expert performance. For instance, when seeking out information about a situation or environment, expert police officers (compared with novices) provide more concrete and intricate descriptions of events and produce more explanations and predictions about what is happening and what might occur (Zimmerman 2008). Experts can identify and process cues to make plausible inferences at a faster rate, indicating a lower cognitive load during decision-making (Boulton and Cole 2016; Persky and Robinson 2017; Zimmerman 2008). These factors highlight experts' ability to quickly obtain a deep understanding of situations, facilitating more accurate and appropriate judgments. Although these results implicate the breadth and speed of cognition in expert performance, they do not address the emotional component, which reveals *how* individuals are experiencing and making sense of their environment and situations.

A vast body of research has demonstrated that "emotions powerfully, predictably, and pervasively influence decision-making" (Lerner et al. 2015, p. 802). Emotion can bias and override decision-making even when cognitive information suggesting other approaches and actions are present (Loewenstein 1996). Emotions are difficult to disentangle from decision targets (i.e., for whom a given decision is made) once they have already been attributed to such decision targets (Rozin et al. 1986) and can impact subsequent decision-making situations (e.g., Keltner and Lerner 2010; Pham 2007; Vohs et al. 2007; Yates 2007). Because this carryover effect often occurs without awareness, individuals typically do not know exactly what caused their emotion (Quigley and Tedeschi 1996). However, some evidence suggests that individuals with high emotional intelligence can correctly recognize what caused their emotions and thus mitigate the biasing effect of emotion on decision-making (Yip and Côté 2013).

How do emotions have such a substantial influence on decision-making? One explanation argues that specific emotions bring out specific adaptive responses (Frijda 1986). In other words, emotions contain specific *action tendencies* that regulate how individuals respond to situations. Certain dimensions of emotion also shape the way individuals appraise situations. For instance, the experience of certain emotional dimensions may lead individuals to construe a situation as either predictable or unpredictable, thus resulting in low- or high-risk perception respectively (Lerner and Tiedens 2006). Emotion also serves as a guide to understanding other people's mental states and intentions (Van Kleef et al. 2004). Despite the negative and ubiquitous view of emotion's function on rationality and logic (Keltner and Lerner 2010), emotion has been shown to be the primary conductor of decision-making time and again (e.g., Ekman 2007; George and Dane 2016; Keltner et al. 2014; Lazarus and Lazarus 1991; Scherer and Ekman 2014; Wray 2020; Zheng et al. 2017).

Despite the extensive amount of evidence showing the influence of emotion on decision-making, literature on the role of emotions in patrol officers' decision-making is sparse and varied. For instance, there have been recent theoretical contributions that address potential impacts

of emotion, such as stress and fear, on police decision-making (e.g., Fridman et al. 2019; Harman et al. 2019). Research has also assessed the role of anticipated regret and decision-making style on officers' decisions using written vignettes (Brown and Daus 2016). Another approach examined how situational, organizational, and environmental factors affect officers' observed negative emotion states using content analysis of police–citizen interactions extracted from body-worn camera videos (Makin et al. 2019).

The literature investigating the role of emotions in police decision-making has primarily assessed emotions as discrete entities (e.g., anger, fear) rather than as independent dimensions (e.g., valence, affect, dominance). Assessing emotion via multidimensional representations allows for a more accurate and refined method of capturing emotionality, given that emotions are complex and cannot always be easily represented by a single label. Additionally, no study has applied natural language processing (NLP) to assess officers' emotionality during decision-making scenarios, even though NLP has been used to assess officer behavior in other contexts (e.g., respect; see Voigt et al. 2017). NLP methods allow researchers to extract emotionality based on the subject's verbal behavior instead of self-report measures or subjective third-party judgments of emotion. We address these points in the current study.

## The Current Study

We examined how emotionality varies in use-of-force decision-making between expert and novice police officers. We used data from a force de-escalation training project funded by the Bureau of Justice Assistance. In that project, a sample of expert and novice police officers observed police body-worn camera footage and then described the course of action they would take, the kinds of information they paid attention to, and their assessment of the situation. Using NLP techniques that are commonly deployed to automatically detect emotion from text (see Mohammad, 2016, for a summary of the literature), measures of emotionality—specifically valence, arousal, and dominance—were extracted from these descriptions and compared between experts and novices.

In psychological research, emotionality is typically characterized and measured via valence, arousal, and dominance (e.g., Gannouni et al. 2020; Sutton et al. 2019; Szameitat et al. 2011). Valence refers to the level of positivity ("goodness") and negativity ("badness") of a stimulus. Using high-/low-valenced language suggests one's attribution of goodness/badness to a given stimulus. Arousal represents the degree of stimulation, ranging from "calm" to "exciting." Using language that is high/low in arousal suggests that one is experiencing a given stimulus with high/low intensity and stimulation. Dominance represents the degree of control, ranging from "out of control" to "in control." Using language that is high/low in dominance suggests that one is experiencing a high/low degree of control over a given stimulus. Based on the previous literature on emotionality and expertise, we present the following hypotheses:

**Hypothesis 1.** *Responses from expert officers should score higher on valence than responses from novice officers.* Encounters with unfamiliar stimuli are more likely to be perceived as potential threats, because brain structures that are responsible for negatively valenced emotions react more strongly to novel stimuli than familiar stimuli (Abdelmageed et al. 2020; Jagiello et al. 2019; Kiehl et al. 2001; Petrides 2007; Ramsøy et al. 2012; Wright et al. 2003). However, repeated exposure to unfamiliar stimuli can reduce this effect and increase one's inclination to the stimuli via the mere exposure effect across a variety of situations (Bornstein 1989; Montoya et al. 2017; Mungan et al. 2019; Zajonc 1968). By virtue of having more experience on the job, experts have been exposed to a wider variety of situations and stimuli more frequently than novices. As such, experts should process scenarios less negatively (more positively) than novices.

