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Special issue

Adaptive Flexibility: Examining the Role of Expertise in the Decision Making of Authorized Firearms Officers During Armed Confrontation

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Identifying the cognitive processes underlying tactical decision making is vital for two purposes: (a) reducing risk through improved training and (b) facilitating the public's attitudes toward the legitimacy of the police and criminal justice system. Despite this, very little research has been conducted into British police decision making involving the use of firearms. This study begins to address this gap by examining the impact that expertise has on British police's use-of-force decisions during armed confrontations. To do so, the tactical decision-making processes of 12 expert specialized firearms officers and 11 novice authorized firearms officers during armed confrontations were compared through cognitive task analysis methods. Data were coded via categories derived from theory and patterns inductively emergent within the data. The results found expert specialized firearms officers to be more flexible in adaptive responding to situational changes, while novice authorized firearms officers reported a more sequential and linear process of tactical decision making. In identifying the key features of expertise within this environment ("adaptive flexibility"), this study has theoretical and practical implications for the acceleration of authorized firearms officers' expertise acquisition to bridge the existing gap resulting from a lack of available qualified operational force commanders.

Keywords: police, UK, cognitive task analysis, critical decision method, naturalistic decision making

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Use of lethal force by police officers lies at the extreme edge of policing activity (Burrows, 2007). There is a fine line between the use of necessary force to achieve legitimate police objectives and the use of excessive force: When an officer uses force that may be considered excessive, public approval for police authority is shaken (MacDonald, Manz, Alpert, & Dunham, 2003). The salience of tactical decision making is evident in the incidents that attract widespread attention, evaluation, and criticism. For instance, the death of Mark Duggan, who was shot and killed by police in Tottenham, North London, sparked riots that spread across England in August 2011. However, the consequences of failing to act in circumstances that pose an imminent threat to life could be equally critical. Therefore, the performance of police firearms teams must be efficient and accurate (Kavanagh, 2006).

Nonetheless, a range of psychophysiologic and cognitive factors can influence the way in which authorized firearms officers (AFOs) perform—many of which are not often taken into account while planning tactical operations and conducting the investigations that follow (Kavanagh, 2006; Thompson & Lee, 2004). External factors (e.g., suspect aggression; location of suspects, victims, or officers; visual and physical cover; and a constant reappraisal of potential hazards) and internal factors (e.g., physiologic arousal) can interact with an AFO's perception and appraisal of an environment (Klinger, 2006; White, 2001, 2003). For instance, officers are more likely to unholster and discharge their weapons and to do so earlier and more often as a result of increased external demand (e.g., suspect aggression) and internal

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demand (e.g., physiologic arousal; Doerner & Ho, 1994; Vrij & Dingemans, 1996; Vrij, van der Steen, & Koppelaar, 1994).

As British police officers are not routinely armed, the role of AFOs who are qualified to carry and use firearms in Britain is highly specialized. Out of the 126,818 full-time-equivalent police officers in the 43 police forces of England and Wales, only 5,875 (4.6%) are currently serving as AFOs (Home Office, 2015a, 2015b). AFOs must meet entry requirements including high levels of physical fitness to qualify for such a role (Association of Chief Police Officers [ACPO], 2011). Before they become operationally active, AFOs complete a rigorous and assessed training package that includes weapon handling, shooting skills, less lethal options, tactical procedures, and scenario-based training. After they are qualified as an AFO, they must complete refresher training and assessment for all tactics on a regular basis (24 month), during which failure results in the instant revocation of an AFO's firearms license (ACPO, 2011).

British AFOs are deployed only to incidents in which there is a perceived threat to life (ACPO, 2011). Circumstances that qualify for AFO deployment typically involve a "reason to suppose" that the attending officer may have to protect the public or oneself from a person who is in possession of, or has immediate access to, a firearm or potentially lethal weapon (College of Policing, 2013). Deployment can be issued by a strategic firearms commander or an accredited tactical firearms commander or through self-deployment. An AFO can self-deploy upon encountering a situation where one believes that delay in seeking authority would be detrimental to public or officer safety.

Specialized firearms officers (SFOs) are a specialized group of AFOs who are trained in skills such as (a) hostage rescue, (b) specialist weapon and equipment use, (c) complicated methods of entry, and (d) prehospital trauma life support. SFOs volunteer themselves for the role, and upon initial approval by way of a rigorous 5-day assessment, they follow a prolonged training program (18–19 weeks). SFOs receive refresher training every 6 weeks. Incidents dealt with by SFOs are deemed too dangerous for standard AFO response. These incidents often involve suspects who are mentally or emotionally distressed, are under the influence of alcohol or drugs, do not have clear goals, and resist attempts by others to resolve the situation. To conclude these incidents without incurring loss of life, high levels of training, skill, and operational expertise are required.

Klein's (1997) recognition primed decision (RPD) model (Lipshitz, Klein, Orasanu, & Salas, 2001) suggests that an expert recognizes critical environmental cues that trigger analogues (i.e., previously encountered similar experiences). This activation is thought to support decision making and reduce associated cognitive demand by focusing attention and integrating related information (Fiore, Ross, & Jentsch, 2012; Loveday, Wiggins, Searle, Festa, & Schell, 2013). Recognition aids identification, evaluation, and implementation of action through reproduction of a previously utilized solution or through more complicated mental simulation and evaluation of potential options and associated outcomes.

Under the dynamic, ambiguous, and critical demands of an armed confrontation, officers will need "adaptive expertise" to cognitively and behaviorally adapt to unpredicted and dynamic events (Kozlowski & DeShon, 2004; Mercier & Higgins, 2013). *Adaptive expertise* refers to understanding when and why particular procedures are appropriate or inappropriate and recognizing shifts in the situation that necessitate adaptability (Wiltshire et al., 2014). Adaptability can therefore be described as an initiated behavioral sequence triggered by recognition of an environmental cue suggesting that a change in tactical decision making should occur (Fiore et al., 2012; Verschaffel et al., 2009). This recognition depends on conceptual understanding of cause–effect connections (insight) and the restructuring of initial mental models (Fackler et al., 2009; Klein & Jarosz, 2011).

