

The role of endogenous and exogenous uncertainty in critical incident decision making: An example from hostage negotiation

Claudia VAN DEN HEUVEL^a, Laurence ALISON^a and Nicola POWER^a

^aUniversity of Liverpool

ABSTRACT

Introduction: This study examined the impact of uncertainty during a simulated live hostage negotiation training event for police officers. **Method:** The nature and origin of uncertainty was assessed using observational methods of performance (at the time and by reference to video footage), decision logs and post-incident simulated recall semi-structured interviews. **Results and discussion:** Thematic analysis revealed a dichotomy of uncertainty sources. Early situation assessment phases of decision making, uncertainty was characterised by endogenous sources (uncertainty about the problem situation) such as concern for victim's welfare. During the plan formulation and implementation of actions, uncertainty was characterised by exogenous sources (uncertainty about management and team) such as low role understanding and trust. Overall, exogenous uncertainty (75%) occurred more frequently than endogenous uncertainty (25%). Naturalistic decision making studies should utilise this dichotomy to assist structured recommendations for uncertainty management research.

KEYWORDS

Uncertainty management; critical incidents; teams; role understanding; trust

INTRODUCTION

Police-related critical incidents are high risk, high stake and uncertain events that can leave a long term negative commercial, behavioural or emotional effect on a community (Alison and Crego, 2008). During critical incident decision making, decision making can be degraded when there is perceived uncertainty about the *situation*, potential *options* and projected *outcomes* (Lipshitz & Strauss, 1997). Van den Heuvel, Alison and Crego's (2012) SAFE-T model of expert critical incident response phases (Situation Assessment, Formulation and Execution of plans, Team learning) found that uncertainty could lead to decision inertia and failures to act. For example, uncertainty during the initial situation assessment phase caused repeated and redundant requests for the same information. In addition, uncertainty during plan formulation and execution phases was found to induce choice deferral. It is important to understand the sources causing uncertainty in order to provide applicable interventions to overcome it and foster effective critical incident decision making.

This paper explores a unique case study of crisis decision making. It presents a model of uncertainty that: (i) operationally categorizes sources of uncertainty; whilst (ii) offering preliminary descriptive accounts of how uncertainty may influence critical incident decision processes during different decision making stages. The model synthesises Lipshitz & Strauss' (1997) three-tier model of uncertainty into two uncertainty sources: endogenous uncertainty (relating to the problem situation) and exogenous uncertainty (relating to management and team processes). It then maps these two types of uncertainty onto the SAFE-T model (van den Heuvel et al., 2012) of decision making to pinpoint when and how they may derail strategic decision making.

DICHOTOMISING UNCERTAINTY

Endogenous (to the problematic situation) uncertainty

In line with naturalistic approaches to decision making, *endogenous* uncertainty is derived from uncertainty about the problem event that one is responding to (Klein, 1993). Such uncertainty may be a product of environmental characteristics specific to the problem incident such as ambiguous information, intense time pressure and high perceived risk (Orasanu & Connolly, 1993). Endogenous uncertainties are situational characteristics which can induce doubt in the decision maker. They can be based upon what one is dealing with in the *present* vis-à-vis situation assessment ("what are we dealing with and what are the risks?") along with what they envision to be facing in the *future* vis-à-vis prospective cognitive modelling and anticipatory thinking



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(“How will this event evolve in the future?”) (Klein, Snowden, & Pin, 2007). High endogenous uncertainty is likely to exist when situational information is sparse, overwhelming, contradictory or novel.

When sensemaking fails then decision makers experience dissonance due to the feelings associated with having a non-definitive and inadequate situational understanding (Koppenjan & Klijn, 2004). During a hostage situation, poor situational understanding can occur due to the fast-paced, unstable and emotionally salient nature of the incident (Nohrstedt, 2000). This perceived lack of control over the potential consequences of one’s choice generates significant emotional distress (Nohrstedt, 2000) and increases experienced uncertainty, with an attendant detrimental effect on a decision maker’s cognitive ability to assess situations and problem solve in subsequent decision phases (Klein, 1993). Situational uncertainty is extremely difficult to resolve in such dynamic incidents; the information received is often inherently complex or contradictory and additional information is unavailable (Fiore *et al.*, 2010). Attempts to reduce endogenous uncertainty via information seeking are thus problematic and so strategic decision makers tend to rely on coping mechanisms (van den Heuvel, Alison & Power, *in press*). The present study provides a detailed account of the role of endogenous uncertainty during a simulated hostage negotiation scenario.