**Hypothesis 2.** *Responses from expert officers should score lower on arousal than responses from novice officers.* Encounters with novel stimuli elicit more arousal than encounters with familiar stimuli (Satpute et al. 2016; Weierich et al. 2010). The amygdala, which plays a key role in emotional processing, has been shown to be reliably reactive to novel stimuli (e.g., Breiter et al. 1996; King and Williams 2017; Wright et al. 2003). However, these heightened arousal levels decrease with repeated exposure to a given stimulus (Yamaguchi et al. 2004). Novices, compared with experts, are more likely to encounter stimuli that they perceive as novel due to their lack of experience on the job. As such, experts should process scenarios more calmly/with less arousal than novices.

**Hypothesis 3.** *Responses from expert officers should score higher on dominance than responses from novice officers.* Having greater breadth and depth of domain knowledge facilitates a greater sense of control and confidence given that more information is available to guide behavior and decision-making (Blair et al. 1999; Persky and Robinson 2017). Novices do not yet have a deep understanding of the subject matter and thus have less domain knowledge to guide their behavior and decision-making. As such, experts should process scenarios with a greater sense of control/dominance than novices.

## Method

The data used in the current study were derived from Mangels et al. (2020), in which police expertise in use-of-force decision-making was examined using data from a force de-escalation training project funded by the Bureau of Justice Assistance (BJA-2016-VI-BX-K005). Their study focused on extracting the *contents* of decision-making that mark expert policing, whereas the current study focused on extracting the psychological *context* of decision-making that marks expert policing (i.e., emotionality). Put another way, Mangels et al. (2020) assessed *what* experts think; we assessed *how* experts think.

In the following sections, we first describe the participant characteristics and procedure of the original project followed by the procedure of the current investigation.

### Participants

Participants in the project were 78 police officers from two urban police departments in the US. Expert officers ($n = 42$; median years of experience = 17) on use-of-force from a very large police department were "identified by the department's commanders and comprised experienced officers who were qualified as use-of-force instructors and police academy instructors. Command staff based their selection of experts on reputation, time on the job, training, achievement of specialty assignment, and being Use-of-Force/Firearms/Defensive Tactics instructors" (Mangels et al. 2020. p. 296). Novice officers ($n = 36$) were in the process of completing their basic academy training course at a mid-sized police department. The novice officers did not yet have any working experience as a police officer.[1]

[1] We used the terms "expert" and "novice" rather than alternatives such as "experienced" and "less experienced" for several reasons. Experts, compared with novices, "…know more, their knowledge is better organized and integrated, they have better strategies for accessing knowledge and using it, and they are self-regulated and have different motivations" (Persky and Robinson 2017, pp. 75) and such expertise is developed "…through years of experience, but years of experience do not guarantee an individual will become an expert" (Persky and Robinson 2017, pp. 73). Experts in our sample were not recruited solely based on their number of years on the job. They were identified as experts by their department's commanders based on the criteria reported in the "Participants" section of this paper. In other words, not only did the experts have considerably more time on the job than novices but they were also identified as having a deep understanding of the subject matter. Being Use-of-Force/Firearms/Defensive Tactics instructors also requires a nuanced understanding of such techniques in order to explain why and when certain tactics should be used in various scenarios. As such, we deemed the terms "expert" and "novice" appropriate for the current research (Klahm and Tillyer 2015).

### Procedure of Force De-escalation Project

After providing demographic information, all officers observed five videos of real-world police body-worn camera footage and then answered questions about the footage in a series of surveys (see https://osf.io/wujkz/ for footage and surveys). Each video showed a different scenario of a police encounter with citizens from across the USA. Each video was divided into three segments. At the end of each segment, officers answered three questions regarding the segment they had just seen by typing their responses in a free-response format in the provided text box. These questions represent factors by which performance is generally evaluated in law enforcement training and captured data regarding the course of action the officer would take (rapid decision), the kinds of information the officer paid attention to (critical cues), and the officer's evaluation of the situation (assessment) of the footage the officer had just seen:

(1) If you were handling this situation, what would you do in the next few seconds? (Describe specifically what you would do if you were actually on scene.)
(2) From the start of the video until it stopped, what are the cues to which you recall paying attention? For example, what were you seeing, hearing, or paying attention to? List the three most important cues you remember and describe their significance.
(3) Based on all of the information available to you at this moment (for example, what you know from the briefing and the cues you were noticing), how would you describe what is happening right now?

