Startle Points: A Proposed Framework for Identifying Situational Cues, and Developing Realistic Emergency Training Scenarios

Jane Barnett, William Wong and David Westley
Middlesex University, UK
j.barnett@mdx.ac.uk

Rick Adderley and Michelle Smith
A-E Solutions, UK
rickadderley@a-esolutions.com

ABSTRACT

Real-world crises are not prescriptive and may contain unexpected events, described here as startle points. Including these events in emergency training simulator scenarios is crucial in order to prepare for startle points that may arise in the real world. Startle points occur when individuals who assess and monitor emergency scenarios, are suddenly faced with an unexpected event, and are unsure how to proceed. This paper offers a non-empirical framework that explores how cues generated by startle points affect decision making. Future research will use the framework to explore how experts and novices experience, and then adapt to startle points, as a function of decision mode, situation awareness, and emotional arousal. The resulting data can then be used to identify cues surrounding startle points and as a consequence, create dynamic scenarios for online training simulators so that individuals can prepare and adapt to them, and transfer acquired skills to real-world emergencies.

Keywords

Startle points, training simulation, decision-making, cognitive interview.

INTRODUCTION

This paper outlines a research framework that aims to inform the design of emergency scenarios for realistic online training simulations. Our particular interest is to understand the nature and consequences of 'startle points' on decision-making processes in crisis situations. Startle points are unexpected events experienced during an emergency situation where the individual freezes for a moment, unsure of what to do next. An understanding of the factors surrounding these events is crucial to the design of simulations that can effectively prepare individuals for real world crisis management (Raybourn, 2006) with regards to unexpected events. This study will preliminarily explore these factors in terms of teams but future research will further explore them in terms of teams.

The purpose of this research is to develop a preliminary understanding of how startle points can affect the decision process, and the characteristics of situations that engender such responses. These characteristics can then be embedded in a training simulation in order to prepare emergency services personnel to recognize and adapt to startle points as they occur. To do this, we intend to: (1) Capture the environmental and cognitive cues experienced by emergency decision makers, during, and after experiencing a startle point; and (2) examine how decision-making adaptation processes vary as a function of startle points.

This paper presents a brief overview of research that has explored startle points, and factors contributing to effective crisis management responses. We then propose a preliminary research framework that seeks to clarify startle points, identify environmental cues that initiate the startle point, and as a consequence, examine how they may affect decision-making, and subsequent control of the crisis situation.

Decision Making and Preliminary Framework of 'Startle Points': A Brief Overview

Crisis events are not prescriptive, and additional unexpected events may continue to occur even when the situation is thought to be under control. Training simulators provide ideal opportunities to train for crisis

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situations in high risk environments, where trainees can rehearse their responses and adaptation to unexpected situations (e.g. Molineaux, Klenk and Aha, 2010), at a low cost. A high level of cognitive functioning is needed to make quick decisions during emergency scenarios. Scripted training with no surprises is limited, as it may not prepare trainees to deal with the realistic aspects of crisis management such as stress. Our methodology has been informed by models of decision-making, situation awareness, sense-making, resilience, and emotional regulation, and the salient points are reviewed here to provide a context for the methods outlined later.

A startle point is a psychophysical reaction that momentarily occurs after experiencing an unexpected or unfamiliar event, which triggers the fight or flight response (e.g. Kalat and Shiota, 2007). The intensity of a startle point may vary as a function of level of anxiety, therefore if an individual is experiencing high anxiety, their experience of the startle point will be stronger (Grillon, 2008). In addition to causing anxiety, startle points may also generate joy or confusion (Ekman and Friesen, 1975), therefore it remains unclear as to how the startle point will emotionally affect subsequent control of the situation. Research has produced varying results when examining how high anxiety and stress affects decision-and sense-making. Complex cues must be quickly adapted and responded to (Entin and Serfaty, 1999) and require a high level of resilience to succeed (Woods and Holnagel, 2006). Whilst some studies have found that unexpected cues slow decision-making and reaction times (e.g. Horstman, 2006) under pressure (e.g. Mann and Tan, 1993), others have shown that higher levels of stress quickened the rate that new information was accumulated (Serfaty, Entin and Deckert, 1993), and improved decision-making (Reykowski, 1966). Numerous studies have supported the fact that information overload will have a negative effect on cognitive functions e.g. working memory, thereby causing a cognitive tunneling effect (Thomas and Wickens, 2001) and increasing the likelihood that errors will be made. Conversely, other research has shown that responses and re-adaptations to rectify the error are quickly undertaken (e.g. Weick and Sutcliffe, 2001). For example, individuals will adopt simplistic strategies (Payne, Bettman and Johnson, 1986) in order to lower the cognitive effort it takes to complete the task. Decisions made in these circumstances may be intuitive or analytical in nature; an area of cognitive skill to which we now turn.

