"Cues" for Non-Routine Decisions on the Fireground

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Abstract: A decision making model for building decision support system is reported here that is developed through working with fireground incident commanders of the United Kingdom. The model is suitable for decision making in non-routine situations. A detailed description of the development of the model is available in Shaikh (2011). There is a need to develop a working prototype decision support systems based on this model particularly for training and helping FGCs working in countries such as Pakistan, Sri Lanka, Indonesia etc.

Keywords: Fireground incident commanders, decision making, non-routine, information systems.

INTRODUCTION

It has been observed that specialists retains extensive domain knowledge as compared to novices however it is also well established that the experts normally depend on pattern recognition as well along with the domain knowledge – something that novices can't depend on; experts see various situations as distinctive thus identify patterns thus obtain course of action quicker [1]. In time pressured situations, professionals depend on intuitive decision making [2, 3] that relies on pattern recognition in routine situations.

Fireground commanders are one prime example of such professionals that make intuitive decisions that are fast paced and they often rely on pattern recognition in routine situations. Among the models developed for training FGCs, majority of them don't explain how experts intuitively make decisions in non-routine situations. It is believed here that understanding decision-making process followed in non-routine situation will be useful for the novices as well who can then be trained to develop better skills. This paper reports an effort (available in detail in [4]) to describe FGC's decision-making process in non-routine situation.

DECISION-MAKING IN FIREFIGHTING

On the fireground, an FGC does not have the liberty to make decision by knowing all the various course of actions and the consequences of applying each of them. This is only possible in a normative style of decision making which dictates thinking more deliberately [5]. However since on the fireground, time is limited and there are real consequences of wrong decisions or delayed decisions therefore the FGC have to be able to make decisions through fast and frugal methods. Such circumstances need descriptive decision models that describes how decisions are actually made in such environments [6, 7] -the naturalistic decision-making (NDM) models are fit for these situations. An example of NDM is intuitive decision-making. Intuiting is method quickly processing information requiring minimum mental effort. The results of intuition are difficult to explain with logic.

For intuitive decision making, researchers have proposed several models. The main idea behind these models is pattern recognition. Recognition primed decision making model [8], recognition/metacognition model [9] are examples of recognition based decision making models. Pattern recognition dictates recalling past experiences that are similar to the current situations.

Whereas intuition is ideal for time pressured situations whether they are of routine nature or of non-routine nature, however in case of non-routine events it is not possible to recall any one specific event that match with the situation thus pattern recognition does not necessarily applies in these events. Mainstream intuition based decision making models have made to look intuition synonym to pattern recognition. It is important to note that if patterns are applied forcefully without match with the current situation, and are forced upon them, what the decision maker will infer from it would lead to error and non-accurate perception [10].

The pattern recognition strategy does not consider that decisions can be made through a bottom-up strategy, i.e., driven by inferences obtained from the processing of cues, experiences with those cues and domain knowledge [11]. This assumption has given rise to the belief wrongly that perhaps pattern recognition is a non-compensatory [12] approach when it is not.

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Though the pattern recognition process look simple however to use it a decision maker must be adequately experienced and must have seen a large number of events that can repeat themselves. Pattern recognition is not useful for novices because they are beginners who have little experience of the situation in which they are expected to perform [13]. With novices, there is evidence that the mapping process (comparison between current and past experiences) is often syntactic and does not take advantage of many semantic considerations of the domain because novices do not have appropriate higher level structures (categories) and therefore, they rely on superficial similarities [14] between the current situation and their limited knowledge of past experiences [13].

Similarly, in a non-routine situation an experienced commander may also find himself thinking like a novice who just have knowledge of specific cues without many representative schemas to exactly depict the current situation. In countries such as Pakistan, FGCs don't have much technological and training support therefore even the most experienced FGCs find themselves in non-routine situations especially in the backdrop of recurring unique terrorism events. Specifically for the third world countries like Pakistan and for the experienced or inexperienced FGCs finding themselves in non-routine situation, there is a need to develop a model that rely on knowledge that is mandatorily inculcated in them during even limited training they get – cues are that knowledge that they may rely on in making decisions in non-routine situations. All FGCs working in any country are always trained with the cues. A set of cues identified can be viewed in [15]. Briefly the following paragraph states what cues are. More details can be found in [4].

Generally, the 'information observed from the environment' is called cues. Cues can be psychologically analyzed [16], can illuminate path to problems and opportunities [17], help in ascertaining the developing situation ([18, 19]). The impact and value of all types of cues emerge from the actor's perception processes [19]. Cues can be classified as central and peripheral with respect to their importance; central cues are the direct result of changes in the stimulus object whereas peripheral cues exist because of central cues; moreover cues can exist as a single dominant symptom to a set of multiple symptoms [20]. Cues can also be categorized on the basis of their strength [17] and structure. Further details can be seen in [4].

