

The effect of dwell time, location and content on the distraction impact of digital billboards

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Abstract

An experiment was conducted utilizing an advanced driving simulator to investigate the effect of three variables on driving performance:

- Dwell time (20, 40 and 60 seconds)
- Location (verge versus overhead gantry)
- Content (complex versus simple)

In general, only the 60 second dwell time did not have a negative impact on driver performance. However, the results also demonstrated a number of complex interactions that can be used to assess the relative safety of existing digital billboard installations and proposals for the installation of new digital billboards.

Background

While there is now a substantial body of evidence that digital billboards have the potential to be distracting, the research to date has typically not been directed at answering questions that could easily be used to inform road authority guidelines. As a result, it is unclear, for example, exactly how much more distracting a 20 second dwell time (duration of message display) is than a 40 second dwell time. Similarly, critical questions for road authorities, such as the relative impact of placement and content differences remain unexplored.

Method

96 Perth-based participants aged between 18 and 80 years with a current WA C class licence (passenger vehicle) were put through a freeway driving simulation. Twelve scenarios were simulated which consisted of a combination of three levels of dwell time (20 seconds, 40 seconds and 60 seconds), two different billboard locations (overhead on a bridge versus post mounted on the side of the road) and two billboard content designs (complex versus simple). The simulated driving scenarios consisted of 3D models which represented approximately ten kilometers of generic Western Australian freeways. In each of the twelve driving scenarios there was a three-lane carriageway separated by a median strip with identical traffic flowing in both directions.

Results

In this study driver performance is operationalized as speed variability. There was significantly more variability in speed ($p < .001$) when driving in the vicinity of a billboard (mean = 10.50, SD = 0.44) compared to no billboard (mean = 1.54, SD = 0.44).

There was a significant two way interaction between billboard presence and dwell time ($F(2,552) = 3.99, p < .05$). This was the result of the 60 second dwell having significantly ($p < .05$) less impact than the other two dwell times on speed variability.

There were three significant three-way interactions. First, there was a significant three way interaction between billboard presence, content and dwell time ($F(2, 552)=4.11, p<.05$). A breakdown of this interaction found that the simple content presented for 60 seconds had significantly ($p<.01$) less adverse effect on speed variability.

The second significant three way interaction was between billboard presence, content and location ($F(1, 552)=4.53, p<.05$). This crossover interaction showed that while simple content had less negative impact when presented on an overhead bridge structure, the opposite was true for complex content (represented in figure 1 below by scores derived from subtracting the 'billboard present' value from the 'billboard absent' value).

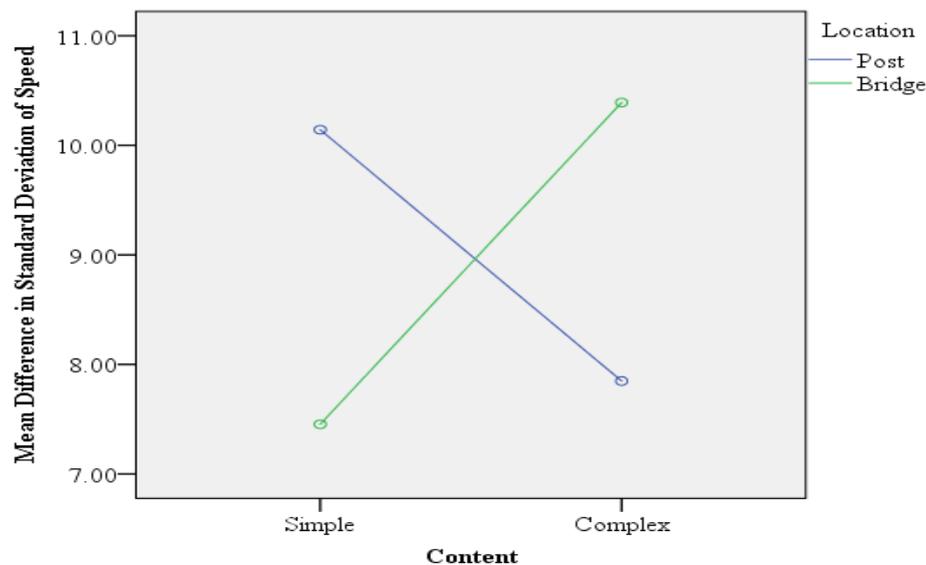


Figure 1. Interaction between Content and Location

The third significant three way interaction was between billboard presence, dwell time and location ($F(2, 552)=3.23, p<.05$). A breakdown of this interaction showed that only post mounted billboards showed the relative immunity from a negative impact on driving performance observed for the 60 second dwell time. This was not the case for bridge mounted billboards.

Conclusions

These results show that, in general, dwell times less than 60 seconds have the capacity to be distracting enough to impair driving performance. The finding of higher order interactions between content complexity and billboard location suggest that shorter dwell times may not always negatively impair driving performance provided that billboard location and content complexity are appropriately matched.