Rasmussen's (1976) decision ladder also posits flexibility and adaptation as the defining characteristics of expert decision making. The decision ladder comprises links between information-processing activities and resulting states of knowledge. Whereas a rational, knowledge-based, and linear behavior sequence is typically associated with novice task performance, experts are thought to flexibly shunt from one

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process to the next and automatically execute preset skill-based responses depending on the situational assessment (Jenkins, 2009; Naikar, 2010).

The purpose of this study was to explore expert tactical decision making during armed confrontations. Despite its critical role in effective policing, little research has been conducted into AFO expertise and decision making (Flin, Pender, Wujec, Grant, & Stewart, 2007; Kilner & Hall, 2005). This knowledge gap reflects difficulties gaining access to police samples, as well as challenges in the collection and analysis of police data that are ecologically valid and scientifically objective. Identifying how tactical decisions are made and how expertise influences this process is vital for reducing risk within these complex and demanding situations and environments through training. The acceleration of expertise is critical owing to a lack of AFOs who were qualified as operational force commanders (OFCs) at the time that the current study was conducted (2013), potentially leading to non-OFC-qualified AFOs being required to lead operations in their absence.

Although some authors have attempted to establish models of police decision making amid firearms incidents, these models are often framed in terms of the outcomes of armed confrontations, neglecting the importance of the antecedents of the shoot–no shoot decision in determining outcome and rarely exploring the importance of expertise (Amendola, 1995, 1996; Binder & Scharf, 1980; Terrill, 2005). Furthermore, current models of firearms decision making among police are typically developed with routinely armed police forces (e.g., United States) and therefore almost certainly lack ecologic validity to nonroutinely armed forces (e.g., United Kingdom; Barton, Vrij, & Bull, 2002; Knutsson & Strype, 2003).

In identifying the cognitive processes underlying expert tactical decision making, this study highlights skills found to be most appropriate and successful in British police firearms domains, and as a result, instructors can concentrate their training accordingly (Klein & Militello, 2001; WBI Evaluation Group, 2007). In other professions requiring rapid decision making in risky environments, there has been significant research to understand and train operational thinking skills—for example, aviation (Orasanu & Fischer, 1997; Seamster et al., 1993) and prehospital/medical emergency (Gunnarsson & Stomberg, 2009; Wong & Blandford, 2002).

RESEARCH APPROACH

This exploratory study employed cognitive task analysis (CTA) methods to examine the expert decision making of British firearms officers during armed confrontations. CTA is a set of methods used to identify and explain the "mental processes involved in performing a task" (Klein & Militello, 2001, p. 163) that is cognitively complex (i.e., requiring an extensive knowledge base, complex inferences, and judgment) and that takes place in a naturalistic environment (O'Hare, Wiggins, Williams, & Wong, 1998). Because AFOs are required to make decisions under high levels of uncertainty, time pressure, and risk, this sample is considered to serve as a paradigmatic example of naturalistic decision making at work (Roth et al., 2010). As such, CTA methods were selected as the most appropriate approach for generating insight and understanding about cognition in this real-world context (Crandall, Klein, & Hoffman, 2006; Tofelgrehl & Feldon, 2013).

CTA has been found to successfully support system operation and aid improvement through the development of effective training recommendations in many various domains (Prasanna, Yang, & King, 2009), including military and defense operations (Riley, Endsley, Bolstad, & Cuevas, 2006), aviation (Endsley & Robertson, 2002), and air traffic control (Endsley & Rodgers, 1994). The results of these CTA studies identified which processes were most important, therefore ensuring their support of improved performance (Adams et al., 2009; Crandall et al., 2006; Tofelgrehl & Feldon, 2013).

Successful CTA should progress through a number of stages (Clark, Feldon, van Merriënboer, Yates, & Early, 2008; Hoffman, Crandall, & Klein, 2008), proceeding from preparatory steps to knowledge elicitation, data analysis, and, finally, knowledge representation (Yusoff & Salim, 2012). Through consideration of the available CTA knowledge elicitation techniques, it was decided that the critical decision method (CDM) interview protocol would be most suitable to

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retrospectively examine the tactical decision-making processes of AFOs and SFOs during a previous firearms incident that they considered to be nonroutine. The CDM (Crandall et al., 2006; Hoffman et al., 2008) is structured as an intensive incident-based interview protocol that aims to identify the decision-making processes involved in the judgments made during a personally experienced "challenging" incident.

The CDM interview is a multistage process that utilizes multiple "sweeps" through an incident. These sweeps build in intensity—from brief and general incident recall to an intensive examination guided by the creation of a visual timeline, identification of decision points, and subsequent probing and hypothetical questioning regarding those decision points (Hoffman, Crandall, & Shadbolt, 1998; Klein & Militello, 2001).

RESEARCH OBJECTIVE

The objectives of this research were to identify the exemplifying characteristics of expert decisional processes involved in the decision making of British firearms officers during armed confrontations to identify potential training recommendations and serve as guidance for empirical evaluation. Although we propose our findings as instructional strategies, we acknowledge that future experimental research will need to be conducted to establish the effectiveness of these strategies. CTA qualitative research methods can generate meaningfully informed hypotheses suited to subsequent empirical testing (Crandall et al., 2006; Wiltshire et al., 2014). For the present purposes, CTA methods are used as exploratory means to derive an integrated theoretical framework, which can then be tested empirically in traditional settings in future studies.

