Psychophysical studies of visual object recognition

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**Psychophysics** is the study of the link between stimulus and perception and it quantitatively investigates the relationship between physical stimuli and the perception/sensation/behavior they produce.
Example psychophysical experiment

Is the object an animate or inanimate object?

Yes!

No!

time
What do typical experiments measure?

**Reaction time:** The time taken by subjects to perform a task or make a judgment. Reaction time can give an indication (or at least the upper bound) or how long the necessary psychological (and neural) processes take.

**Performance:** The accuracy of performing a task. Performance is often inversely related to reaction time.

**Threshold:** Stimuli can be varied (e.g., presentation duration) to determine the threshold for detection or discrimination.
Gestalt laws

Law of closure
Law of similarity
Law of proximity
Law of symmetry
Law of continuity
Law of common fate
Law of closure

We perceive objects such as shapes, letters, pictures, etc., as being whole when they are not complete. Specifically, when parts of a whole picture are missing, our perception fills in the visual gap.
Law of similarity

We group similar elements into collective entities or totalities. This similarity might depend on relationships of form, color, size, or brightness.
Law of proximity

We group objects that are **proximate** to each other (either spatially or temporally) tend to be grouped together.
We group elements that are **symmetrical** to each other tend to be perceived as a unified group.
Law of continuity

We perceive points that are connected by straight or curving lines are seen in a way that follows the smoothest path.
Law of common fate

We perceive elements with the same moving direction as a collective unit.
Hollistic process of face perception

Part-whole effect

Inversion effect

Composite face effect
Parts vs wholes effect in face perception

Tanaka & Farah (1993)
Parts vs wholes effect in face perception

Tanaka & Farah (1993)
Part-whole illusion

McKone et al (2013)
Part-whole illusion

McKone et al (2013)
Inversion effect

McKone et al (2013)
Composite face effect
Composite face effect
Properties of object recognition

Invariant object recognition

Speed of visual recognition

Recognition from minimal features

The value of experience
Scale/size tolerance
Size invariance in visual object priming

1\textsuperscript{st} block

same exemplar
same size

same exemplar
different size

2\textsuperscript{nd} block

different exemplar
same size

different exemplar
different size

Biederman & Cooper (1992)
Size invariance in visual object priming

Biederman & Cooper (1992)
Position invariance in visual object priming

Biederman & Cooper (1991)
Position invariance in visual object priming

Biederman & Cooper (1991)
Properties of object recognition

Invariant object recognition

Speed of visual recognition

Recognition from minimal features

The value of experience
Speed of visual recognition

RSVP (Rapid Serial Visual Presentation)
Probing the timing of the visual system

Go- no go animal categorization task

Fize et al. (2005)
Properties of object recognition

Invariant object recognition

Speed of visual recognition

Recognition from minimal features

The value of experience
Object recognition from minimal features

Shimon et al (2016)
MIRCs: Minimal Recognizable Configurations

Shimon et al (2016)
MIRCs: Minimal Recognizable Configurations

Shimon et al (2016)
Diagnostic features at the part-level

Non-recoverable

Biederman (1987)
Properties of object recognition

Invariant object recognition

Speed of visual recognition

Recognition from minimal features

The value of experience
Visual recognition depends on experience
Waterfall illusion

http://www.michaelbach.de/ot/mot-adapt/index.html