Traffic signage conspicuity

Traffic signs, as we all know, are created so that drivers can navigate on the road. According to the government’s Traffic Signs Manual, drivers rely on traffic control devices, such as signs, for information and guidance (Department of Transport, 2008). Their role, therefore, is to deliver information clearly and precisely on time, so that they are speedily understood.

However, the efficiency of traffic signs in the urban environment depends on factors that are difficult to control. Urban areas usually have a greater number of buildings and vehicles, which could create visual distraction and clutter in the background behind the signs. This effect could be either to make sign seeing more difficult, or have the opposite effect, as the simply-designed sign could stand out from the background and become more visible.

Therefore, conspicuity is a good measure of how successful a sign can be in guiding drivers. Conspicuity is defined as the quality of an object or a light source to appear prominent in its surroundings. It is a measure of how a sign can attract attention (attention conspicuity) or gain (search conspicuity) the driver’s attention (CIE International Lighting Vocabulary).

PREVIOUS RESEARCH

Previous research (summarized in the table opposite), has found that conspicuity is determined by several factors related to:

- Size difference, particularly because the human eye tends to see closer objects that provide a larger visual angle
- Luminance differences between the target object (traffic signs) and its background
- Complexity and density of background patterns
- Colour differences

Although the past studies are informative, research in the field would benefit from further studies. For example, investigation of the influence of luminance contrast and colour difference between the sign and the background could be valuable. An investigation that compares daytime and night-time conspicuity could also be useful because, although it seems to be obvious that the conspicuity of signs is different between night and day, the importance of various parameters may change.

By exploring this issue in more detail, the effectiveness of signs for both daytime and night-time conditions can be understood. The following experiment was designed in order to do this.

METHODOLOGY

A controlled indoor experiment was designed based on the outcome of a field observation which identified sites in London for study, and two pilot studies which revealed the experiment method, to ensure clarity in the procedure. The decision to complete an indoor controlled experiment was taken partly because of the feasibility of this approach within the time constraints of an MSc dissertation. Also, a field study in real traffic is considerably more difficult to control because of the varying number and speed of vehicles in the background. An indoor experiment involving a still scene meant participants have the same experience, so patterns in their responses can be identified. A total of 24 subjects from the ages of 20-years-old to 54-years-old participated. All had either normal vision or vision corrected with glasses or contact lenses. No participant in the study was reported to be colour blind.

The experiment was a visual search task where eight different scenes from London urban areas were presented under day-time and night-time conditions.

Every scene appeared for 200 milliseconds, and was repeated twice in random order between night and day to reduce bias from order effects. A blank screen with a ‘+’ symbol in the centre appeared after each scene to help participants fixate before moving to the next scene. Participants were asked to detect any traffic signs they saw in the scene and record the type and occurrence of sign on an answer sheet provided.

Four parameters were tested: size/distance of sign to driver; background complexity; relative luminance contrast; and...
FACTORS THAT AFFECT CONSPICUITY

1) Size and the distance from the sign to subject’s eye
Size and distance are strongly related because the diameter of the sign is bigger if it is closer to observer’s eye. The scatter plot below (Figure 5) shows a consistent pattern where the conspicuity of the sign increase as it is closer and therefore appear bigger to subject’s eye. It declines as the sign appears smaller.

2) Luminance contrast
Previous study suggests that providing a high contrast on the edge of the sign could increase its conspicuity and therefore isolate uncertainties from the immediate background (Jenkins, 1986).

In this research, the term luminance contrast is defined as the contrast between sign and its immediate background measured as half of the diameter.

Local luminance contrast seems to have an influence in determining conspicuity in the night-time condition. As Figure 6 shows, participants tend to detect more signs at low luminance contrast increases particularly above 1 cd/m². Slightly fewer participants detected signs with high luminance contrast in the daytime scenes.

3) Colour difference
Because of less influence of luminance contrast in daytime scenes, perhaps in these circumstances colour difference contributes to sign detection. However, this supposition is only supported by the surface plots for local colour difference (in lab colour space).

The relative luminance contrast map illustrates that several signs with high contrast on the edge have better conspicuity. However, some of the signs are conspicuous, despite less immediate background luminance contrast in daytime. The results tend to agree with statistical analysis showing that local luminance contrast at night matters more than in daytime. This makes sense because in daytime the overall scene is still clearly visible.

4) Background complexity
Background complexity was the most difficult to characterise of all parameters. Because of the time constraints within this study, a ranking method was chosen in which participants ranked each scene in order of complexity.

As the scenes were typical environments found in central London, they were not too different from each other, which meant the ranking method created a simplistic difference between scenes which did not necessarily exist in reality. Therefore, it is not surprising that correlation test results for this parameter were weak.

It is interesting to note that the trend lines point downwards, which although non-significant, reveals a possible trend for a lower proportion of people detecting the signs if the scene is more complex (with rank one as least complex and eight most complex). Jenkins and Cole also argue that if difficult to characterise types of background complexity (Jenkins and Cole, 1979).

Their other research also mentions that there is no satisfactory explanation for the effect of the background density on sign detectability (Jenkins and Cole, 1982).

Distributing driver attention over a wide peripheral area might be an alternative solution, as it could increase their per...
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The conspicuity of traffic signs might be identified as a complicated area of research, yet it is considerably useful to road users. The complexity of traffic signs might strongly affect participants’ performance slightly decreased during night-time. To illustrate, the same sign was detected 100% during daytime, but the percentage of people who detected the sign decreased to 96% at night, although it was the most conspicuous sign both during day and night. From our experiment, it is suggested that each parameter has a different effect towards conspicuity. Notably:

- The size of the sign might strongly affect the percentage of sign conspicuity for both day and night.

- Luminance contrast seems to have more influence in the night condition and colour difference seems to have less of an effect for both conditions. However, the influence of background complexity was not proved in this study.

REFERENCES

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