METHOD

Participants

Twenty-three firearms officers voluntarily participated in this study, representing 20% of the AFOs in Merseyside Police. All were nationally accredited AFOs in the United Kingdom. This included 12 expert SFOs (all men) and 11 novice AFOs (9 men, 2 women). This sample size exceeds many CTA studies, which are typically small ($n < 10$) owing to the large amounts of qualitative data generated by these approaches and to the limited access to experts of specific fields of interest (see Crandall et al., 2006; Wiltshire et al., 2014). The mean age of the expert SFOs was 46 years ($SD = 5.09$), and their length of service as firearms officers ranged from 7 to 21 years, with a mean and median of 17 years ($SD = 3.63$). The mean age of the novice AFOs was 32 years ($SD = 4.59$), and their length of service as a firearms officers ranged from 10 to 48 months, with a mean and median of 23 months ($SD = 13.43$) and 21 months, respectively. Data are not available in the public domain to determine the representativeness of the sample in terms of age and sex. Prior to data collection, ethical approval was gained, and each participant signed informed consent.

Based on the assumption that expertise is characterized by specialized skills or knowledge derived from extensive experience with a domain (Crandall et al., 2006), the level of expertise required for this investigation was SFO-qualified participants with at least 10 years' experience working as firearms officers. In contrast, to align with the statement that novices should have "minimal exposure to the domain" (Hoffman et al., 2008), novice AFOs were chosen on the basis of having qualified as an AFO and therefore being competent enough to have done so and to subsequently have enough experience to be able to complete the CDM process but having ≤3 years' experience as firearms officers (relative novice status in comparison with expert sample). Only 1 participant in the novice AFO group was qualified as an OFC and SFO; the rest had qualified as AFO only.

Materials

To conduct the analysis, permission was sought to record the knowledge elicitation sessions in audio format via multiple Dictaphones (ALBA digital voice recorder and MP3 player: model number T858): one on the lapel of the analyst, one on the lapel of the participant, and one on the table of the room in which the interview was being conducted. The participant was informed of this procedure before signing consent forms. The interviews were guided by a script, and an

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A3 blank-page pad was used to draw timelines of the recalled incidents. Qualitative data analysis software (NVivo 10; QSR International, 2013) assisted the analysis of the current studies and created a transparent and "auditable footprint" (Sinkovics & Alfoldi, 2012, p. 827).

Procedure

Access was granted from the head of the firearms department and the chief constable (ACPO level approval), but emphasis was placed on the importance of officer anonymity. To protect anonymity, the demographic information collected was kept to a bare minimum, and participant numbers were used throughout analysis. Data collection consisted of knowledge elicitation sessions via the CDM. Through the CDM script, each participant was asked to walk through a "challenging" and nonroutine armed confrontation that he or she personally experienced as an AFO. The CDM interviews were conducted in the officers' workplace. Each interview lasted between 1 and 2 hours.

Data Analysis

All knowledge elicitation session audio recordings were transcribed. The transcripts were reviewed for accuracy immediately after collection, utilizing interview notes, timelines, and any other drawings or notations, to ensure quality control of the final transcript and to identify any discrepancies. For the current study, the data analysis reflected a framework analysis methodology, which allowed for both a "top-down" (theory-driven) approach and a "bottom-up" (data-driven) identification of emergent patterns (Wiltshire et al., 2014).

First, the data set was read multiple times and cognitive issues that appeared to be relevant to the analysis were considered; repeated ideas were also noted to gain insight and to evaluate the data set (Crandall et al., 2006). The 23 interview transcripts were then inductively coded for repeated ideas, which were reviewed and grouped into themes and subthemes. This process was iterative and involved multiple code and theme revisions. Summaries of the themes, subthemes, and supportive narrative are presented in Table 1.

Data from the interview transcripts and field notes were consolidated into a decision requirements table (DRT) to represent key decisions (see Table 2). The DRT was used to document and organize recalled cues (a sensory signal), information, strategies, and practices associated with expertise, as well as to identify specific challenges, potential pitfalls, and errors typically associated with inexperience. The DRT helped to synthesize and integrate the data across the 12 recalled incidents from expert SFOs and the 11 recalled incidents from novice AFOs, revealing overall key trends (Crandall et al., 2006).

Quality Control Procedures

To demonstrate the objectivity of the research method, analysis, and conclusions, qualitative assessments were tested for interrater reliability to quantify the level of consistency between two independent raters who coded 30% of the data. The percentage of direct agreement for initial independent coding of the data was 62%, and Cohen's kappa coefficient was .71 (range across transcripts: κ = .48–.83). Based on criteria set forth by Banerjee, Capozzoli, McSweeney, and Sinha (1999), a kappa coefficient of .71 represents a fair level of agreement beyond that due to chance. Instances of disagreement between raters were discussed, and the coding system was adapted accordingly. The percentage of direct agreement for the reconciled coding was 92%, and Cohen's kappa coefficient was .89 (range across transcripts: κ = .83–.97). Based on the criteria of Banerjee and colleagues, the reconciled coding had a substantial level of agreement beyond that due to chance.

RESULTS

Incident Demographics

Out of the 12 SFOs interviewed, 9 (75%) recalled spontaneous incidents to which they were deployed or self-deployed while on armed response vehicle patrol. Two (17%) recalled incidents that, due to circumstantial factors, involved a rushed and partial deployment briefing, and only one recalled a preplanned operation. Recalled incidents occurred between 2000 and 2011. Eleven incidents involved contact

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TABLE 1: Themes and Subthemes With Supportive Narratives From the Transcripts

Theme: Subtheme	Officers referring to subtheme, *n*		Sample data extracts
	Expert SFOs	Novice AFOs	
Experiential knowledge			
Assumptions	8	4	We generally don't run into fights with people who have various issues [mental health, alcohol or drugs] 'cause they're more volatile and more prone to doing something that's unexpected. (SFO2)
Prototypes and analogues	9[a]	6[b]	Try your best to, to stop anything like that [7/7, 9/11] happening, in your patch. (SFO10) It took me back to the training course. (AFO3)
Mental modeling	11	11	I always try and preempt the "what if" factor . . . in a position where it's not a surprise. (SFO4) Try and cover any contingencies. . . . I was told when I first come down, when a job is coming in, give yourself hypothetical scenarios, what if, what if, what if. (AFO11)
Typicality	11	9	You'll pick up, as a result of the experience on any, er, anything that's missing. (SFO8) Every job is not the same but there are certain aspects of it that you always look for. (AFO9)
Intuition	10	5	You could tell straight away . . . you get a bit of a feeling for a job. (SFO1) A sixth sense. (AFO7)
Shared situational awareness	8	0	Everyone had the same mind-set. (SFO7)
Strategies			
Control	11	1	Hadn't put my blue's and two's on because I didn't want to alert the suspects . . . didn't want to give them any advantage on us, in preparing themselves to deal with armed police . . . a game of chess. (SFO11)
Training mode	11	5	You go into a training mode . . . just tends to come automatically as a result of your training. (SFO8) I actually, sort of reverting to type if you like and reverting to training. (AFO2)
Chunking	6	0	You're subconsciously prioritizing. . . . That's borne out of years of experience. (SFO5) Each stop was a separate little individual event. . . . You're kind of ticking the boxes. (SFO11)

