Individual items make your life more pleasant. We call a large number of individual items “clutter”, which can make your life much less pleasant.

It’s like living in a thrift store.

Yeah, or a Russian sub.

NO, wait! It’s like a thrift store built in a Russian sub!

YES! That’s it!
Predicting Perceived Screen Clutter By Feature Congestion

Chris Lafleur, Bernard Rummel
User Experience Research, Methods and Communication, SAP AG
Agenda

What is Clutter?
Clutter as Feature Congestion
Methods
Data Analysis and Results
Discussion
What is clutter, can it be measured?
What is Clutter?

CONFERENCE PICTURE HERE
What is Clutter?
What is Clutter?

A state where the organization and/or representation of a number of items exist in a given space leads to a decrease in performance.
What is feature congestion?
Rosenholtz et al. (2005) describes clutter from within a feature space

Combination of three feature maps
- Colour
- Contrast
- Orientation
1) Compute local feature (co)variance ellipsoid of color, contrast, and orientation for three scales

2) Combine across scale

3) Combine clutter across feature types; and

4) Pool over space to get a single measure of clutter for each input image.

from Rosenholtz, Li, and Nakano (2007a)
Computational Details

1. Convert image into (physiological) CIExab color space

2. Create Gaussian pyramid by alternately smoothing and subsampling the image

3. For each of three scales, find features:
   a. Luminance contrast: “contrast energy“ (filter by squared difference of two Gaussians)
   b. Color: extract local mean by pooling with Gaussian filter
   c. Orientation: oriented opponent energy (Bergen & Landy 1991)

4. Compute local covariance matrix for each feature

5. Compute volume of covariance ellipsoid

6. Combine across scales = maximum at each pixel. A feature is locally congested if it is congested at any scale

7. Combine across features
   a. 3 congestion maps: color (a volume), texture (an area), and orientation (a scalar)
   b. Normalize at each point: scale $\sqrt[3]{\text{color}}$, $\sqrt{\text{texture}}$ and orientation by respective large-sample SDev
   c. Add.
Methods
Methodology

30 SAP employees (6 females, 24 males)
3 identically configured computers
11 Website screenshots
Paired comparison paradigm
Scaling in a Nutshell: using changing preferences to estimate scale distance

Subject 1

Subject 2

... ... 

Stats

Scale
Stimuli
Procedure
Results & Discussion
Results

\[ R^2 = 0.8477 \]
Discussion

- Feature congestion explains 85% perceived clutter variance
- Log curve: effect of feature congestion not additive but exponential
  - Not much effect in low-FC area
  - “inherent cutoff“ with increasingly strong effect
    – visual system can’t deal with it any more (congestion metaphor)
Feature Congestion in the Web (333 sites)
Practical Implications
1. **Design rationale: mind the feature space!**
   a. Don’t use it up with decoration
   b. Make smart use of dimensions
   c. Use outliers for emphasis
Practical Implications

2. Don’t worry if screens are not too cluttered

3. ...but when clutter hits it hits hard
Practical Implications

4. You need to add significant chaos to a screen to have it perceived as cluttered

5. ...but people do it!
6. Feature Congestion algorithm is sufficient for automatic screening

7. ...but not for detail comparisons of „reasonable“ designs
   (critical FC difference ~ 2)
References


Thank You!

Contact information:

chris.lafleur@sap.com
Bernard.rummel@sap.com