Processing Global Properties in Scene Categorization

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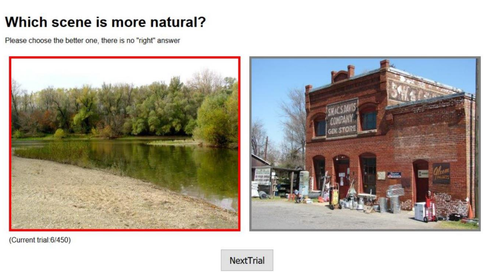
Reference Ranking Scales of Naturalness and Openness

Goal Build subjective reference ranking scales that can describe the characteristics representing the dimension changes of global properties – naturalness and openness.

Subjects 1055 subjects on Mturk

Stimuli 7035 scene images from Scene Understanding (SUN) database[1]

Task



Bradley-Terry Model[2]

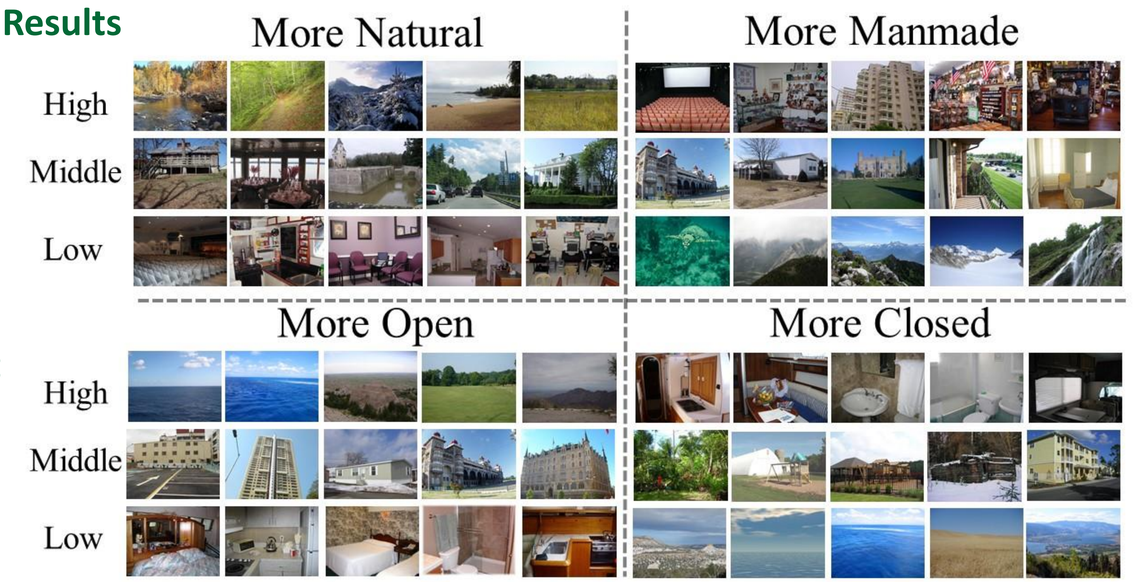
$$\Pi_{ab} = \frac{\exp(\lambda_a)}{\exp(\lambda_a) + \exp(\lambda_b)}$$

Π_{ab}: the probability that a > b
λ_i : ability parameter

Spearman's rank correlation coefficient

- Natural and Manmade: r = - 0.86
- Open and Closed: r = - 0.93
- Natural and Open : r = 0.83
- Manmade and Closed: r = 0.77

Results



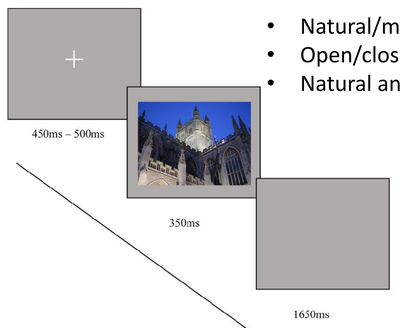
Capacity Coefficient Test

Goal Test human observers' processing efficiency of conjunctive decisions in multiple global properties.