After submitting their response to each question, officers were prompted to answer additional questions about the footage. These additional data were not pertinent to the current investigation and were not used (more information about these additional data can be found in Mangels et al. 2020). The videos were presented in the same order for all officers, and surveys were completed on computers or laptops with headphones. All surveys were typically completed in 135 minutes or less, and officers did not report any fatigue during completion of surveys.

### Procedure of Current Investigation

To automatically detect and measure valence, arousal, and dominance of each response, we first constructed dictionaries of words that scored high and low on each emotional dimension using Warriner et al.'s (2013) database of emotion norms. This database contains nearly 14,000 English words (representing up to one half of the words known to individuals) that have been reliably scored on valence, arousal, and dominance. Higher scores on valence,

arousal, and dominance are positive, exciting, and in control, respectively, whereas lower scores on these dimensions are negative, calm, and uncontrolled, respectively.

First, the average valence, arousal, and dominance scores among all words in the database were calculated. Words in the database that scored 1 standard deviation or more above and below the average valence score were identified as words that were high and low in valence, respectively; words that scored 1 standard deviation or more above and below the average arousal score were identified as words that were high and low in arousal, respectively; and words that scored 1 standard deviation or more above and below the average dominance score were identified as words that were high and low in dominance, respectively.

A total of six dictionaries were constructed containing words that were identified as positive (high in valence), negative (low in valence), exciting (high in arousal), calm (low in arousal), in control (high in dominance), and uncontrolled (low in dominance). Table 1 provides sample terms within each dictionary. These dictionaries were imported into the Linguistic Inquiry and Word Count software (LIWC; Pennebaker et al. 2007) which was then programmed to detect the percentage of words within each response that were high in valence, low in valence, high in arousal, low in arousal, high in dominance, and low in dominance.

These scores were then aggregated so that the emotionality of each response could be represented by a single valence score, a single arousal score, and a single dominance score rather than six individual scores. First, all percentages were standardized. Then, difference scores were calculated for each emotionality dimension by taking the difference between the high and low measures of a given emotionality dimension (% high valence minus % low valence = valence difference score; % high arousal minus % low arousal = arousal difference score; % high dominance minus % low dominance = dominance difference score). Positive scores indicated that a given response contained a greater degree of high valenced/arousal/dominance language than low valenced/arousal/dominance language. Negative scores indicated that a given response contained a greater degree of low valenced/arousal/dominance language than high valenced/arousal/dominance language. Greater/lower scores also represented greater/lower discrepancies in this regard. For example, let the valence score for response A = 3 and the valence score for response B = 5. Both responses contain a greater degree of high valenced language than low valenced language, but this discrepancy was more prominent in response B.

These difference scores served as the emotionality scores for each response.

Responses were not aggregated by question type, segment, scenario, or officer. In other words, responses for each question within each segment, scenario, and officer were submitted into LIWC separately, resulting in three emotionality scores for each of the forty-five responses (5 scenarios × 3 segments × 3 question types).

**Table 1** Example emotionality terms

| | |
|---|---|
| High valence | Accessible, care, harmless, protect, secure |
| Low valence | Counterfeit, dispute, erratic, murder, scream |
| High arousal | Abduct, gun, kidnap, shooter, thief |
| Low arousal | Fatigue, citizen, polite, unharmed, equipment |
| High dominance | Conversation, admissible, progression, usual, alert |
| Low dominance | Resistance, stressful, deception, disturbance, injure |

## Results

Because officers provided responses to multiple questions within multiple segments and scenarios, we conducted linear mixed-effects models to account for the violation of independent observations. Officer skill level (expert vs. novice) was entered as a fixed effect and the emotionality scores for each response were entered as the dependent variable in three separate mixed-effects models, with each model predicting an emotionality score (i.e., valence, arousal, or dominance; Table 2). We also included the specific question that each response corresponded to (rapid decision, critical cues, assessment) as a fixed effect to examine the interaction between skill level and question type. This allowed us to determine if any links between skill level and emotionality varied as a function of the type of question the officers were responding to. The officers' gender, education level, years of police service, and military service history (whether they had served in the US armed forces or not) were entered as covariates. Scenarios nested within officers were included as random intercepts.

Results are illustrated in Fig. 1. Consistent with Hypothesis 1, in Model 1 (DV = valence) there was a main effect of skill level such that responses from experts contained a greater degree of high-valenced language than responses from novices. This effect did not vary by question type, suggesting that experts generally processed scenarios more positively than novices. Consistent with Hypothesis 2, in Model 2 (DV = arousal), there was a main effect of skill level such that responses from experts contained a greater degree of low arousal language than responses from novices. This effect was significantly stronger in rapid decision responses than both assessment responses and critical cues responses. Consistent with Hypothesis 3, in Model 3 (DV = dominance), responses from experts contained a greater degree of high dominance language than responses from novices. This effect was stronger in rapid decision responses than assessment responses.

