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# Simultaneous colour search renders other object properties less salient

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## Abstract

A common approach to visualise multidimensional data sets is to map every data dimension to a separate visual feature. It is generally assumed that such visual features can be judged independently from each other. However, we have recently shown that interactions between features do exist [Hannus et al. 2004; van den Berg et al. 2005]. In those studies, we first determined individual colour and size contrast or colour and orientation contrast necessary to achieve a fixed level of discrimination performance in single feature search tasks. These contrasts were then used in a conjunction search task in which the target was defined by a combination of a colour and a size or a colour and an orientation. We found that in conjunction search, despite the matched feature discriminability, subjects significantly more often chose an item with the correct colour than one with correct size or orientation. This finding may have consequences for visualisation: the saliency of information coded by objects' size or orientation may change when there is a need to simultaneously search for colour that codes another aspect of the information. In the present experiment, we studied whether a colour bias can also be found in a more complex and continuous task. Subjects had to search for a target in a node-link diagram consisting of 50 nodes, while their eye movements were being tracked. Each node was assigned a random colour and size (from a range of 10 possible values with fixed perceptual distances). We found that when we base the distances on the mean threshold contrasts that were determined in our previous experiments, the fixated nodes tend to resemble the target colour more than the target size (Figure 1a). This indicates that despite the perceptual matching, colour is judged with greater precision than size during conjunction search. We also found that when we double the size contrast (i.e. the distances between the 10 possible node sizes), this effect disappears (Figure 1b).

Our findings confirm that the previously found decrease in saliency of other features during colour conjunction search is also present in more complex (more 'visualisation-realistic') visual search tasks. The asymmetry in visual search behaviour can be compensated for by manipulating step sizes (perceptual distances) within feature dimensions. Our results therefore also imply that feature hierarchies are not completely fixed and may be adapted to the requirements of a particular visualisation.

## References

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- VAN DEN BERG, R., HANNUS, A., ROERDINK, J., AND CORNELISSEN, F., 2005. A colour-size processing asymmetry in visual conjunction search. (submitted for ECVP 2005).

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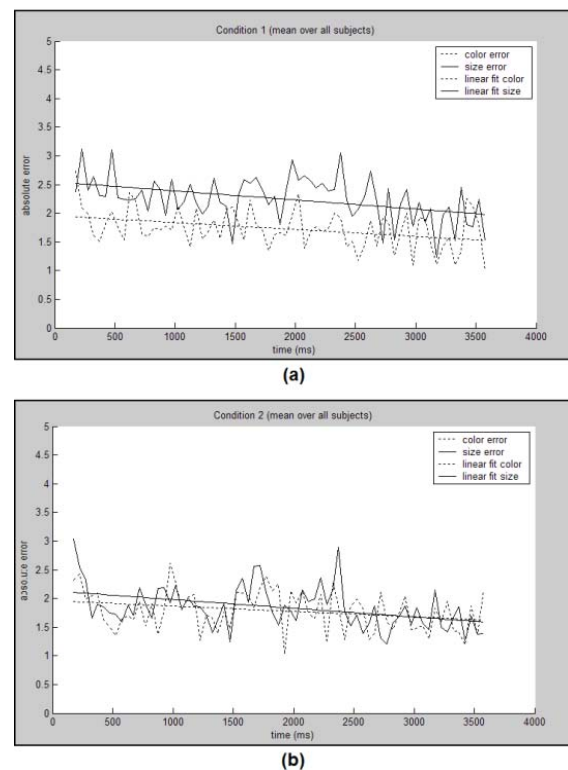


Figure 1: Colour and size error during fixations as a function of fixation onset time (mean of 4 subjects). Errors are averaged for fixations in 50 ms bins. In the condition with matched colour and size discriminability, the size error is substantially larger than the colour error over the entire time course (figure a). When doubling size contrast, this apparent colour dominance disappears (figure b)

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