METHODOLOGY

Nineteen FGCs from Lincolns hire fire and rescue service UK and Nottinghamshire fire and rescue service UK were interviewed. Interviews were about the fire incidents of their choice which they think had non-routine elements to them. FGCs were sent a data collection form ahead of the interviews to describe a non-routine incident which was then probed during an interview.

The transcribed interviews were analyzed through deductive thematic analysis [21] and latent thematizing [21] backed by 'process reconstruction' [23].

DATA ANALYSIS

FGCs reported that the sense making of the situation starts whilst en route to the incident scene and this pressure increases many folds the moment they are at the fireground this is irrespective of whether it is unique or a routine event. In case of a non-rotuine situation, the information search results in the identification of multiple and most crucial cues that aided in making their decisions (whereas in case of a routine situation, time is spent in extracting a representative mental image of the situation). These cues were collected on the basis of their diagnosticity, relevance and/or importance.

Some cues were observed to be reported more as used compared to others. Other cues were not discarded instead they were noticed for they may be needed later. Whilst looking for the cues, the FGC simultaneously builds a picture or mental image of the situation, which also confirms the uniqueness of the situation further. This leads them to proposing and validating a potential action plan. Before a course of action is identified it is ensured that all diagnostic, relevant and/or important cues are gathered and the course of action is based on these very cues. Off-course, the building of mental image and identification of course of action is a very quick step and is not analytic in nature at all.

In summary, an FGC in non-routine situations approach a problem by gathering information for problem recognition which includes visualization the problem whilst en route, problem specific expectations building beforehand, and whilst on site, extracting cues, classifying cues as central or peripheral, selecting a cue based on its diagnosticity, importance, and/or relevance, decomposing the compound cues, solving cue discrepancy, generating hypothesis for grasping

the situation, understanding the probability and possibility of loss, noting the leverage points, assessing the threats, setting problem goals, and anticipating the dynamics of the situation. For finding a best course of action they depend on using standard operating procedure, or generating solution for ambiguous situations anew and getting feedback from implemented solutions. Details of each of these factors can be found in [4].

"CUES" FOR NONROUTINE DECISIONS ON THE FIREGROUND

It is found by [4] that in non-routine situations for defining a problem, the FGCs extract those environmental cues that have high diagnosticity, importance and/or relevance with respect to the current situation. A representative model is developed using these cues. This model is compared mentally with the mental model obtained if any through parallel and naturally occurring phenomenon of pattern recognition. This may further confirm the uniqueness of the situation if no mental image fits the situation without neglecting any collected cues. As soon as a clear mental picture of the situation is built, a course of action (COA) is also recommended. This is then evaluated through mental simulation and assessing its sensitivity for different situations. After implementation of COA feedback is obtained. If a COA is found inappropriate then those cues are also included in building mental image that were deemed not diagnostic, relevant and/or important. Figure **1** depicts the model.

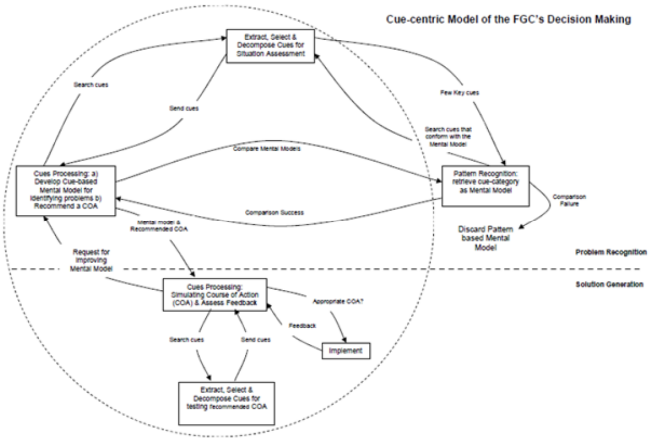

Figure 1: Cue based model for FGC' decision making.

CONCLUSION

Decision making models for non-routine situations are most important in third world country scenario. This is mainly because in countries such as Pakistan, mostly infrastructure is built of concrete and cement blocks. Therefore the incidences of fire at household level are not so extreme. This does not expose the FGCs to very many incidences to build mental schemas for all sorts of situations. The result is that when the fire commanders are called to real situations with urgent need of intervention, they find themselves helpless; a case in point is the Baldia factory fire in Karachi. Moreover, there is no rigorous trainings available nor any decision support systems developed for helping the FGCs. A decision support system based on this model can not only train the FGCs novice and experts alike in decision making but also in training in countries like Pakistan.

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