Effect of driving experience on change detection based on target relevance and size

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1. Introduction

- Learning to drive involves learning to prioritize safety-related information over unrelated information for attentional selection[1].
- Visual conspicuity[2], such as size, can also affect selection strategies (e.g., larger objects tend to be selected better than smaller objects).

Research questions

- Does learning to drive involve learning to prioritize visual information differently based on relevance?
  - Do experienced drivers allocate more resources to less visually conspicuous relevant information and thus select small and large road users similarly?
  - Do novice drivers select road users based on size?
  - Does this experience effect disappear when selecting irrelevant information?

2. Method

Participants

Group	*n*	*M* age (*SD*)	*M* years of experience (*SD*)
Experienced	19	23 (1.9)	7 (1.5)
Novice	19	19 (1.9)	0.5 (0.3)

Design

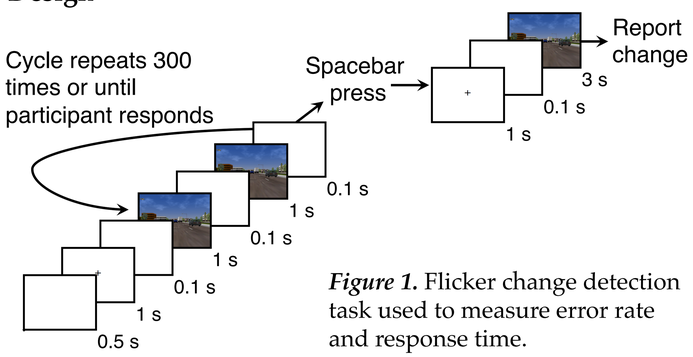

Figure 1. Flicker change detection task used to measure error rate and response time.

- Target type variables: (1) safety relevance and (2) size.

	Relevant	Irrelevant
Small	pedestrians, cyclists, motorcyclists	mailboxes, garbage bins, phone booths
Large	sedans, SUVs, pickup trucks	dumpsters, sheds, construction arrow trailers

Figure 2. Road traffic scenes were created from multiple vantage points of a driver's point of view to control target location.

3. Results

Error rate

- Driving experience x safety relevance ($p < .01$):
  - Experienced drivers detected irrelevant targets more accurately than novice drivers ($p < .01$), but there was no difference between the two groups when detecting relevant targets. In general, relevant targets were detected more accurately than irrelevant targets ($p < .001$).

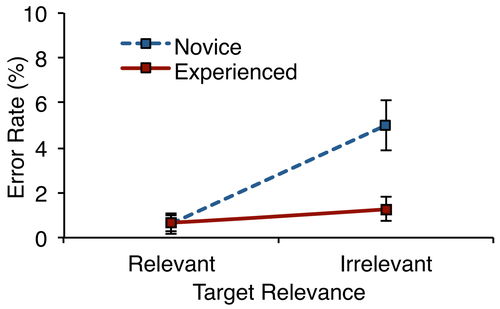

Figure 3. Error rate as a function of driving experience and target safety relevance. Error bars are ± 1 SE.

Response time (of correct detections with $\log_{10}$ transformation)

- Safety relevance x size ($p < .01$):
  - Large relevant targets were detected faster than small ones ($p < .05$), but large and small irrelevant targets were detected similarly. Overall, relevant targets were detected faster than irrelevant targets ($p < .001$).

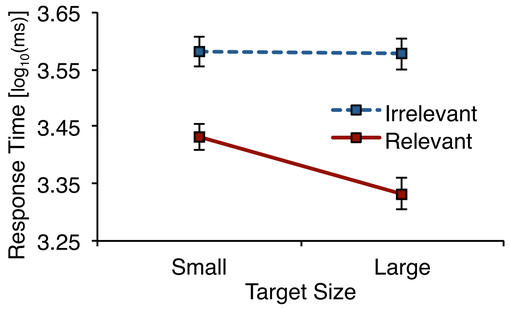

Figure 4. Response time (with $\log_{10}$ transformation) for correct change detection as a function of target safety relevance and size. Error bars are ± 1 SE.

- No experience x relevance x size interaction on response time or error rate.

4. Conclusions

- All observers detected relevant targets better than irrelevant targets, but experienced drivers appear to have more efficient selection strategies as they had more spare resources to select irrelevant targets.
- Regardless of experience, relevant information is given precedence for processing and visual conspicuity is used to determine its priority for selection. Irrelevant information is downgraded and visual conspicuity does not affect its selection.
  - Alternatively, familiarity with typical speeds, size, and behaviour of each vehicle type might have affected detection speed. Observers were likely less familiar with irrelevant objects in the driving context which might have slowed detection speed.

- Absence of a three-way interaction suggests that the paradigm may not be sensitive enough if those effects exist. Nevertheless, we found an effect of driving experience with a minimal age difference between groups and we have shown that all drivers appear sensitive to visual conspicuity in relevant information. This may be useful for driver training programs to teach drivers to better detect small road users.

5. References

1. Trick, L. M., Enns, J. T., Mills, J., & Vavrik, J. (2004). Paying attention behind the wheel: A framework for studying the role of attention in driving. *Theoretical Issues in Ergonomics Science, 5*(5), 385-424.
2. Engel, F. L. (1977). Visual conspicuity, visual search and fixation tendencies of the eye. *Vision Research, 17* (1), 95-108.

6. Acknowledgements

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