Deciding Whether to Use a Fire Extinguisher: The Impact of Fire Intensity, Smoke, and Growth Rate

Supplementary Material

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Results

Exploratory Analyses with Demographic Variables

Past research examining human behavior in fire has observed that demographic characteristics of occupants, including age, biological sex, and fire knowledge, are associated with actions made during fire incidents (Bryan, 1977; Canter et al., 1980; Kinateder et al., 2015). To investigate similar effects in the present study, an exploratory analysis was conducted to examine whether differences in fire extinguisher threshold were associated with participant age (in years), biological sex (male, female), and fire extinguisher experience (no experience, have experience). Note that a subset of the total sample provided demographic information ($N = 119$).

No significant correlation (Spearman's rho, ρ) was observed between age and threshold, $\rho(117) = -.072$, $p = .435$ (Figure S1). Similarly, no significant difference in threshold was observed for those with and without fire extinguisher experience, Mann-Whitney $U = 3118.50$, $p = .599$ (Figure S2). However, the extinguisher thresholds for men were shifted significantly higher compared to women, Mann-Whitney $U = 342$, $p = .014$ (Figure S3). We further analyzed whether these effects were observed with the manipulation check measure of perceived risk; no significant effects were observed for age ($\rho = -.102$, $p = .272$), experience ($U = 3138$, $p = .518$), nor sex ($U = 133.5$, $p = .919$). These results suggest that while the perceived risk of the fire when stopping the use of the extinguisher was similar for men and women, the heat release rate (HRR; intensity) of the fire was greater for men than women. This indicated that men were more likely to continue to judge that the extinguisher could suppress the fire at higher HRRs compared to women.

Figure S1

Scatterplots and lines of best fit for age (in years) and extinguisher thresholds (left) and risk ratings (right).

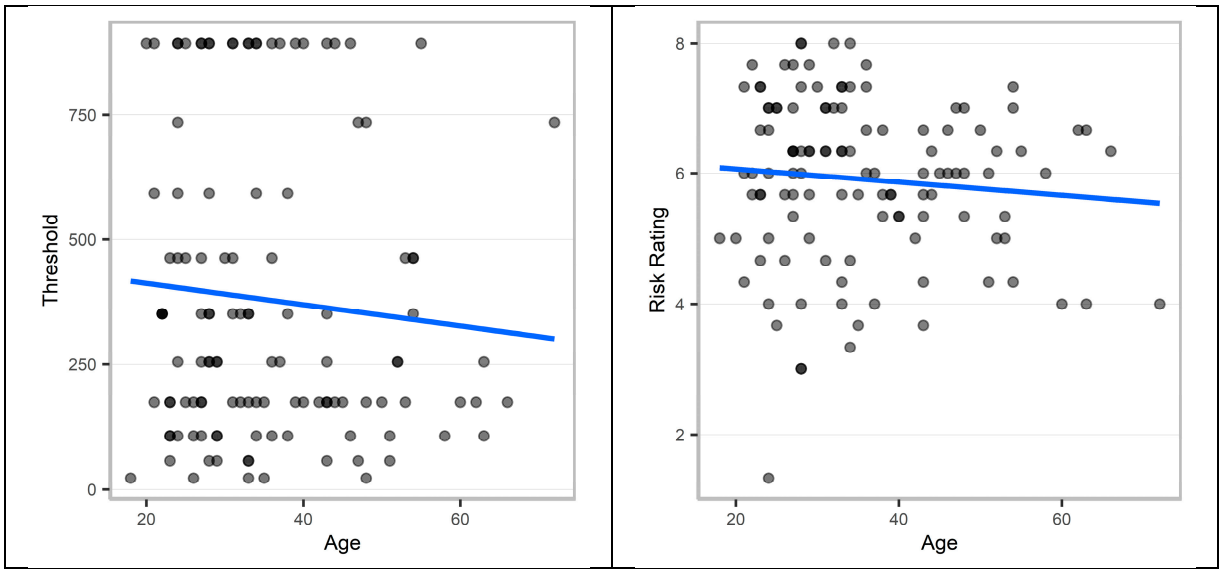


Figure S2

Boxplots of extinguisher thresholds(left) and risk ratings (right) by fire extinguisher experience (horizontal line = median; diamond = mean).

