Processing Global Properties in Scene Categorization
Hanshu Zhang, Joseph W. Houpt
Department of Psychology, Wright State University. Dayton OH 45435
Contact: zhang.180@wright.edu

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

Task: Which scene is more natural?

Bradley-Terry Model

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

\( \Pi_{ab} \): the probability that \( a > b \)
\( \lambda_i \): 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: \( r = 0.77 \)

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: Select the image that is more natural/open/ manmade or closed.

Capacity Coefficient

\[ C_{OR}(t) = \frac{H_{\text{manmade-closed}}(t)}{H_{\text{manmade}}(t) + H_{\text{closed}}(t)} \]

\[ C_{AND}(t) = \frac{K_{\text{natural}}(t) + K_{\text{open}}(t)}{K_{\text{natural-closed}}(t)} \]

Results

- More Natural
- More Manmade
- More Open
- More Closed

- More efficient
- Less efficient

- 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