(continued)

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TABLE 1: (continued)

Theme: Subtheme	Officers referring to subtheme, *n*		Sample data extracts
	Expert SFOs	Novice AFOs	
Adaptation			
Flexibility	12	4	The experience sort of made my decision making a lot quicker to say "Well I'm now not doing this role, I'm doing that role." (SFO3) Think on your feet and make a decision and look and be flexible. . . . Because of your training and experience it just kicks in to think, "No one's there, I'll go there and do my job there." (SFO9)
Confidence	9	5[c]	I was very well trained. . . . Definitely the experience helped without a doubt. (SFO11) As opposed to training, this was difficult for me. . . . I didn't have the experience. . . . I was working out of my comfort zone. (AFO1) Sought the opinion of someone who was at the back with me who had more experience. (AFO6) Instead of, I suppose you could say asking permission I would probably say I think I should go here because of this . . . more confident in my own judgement. (AFO6)
Defensive adaptation	8	1	It's fight or flight isn't it? . . . It's survival. (SFO2) I thought, "Oh, **** me, I'm gonna' die." . . . What it boiled down to was me or him. (SFO11)

Note. AFO, authorized firearms officer; SFO, specialized firearms officer.
[a]Prototype.
[b]Analogue.
[c]Seeking verification.

with the suspects, and only one was resolved without direct engagement with a suspect. In this case, the suspect had already left the scene before police arrival; however, this information was known only retrospectively; therefore, every incident recalled involved potential suspect contact.

All 11 novice AFOs recalled spontaneous incidents to which they were either deployed by the force incident manager via the back-to-back radio transmission system or were self-deployed upon hearing the details of the incident through the radio while on armed response vehicle patrol. Two participants were required to act as the OFC during the recalled armed confrontation; however, neither was formally trained to perform this role at the time of the incident (owing to a lack of qualified OFCs available to lead the operation). Both incidents were resolved with the security of a trained OFC available to verify the participants' decisions; however, in both cases, the participant continued the role of OFC until the conclusion of the incident. Nine (82%) officers recalled an incident in which a contact with the suspect was encountered, whereas two (18%) recalled incidents that incurred no contact (i.e., suspect had already escaped before the police had arrived).

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TABLE 2: Decision Requirements Table

Phase			
Decision challenge	Cue/information	Expert strategy/practice	Novice traps
Prearrival			
Spontaneous deployment, uncertainty, environmental challenges	Visual cues, audio intelligence feeds, suspect's previous offenses or emotional/mental health/intoxication, previous knowledge of suspect/case	Situational awareness and assessment, instinct, assumptions, and expectations based on prototypes, predictive mental modeling, and contingency planning	Lack of previous knowledge to inform mental modeling, assumptions, and expectations
Arrival and contact			
Ascertaining control over the situation	Visual assessment of the suspect (attitude, demeanor, likelihood of compliance)	Maintaining covert tactics for an advantage on the suspect, initial dominance/aggression, typicality, and anomaly recognition	Rushing in—lack of situational reassessment
Dynamic	Fast-paced changes in environmental cues, suspect assessment, and intelligence	Tactical action based on training mode, adaptation, and flexibility aided by mental modeling and preparation	Defied expectations, reluctance to adapt
Situational limitations	Lack of resources, equipment, or training	Adaptation, tactical dominance, shared situational awareness	Seeking verification, lack of confidence
Threat to life, contact, shoot–no shoot	Visual assessment of suspect aggression, presentation of a weapon, knowledge of suspect intent/capability, increased physiologic arousal, and perceptual changes	Slowed perception—time to react, controlled adrenaline—faster reactions and stronger disposition, narrowed focus on hands (location of threat), cover, safety in numbers	Uncontrolled adrenaline response, speeded time—rushed and time-pressured decisions
Time pressure, responsibility	High speed, potential suspect escape	Best fit (fast response over optimal but timely decisions), chunking, predictive-consequence mental modeling	Tactics not yet conducted automatically—active analogue recall needed to guide action.
Postincident			
Scene preservation, handover	Lack of pressure	Standard operating procedures, hindsight, and hypotheticals	

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Qualitative Results

The incidents described by expert SFOs and novice AFOs could be broadly split into three general phases: prearrival, arrival/contact (active involvement of tactical performance or contact with a suspect), and postincident (see Table 2). In general, expert SFO decisional processes were not consistently distinct across the phases in a linear manner but were instead applied flexibly throughout the armed confrontation. Expert SFO decision making was adaptive to circumstantial demands, leading to either an establishment of control and typicality or a "tipping point" of struggle for dominance and perceived time-critical threat to life that initiated defensive behaviors. Compared with the flexible experiential decisions of expert SFOs, novice AFOs reported a more sequential and linear process of tactical decision making, which involved extended verbalizations and continued conscious processing throughout. Flexibility and adaptation to dynamic and time-pressured changes were therefore postulated by the SFOs to be the distinguishing feature of expertise in this context.

Our analysis generated four main themes with related subthemes that were relevant to the influence of expertise in decision making during armed confrontation. The details of these themes and related subthemes are discussed in turn, whereas examples and supportive narratives from the transcripts for each theme and subtheme are provided in Table 1. Together, these themes reflect the importance of adaptability to expertise in this context. In this sample, adaptive expertise reflects the flexible application of experiential knowledge, strategies, and skills with confidence in response to situational demands.

