Dynamic Adaptation to Critical Care Medical Environment: Error Recovery as Cognitive Activity

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Introduction

Early research on errors focused on studies of human reliability in engineering domains. Human components were considered as additional elements in the system, similar to other technical components. Just as technical safety is improved through the reduction of technical breakdowns, it seemed common sense to use a symmetrical rationale to improve safety through the reduction of human errors. In the last few years, Patel and colleagues have reported a number of studies that focused on understanding dynamic decision making in high velocity medical environments, namely intensive care and medical emergency units (Patel and Arocha, 2000; Patel, Kaufman, and Magder, 1996). These and other studies have identified the problems of post-hoc analysis in research on error detection and faults in such environments, that are characterized by high levels of urgency, uncertainty, and shifting, ill-defined, and competing goals. Although such investigations into human error sometimes necessitate a post-hoc analysis, and can be very informative in identification and reduction of future errors, such retrospective analysis presents several problems.

Methodology

The data were collected in the cardiothoracic intensive care unit at a large teaching hospital using naturalistic approaches. The methods used represent an extension of the information-processing, cognitive science tradition. In order to examine the nature of the interactions and negotiations occurring within the workflow of the ICU, we performed approximately four months of ethnographic observation to collect data about the employees and general workflow of the ICU. We then shadowed three nurses for the duration of their 12-hour shifts. During shadowing, we followed the nurse wherever they went, audio-recorded their conversations with other ICU team members, and took notes in a journal to record non-verbal activities. The audio-tapes were transcribed for later analysis.

Results

The data provided us with information about the daily patterns of communication within the ICU and insight into the professional and social relationships between staff members in conducting daily activities. Through protocol analysis of the transcriptions, we were able to characterize specific instances of errors made and circumstances which are highly susceptible to such errors. While many errors occurred, most of them were often detected and resolved very quickly, either through (1) communication between team members or (2) feedback from the ICU environment. For instance, continued use of a sedative to deal with patient pain was quickly rejected as a treatment plan when one team member realized that it was contributing to liver failure. While one ICU staff member alone may have missed this error, with it perhaps leading to an adverse event, the ICU team was able to, through their interactions, identify the potential for error and take steps to prevent it. Although this situation was managed with error recovery, instances such as these can be missed and contribute collectively to more serious errors.

Discussion and Conclusion

We suggest that mistakes are an inevitable, cognitively useful phenomenon that cannot be totally eliminated. We view human errors as products of cognitive activity regulated in a broader context of adaptation to one's environment and work activities. In this view, where human activity is seen as dynamic adaptation to the work environment, most errors can be considered as the price paid for making compromises in trading off between various alternatives. Unlike the popular goal of achieving flawless performance (through development of error-free systems), our study argues for developing systems that are adaptive enough to allow for the specific nature of human errors.

Acknowledgments

This research was funded by US Army Grant #2000-36-U-of-Texas. We would like to extend our warmest gratitude to the nurses and doctors of the ICU, especially to the three nurses who shared an entire day of their lives with us.

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