Exogenous (non-situation specific) uncertainty

Exogenous uncertainty stems from ambiguity surrounding management and team processes. Exogenous uncertainties can derive from confusion over the the expectations from one’s own and others’ performance within the decision making team which can influence the planning and execution of decisions and actions. Critical incident command teams are often interdisciplinary and cross-functional; they involve individuals from different backgrounds, with different roles and with different levels of operational experience (Nohrstedt, 2000). The ad hoc nature of such teams can produce limitations in interoperable functioning. This is due to role and responsibility confusion, both regarding one’s own role and in interpreting the roles of others (Nohrstedt, 2000). Poor role understanding can reduce confidence (Shanteau, 1997) and self-efficacy (Bandura, 1997). This can cause problems for dynamic decision making, where high self efficacy and confidence are useful for effective goal setting and action planning (Olsen, Roese & Zanna, 1996). A lack of role clarity can produce confusion about individual’s goals, actions and responsibilities, and is predicted to be a key source of exogenous uncertainty.

Poor understanding of a team member’s role can also impede decision making by reducing interpersonal trust in that individual’s perceived competence (Bonaccio & Dalal, 2010). Specifically, a lack of inter-positional knowledge (knowing how each other’s roles interact) can reduce the perceived reliability of other team members’ judgments, decisions and advice (Budescu & Rantilla, 2000) due to erroneous expectations for what others should be doing. Mayer *et al.*, (1995) defined trust as a willingness to be vulnerable to the actions of another party, underpinned by three perceived antecedents relating to the trustee’s: i) *ability* to perform the task; ii) *benevolence* to the best interests of the trustor; and iii) *integrity* to act consistently. In high risk situations such as hostage events, where an Incident Commander’s (team leader) area of expertise is often different from their advisors, they must trust the advisors’ abilities and intentions to provide accurate advice on potential courses of action (Bonaccio & Dalal, 2010). Trust is therefore predicted to be a source of exogenous uncertainty without these incidents.

METHOD

Participants

Police officers (n=16) from the United Kingdom participated in one of two live hostage negotiation simulation training events. Trainees were experienced police officers who might be called out to an actual hostage scenario. Participants (who ranked from inspector to chief superintendents) included first responders, hostage negotiators, negotiator coordinators (NC), tactical advisors and incident commanders (IC). In addition, 14 role players (one police officer and 13 civilians) also participated at the event playing the roles of hostage takers (n=3) and hostages (n=4) across two training nights. The main hostage taker was played by a police officer with previous experience enacting this role. The additional two hostage takers were played by civilians who were given direct instructions on their role. The remaining role players acted as hostages and were also directed.

Procedure

Data was collected at the two training exercises. The scenario involved hostages being held on a bus within a tunnel over a number of hours at night. A detailed exercise plan was designed in conjunction with police negotiation trainers. Key events and information injects were adhered to on both nights; however, to maintain fidelity and realism, the timing of injects was adjusted to reflect trainees’ decisions. The same narrative arc was achieved with trainees’ making similar key decisions (Table 1).

Table 1. Key decisions from both training nights

	What happened during the event?	How was the event resolved?
Event one	Hostage taker demanded a car three times A hostage had their thumb cut off A hostage was shot and killed	Release of the four hostages Main hostage taker left bus with aim of being shot but was successfully detained
Event two	Hostage taker demanded a car three times A hostage was ‘seriously injured’ by being thrown across the bus A hostage was shot and killed	Release of two hostages Release of two fellow hostage takers Main hostage taker committed suicide on the bust

Data Collection and Analysis

Decision Logs

Both the IC and NC completed decision logs during the scenario. Endogenous sources of uncertainty (relating to the problematic event) were measured quantitatively via a rating scale on perceived risk along with ratings for concern about the victims, other police officers, the hostage taker and themselves. Exogenous sources of uncertainty (relating to management and team processes) were measured quantitatively by ratings on perceived quality and trustworthiness of advice received from others (IC only) and by confidence in decisions. Confidence was used as an inverse measure of uncertainty so that low confidence represented high uncertainty (Kuhthau, 1991).