**Table 2** Results of linear mixed effects models

| Fixed effects | Model 1 Valence β (SE) | Model 2 Arousal β (SE) | Model 3 Dominance β (SE) |
|---|---|---|---|
| Intercept | 0.43 (0.14)** | − 0.53 (0.12)*** | 0.47 (0.18)* |
| Skill (Expert) | 0.57 (0.24)* | − 0.48 (0.20)* | 1.20 (0.29)*** |
| Sex (Male) | − 0.20 (0.11) | 0.13 (0.09) | − 0.06 (0.14) |
| Years of Service | − 0.08 (0.10) | 0.10 (0.09) | − 0.17 (0.13) |
| Veteran (Yes) | 0.08 (0.11) | − 0.05 (0.09) | 0.12 (0.14) |
| Education (Bachelor's) | 0.10 (0.11) | − 0.02 (0.09) | − 0.01 (0.14) |
| Question (A) | − 0.83 (0.06)*** | 0.99 (0.06)*** | − 1.01 (0.06)*** |
| Question (CC) | − 0.21 (0.06)*** | 0.37 (0.06)*** | − 0.31 (0.06)*** |
| Skill (Expert): Question (A) | − 0.19 (0.12) | 0.44 (0.12)*** | − 0.27 (0.12)* |
| Skill (Expert): Question (CC) | − 0.22 (0.12) | 0.25 (0.12)* | − 0.16 (0.12) |
| Random effects | Variance (SD) | Variance (SD) | Variance (SD) |
| Subject | 0.08 (0.29) | 0.04 (0.19) | 0.17 (0.41) |
| Scenario | 0.01 (0.09) | 0.01 (0.10) | 0.02 (0.15) |
| Residual | 1.86 (1.36) | 2.05 (1.43) | 1.89 (1.37) |

Reference levels are novice officers, female officers, officers who have never served on active duty in the US Armed Forces, and Rapid Decision responses. Standardized coefficients are reported

*A* assessment, *CC* critical cues

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

## Discussion

Given the vast amount of evidence showing the substantial influence of emotion on decision-making, we examined emotionality in police use-of-force decision-making between expert and novice officers in the current study. This allowed us to assess how officers react to stimuli, and how such reactions differ between experts and novices in use-of-force decision-making. Our results yielded three notable outcomes that supported our hypotheses. Responses from experts were more positively valenced, more dominant, and less arousing compared with responses from novices. That is, experts construed scenarios with an evaluative tone that was more positive (less negative), a greater sense of control, and more calmly than novices. Unfamiliar stimuli typically elicit more arousal and are perceived more negatively than familiar stimuli, and this effect is weakened with repeated exposure. Given their lack of exposure on the job, novices would likely react to stimuli more negatively and with higher arousal than those who have had extensive experience (i.e., exposure). Because one's experience is used to guide future behavior, having more experience enables a greater sense of control and confidence on the job than having less experience. Overall, it appears that having a wealth of policing-related knowledge and experience facilitates the interpretation of stimuli in a manner that is less threatening, less intense, and with a greater level of confidence and control.

The magnitude of these effects also varied across question types for arousal and dominance, but not valence. Although experts were generally calmer than novices, this was more prominent when officers described courses of action (i.e., what actions officers would perform) than the kinds of information they paid attention to (i.e., cues) and their assessment of the situation. Moreover, while experts were generally more dominant than novices, this was more prominent when officers described courses of action than their assessment of the situation. It is unclear why question type moderated the expertise–emotionality effect for arousal and dominance but not valence, and why question type moderated the expertise–emotionality effect at all. It is possible that particular questions are more optimal for emotionality detection and discrimination than others. Perhaps certain emotionality dimensions, such as valence, are less sensitive to question variation than arousal and dominance. Or, perhaps these variations highlight meaningful differences in the way that expert and novice officers think about use-of-force. Although the results of the current study cannot provide any definitive conclusions about why question type moderated the expertise–emotionality effect, they indicate that question type should be further examined in follow-up studies.

These results highlight the importance of assessing how officers react to stimuli in use-of-force decision-making. Because "…every situation is inevitably filtered through the perceptions of each person who experiences it" (Sherman et al. 2013), the same stimuli can be construed differently across individuals. And, as our study shows, how officers evaluate stimuli appears to vary by their level of expertise.

