Personal Safety is More Important Than Cost of Damage During Robot Failure*

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ABSTRACT

As robots become more common in everyday life it will be increasingly important to understand how non-experts will view robot failure. In this study, we found that severity of failure seems to be tightly coupled with perceived risk to self rather than risk to the robot's task and object. We initially thought perceived severity would be tied to the cost of damage. Instead, participants placed falling drinking glasses above a laptop when rating the severity of the failure. Related results reinforce the primacy of personal safety over the financial cost of damage and suggest the results were tied to proximity to breaking glass.

KEYWORDS

Human-robot interaction; failure; safety

1 INTRODUCTION

The main goal of this study was to assess possible factors contributing to a non-expert's reaction to robot failure. We were particularly interested in how bystanders would react to failure events and whether they would be willing to intervene. Past work in human trust in robots suggests financial risk is important (e.g., [1]), but more insights are needed on whether other types of risk are important during robot autonomy failure.

Of immediate interest are risk factors that might suppress or alter intervention by bystanders. Concerns about personal risk in close quarters have been seen for autonomous vehicles [2].

2 METHODS

This Amazon Mechanical Turk study ($n=261$) explored how four failure scenario factors influenced intervention. There were 36 video clips showing permutations of these four factors. Specifically, we manipulated whether a human was present (not present, off-screen operator, human working with the robot), damage (food, drinking glasses, laptop), robot behavior (wobbling

arm motion, no wobble), and prior task success (failure on first instance, success on first and failure on second).

Participants were shown a single, randomly assigned video clip showing a Baxter robot failing to place an object into a receptacle and items falling towards the floor. The view was framed so impact could not be seen and there was no audio. Participants then responded to questions on severity of the failure, willingness to intervene, and intervention type.

3 RESULTS

Detailed analyses are still underway, but several initial findings are immediately apparent. First and foremost, participants placed the drinking glasses above the laptop when rating the severity of the failure ($F(2,254)=4.75$, $p<0.01$), with no difference between the laptop and the food.

A related result was seen for three safety questions framed around the participant's hypothetical distance from the robot (20', 10', and 3'), which showed a large drop for only the drinking glass at 3'. Likewise, participants showed greater willingness to press an E-stop button when the robot was handling the drinking glasses, as compared to the other items ($F(2,258)=4.14$, $p<0.05$).

4 CONCLUSIONS

Based on these results, it is reasonable to assume that perceived personal risk takes priority over perceived damage when considering intervention. This is, at a smaller scale, comparable to aversion to personal risk when near crimes, natural disasters, and other more extreme events. This needs to be explored with in-person studies with more realistic perceived risk.

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