1. Experiential Knowledge. Whether declared explicitly or as a guiding force behind tactical confidence, all expert SFOs described their extensive firearms experience as a positive influence on their situational assessment and tactical decision making during the recalled incidents. The influence of SFO experiential knowledge was broadly described in the utilization of assumptions and expectations that were mentally modeled on the basis of personal or working experiences. These assumptions and expectations identified typicality and anomalies in the current set of cues and indicated appropriate tactical strategies based on this assessment. Such processes were often described as intuitive and were believed to be shared with their partners and team.

1a. Assumptions. The influence of SFO experiential knowledge was broadly described in the utilization of assumptions regarding the unfolding incident based on personal or working experiences. Individual situational awareness of audio cues, visual cues, and intelligence feeds interacted with previous expectations to generate assumptions regarding incident legitimacy, suspect intention, and appropriate tactical action. In particular, intelligence feeds (e.g., initial report, background checks on the address, and suspect previous offenses and mental health history) informed assumptions of suspect intention and capability, which indicated expected tactical roles, responsibilities, and actions. These assumptions were predominantly influential during the five recalled incidents that involved suspects who were deemed to be emotionally or mentally distressed and/or intoxicated. The overall underlying concern when dealing with an emotionally or mentally distressed suspect was the potential negation of achieving compliance as a result of an assumed unpredictability and lack of rationality or reasoning. This is supported by previous reports acknowledging that the unpredictability of these suspects typically negate the assumption of rational compliance (Police Complaints Authority, 2003; Squires & Kennison, 2010). Therefore, additional tactical consideration, caution, and urgency were emphasized in these cases as a reflection of the increased risk associated with suspect unpredictability.

1b. Prototypes and Analogues. Supporting previous studies suggesting that experiences merge in memory with increasing expertise, nine expert SFOs used analogues nonspecifically as prototypes rather than standout cases (Fackler et al., 2009; O'Hare et al., 1998). These prototypes built assumptions regarding the suspect's mentality, capability, and intent. In six cases, the suspect was known to the SFO. This experience helped build strong assumptions and expectations regarding the suspect's potential behavior.

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In contrast, six novice AFOs recalled utilizing specific analogues in their tactical decision making. For instance, analogues of training events in which a mistake was made were used as a reminder to be vigilant to potential error. Analogue recall was described as a visual process; AFOs would picture themselves at an analogous scene of training, run through what happened in these scenarios, and marry up similarities to guide predictions and preparation. One AFO recalled using past experiences as a "portfolio of jobs" matched to the current context to identify appropriate tactical options (AFO9).

1c. Mental Modeling. Information received on deployment and any other further intelligence feeds interacted with officers' models of typicality, or "schemata" (Plant & Stanton, 2012; Plant, Stanton, & Harvey, 2013), to build mental models of the unfolding events. *Mental model* refers to a representation of the core relationships within a domain based on conceptual knowledge and understanding (Wiltshire et al., 2014). Mental models enabled officers to consider potential tactical options and appropriate standard operating procedures (SOPs) in accordance with projected events, and they initiated consideration and preparation of associated equipment (ballistic protection or weaponry).

Mental modeling was described by 11 expert SFOs as a preparatory process, which aided later adaptation (Klein & Militello, 2001; Pirolli & Card, 2005). Eleven expert SFOs used mental models to mentally simulate potential solutions and the associated outcomes to assess these options and adapt their behavior accordingly. This was formally acknowledged as "contingency planning" and included physically preparing to deal with predicted events and outcomes (e.g., positioning self and equipment).

Predictive mental modeling was described as a preparatory skill developed over time based on previous knowledge, experience, and training. Nevertheless, all novice AFOs also described a process of mental modeling (i.e., "what if"), and for 10 novice AFOs, this involved mentally visualizing potential actions and "worst case" outcomes to prepare contingencies for such events. Expert SFOs and novice AFOs both described mental modeling as a visual process that directs choice; however, although expert SFOs exclusively discussed predictive mental modeling prearrival, AFOs reported mental modeling to be most influential on contact with a suspect.

1d. Typicality. By comparing environmental cues to schematic models of typicality, officers were able to either identify a match or recognize an anomaly. Identifying a match between cues and typicality triggered procedural knowledge and action known to be successful in previous analogous situations. In contrast, anomaly recognition heightened situational awareness to notice and address critical cues (Crandall et al., 2006; Klein & Militello, 2001) and therefore was crucial to AFO/SFO tactical decision making. Eleven expert SFOs reported that the ability to quickly recognize anomalies was accounted for by their experience. The most common and influential recognized anomaly was instances in which the suspect did not meet the officer's expectations of compliance. As a deviation from typicality, noncompliance instigated suspicion of the suspect's intent.

1e. Intuition. AFOs' development of expertise was emphasized in reports of intuitive assessments regarding incident legitimacy, severity, address, and suspect identification. This was described as a skill that developed over time with experience. Expert SFOs reported having a "feel" for an incident, which helped them judge safety, priorities, and tactical decisions. Some novice AFOs also reported beginning to utilize intuition in this way (see Table 1). Expression of the incident "not being right" indicated intuitive anomaly recognition, triggering subsequent redirection of attention to focus on these anomalous features.

1f. Shared Situational Awareness. If afforded time to do so, individual situational awareness was verbally shared among team members to promote interteam coordinated responses. Team communication often reflected a prescribed script of routinely practiced verbal drills, which confirmed that an officer was currently conforming to tactical expectations. Nonetheless, eight expert SFOs described a lack of overt communication with the team during contact

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with the suspect that reflected an implicit shared understanding and trust with the team. As a result of this shared understanding, eight expert SFOs said that they could make predictions regarding their colleagues' actions and utilize these predictions to speed up their own response in support. This supports literature that identifies expert team decision making in terms of shared cognition and shared mental models, which rely on a common knowledge base and aim (Cannon-Bowers & Salas, 2001; Salas, Cooke, & Rosen, 2008; Sonesh, Rico, & Salas, 2013). Furthermore, as an alternative to verbal discussion, expert SFOs sometimes established and exchanged visual communication with one another to ascertain their safety, shared knowledge, and collaborative understanding. A lack of ability to establish this visual communication resulted in a sense of isolation and vulnerability.