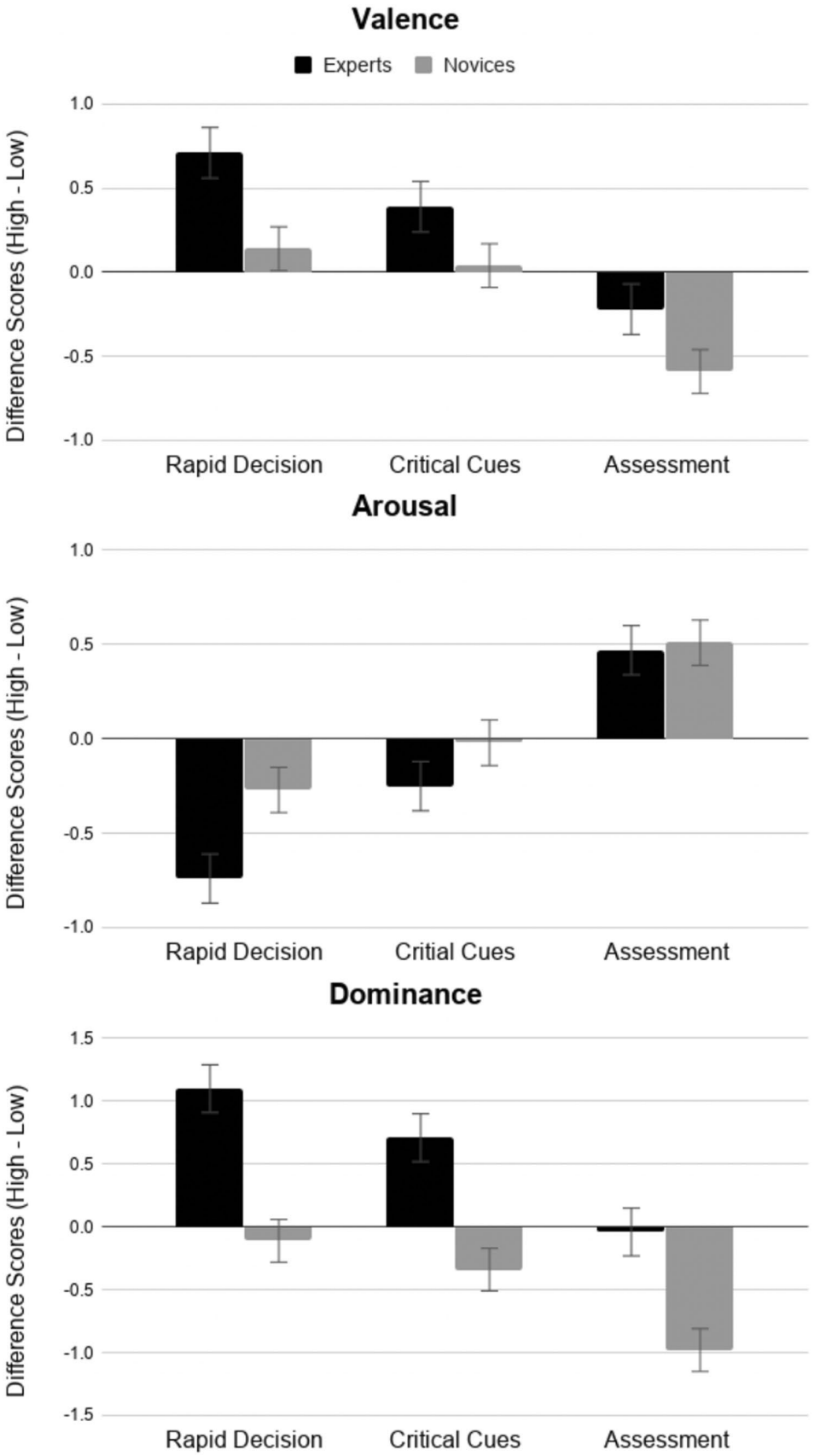


**Fig. 1** Emotionality levels in each response type compared between experts and novices

Researchers cannot ignore officers' subjective thoughts and reactions that are involved in use-of-force decision-making if the goal is to understand the processes involved in choosing appropriate uses-of-force. Incorporating how officers attach subjective meaning to stimuli can also help to better inform and provide more context to *what* officers are thinking about, thus complementing studies that focus on the contents of officer cognition.

These results also have practical implications for use-of-force training. Although expert and novice officers watched the same videos, they did not react to them in the same way. This suggests that use-of-force training may be more effective if it is tailored to address variations in emotional reactivity. For instance, novices may benefit more from training that has a greater emphasis on the reduction of arousal given their propensity to construe stimuli with greater levels of arousal than experts. Learning emotion regulation techniques, such as reappraising the meaning of stimuli, may help officers learn how to elicit a specific emotional reaction and subsequent behavior that is in line with expert performance (Blumberg et al. 2019). Emotional reactivity detection can also be used as a helpful tool for officers to better understand how they react to a variety of stimuli and situations. As an example, officers could compare their own emotionality scores across certain kinds of scenarios or across interactions with different groups of people to determine if any patterns emerge. This can help inform the types of training that a given officer would benefit from the most.

Our study has a number of strengths. Officer responses were derived from a previous study that used cognitive task analysis to extract the cognitive processes involved in officer decision-making—a method that produces rich qualitative data (Crandall et al. 2006) that is ideal for analyzing emotionality. Officers were prompted to answer specific questions using an open-response format and were thus free to be as descriptive in their responses as they wanted. We employed a method that has widely been used to detect and measure emotion in text and used a large, high-quality database of words that have been validated and reliably scored on valence, arousal, and dominance. Dictionary-based methods can perform better than other approaches (e.g., topic modeling), as they tend to be extensively validated, are corpus agnostic, and allow researchers to peer inside the "black box" to examine the exact components that comprise a construct and contribute to a score (Hardeniya and Borikar 2016; Reagan et al. 2017; Rice and Zorn 2013). The output is based on the objective and observable occurrence of specific words in a document rather than subjective inferences. Moreover, emotionality scores were based on the percentage of words within a response that represented a given emotionality dimension, ensuring that scores were not driven by response length. We also controlled for officer gender, education level, years of police service, and military service history in our statistical models to ensure that results were not driven by these variables.