Videoed Strategic Command Meetings

Strategic command meetings during the scenario were recorded and transcribed. Transcriptions were divided into frames from one source (e.g. IC) to a target (e.g. NC) resulting in 735 discussion frames. Thematic analysis was utilised to code uncertainty sources (Braun & Clarke, 2006) with frames firstly coded semantically for specific sources of uncertainty (e.g. concern for victim; role understanding) and then split into two theory-driven categories (i.e. endogenous; exogenous). Discussion frames were also coded to reflect the decision phase that participants were discussing using the SAFE-T model to indicate whether discussions were about situation assessment, plan formulation or plan execution (van den Heuvel et al., 2012). Coding for decision phases (Kappa = .63; $p < .001$) and uncertainty sources (Kappa = .58; $p < .001$) had moderate yet significant inter-rater reliability between two independent coders.

Post-event Interviews

Interviews with participants (n=5) were conducted in the weeks following the training event. Interviewees were shown their videoed strategic command meetings and asked to identify and particularly uncertain decisions and why they had felt uncertain. Interviews were recorded, transcribed and thematically analysed. As above, semantic codes for uncertainty sources were initially coded semantically and then themed into theory-driven exogenous and endogenous uncertainty categories.

RESULTS

Decision-phase analysis of uncertainty

Overall, 25% (n=43) of discussion frames focussed on endogenous uncertainty and 75% (n=134) on exogenous uncertainty (Table 2). During situation assessment discussions, 37% of discussions were about endogenous uncertainty which was higher than the base rate probability of 25% across the scenario. During plan formulation and plan execution, 82% and 95% of discussions were about exogenous uncertainty which was higher than the base rate probability of 75%.

Table 2. Proportional representation of uncertainty type during each decision phase

	Situation assessment	Plan formulation	Plan execution	Total
Endogenous uncertainty (about problematic situation)	29 (.37)	14 (.18)	1 (.05)	43 (.25)
Exogenous uncertainty (about management and team)	49 (.63)	66 (.82)	19 (.95)	134 (.75)
Total	78	80	20	178

Sources of endogenous uncertainty

Both risk perception and concern for others were used as quantitative measures for endogenous uncertainty. Risk was perceived as high throughout the entire scenario ($M = 8.83$, $SD = 1.60$) with officers significantly more concerned about victim safety ($M = 9.45$, $SD = 1.50$) than with the safety of other officers ($M = 5.61$, $SD = 2.87$), hostage takers ($M = 4.08$, $SD = 2.75$) or themselves ($M = 4.76$, $SD = 2.87$) ($t(37) = 38.79$, $p < .001$).

Qualitative analyses of interviews also found victim safety to be a key source of endogenous uncertainty. When victim safety was ambiguous, officers were found to rapidly re-evaluate their situation assessment to try and overcome uncertainty. This was evident when unprovoked violence occurred during the scenario. As two NC's noted during interview: *"I didn't feel uncertain at any point UNTIL he allegedly cut a finger off. Until then I couldn't see any rationale for an outcome that wasn't positive"* (NC); and *"It was as the scenario became more difficult and there was more risk to individuals - that was when [my] decision making changed. Because it's harder because now you are playing with people's lives."* (NC).

Sources of exogenous uncertainty

Confidence and trust in advice measures were used to quantitatively assess exogenous uncertainty about management and team processes. On average, trainees were confident in their decisions ($M = 7.37$, $SD = 2.08$) but recorded low trust ($M = 4.71$, $SD = .83$). Correlations found that trust was not significantly related to confidence ($r = .12$, $p > .05$), but a positive trend in the data did suggest that low trust was associated with low confidence (i.e. uncertainty).

Poor role understanding

Qualitative analysis of interviews indicated that a lack of understanding in one's role was a prevalent source of exogenous uncertainty: *"I should be in a stage where I know exactly what I should be doing, and I didn't"*. Poor role understanding was primarily due to perceived insufficient experience: *"...it's out of my comfort zone, I am not used to performing that role"* (NC), which manifest itself as either role confusion or role corruption. Role confusion involved officers not knowing what decisions and actions were their responsibility: *"The NC had never done the role before so he did not have the experience. I think he showed some confusion as to what was his or somebody else's responsibility"* (IC). Role corruption involved officers engaging in behaviour that was outside of their responsibility by: *"trying to cross over into other people's roles and responsibilities"* (IC). A recurrent theme involved individuals constantly having to remind themselves of their role: *"In my decision making I was constantly spinning the Conflict Management Model. But for me, in the role of Coordinator I thought 'wait there, that is not for you in your role, that is for [the IC]' ... it's knowing to keep you negotiator hat on... You often get a bit of role corruption"* (NC).