Subjects 17 undergraduate students

Stimuli Four image types from the ranking scales

Task

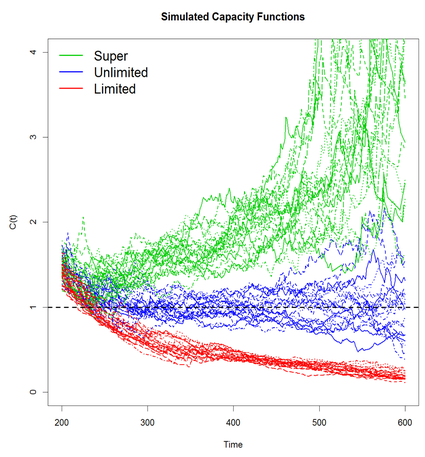


- Natural/manmade
- Open/closed
- Natural and open/ manmade or closed

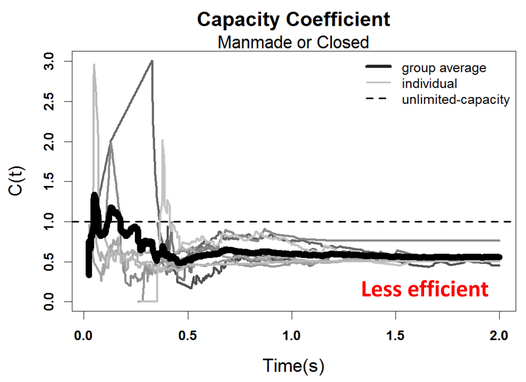
Capacity Coefficient[3,4]

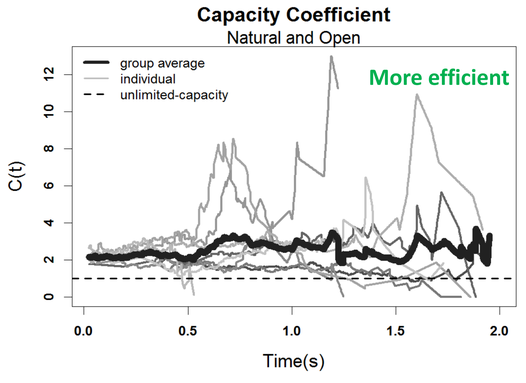
$$C_{OR(t)} = \frac{H_{manmade-closed(t)}}{H_{manmade(t)} + H_{closed(t)}}$$

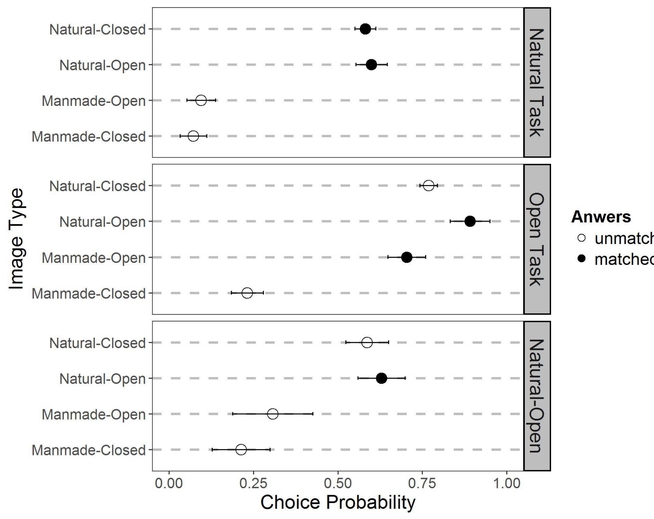
$$C_{AND(t)} = \frac{K_{natural(t)} + K_{open(t)}}{K_{natural-open(t)}}$$



Results







- Subjects tended to choose "open" image as "natural".
- Subjects were more efficient in answering "natural and open" but less efficient in answering "manmade or closed" questions.
  - ➢ High correlation between "open" and "natural"
  - ➢ Image selection
  - ➢ Simplify decisions

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References

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2. Turner, H., & Firth, D. (2012). Bradley-terry models in R: The BradleyTerry2 package. *Journal of Statistical Software*, *48*(9), 1-21.
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4. Houpt, J. W., Blaha, L. M., McIntire, J. P., Havig, P. R., & Townsend, J. T. (2014). Systems factorial technology with R. *Behavior Research Methods*, *46*, 307-330.
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