2. Strategies. Experiential strategies included the active pursuit of control, a reliance on an automated "training mode," and a process of "chunking" that involved compartmentalizing and prioritizing tasks.

2a. Control. Ascertaining a level of control over the incident was repeatedly reported by 11 expert SFOs to be a prioritized aim. For expert SFOs, a lack of control reflected a lack of predictability, on which the likelihood of a successful and safe conclusion was presumed to be reliant. Having sight of the suspects while working within a prescribed and familiar tactic enabled a greater sense of control. Ascertaining physical control of the suspects signaled an end of the immediate perceived threat and instigated postincident considerations.

To ascertain early incident control, expert SFOs initially used covert tactics. Covert methods allowed SFOs to be completely prepared to enforce a tactic within a highly controlled and rehearsed framework. By alerting the suspect to the ongoing police operation, six SFOs feared that "blowing the job" would give the suspect preparation and reaction time to escape or pose a lethal threat. Initial police dominance on arrival was reported by 10 expert SFOs as a method of establishing early compliance to ease the pressure of the subsequent phases by negating unplanned, responsive, and therefore more risky methods and outcomes.

Whereas 11 expert SFOs heavily emphasized gaining and maintaining control as the strategy behind their tactical decisions, only one novice AFO discussed this. Yet, despite a lack of explicit discussion of this issue, novice AFOs did prioritize covert methods as a means to maintain an advantage over a suspect and to reduce the opportunity to escape.

2b. Training Mode. Through repeated practice, certain behaviors are automatically initiated in response to specific situational cues without conscious cognitive deliberation (Shachak, Hadas-Dayagi, Ziv, & Reis, 2009). Supporting this, if situational assessment indicated that control was achievable, officers from both samples (11 expert SFOs and 5 novice AFOs) automatically reverted to tactical responses in accordance with SOPs (referred to as "training mode"). Because they require little monitoring, automatic responses are fast and efficient, freeing limited cognitive resources to consider other aspects of the incident (e.g., situational assessment, recognition of critical cues, and adaptation). Training mode was more readily utilized by expert SFOs than novice AFOs, although only up to a tipping point of a perceived immediate threat to own life, which instead automatically initiated defensive behavioral responses.

2c. Chunking. Seemingly endless lists of considerations and simultaneously occurring events and tasks were described to generate an overwhelmingly high level of perceived cognitive demand (referred to as "spinning plates"; AFO9). As a result of this overwhelming demand, six expert SFOs reported chunking (Gobet et al., 2001) the incident into separate tasks to be dealt with of priority. This chunking process helped expert SFOs identify and prioritize tasks, reducing cognitive demand while serving to highlight anomalies and tasks to be addressed: It increased situational awareness. Supporting naturalistic decision making claims of an expert "in-built prioritization" scheme of environmental cues (Seamster et al., 1993), prioritized judgments were made subconsciously and quickly as an outcome of SFOs' expertise. Novice AFOs did not report this strategy in their

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description, indicating a discrepancy among the strategies across differing levels of expertise.

3. Adaptation. Armed confrontations involve highly dynamic and changeable threats; therefore, in addition to tactical proficiency to take immediate action (i.e., "training mode"), officers must be prepared to behaviorally adapt. All 12 expert SFOs referred to adaptations in their decisions, roles, positions, and tactical actions. Most adaptation reported was made in response to situational limitations (e.g., threat to own life, time pressure, and resource strategies). Threat to own life resulted in adaptations such as sacrificing speed for safety, whereas time-pressured adaptations included going without a preferred (primary) weapon or quickly implementing tactics in a nonpreferred location to effect a quick arrest. Sometimes, this adaptive need meant resorting to a satisfying "best fit" option to avoid "worst case" outcomes.

3a. Flexibility. Through experiential knowledge, SFOs were aware of the unpredictability of armed confrontations and could recognize when they needed to be flexible to changing circumstantial demands and adapt their decisions, roles/positions, and tactical actions accordingly (i.e., deciding to enter a house as a team of two, rather than contain it and wait for further resources, in accordance with policy and guidelines based on the intelligence of an injured victim inside). Whereas expert SFOs intuitively recognized a need for flexibility and implemented adaptation quickly, novice AFOs relied more heavily on SOPs and were reluctant to implement change. For example, one novice AFO described how, following SOP guidance toward baton gun availability and access, he or she prioritized this in the recalled situation. However, in hindsight, this participant declared that he or she would not do so again based on experience that freedom of movement and speed in that situation were more advantageous than access to use a baton gun.

3b. Confidence. Confidence enabled expert SFOs to be flexible with tactics or decisions and to do so quickly. In contrast, novice AFOs were more cautious in their tactical decision making and reluctant to adapt, preferring to act within a prescribed tactical framework despite contextual redundancy. Novice AFOs were able to recognize anomalies and identify when SOPs could no longer be adhered to under the demands of the armed confrontation; however, they were not always confident enough to adapt to these demands. Instead, novice AFOs dealt with their inexperience by seeking verification before implementation of a decision from a more experienced officer.

Five novice AFOs sought verification from an officer of higher authority or with more experience before implementing a tactical decision or action. This "safety net of other, more experienced colleagues" (AFO1) acted as a "cushion" (AFO9) to verify decision making. Such verification involved "appraising ideas" (AFO2), assessing response appropriateness (checking for glaring mistakes), and reassurance. One officer described this process through the analogy of a child looking to an adult for verification of her or his answer when learning a new word (AFO4).