Current models of decision-making tend to offer 'dual-processing' accounts that separate decision processes into unconscious (System 1) and conscious (System 2) modes (Evans, 2008). System 1 (S1) thinking is automatic and driven by heuristics and quickly offers intuitive responses to situations as they arise. System 2 (S2) thinking is slow, effortful, and conscious, and may also be employed to monitor the quality of answers provided by S1. If S2 thinking evaluates S1 answers as incorrect then it can correct or override automatic judgments. In terms of decision-making during emergency situations, expert's choices could be suggested through S1 and evaluated and refined through S2. In contrast, novices would be more likely to rely exclusively on an S2 thinking mode (Reyna, 2004). S1 and S2 thinking can also be applied to the Skills, Rules, and Knowledge model (Rasmussen, 1983), which attempts to explain human performance when undertaking routine and unfamiliar tasks. Whereas Skills are behaviours that utilise a S1 style of thinking, Rules uses S2, where procedures or past experiences may be referred to, in order to reach a decision. Knowledge is relevant when attempting to understand and react to unfamiliar situations, or startle points. After a goal is formulated, an individual may create mental models to assess how different plans may work towards reaching that goal via sense-making (Weick, 1995). That is, making sense of ambiguous or uncertain cues and then predicting the efficacy of the plans. Furthermore, the Information Processing Model (Wickens and Flach, 1988) maintains that there is dynamic interaction between working and long-term memory sources, i.e. referring to past experiences, and attention to environmental cues will allow decision makers to develop accurate representations of situation awareness.

One aspect of S2 thinking that is crucial to emergency management is Situational Awareness (SA), which has been described as a distinct form of vigilance that creates sensitivity to cues, indicating a change in the situation (Bolstad and Cuevas, 2010). SA plays a critical role in decision-making, when a high level of control is needed during an emergency (Blandford and Wong, 2004). There are three levels of SA that are crucial for maintaining knowledge of the emergency (Endsley, 1995). These are *perception* (i.e. constant monitoring of cues), *comprehension* (i.e. the cues should form a mental model of the scenario), and *projection* (i.e. cues and mental models are used to predict eventual outcomes). Startle points will generate additional cues, therefore an individual's attentional focus should quickly switch to, and incorporate them into the existing mental model.

In Figure 1, we provide an overview of decision-making challenges with respect to identifying startle point cues. The purpose of this is to help us identify relevant sources of situational cues that could stimulate or trigger startle points, and their effect on subsequent decision making processes. This framework is based on our preliminary understanding of the emotive and information processing factors that contribute towards causing startle points, such as, anxiety, time pressure and sudden or rapidly changing conditions. Drawing on current models of decision-making and situation awareness, we focus on the 'momentary lapse' outcome of a startle occurrence.