Although these results make a fairly compelling case for the continued investigation of emotionality on expert performance in police use-of-force decision-making, it is important to note some limitations. It is possible that some of the words that officers used in their descriptions were domain-specific and were not represented in any of our dictionaries. Domain-specific terms may also demonstrate different emotionality levels among those working in that specific domain compared with laypeople. A database of policing-specific terms that have been scored on each emotionality dimension by officers could be developed to address these limitations. More advanced procedures, like machine learning, can also perform better than dictionary-based approaches. However, this assumes that an appropriately sized dataset is available for training, which is often not feasible. Future studies could also examine emotionality in officer decision-making using other approaches that complement our dictionary-based approach. Potential alternative approaches include those that utilize physiological, experiential, and behavioral indicators of emotionality. Because experts and novices in the current study were from different agencies, we were not able to control for department-level factors (e.g., department culture) in our analyses. Thus, the differences observed could have been driven by departmental differences rather than expertise. Future research should recruit officers from the same agency or strive to recruit a more representative sample of officers.

In conclusion, the current study provides strong evidence that the ability to react and assess situations calmly, with a greater sense of control, and less negatively may be related to the production of accurate, effective, and efficient behaviors that mark expert policing. These results shed light on the ways in which expert and novice officers understand and experience stimuli involved in use-of-force decision-making and have important implications on use-of-force training. This provides a promising path for the continued investigation of emotionality in expert policing and decision-making.

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## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

**Ethical Approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

## References


Abdelmageed S, Trotti R, Parker D, Sabatinelli D, Tamminga C, Gershon E, McDowell JE (2020) Effects of stimulus repetition on emotional processing in psychosis biotypes: findings from bipolar-schizophrenia network on intermediate phenotypes (B-SNIP) consortium. Biol Psychiat 87(9):S389

Andersen JP, Gustafsberg H (2016) A training method to improve police use of force decision making: a randomized controlled trial. Sage Open 6(2):2158244016638708

Blair DV, O'Neil HF Jr, Price DJ (1999) Effects of expertise on state self-efficacy and state worry during a computer-based certification test. Comput Hum Behav 15(3–4):511–530

Bornstein RF (1989) Exposure and affect: overview and meta-analysis of research, 1968–1987. Psychol Bull 106(2):265–289

Boulton L, Cole J (2016) Adaptive flexibility: examining the role of expertise in the decision making of authorized firearms officers during armed confrontation. J Cogn Eng Decis Mak 10(3):291–308

Blumberg DM, Schlosser MD, Papazoglou K, Creighton S, Kaye CC (2019) New directions in police academy training: A call to action. Int J Environ Res Public Health 16(24), Article 4941. https://doi.org/10.3390/ijerph16244941

Brandl SG, Stroshine MS, Frank J (2001) Who are the complaint-prone officers?: an examination of the relationship between police officers' attributes, arrest activity, assignment, and citizens' complaints about excessive force. J Crim Just 29(6):521–529

Breiter HC, Etcoff NL, Whalen PJ, Kennedy WA, Rauch SL, Buckner RL, Rosen BR (1996) Response and habituation of the human amygdala during visual processing of facial expression. Neuron 17(5):875–887

Brown SG, Daus CS (2016) Avoidant but not avoiding: the mediational role of anticipated regret in police decision-making. J Police Crim Psychol 31(4):238–249

Crandall B, Klein G, Klein GA, Hoffman RR (2006) Working minds: a practitioner's guide to cognitive task analysis. MIT Press

Damasio AR (1994) Descartes' error: emotion, reason, and the human brain. Putnam.

United States Department of Justice. (2020, June 23–24). Hearing twelve: policing culture. President's Commission on Law Enforcement and the Administration of Justice. https://www.justice.gov/ag/page/file/1319456/download

Ekman P (2007) Emotions revealed: Recognizing faces and feelings to improve communication and emotional life. Holt

Ericsson KA, Krampe RT, Tesch-Römer C (1993) The role of deliberate practice in the acquisition of expert performance. Psychol Rev 100(3):363–406

Estes Z, Jones LL, Golonka S (2012) Emotion affects similarity via social projection. Soc Cogn 30(5):584–609

Forgas JP (1995) Mood and judgment: the affect infusion model (AIM). Psychol Bull 117(1):39–66

Foster M (2020) Police use of force: overview and considerations for Congress. Federation o American Scientists: Congressional Research Service, *LSB10516.* https://crsreports.congress.gov

Fridman J, Barrett LF, Wormwood JB, Quigley KS (2019) Applying the theory of constructed emotion to police decision making. Front Psychol 10(1), Article 1946

Frijda NH (1986) The emotions. Cambridge University Press

Gannouni S, Aledaily A, Belwafi K, Aboalsamh H (2020) Adaptive emotion detection using the valence-arousal-dominance model and EEG brain rhythmic activity changes in relevant brain lobes. IEEE Access 8(1):67444–67455

George JM, Dane E (2016) Affect, emotion, and decision making. Organ Behav Hum Decis Process 136:47–55

Greene J, Haidt J (2002) How (and where) does moral judgment work? Trends Cogn Sci 6(12):517–523