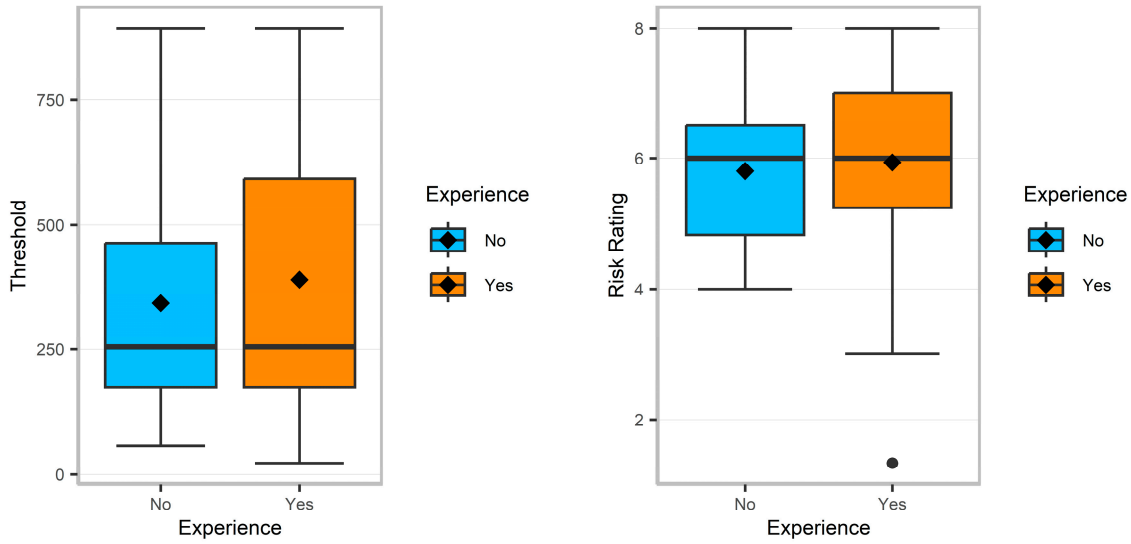
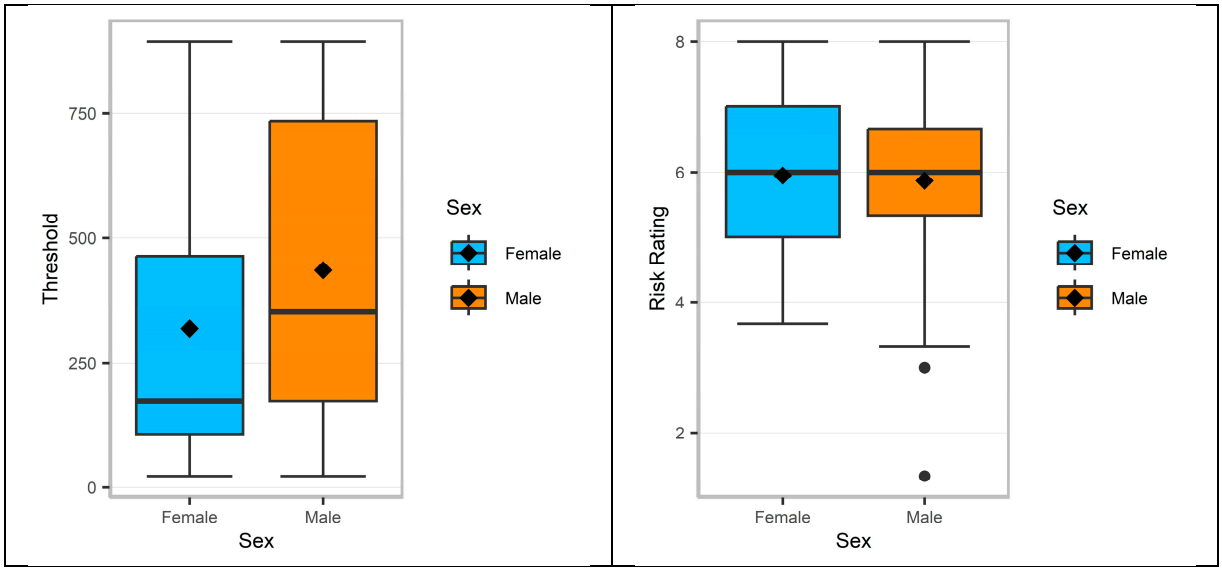


Figure S3

Boxplots of extinguisher thresholds(left) and risk ratings (right) by biological sex (horizontal line = median; diamond = mean).



A robust linear regression model was used to further examine the impact of demographic factors on extinguisher threshold when accounting for experimental factors. The model was fitted to predict extinguisher threshold with main effects of continuous factors (centered and scaled) of smoke opacity, growth rate, age, categorical factors of extinguisher experience and sex, and an interaction effect between smoke opacity and growth rate. Similar to the main analysis, a significant effect of smoke opacity was observed, $z = -3.32$, $p = .001$, and the effect of sex remained significant, $z = 2.27$ $p = .023$ (all other ps $> .3$). The results of this model indicate that both smoke opacity and biological sex had an impact on extinguisher threshold that were not accounted for by other factors. With regard to sex, this aligns with prior research using post fire incident interviews which observed that male occupants were more likely to attempt to engage with a fire than female occupants (Canter et al., 1980). However, it is important to note that the present study was not designed to systematically sample participants from different demographic backgrounds. Further research is required to investigate whether sex differences in fire extinguisher use are present, and factors associated with said differences.

References

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Canter, D., Breaux, J., & Sime, J. (1980). Domestic, multiple occupancy, and hospital fires. *Fires and Human Behaviour*, *8*, 117–136.

Kinateder, M. T., Kuligowski, E. D., Reneke, P. A., & Peacock, R. D. (2015). Risk perception in fire evacuation behavior revisited: Definitions, related concepts, and empirical evidence. *Fire Science Reviews*, *4*, 1–26. https://doi.org/10.1186/s40038-014-0005-z