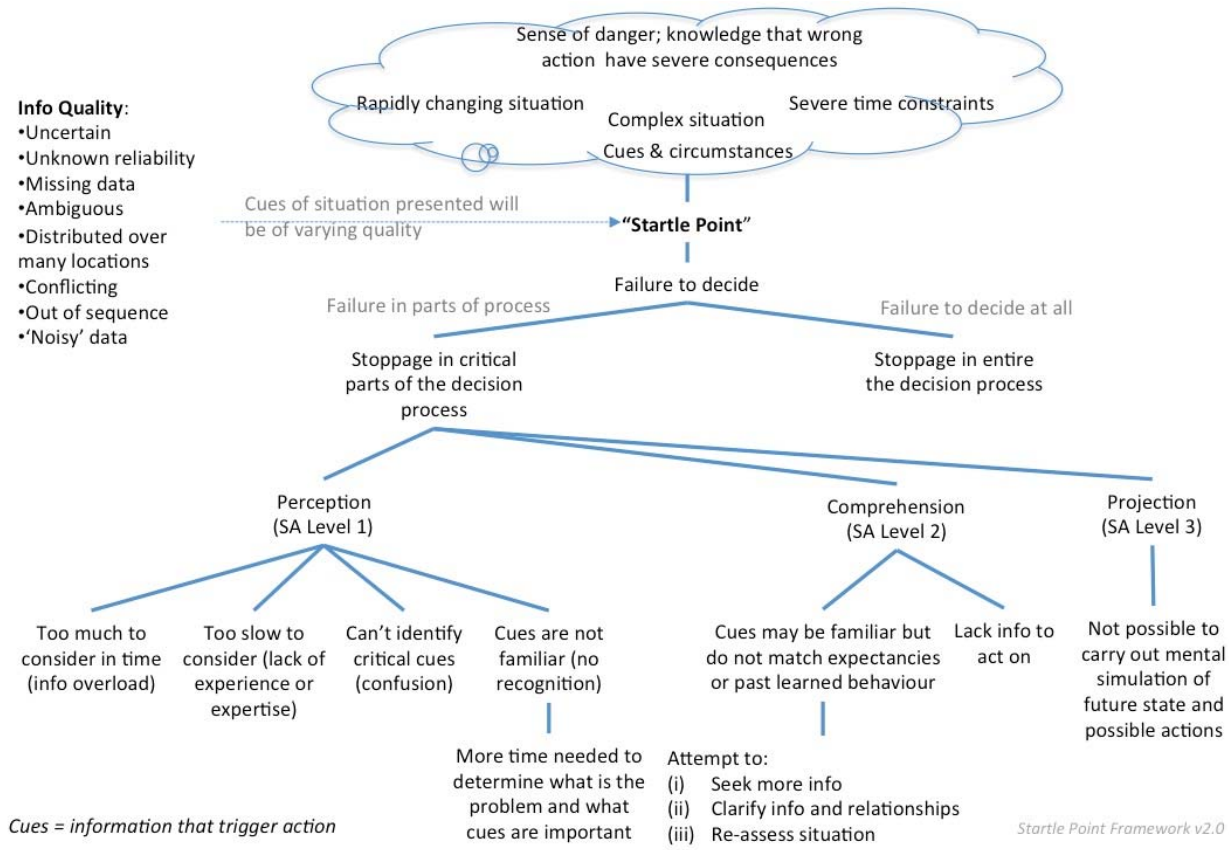

Figure 1. Proposed framework for identifying sources of situational cues that contribute to generating startle.

At this early stage of the research, the proposed framework is not intended to explain the *psychological procesess* by which startle occurs. Instead, its focus is to help us identify the situational cues that can be designed into the development of realistic training simulations.

In future work, we hypothesise and intend to evaluate that crisis situations may invoke startle points that elevate emotional arousal leading to a number of potential consequences. A startle point or unexpected event may cause a momentary pause in thinking, following which the individual may experience high, or optimal arousal (anxiety, joy, or confusion). Evidence suggests that high arousal will lead to cognitive tunneling which will lead to either hesitation or failure to incorporate the new cues generated by the startle point. This diminished attentional state can either result in poor decision-making, or alternatively a switch to skills-based S1 thinking that permits recovery. Conversely, optimal arousal will promote arise from a resilient and optimal attentional mode. whereby the individual will have a maximal situational awareness and sensemaking and as a result, incorporate the new cues into the existing goal. In this case, S2 thinking complements S1 knowledge and will allow the individual to provide an effective response. Given this, we can now use this as a guide to our future field investigations to identify factors that contribute towards (i) creating the environment that generate anxiety and shock, and (ii) aspects of situational information that hinder perception, comprehension or the ability to project and anticipate.

Methodology

We intend to use the Critical Decision Method (CDM) (Klein, Calderwood and Macgregor, 1989; Wong, 2006) combined with the principles of the Cognitive Interview (CI) (Fisher and Geiselman, 1992). CDM is a widely used technique for eliciting expert knowledge, decision strategies and cues attended to in decision-making about particularly memorable incidents in naturalistic environments. CDM is a retrospective protocol analysis interview method that employs a set of cognitive probes to non-routine incidents that require expert judgment. The CI has been shown to be effective in enhancing memory for events that provoke strong emotional responses. It utilises principles of memory retrieval, including context reinstatement and multiple representations of a single event, in order to facilitate accurate and detailed recall of events. Examples of interview probes are 'Describe what you saw, smelled, and heard' (cue identification); 'Were you anxious about making mistakes?' (assessing the likelihood of errors); 'How did the startle point change your decision-

making?' (decision-making); and 'How long did it take to regain assessment of the situation?' (situation awareness). Two types of expert and novice decision makers will be interviewed i.e. real-world emergency personnel, and people who hold similar roles of expertise in online team-based activities. Both groups use decision-making, and situation awareness to achieve a common goal under considerable time pressure (Barnett, Wong and Coulson, 2010). These data will allow us to understand how cues generated by the startle point will generate decision-making challenges.

CONCLUSION

The purpose of this research is to develop a preliminary understanding of the characteristics surrounding startle points and how they may affect decision-making. The results will provide invaluable evidence to enable us to develop simulated emergency training scenarios containing unexpected events in two ways. First, the simulated scenarios can be adapted in terms of level of complexity, allowing novice and expert trainees to undertake high cost modes of training, and make errors at low risk. Second, trainees will be able to review their startle point reactions and subsequent adaptations, using a computer-based after-action review system. To conclude, simulating situations containing startle points will provide a more realistic training environment, and as a consequence increase the likelihood that the transfer of training to the real-world will be positive (Oskarsson, Nählinder and Svensson, 2010). Future research will quantitatively explore the preliminary framework in terms of teams and stress management.

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