

Towards Empathetic Interfaces

- Effect of Sadness Expression Feedback on Headway Distance Maintenance Characteristics -

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1. Introduction

Maintaining appropriate headway distance is important for both traffic safety and traffic flow stability. However, communication between drivers is limited, especially between lead and following vehicles. Based on the Theory of Affective Pragmatics, this study focused on whether facial expression icons representing the lead driver's feelings could function as communicative signals that influence the following driver's responses. In particular, we examined whether sadness expressions, and tears added to sadness expressions, promote headway distance maintenance while reducing irritation and increasing the following driver's inference about the lead driver's difficulty.

2. Method

Qualtrics was used to conduct two web-based scenario studies. In Study 1, 340 drivers (169 men and 171 women; M age = 26.02 years, SD = 2.51) were included in the analysis. In Study 2, 343 drivers (171 men and 172 women; M age = 26.12 years, SD = 2.50) were included in the analysis. Both studies used the same two driving scenarios (normal vs. irritating). Participants imagined driving on a single-lane road with one vehicle ahead and no possibility of overtaking. In the normal scenario, the lead vehicle was traveling slightly below the speed limit, whereas in the irritating scenario, it was traveling far below the speed limit. Participants were assigned to one of these scenarios. Traffic-scene images from the driver's perspective were used as stimuli. In the baseline condition, no icon was presented. In Study 1, neutral, angry, and sad facial expression icons were presented; in Study 2, sadness without tears, sadness with tears, and joy icons were presented. The icons were superimposed on the center rear of the lead vehicle and were assumed to represent the lead driver's feelings on a head-up display projected onto the windshield. Participants rated desired headway distance, their own irritation, and inference about the lead driver's difficulty using slider scales. Change scores were calculated relative to the baseline condition.

3. Results

In Study 1, facial expression significantly affected all three dependent variables. Angry expressions produced the largest increase in headway distance, but also increased irritation. Sad expressions also promoted headway distance maintenance, although less strongly than angry expressions, and at the same time reduced irritation and increased inferences about the lead driver's difficulty. In Study 2, both sadness conditions produced greater headway distance maintenance than joy, but the direct difference between sadness with tears and sadness without tears was not significant. Nevertheless, sadness with tears produced the lowest irritation and the highest difficulty inference. Structural equation modeling further showed that, in the sadness-with-tears condition, lower irritation was associated with greater headway distance maintenance through increased inference of the lead driver's difficulty.

4. Discussion

Unlike angry expressions, sadness expressions promoted headway distance maintenance while reducing irritation and increasing inference about the lead driver's difficulty. Although tears did not show a clear direct effect on headway distance maintenance, they may have strengthened the social signal of sadness by further reducing irritation and enhancing perceived difficulty. Future studies should examine these effects in more dynamic and realistic driving environments.

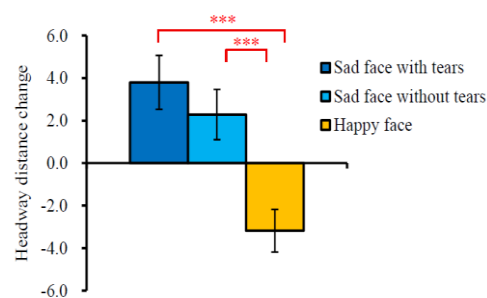


Fig.5 Change in headway distance by facial expression icon condition. Note. Error bars indicate standard errors. *** $p < .001$.

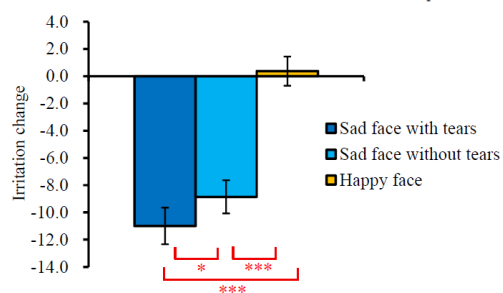


Fig.6 Change in irritation by facial expression icon condition. Note. Error bars indicate standard errors. * $p < .05$, *** $p < .001$.

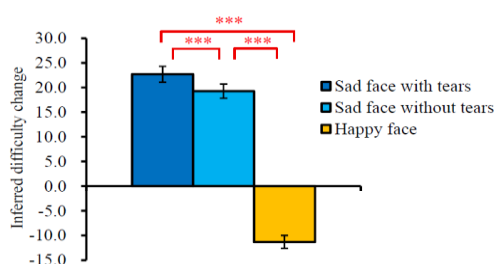


Fig.7 Change in inferred difficulty by facial expression icon. Note. Error bars indicate standard errors. *** $p < .001$.