Six novice AFOs acknowledged that, since the recalled armed confrontation, their confidence had grown. This increase was described as a predicted behavioral change—from seeking verification to informing teammates of decisions and enforcing one's own judgment, even if it contrasts the actions of a more experienced officer. Such changes were expected to involve the confidence to act quickly on one's intuition, as opposed to waiting for instructions. These behavioral changes may reflect the development of trust in one's adaptive decision making or mental modeling of skills over time.

3c. Defensive Adaptation. Upon a struggle to acquire control, expert SFOs' threat perception was heightened, resulting in internal changes, recognition of a need for adaptation, and defensive behavior. Eight SFOs and nine AFOs reported perceiving a direct threat to their lives at some point during the recalled incident. Perceiving there to be a direct threat to life reflected three factors: (a) an increase in the suspect's physical or verbal aggression; (b) the presence, perception, or presentation of a weapon; and (c) dangerous environmental conditions (a lack of ballistic or visual cover). Considerations of self-preservation influenced positioning and tactical

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options. Under personal threat, tactical considerations (e.g., victim, containment of house, and public cordons) were sacrificed in favor of prioritizing a "reactionary gap" (AFO8)—that is, enough distance between themselves and the suspect to enable effective defensive behavior in response to any potential threat posed by the suspect, full focus on the threat posed to self, and addressing that threat. Novice AFOs explained that without the prioritization of their safety, their ability to safely conduct a tactic is compromised. After surpassing a tipping point of a perceived time-critical threat to life, final shoot–no shoot decisions were instinctual defensive responses based on a dual judgment of self-preservation (i.e., "me or him"; SFO11), which took precedence over tactical objectives.

DISCUSSION

This study sought to compare the processes underlying the tactical decision making of expert SFOs and novice AFOs. Comparing these results highlighted similarities and differences. This information was consolidated into a DRT to synthesize and integrate the data across the two groups, which revealed key trends and disparities and highlighted potential areas of training (Table 2). Noted disparities included (a) a difference in coping with cognitive load, (b) SFOs' confident implementation of intuitive decision making versus AFOs' reliance on instruction and verification before decision implementation, and (c) SFOs' recognition of situational changes and subsequent tactical adaptation versus AFOs' reluctance to move away from SOPs despite their contextual irrelevance.

The results from both CTAs suggest adaptive flexibility to be a distinguishing factor of SFO expertise. SFOs are proposed to have adaptive expertise, which consists of the ability to (a) understand when and why particular procedures are appropriate or inappropriate; (b) recognize shifts in the situation that necessitate adaptability; (c) respond to situational cues that indicate the prioritization of speed and accuracy (Verschaffel et al., 2009); and (d) implement rapid, accurate, and contextually appropriate tactical changes (Kavanagh, 2006; Kozlowski & DeShon, 2004).

SFOs and AFOs both formed and tested mental models and relied on schematic models of typicality for pattern and anomaly recognition (Klein & Hoffman, 1993). However, experience enabled expert SFOs to use these processes more flexibly in response to dynamic situational demands. For instance, both samples recognized situational cues that indicated the need for adaptation of SOPs in favor of more appropriate tactical actions, but expert SFOs understood the interactions between the cues and the unfolding incident and responded by quickly and intuitively adapting appropriately. In contrast, novice AFOs preferred to stick with SOPs for as long as possible, even when doing so inhibited the progress of the incident, adapting their tactical actions only if faced with an immediate threat to life (in which case, defensive behaviors took over) or when doing so was verified by a more senior and experienced officer. This disparity may reflect a different reliance on perceptual and conceptual knowledge between the two groups. Perceptual knowledge, which enables recognition of critical environmental cues, is thought to develop much quicker than conceptual knowledge (the ability to interpret the relevance and meaning of such cues; Melcher & Schooler, 2004). Supporting this, novice AFOs were able to see when current SOPs were not working (perceptual knowledge), but they were not always able to understand how they could adapt to these cues (conceptual knowledge; Fiore et al., 2012).

The ability to flexibly transfer and apply experiential knowledge to new contexts depends on the ability to recognize the underlying principles that govern the situation (Verschaffel et al., 2009). For instance, as expert SFOs described, mental modeling reflected a process of "picture developing" to (a) causally connect and explain the situation in a meaningful way, (b) build expectations, (c) direct decision making, and (d) prepare for subsequent actions and outcomes (Fackler et al., 2009). Mental models (conceptual knowledge) not only enabled expert SFOs to immediately recognize contextual changes and when standard tactical options were failing in the current context (based on previously projected occurrences, outcomes, and own responses) but also enabled their understanding of how and why they could adapt their training or assigned role to the identified situational changes (Fiore et al., 2012). Both samples uti-

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lized mental modeling strategies; however, expert SFOs were able to quickly generate a larger number of hypothesized potential occurrences. A greater number of anticipated task-relevant options have been found in previous studies to help experts predict actions and outcomes more accurately under uncertainty, enabling greater flexibility to respond to projected events (Gutzwiller & Clegg, 2013; Ward, Ericsson, & Williams, 2013). Similarly, expert SFOs described mental modeling before arriving at the scene as a preparatory process that aided adaptation in later phases of the armed confrontation. In contrast, novice AFOs' inexperience was shown in their lack of confidence and reliance on verification of tactical decisions before implementation of adaptive action.

Reflecting Rasmussen's (1976) decision ladder, novice AFOs were found to respond to the circumstances occurring during a firearms incident in a linear process of reasoning, as compared with expert SFOs, who flexibly shunt from cue to cue depending on the contextual demands (Jenkins, 2009; Naikar, 2010). The parallel between these findings and Rasmussen's decision ladder suggests implication for training recommendations.