Hardeniya T, Borikar DA (2016) Dictionary based approach to sentiment analysis—a review. International Journal of Advanced Engineering, Management and Science 2(5):317–322

Harman JL, Zhang D, Greening SG (2019) Basic processes in dynamic decision making: how experimental findings about risk, uncertainty, and emotion can contribute to police decision making. Front Psychol 10(1), Article 2140

Jagiello R, Pomper U, Yoneya M, Zhao S, Chait M (2019) Rapid brain responses to familiar vs. unfamiliar music–an EEG and pupillometry study. Sci Rep 9(1):1–13

Johnson RR, Stone BT, Miranda CM, Vila B, James L, James SM, Berka C (2014) Identifying psychophysiological indices of expert vs. novice performance in deadly force judgment and decision making. Front Hum Neurosci 8(1), Article 512

Kalvin CB, Bierman KL, Gatzke-Kopp LM (2016) Emotional reactivity, behavior problems, and social adjustment at school entry in a high-risk sample. J Abnorm Child Psychol 44(8):1527–1541

Keltner DT, Lerner JS (2010) Emotion. In DT Gilbert, ST Fiske, G Lindzey (Eds.), The handbook of social psychology:Vol. 1. (5th ed., pp. 317–352). Wiley

Keltner D, Oatley K, Jenkins JM (2014) Understanding emotions. Wiley

Kiehl KA, Laurens KR, Duty TL, Forster BB, Liddle PF (2001) Neural sources involved in auditory target detection and novelty processing: an event-related fMRI study. Psychophysiology 38(1):133–142

King SO II, Williams CL (2017) The brainstem, arousal, and memory. In R. Lalonde (Ed.), Neuroscience research progress. The brainstem and behavior (pp. 255–289). Nova Biomedical Books

Klahm CF, Tillyer R (2015) Rethinking the measurement of officer experience and its role in traffic stop searches. Police Quarterly 18(4):343–367

Klein G, Shneiderman B, Hoffman RR, Ford KM (2017) Why expertise matters: a response to the challenges. IEEE Intell Syst 32(6):67–73

Larrick RP, Feiler DC (2015) Expertise in decision making. In G. Keren, G Wu (Eds.), The Wiley Blackwell Handbook of Judgment and Decision Making (pp. 696-721). John Wiley & Sons, Ltd

Lazarus RS, Lazarus RS (1991) Emotion and adaptation. Oxford University Press on Demand

Lerner JS, Li Y, Valdesolo P, Kassam KS (2015) Emotion and decision making. Annu Rev Psychol 66(1):799–823

Lerner JS, Tiedens LZ (2006) Portrait of the angry decision maker: how appraisal tendencies shape anger's influence on cognition. J Behav Decis Mak 19(2):115–137

Loewenstein G (1996) Out of control: visceral influences on behavior. Organ Behav Hum Decis Process 65(3):272–292

Makin DA, Willits DW, Koslicki W, Brooks R, Dietrich BJ, Bailey RL (2019) Contextual determinants of observed negative emotional states in police–community interactions. Crim Justice Behav 46(2):301–318

Mangels L, Suss J, Lande B (2020) Police expertise and use of force: using a mixed-methods approach to model expert and novice use-of-force decision-making. J Police Crim Psychol 1–10

Mohammad SM (2016) Sentiment analysis: Detect valence, emotions, and other affectual states from text. Emotion Measurement 201–237. https://doi.org/10.1016/B978-0-08-100508-8.00009-6

Montoya RM, Horton RS, Vevea JL, Citkowicz M, Lauber EA (2017) A re-examination of the mere exposure effect: the influence of

