# Identifying Parts and Wholes in Real-World Objects: An Application of Critical Spacing

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## Introduction

Visual system utilizes distinct modes of visual processing\(^1\)\(^2\) based on level of information; mediated by activity in unique brain areas
- **Holistic**: Global shape, outlines, Gestalt; lateral occipito-cortical (LOC)\(^3\)\(^4\)
- **Configural**: Local features, details, parts; intraparietal sulcus (IPS)\(^5\)\(^6\)

Number of visual parts present within a stimulus influences the type of processing used\(^7\)
- Fewer parts = more holistic
- Many parts = more configural

Visual stimuli may not be perceived strictly by the visual system utilizes distinct modes.

## Stimuli

- **Bank of Standardized Stimuli (BOSS)**\(^8\)
- High-resolution photographs of real-world objects
- Includes normalized data with ratings of semantic and higher-level visual properties (e.g., familiarity, category, complexity)

## Method

### Preprocessing

- Converted to grayscale
- Normalized for contrast and luminance using the SHINE toolbox\(^9\)

Tasks presented using MATLAB and Psychophysics Toolbox software

### Experiment 1

- **2. Incorrect**: Image moved 75 px (2.8\(^\circ\)) closer to fixation when it next appeared on same side of screen
- **Correction**: Location on screen recorded as critical eccentricity

Objects were correctly identified on both sides of screen before being removed from the set.

- **Maximum eccentricity = 42\(^\circ\)**

### Experiment 2

- Explore relationship between holism and diagnosticty of parts
- 24 participants
- 23 objects
- Replicated Expt 1 procedure
- **Additional task**: Identify region of image that is most informative or distinguishing for that object
- Image presented at fixation (0.5 s) then masked to reveal Gaussian window of visibility of fixed size (~100 px)

- Participant centered window desired area and pressed left mouse button
- Location of mouse click on screen recorded

## Results

### Experiment 1

- **No significant relationships between average critical eccentricity and BOSS data**
- **Significant relation with subjective report of diagnostic parts**

### Experiment 2

- **Continuous range of average critical eccenticities found in both experiments**

## Discussion

Lack of significant relations amongst higher-level properties and critical eccentricity suggests this technique is a valid measure for determining relative number of parts in real-world objects

- **Continuous distribution suggests sensitivity to subtle differences in part/whole structure**
- **Supports non-binary perspective of holistic and configural processing**\(^7\)

Both holistically- and configurally-perceived objects may contain distinct diagnostic parts

- **No clear relationship with critical eccentricity**

## Limitations

- Variation in viewpoint may have biased recognition
- Crowding implies number of component parts not their size, location, or informative properties

Future directions

- Use fMRI to study differential neural activation during object perception at fixation
- Examine relationship between critical eccentricity and brain areas related to holistic (LOC) and configural processing (IPS)
- Investigate reliability of identified diagnostic parts
- Analyze accuracy and reaction time to define what qualifies as diagnostic

## References


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