

Understanding Distance & How Humans See Interfaces & Designs



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Problem How do we know what people can or cannot see when viewing visual interfaces, designs & signs at different distances?

Motivation Clothes, floors, buildings, human skin & many physical surfaces are becoming pervasive interactive visual displays.

Opportunity Usability of visual displays can be improved by adapting them to the viewer's perceptual abilities & environment.

What We Did

Created a **perceptual usability measure** of how easy or hard visual designs are to see when viewed over different distances

How The Perceptual Measure Works

The measure predicts the relative perceivability of sub-parts of a visual design by using simulations of human visual acuity coupled with an information theoretic measure.

Human Visual Acuity is...

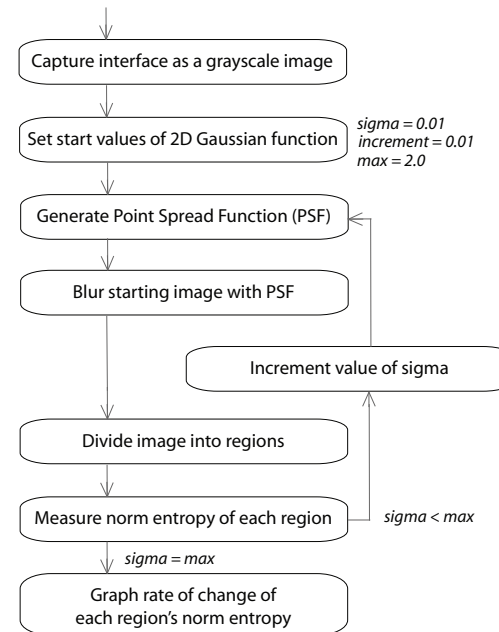


"Spatial visual acuity is the smallest spatial detail that can be visually detected, discriminated, or identified."

from The Psychophysical Measurement of Visual Function

Perceptual Measure Algorithm

Measures rate of change of visual entropy due to blur.



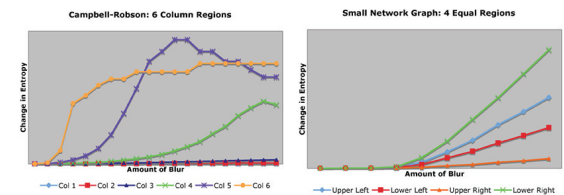
$$NormEntropy = \frac{-\sum_{i=1}^n p(x_i) \log_2 p(x_i)}{n}$$

$$ChangeMeasure = \frac{d(NormEntropy)}{d(Blur)}$$

Experiments & Results

Tested on eye charts, a network graph and website design.

Makes predictions consistent with human judgements about eye charts.



Experiment: Details

How: Implemented in Matlab & ran on a series of test images.

Result (above left graph): Shows the results where the perceptual usability measure was tested on a Campbell-Robson Contrast Sensitivity Chart, which was divided into 6 column regions of equal width. Perceptual measure predicted Col 6 would change the most initially, then Col 5, Col 4, and so on. This result conforms to experimental evidence from optometry research about how people see CSF charts.

Result (above right graph): Shows the results of a network graph (right) divided into four equal regions. The lower right hand region changed the most due to distance blur & the mostly empty upper right region changed the least.



Funding: Thanks to UCD for a postgraduate research scholarship.

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