repeated exposure on recognition, familiarity, and liking. Psychol Bull 143(5):459–498
Mungan E, Akan M, Bilge MT (2019) Tracking familiarity, recognition, and liking increases with repeated exposures to nontonal music: Revisiting MEE-Revisited. New Ideas Psychol 54:63–75
Paluck EL, Shafir E (2017) The psychology of construal in the design of field experiments. In Handbook of Economic Field Experiments (Vol. 1, pp. 245–268). North-Holland
Persky AM, & Robinson JD (2017) Moving from novice to expertise and its implications for instruction. Am J Pharm Educ 81(9), Article 6065
Pennebaker JW, Booth RJ, Francis ME (2007) Linguistic inquiry and word count: LIWC [Computer software]. Austin, TX: liwc. net, 135
Petrides M (2007) The orbitofrontal cortex: novelty, deviation from expectation, and memory. Ann N Y Acad Sci 1121(1):33–53
Pham MT (2007) Emotion and rationality: a critical review and interpretation of empirical evidence. Rev Gen Psychol 11(2):155–178
Quigley BM, Tedeschi JT (1996) Mediating effects of blame attributions on feelings of anger. Pers Soc Psychol Bull 22(12):1280–1288
Ramsøy TZ, Friis-Olivarius M, Jacobsen C, Jensen SB, Skov M (2012) Effects of perceptual uncertainty on arousal and preference across different visual domains. J Neurosci Psychol Econ 5(4):212–226
Reagan AJ, Danforth CM, Tivnan B, Williams JR, Dodds PS (2017) Sentiment analysis methods for understanding large-scale texts: a case for using continuum-scored words and word shift graphs. EPJ Data Science, 6(1), Article 28
Rice DR, Zorn C (2013) Corpus-based dictionaries for sentiment analysis of specialized vocabularies. Polit Sci Res Methods 1–16
Rowe G, Hirsh JB, Anderson AK (2007) Positive affect increases the breadth of attentional selection. Proc Natl Acad Sci 104(1):383–388
Rozin P, Millman L, Nemeroff C (1986) Operation of the laws of sympathetic magic in disgust and other domains. J Pers Soc Psychol 50(4):703–712
Satpute AB, Hanington L, Barrett LF (2016) Novel response patterns during repeated presentation of affective and neutral stimuli. Soc Cogn Affect Neurosci 11(12):1919–1932
Scherer KR & Ekman P (Eds.) (2014) Approaches to emotion. Psychology Press
Schwarz N (2000) Emotion, cognition, and decision making. Cogn Emot 14(4):433–440
Sherman RA, Nave CS, Funder DC (2013) Situational construal is related to personality and gender. J Res Pers 47(1):1–14
Suss J, Ward P (2018) Revealing perceptual–cognitive expertise in law enforcement: an iterative approach using verbal-report, temporal-occlusion, and option-generation methods. Cogn Technol Work 20(4):585–596
Sutton TM, Herbert AM, Clark DQ (2019) Valence, arousal, and dominance ratings for facial stimuli. Q J Exp Psychol 72(8):2046–2055
Szameitat DP, Darwin CJ, Wildgruber D, Alter K, Szameitat AJ (2011) Acoustic correlates of emotional dimensions in laughter: arousal, dominance, and valence. Cogn Emot 25(4):599–611
Tausczik YR, Pennebaker JW (2010) The psychological meaning of words: LIWC and computerized text analysis methods. J Lang Soc Psychol 29(1):24–54
Van Kleef GA (2009) How emotions regulate social life: the emotions as social information (EASI) model. Curr Dir Psychol Sci 18(3):184–188
Van Kleef GA, De Dreu CK, Manstead AS (2004) The interpersonal effects of emotions in negotiations: a motivated information processing approach. J Pers Soc Psychol 87(4):510–528
Vickers JN, Lewinski W (2012) Performing under pressure: gaze control, decision making and shooting performance of elite and rookie police officers. Hum Mov Sci 31(1):101–117
Vohs KD, Baumeister RF, Loewenstein G (2007) Do emotions help or hurt decision making? Sage, A hedgefoxian perspective
Voigt R, Camp NP, Prabhakaran V, Hamilton WL, Hetey RC, Griffiths CM, Eberhardt JL (2017) Language from police body camera footage shows racial disparities in officer respect. Proceedings of the National Academy of Sciences 114(25):6521–6526
Ward P, Suss J, Eccles DW, Williams AM, Harris KR (2011) Skill-based differences in option generation in a complex task: a verbal protocol analysis. Cogn Process 12(3):289–300
Warriner AB, Kuperman V, Brysbaert M (2013) Norms of valence, arousal, and dominance for 13,915 English lemmas. Behav Res Methods 45(4):1191–1207
Weierich MR, Wright CI, Negreira A, Dickerson BC, Barrett LF (2010) Novelty as a dimension in the affective brain. Neuroimage 49(3):2871–2878
Wood G, Tyler TR, Papachristos AV (2020) Procedural justice training reduces police use of force and complaints against officers. Proc Natl Acad Sci 117(18):9815–9821
Wray JM (2020) The weight of emotions on decision-making: a comparative analysis. Inquiries Journal 12(09)
Wright CI, Martis B, Schwartz CE, Shin LM, Fischer HH, McMullin K, Rauch SL (2003) Novelty responses and differential effects of order in the amygdala, substantia innominata, and inferior temporal cortex. Neuroimge 18:660–669
Yamaguchi S, Hale LA, D'Esposito M, Knight RT (2004) Rapid prefrontal hippocampal habituation to novel events. J Neurosci Off J Soc Neurosci 24:5356–5363
Yates FJ (2007) Emotion appraisal tendencies and carryover: how, why, and… therefore? J Consum Psychol 17(3):179–183
Yip JA, Côté S (2013) The emotionally intelligent decision maker: emotion-understanding ability reduces the effect of incidental anxiety on risk taking. Psychol Sci 24(1):48–55
Zajonc RB (1968) Attitudinal effects of mere exposure. J Pers Soc Psychol 9(2 PT. 2), 1–27
Zheng Y, Yang Z, Jin C, Qi Y, Liu X (2017) The influence of emotion on fairness-related decision making: a critical review of theories and evidence. Front Psychol 8, Article 1592
Zimmerman LA (2008) Making sense of human behavior: explaining how police officers assess danger during traffic stops. In J.M. Schraagen, L. Militello, T. Ormerod, R. Lipshitz (Eds.), Naturalistic Decision Making and Macrocognition (pp. 121–140). Ashgate Publishing
Di Nota PM, Huhta JM (2019) Complex motor learning and police training: applied, cognitive, and clinical perspectives. Front Psychol 10:1797