Schematic of a Feature System

Supporting Evidence

3 main types of cells in primary visual cortex

• Simple
• Complex
• End-stopped (formerly Hypercomplex)
Complex

- Orientation
- **Direction-selectivity:**
  - they fire more when the bar moves in one direction, and are suppressed by motion in the opposite direction
End-stopped (formerly Hypercomplex)

- *Length summation*
  - if an appropriate bar is placed in the visual field, they fire action potentials; if the bar is made longer, they fire more, up to the extent of the full receptive field

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Prototype Theory

**Basic Assumptions**

1. The stored representation is a prototype (an abstraction of the typical or best example of an object).
2. Inputs are broken down into feature lists.
3. Recognition is process of comparing the features of the input to the features of prototypes, and selecting the best fit (examples: chairs, cars, and trucks)
Prototype Theory and Attractiveness

1. “goodness” of category membership can be defined with respect to the prototype.
2. “good” category members may be seen as more attractive, or desirable, than “poor” category membership

Example: attractive faces are average

- (Langlois & Roggman, 1990)
- Stimulus set:
  - individual faces
  - composite faces containing 2 - 32 faces.
- Results (rated attractiveness—higher = more attractive)
- **Number of faces** **average rating**
<table>
<thead>
<tr>
<th>Number of faces</th>
<th>Average Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.51</td>
</tr>
<tr>
<td>2</td>
<td>2.87</td>
</tr>
<tr>
<td>4</td>
<td>2.84</td>
</tr>
<tr>
<td>8</td>
<td>3.03</td>
</tr>
<tr>
<td>16</td>
<td>3.06</td>
</tr>
<tr>
<td>32</td>
<td>3.25</td>
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</tbody>
</table>
Face Recognition

- A special problem for theories of pattern recognition:
  Different set of rules? (Example: object vs. facial recognition)
- Yin (1970), and Rock (1974) demonstrated that facial recognition is more easily impaired by inversion than is object recognition.

Inverted Face Effect
Different Neurological Structures?

• Dissociation between loss of object recognition (visual agnosia) and face recognition (prosopagnosia*) in stroke victims.

(Moscoviitch, Winocur, & Behrman, 1997)

*See Bill’s Face Book website (linked to class cool links page)
Conclusions on Visual Pattern Recognition

- Template and Feature Models are inadequate
- Context and top-down processing are very important (though some neural networks account for top down processes)
- Important role of prototypes
- Challenges of data on face recognition

What about auditory pattern recognition?

OVERVIEW
- Variable production (exquisite phoneme recognition…and parsing is in your head)
- Contextual guidance
- Audio-visual interaction
• A landscape overview of the spectral characteristics and spectral changes in the time domain
• A 3-D display with y-axis representing frequency, x-axis representing time, and the shade of darkness representing amplitude
Encoding phonemes in sound via articulatory commands

- How do speakers convert a phoneme sequence into muscle commands, articulator movements and, hence, sound?
  - no 1-to-1 mapping from phonemes to muscle commands, articulator positions, or acoustics
  - phonemic variation results from co-articulation
Coarticulation

• Important part of what enables us to communicate at five syllables a second
• While speaking, we move the lips, tongue and jaw rapidly
• Our brain coordinates movements, such that movements needed for adjacent vowels and consonants are produced simultaneously
• This \textit{coarticulation} allows speech to be produced smoothly
Role of Context in Comprehension

• Phonemic restoration
  \textit{(Warren & Warren, 1970; Samuel, 1987)}
  - the ability to fill in sounds that are missing, using context as a cue
    • It was found that the *eel was on the axle.
    • It was found that the *eel was on the shoe.
    • It was found that the *eel was on the orange.
    • It was found that the *eel was on the table.

McGurk Effect

• Visual cues influence audio experience