

Techniques for Evaluation of Occupational Safety and Health (OSH) Signage to Ensure Better Comprehensibility

Short Abstract

‘Safety first’ is the slogan of every organization to avoid any unwanted Occupational safety and health (OSH) hazards. The purpose of the OSH signs is to grab the attention of people rapidly to objects or situations affecting OSH and to gain a rapid understanding of a specific message. However, they are not always effective in communicating the intended message or necessary information to the employees or ordinary people. The result is that people misinterpret the signs, which may cause disaster and become hazards for them. Literature reveals a need for more study concerning the methods or techniques of sign comprehensibility, which is essential for the proper evaluation of the signs. Hence this necessitated the study of the techniques of comprehensibility of OSH signs.

Four techniques have been studied here one by one, and each technique has been found to perform well in finding comprehensibility levels of the signs. Seven sign pairs (seven with text and seven without text) have been used as a stimulus for all the techniques implemented here. A rigorous study has been performed for all four techniques, and both advantages and disadvantages have been elicited and discussed in the thesis. Research is designed in such a way that the weakness of one technique is followed to design the consecutive, more standardized technique.

Initially, a subject-based technique was designed where the subjects scored comprehensibility of signs in response to the questions in the questionnaire. The subject-based technique suffers from ambiguous scores from the novices who are not experts in the scoring procedure. Hence, an expert-based technique has been designed where experts from industries score the textual responses of the subjects. This technique is standard; however, it may suffer from the biases of the experts while scoring the responses, which might be due to their thoughts, previous exposure, prolonged working hours, context, persuasion, etc. This biased result might produce inconsistent data.

To relieve the experts from this tedious scoring procedure and to generate a consistent result, a computational technique has been developed that is capable of generating scores without any ambiguity. The system can consistently decide whether a sign is comprehensible or incomprehensible. The model is validated by expert judgment and Pearson value >0.80 (p -value <0.05) which is significant. This novel technique will act as a tool and assist the OSH experts in scoring the extensive surveys automatically within seconds.

Each technique designed generates two categories of signs- comprehensible and incomprehensible. However, these three techniques discussed may suffer from the personal biases of the subjects. It is impossible to eliminate the biases in their entirety, as subjects’ views are essential in the case of human-centered evaluation and design. A fourth behavioral

technique- eye tracking, has been designed and implemented, which helps collect objective data from the users. This eye-tracking technique provides unobtrusive data; however, it was not possible to eliminate the subjective data. The subjective score is collected in this technique so that a correlation study can be framed to find a correlation between subjective and objective data. Forty-six (46) significant objective measures have been identified from the bivariate correlation between subjective and objective data.

All the data obtained from four techniques have been tested for descriptive statistics and data distribution. Finally, statistical tests have been performed to check the hypothesis proposed in the research. The comprehensibility scores generated in each technique have been used to check whether OSH-related textual information affects the sign's comprehensibility. Another test has been performed where the variances of the signs' comprehensibility are identified. A separate test has been conducted to check whether objective measures vary according to comprehensibility levels. Correlation (Pearson) plot and bivariate correlation have been used to see correlations between the objective measures and the comprehensibility of the signs. All the tests have been conducted using SPSS statistical software. Each technique in this work is unique in its way and standard. So any individual techniques and triangulation of the techniques can also be implemented and used based on the needs of the organizations.

It is significant to note that a user-centered design approach has been followed throughout the research work, and the research generated 'knowledge' and 'design' both at the end. A novel evaluation framework is generated, which will assist the organizations in evaluating the signs based on their severity, complexity of the situation, environment, experts available, etc. A comparative study has been done between the techniques, and the models (techniques) have been validated. The research is a contribution in terms of developing the framework for comprehensibility evaluation following four different techniques. The comparative study will assist the organizations in choosing the evaluation techniques based on various parameters discussed in the study. The novelty of the study lies in the contribution to the 'design process', 'research through design', and development of an assistive tool for experts, which is an intervention in the domain of OSH. The assistive tool will indirectly improve the design life cycle in terms of time and quality. The eye-tracking study helped identify important eye features that can represent subjective data.