An Episode as a Trace of Resilient Performance in Large-Scale Incident Management Systems

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Disasters have revealed persistent challenges for incident management systems in preparing for, responding to, and recovering from disruptive events. Such challenges have been reflected in recent catastrophic events such as natural disasters, industrial accidents, and terrorist attacks. To address the challenges, a need for resilience of incident management systems has been increasingly recognized (Comfort, Boin, & Demchak, 2010). Resilience is defined as a system's capacity to adjust its performance before, during and after a disturbance (Hollnagel, Woods, & Leveson, 2007). From the theory of Joint Cognitive System (JCS), resilient performance is rendered through an interplay among the JCS triad: human operators, technological artifacts, and demands from the world (Hollnagel & Woods, 2005; Woods & Hollnagel, 2006). Hence, this study aims to identify resilient performance of an incident management system (e.g., Incident Management Team (IMT)) by investigating interactions among the JCS triad.

The research team conducted two naturalistic observations at a high-fidelity emergency exercise facility and collected audio and video recordings from participants. These recordings were then weaved together to facilitate the analysis of interactions. To represent the interactions among humans and technological tools that cope with demands from an incident, an Interactive Episode Analysis (IEA) was developed and applied to the collected data. The IEA was designed to capture three C's of an interaction: Context, Content and Characteristics. Context refers to an initiator, a receiver of the interaction, and a technology used. Content indicates actions and communications that occur between human operators and technical tools. Characteristics refer to frequency and time duration of the interaction. To identify the IMT's performance to cope with incident demands, an episode was constructed after an inject (a piece of simulated information input) was given to the IMT.

Using the IEA, two episodes were extracted as preliminary results. Both similar and different patterns of information management were observed. First, both episodes suggest that the IMT follows a common information flow: collecting incident data (e.g., field report), documenting the data, and disseminating the data to other members of the IMT. In both episodes, participants tended to use similar technologies for a certain information management task. For example, a telephone was used for collection of incident data, a photocopying machine (i.e., printer and photocopier) for documentation, and a paper form for dissemination. On the other hand, dissimilar patterns were captured. As members of I/I Unit in the second episode struggled to find out a preferred method of communication (e.g., paper vs. email), the members interacted with instructors that were not seen in the first episode. As such, the second episode took almost twice the duration of the first episode.

The findings from the current study, albeit preliminary, suggest non-linear and dynamic interactions among emergency operators, technical tools, and demands from an incident. As Woods (2006) noted, resilience of a system may not be visible until the system faces disruptive events. In such regards, the IEA would serve as a tool to represent the system's resilient performance after a work demand. In addition, the IEA showed promise as a diagnostic tool that examines the interactions among the JCT triad.

To gather more evidence to support findings in the preliminary analysis, future research will focus on extracting more episodes from the collected data and identifying emerging patterns of resilient performance of the IMT.

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