Theoretical Implications

In all, the current findings complement previous models of expertise. For instance, models such as Klein's RPD model (1997, 2008) indicate expertise to be exemplified by a recognitional shift from analytic processes toward automatic intuitive response (Benner, 2004; Lipshitz et al., 2001). The current results support the gradual development of reliance on intuitive processes: expert SFOs reported having a "feel" for an incident (SFO1), which helped them judge priorities and tactical decisions. In addition, almost all expert SFOs reported relying on an automatic response that they referred to as "training mode," which echoes a simple match process via the RPD model (Klein, 2008). However, the data show that under some circumstances (low levels of time-critical threat; i.e., prearrival and postincident procedures), experts continue to utilize analytically planned processing, such as compartmentalization (e.g., "You're kind of ticking the boxes"; SFO11) and mental modeling (e.g., "I always try and preempt the 'what if' factor"; SFO4). Therefore, the current data suggest that expertise in the context of tactical decision making during an armed confrontation is not defined by either intuitive or analytic processing alone but rather is exemplified as the flexibility to adapt one's responses quickly and confidently to situational changes under increased demand. Consequently, this study provides support for the RPD model (Klein, 1997, 2008), theories of adaptive expertise (Mercier & Higgins, 2013; Verschaffel et al., 2009; Wiltshire et al., 2014), and Rasmussen's (1976) decision ladder, which similarly sees flexibility and adaptation as the defining characteristic of expert decision making (Jenkins, 2009; Naikar, 2010).

Practical Implications

Applications to Police Policy. The current study presents an evidence-based framework of tactical decision making during armed confrontations that accounts for contextual influences on performance. Increased general understanding of the complexities involved in AFO decision making during armed confrontations may similarly improve public trust in the accountability of police decision making around the use of firearms. Although it is currently unclear whether the attentional capacities of AFOs can be improved, an awareness of the limitations of attentional processes in high-demand situations is crucial, both for the AFOs themselves and for those investigating their responses (Kavanagh, 2006).

Police Training. The comparative results of both CTAs highlight adaptive flexibility to be associated with firearms expertise; therefore, it is suggested that police firearms training could enforce adaptive expertise more strongly to enhance AFO flexibility to changing task demands under high-stress conditions. Cognitive transformation theory claims that the development of adaptive expertise depends on pattern recognition, perceptual discrimination, understanding of the interconnections of knowledge, and the ability to modify knowledge to the specifics of situation or domain (Klein & Baxter, 2009; Wiltshire et al., 2014). Therefore, to promote

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adaptive expertise, development of the following is recommended: mental models (Gutzwiller & Clegg, 2013; Klein & Militello, 2001; Pirolli & Card, 2005; Ward et al., 2013), sense-making skills to recognize conflict between mental models and current situational cues (Fiore et al., 2012; Morrison, Wiggins, Bond, & Tyler, 2013), and the ability to revise or reject mental models in response to situational assessment (Ando, Kida, & Oda, 2002; Wiltshire et al., 2014).

Speculatively, this may be accomplished by systematically exposing AFOs to a variety of scenarios where, through guided practice and feedback, they can develop the models of typicality necessary for rapid and accurate situation assessment and anomaly recognition (Fiore et al., 2012). Exposure to high-fidelity "worst case" armed confrontation simulations involving situations that cannot be solved through traditional methods (tactical SOPs) may encourage adaptive flexibility to complete the exercise (Ando et al., 2002; Williams & Westall, 2003). Future research is needed to fully examine how the acceleration of adaptive expertise can be implemented in practice, and any implementations should be fully evaluated to assess their effectiveness.

Limitations

As previously discussed, because of the automaticity and therefore often unconscious nature of expert decision making, experts in particular may find it difficult to articulate any intuitive processes via interviewing techniques (Feldon, 2010; Smink et al., 2012; Tofelgrehl & Feldon, 2013). Whereas CTA has been shown to succeed in extracting up to 43% more decision-based performance-relevant information from experts than standard interview protocols (Clark & Estes, 1996), it must be acknowledged that as a form of interview methodology, CTA is likely to suffer from the same limitations in terms of extraction of intuition. However, the publication and high citation of reports that utilize interview methods such as CTA for the extraction of expert intuition in a variety of decision making environments (i.e., Benner, 2004; Klein, 1997; Wong & Blandford, 2002) support the use of interview methods for the study of expertise

The length of time passed between the incident and expert SFOs' recall was substantial in some cases and therefore could present a methodological issue; however, the recall of unverified retrospective events must be considered as a possible limitation of both CTAs. Previous studies have used the CDM technique to interview participants regarding the decisions made during an observed event (Brezovic, Klein, & Thordsen, 1990). Therefore, to combat the possibility of memory fragility in the recall of unverified retrospective armed confrontations, a follow-up study is proposed to examine the decisional processes occurring during the completion of a recorded firearms training exercise.

It should be noted that analysis is based on only 23 participants, all recruited from a firearms department within the same British police force. Although it is acknowledged that generalizability is a shortcoming, AFOs are a specific group of decision makers, and as such, generalization to a larger population is not a major consideration, as findings are to be applied to these particular decision makers (McAndrew & Gore, 2013; Roth et al., 2010). More relevant, it is possible that these results represent force-specific novice AFO and expert SFO tactical decision making, and a larger sample generated across UK-wide forces could help decipher the generalization of these findings to UK AFO tactical decision making more accurately (Smick et al., 2012). Nonetheless, given the limited time available and difficulties in gaining access to such a specialized group of officers, this was not possible. Future research may seek to clarify these issues through replication with officers across different forces to examine relationships and whether they exist in different policing areas.

CONCLUSION

Similar processes were reported across the two groups, whereas strategies used, tactical implementation, and confidence differed. Expert SFOs had a great deal of experiential knowledge. With this knowledge, expert SFOs were able to (a) categorize incidents, (b) recognize anomalies, (c) have awareness of and be able to quickly adapt to the dynamic environment, (d) use their training unconsciously and automatically, and (e) demonstrate confidence in their abilities. Confidence in one's ability enabled expert SFOs

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to utilize experiential strategies that freed cognitive resources, affording implementation of adaptive tactical decisions and actions assessed through mental modeling. Novice AFO comparison highlighted the gradual development of confidence in one's own ability. These findings can be implemented into AFO training, thereby highlighting the importance of these cognitive processes as a contributor to expert tactical decision making during firearms incidents.

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