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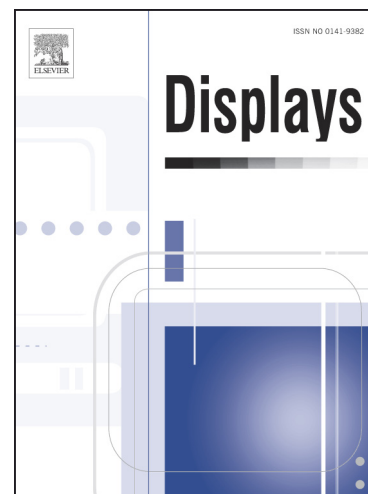
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## Visualizing Complex Processes On Large Screen Displays: Design Principles Based On The Information Rich Design Concept

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### Abstract:

Large Screen Display technology has in recent years become available to industrial control rooms as a supplement to smaller displays. Due to the greater complexity and scale, measured in meters, not inches, it is now a challenge to design for readability and Situation Awareness. Information Rich Design is a design concept for large displays used in many real-life complex processes for almost a decade. The concept simplifies the understanding of large data sets through alignment and Gestalt grouping of process data through a few generic process objects.

This paper describes recent design modifications where new functionality is integrated into existing graphical objects, keeping the original simplicity. This paper proposes design principles for Large Screen Displays based on theoretical discussions of Situation Awareness and a user test using crews of certified operators. The user test shows positive results on pattern recognition of process data and a newly developed animation of unacknowledged alarms; however, the concept still suffers from colour and readability issues.

**Keywords:** Large Screen Display, Complex processes

### 1. INTRODUCTION

Industry control rooms are in a process of change; large hardwired panels displaying information through analogue indicators are being phased out in favour of computerized interfaces. Even in conservative domains such as nuclear power plants, old analogue technology is being replaced with desk mounted operator stations offering great flexibility and low-cost system upgrade potential.

Vicente, Roth and Mumaw [1] found however several difficulties by this approach. In a field study of older nuclear power plant control rooms, they pointed particularly to the unfortunate keyhole effect: *“there are not enough CRTs to comprehensively monitor all of the control systems status displays”*. This view is supported by a more recent study on conventional and nuclear power plant by Salo, Laarni and Savioja [2]. They concluded that it has become more difficult to get the instantaneous process state overview on desktop workstations than through large panels.

More recently, control rooms have begun to take advantage of large screen display (LSD) technology as a supplement to smaller operator stations, having the potential to increase situation awareness (SA) through the big-picture and to reduce keyhole-related problems. Several studies suggest that the use of LSDs is beneficial. Ball, North and Bowman [3] found that users prefer physical navigation in visualizing tasks; and that LSDs also improved user performance. Recent work by Endert et al. [4], suggested however that the choice of visual encodings in large displays directly affected users' performance. Andrews et al. [5] found that it is not just a matter of scaling up existing visualizations intended for smaller displays.

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