Impact of Functional and Schematic Overview Displays on Console Operators’ Situation Awareness

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Abstract

Console operators in process plants have to maintain a high level of situation awareness to operate the plant safely, effectively and efficiently. An overview display is one of the primary displays in a control room that operators monitor to gain and maintain an understanding of the plant. In this study we evaluated operator performance using two different overview display formats. The first format, characterized as a functional design, used qualitative, graphical indicators for process parameters and organized the position of the indicators based on functional relations of the process equipment. The second format, characterized as a traditional schematic display, showed connecting process lines between equipment and numerical fields to present process information. Both displays contained the same indicator values. Eighteen plant operators used both display formats to monitor a crude unit process for process parameters that deviated from normal values. Operators’ situation awareness using think-aloud protocols and SAGAT, subjective workload and usability ratings were measured. Results indicated that operators’ situation awareness was significantly higher when they monitored the process on a functional display compared to a schematic display. Their subjective workload and usability ratings also favored the functional overview display format. Implications of the findings for continuous process control and overview display design are discussed.

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