Is Visual Access to a Fire Enough to Initiate Evacuation?

Investigations of past fires suggest that building occupants who are faced with a fire have problems defining the severity of it, especially in the initial stages of the fire. An experimental study, including 535 persons, was therefore carried out with the purpose to study people's ability to estimate fire growth, and their perceived ability to extinguish a fire with a portable fire extinguisher. The results suggest that people in general are not very good at estimating fire growth, and also that the perceived ability to extinguish a fire often is misjudged. Based on the results it is argued that the perceived risk not always conforms to the real risk in a fire situation. This can explain why building occupants not immediately have initiated evacuation in past fires where the flames have been visible.

On the 14th February 1981, a fire started in a nightclub in Artane, a suburb in the north of Dublin. Of the 846 attending guests, 48 lost their lives and an additional 128 guests were badly injured. Four years later, on 11th of May 1985, a fire broke out in one of the stands during a football match in Bradford city, England, killing 56 persons and injuring another 265.

The fires are today known as the Stardust Club Fire and the fire at Bradford City Football Ground. The fact that the occupants failed to take the initial events of the fires seriously, which evidently postponed the evacuation, was not the sole factor contributing to the many deaths. However, it effectively reduced the time available for them to reach an area of safety before untenable conditions were reached.

Theories in Human Behaviour

The behaviour sequence model, developed by Canter, Breaux and Sime (1980), see Figure 1, can help us understand why the fires initially were not taken very seriously by the building occupants. The model suggests that human behaviour in fire can be described by three sequence categories: (1) interpret, (2) prepare and (3) act.

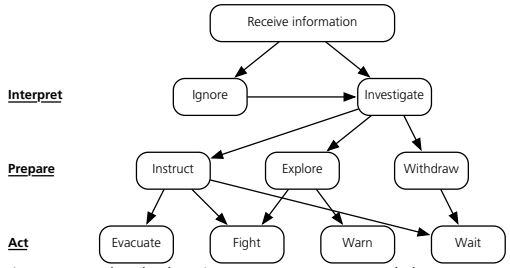

Figure 1. The behaviour sequence model.

This model can somewhat be reduced into Figure 2, which describes the decision making process in a fire. This model was developed by Kuligowski (2008, 2009) and the main difference from the behaviour sequence model is that Kuligowski (2008, 2009) explicitly states that before a person can reach an appropriate decision on how to act in a fire, the situation must be defined as a risk.

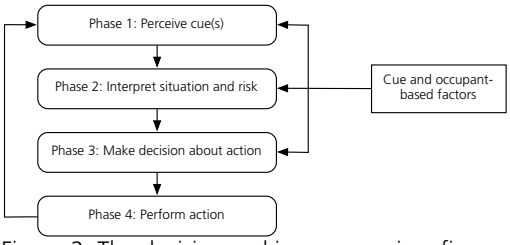

Figure 2. The decision making process in a fire.

Hence, adopting Kuligowski's (2008, 2009) model it is argued that a fire must be defined as a risk before evacuation, or any other appropriate action in a fire situation, is initiated. This consequently means that the building occupants defined the risk too late in both the Stardust Club Fire and the fire at Bradford City Football Ground. The question is why?

One theory is that people in general are not very good at predicting fire growth, i.e., that the subjective estimation of fire growth not conforms to the real fire growth (Canter, Powell and Booker, 1988). Hence, by underestimating the fire growth, the situation is not defined as a risk until it is too late.

Testing the Theory

To explore this theory an experimental study was performed with the purpose to examine people's subjective estimation of fire growth. In addition, people's perceived ability to extinguish a fire with a portable fire extinguisher was studied. A total of 535 persons participated in this experimental study, namely 304 men and 231 women.

The data was collected through a questionnaire, which was divided into three parts. In the first part the participants were asked to estimate the time difference between two film sequences of the same fire, see Figure 3. In the second part they were asked about their perceived ability to extinguish a fire with a portable extinguisher, namely a 6-kilogram powder extinguisher. The third part included general questions about age, gender and academic background.

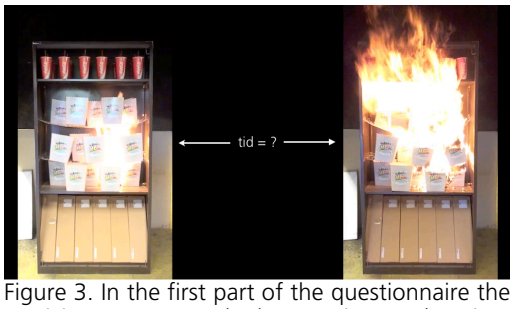

Figure 3. In the first part of the questionnaire the participants were asked to estimate the time between two film sequences of the same fire.

Results

The results of the questionnaire suggest that people's subjective estimation of fire growth does not conform to the real fire growth. However, it cannot be assumed that a person systematically underestimates fire growth, which is suggested by previous research in the same field (Canter et al., 1988). The results also suggest that a person's estimation of fire growth is more or less independent of the growth rate of the fire.

It was also concluded that a large proportion of the participants underestimated their own ability to extinguish a fire with a portable fire extinguisher. This suggests that people are not only bad at predicting fire growth, but also not very good at understanding the severity of a fire.

No statistical significant differences were found between men and women's estimation of fire growth, neither were any differences found between young and old. However, a statistical significant difference was found between men and women's perceived ability to extinguish a fire; a larger proportion of the men believed that they had been able to extinguish the fires shown in the second part of the questionnaire. This suggests that women's perception of risk is somewhat higher than men's.

Implementing the Results

The results presented above imply that the perceived risk from a visually accessible fire not always conforms to the real risk. In turn, this may explain why people sometimes have postponed their evacuation in fire situations, even though the flames have been clearly visible. This could, among other things, be used to explain the many deaths and injuries in both the Stardust Club Fire and the fire at Bradford Football City Ground. Thus, it is argued that visual access to a fire not always is enough to initiate evacuation.

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