Poor interpersonal trust

Qualitative analysis of interviews indicated that poor interpersonal trust was also a prevalent source of exogenous uncertainty: *"No I don't think it (uncertainty) had anything to do with the situation, it was the interpersonal side of things"* (NC). Poor trust appeared to be a product of the perceived inability of team members to perform their roles: *"I would be considering whether X was the right individual to perform that role."* (IC). If officers judged their colleagues as incompetent, they tended to distrust that individual's advice, which was potentially exacerbated by erroneous role understanding. Alternatively, perceived ability improved trust: *"I found it easier to deal with the experienced one because I could see what he was doing. With the novice I was spending time training them from scratch"* (IC).

Perceived benevolence ('the extent to which a trustee is believed to want to do good for the trustor'; Mayer et al., 1995, p.718) also reduced trust and increased exogenous uncertainty. ICs often perceived information provided by advisors as being in pursuit of individual rather than collective goals by: *"trying to assert control over the situation and run it the way they wanted it to run rather than allowing me to be the decision maker"* (IC). Trust in advice was reduced and exogenous uncertainty increased when advisors were perceived to lack benevolence and be focussing on their own personal goals by: *"making decisions to influence me instead of giving me all the information and options"* (IC).

DISCUSSION

This paper has presented a hostage negotiation simulation as a case study for assessing uncertainty in critical incident decision making. It has built upon existing theories of uncertainty (Lipshitz & Strauss, 1997) and naturalistic decision making (van den Heuvel et al, 2010) by synthesising sources of uncertainty into two categories: *endogenous* uncertainty (relating to the problematic situation) and *exogenous* uncertainty (relating to management and team processes). The quantitative and qualitative results illustrated that endogenous uncertainty caused decision makers to re-evaluate their situation assessment, and stemmed primarily from ambiguity over the welfare of innocent parties. Exogenous uncertainty, which was the more prevalent form of uncertainty, arose during the plan formulation and execution phases of decision making and stemmed primarily from poor role understanding and lack of trust.

Poor role understanding stemming from misunderstanding one's own and other team members' responsibilities has been associated with increased stress and frustration (Kuhlthau, 1991) and reduced satisfaction in decision making (Rizzo, House & Lirtzman, 1970). When a team member failed to meet (potentially erroneous) role expectations, their perceived competence and ability degraded (Bonaccio & Dalal, 2010). In addition, poor trust and a low perceived ability and benevolence of other team members increased uncertainty during the formulating and executing of decisions (Mayer et al., 1995). This potentially reduced team cohesion and willingness to share information (McKay, 1991), where NCs were unwilling to *share* information (Koppenjan & Klijn, 2004), and ICs were also reluctant to *seek* information (Snizek & Van Swol, 2001). Moreover, received advice was suspected of being biased towards personal ulterior motives (Petty & Cacioppo, 1979). This focus on information source rather than message content has been identified as a frequently occurring issue which can significantly derail critical incident decision making (Rake & Njå, 2009).

IMPLICATIONS

It is suggested that exogenous uncertainty may improve with role-exposure training. Interoperable training may: i) aid understanding of one's own and team members' roles (Fiore *et al*, 2010); and ii) enhance interpersonal trust and information sharing (Bonaccio & Dalal, 2010). Reducing exogenous sources of uncertainty (relating to management and team processes) may indirectly improve coping with endogenous uncertainties, where the team can respond cohesively to the problem environment. It is hoped that by dichotomising sources of uncertainty as endogenous (to the problematic situation) or exogenous (to general management and team processes) that naturalistic research into uncertainty can be more objectively structured. Future studies exploring endogenous uncertainty can highlight specific elements of problematic situations which may derail decision making, whereas studies exploring exogenous uncertainty can address the psychological processes involved in team management which may derail decision making in critical incidents.

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