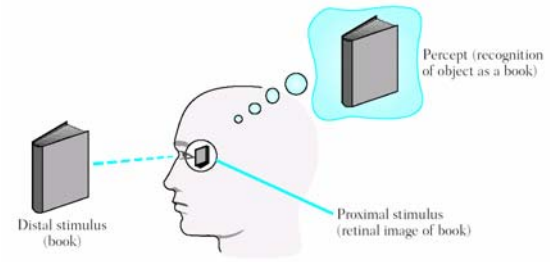
Perception & Pattern Recognition

Classic Model of Perception

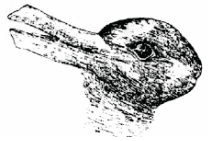


Pattern Recognition

- Process of connecting perceptual information w/info in LTM
  - Visual Pattern Recognition
  - Auditory Pattern Recognition (Speech)
  - Importance of Context

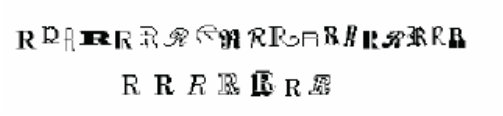
Why is pattern recognition difficult?

- Accomplished with incomplete or ambiguous information



Challenge

- Many different exemplars are recognized as being the same



Robust

- Used by on-line vendors to test for presence of a human (Turing Test)

Models of Pattern Recognition

- Template Models
- Feature Models
- Neural Network Models
- Prototype Models

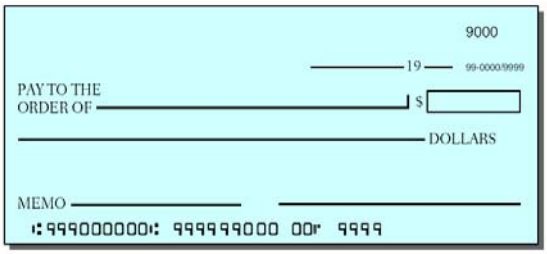
Template Matching

- Retinal image matched to pre-existing patterns

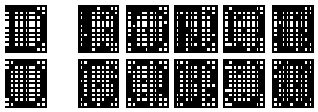
Recognition – when retinal image matches pattern

Examples

- Check Reading
- Zip Code Sorting



Problems



- Image falls on wrong part of retina
- Image different size than template
- Orientation
- Templates, templates, templates
- New objects?

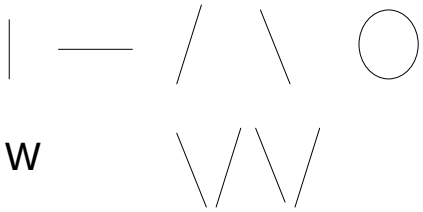
Models of Pattern Recognition

- Template Models
- Feature Models
- Prototype Models
- Neural Network Models

Feature Theory

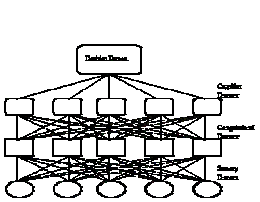
- Stimuli broken down into features
- Features combine and recombine
- Objects defined by
  - Constituent features
  - Relationships between features

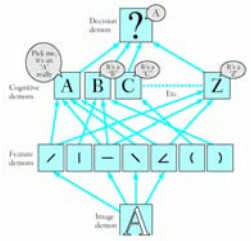
Letter Recognition



W

Pandemonium

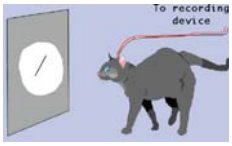




A depiction of Selfridge's (1959) Pandemonium model

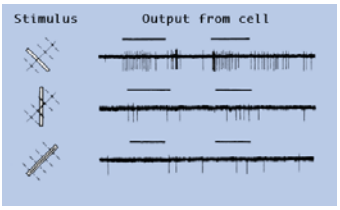
Supporting Evidence

- Edge detection cells in cats (Hubel & Wiesel, 1962)



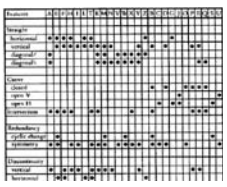
Hubel & Wiesel

- Different cells like different features

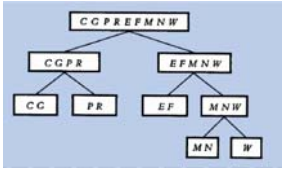


Gibson, Shapiro, & Yonas (1968)

- Analyze letters in terms of features
- Ask people to determine if 2 letters are the same vs. different
- Compare the clustering of letters in the reaction time task to the similarities of the features



Groupings by RT

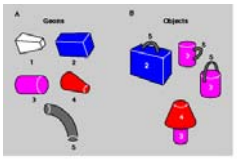


Find the ‘Z’ vs ‘Q’

EIMVWX	CDG9RU
XMZWVI	RDQOCG
VIEXWM	GRDCOU
WVXQIE	DCURZG

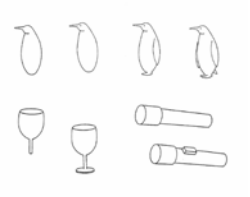
Faster to find ‘Z’ on the right,
Faster to find ‘Q’ on the left
(due to letters w/similar features in the surround)

Object Perception



Geons

- Can help explain recognition of degraded objects



Degraded Objects

- Disrupt Geon
  - (concavity)
- Deletion Control
  - (midsegment)

Limitations of geons

- Not all 3-d objects easily decompose into parts
  - puddle
- How to represent differences between objects composed of similarly related geons?

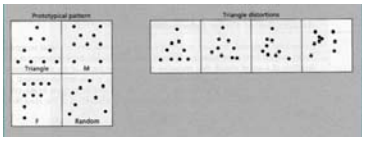
Features vs. Templates

- Simpler
- Combine and Recombine

Prototype Theories of Pattern Recognition

- Idealized, representative element of a category
- Recognition based on “distance” between perceived item and prototype
- Nature of computation (formation of prototype) still relatively unknown

Posner et al.

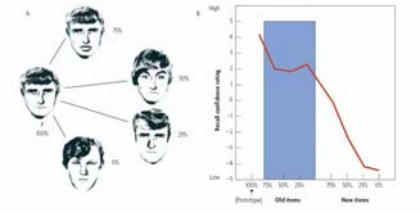


- People form prototypes rapidly!
- 87% of old stimuli grouped correctly
- 67% of new stimuli grouped correctly
- 85% of prototypes grouped correctly
  - Even though they had never seen the prototype stimuli during training

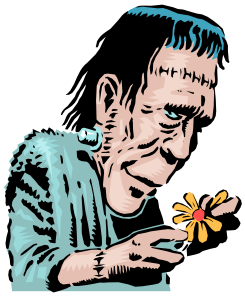
Solso & McCarthy (1981)

- Show people exemplar faces w/different degrees of similarity to a prototype
  - Never show them the prototype
- Show people second group of faces and ask them to rate how confident they were they had seen each face before
  - “Old” Faces (ones they had seen) with varying degrees of similarity to the prototype
  - New faces with varying degrees of similarity to the prototype
  - Prototype Face

Solso & McCarthy (1981)



Story



- Basic features used to ID and recognize objects
- Bottom-up processing