Psychological studies of face recognition:

The Bruce and Young (1986) model of face processing:

- Structural encoding: "this is a face"
- Expression
- Facial Speech
- Age, Gender
- Face Recognition Units: stored faces
- Person Identity Nodes: stored semantic information
- Name Generation

Interactive Activation and Competition (IAC) model (Burton, Bruce and Johnston 1990):

1. Charles FRU activates Charles PIN.
2. Charles PIN activates Royalty SIU.
3. Royalty SIU activates Diana PIN.
4. Diana PIN now "primed".

FRU - face recognition unit
PIN - person identity node
SIU - semantic information unit
NIU - name input unit

Semantic priming:
Interactive Activation and Competition (IAC) model: Repetition priming:

1. Charles FRU activated.
2. Charles PIN activated.
3. FRU-PIN link strengthened.
4. Less Charles FRU activation now required for PIN to be activated.

Stages in Face recognition:

Structural encoding:
Based on features, or their configuration (spatial relationship)?

Face Recognition Unit:
Activated by a match to a stored face representation

Person Identity Node:
Contains semantic information about the person

Name Generation

What does the "structural encoding" consist of?
(a) Featural (piecemeal) processing:
"Big nose"
"Brown hair"
"Chubby face"
"Eyes close together"

(b) Configural /relational/holistic processing:
Evidence for existence of configural processing:

The Inversion Effect: (e.g. Yin 1970, Diamond and Carey 1986). Upside-down faces are hard to recognise.

The Thatcher Illusion: (Thompson 1980). Subtle relational changes are not apparent in inverted faces...

Further evidence for configural processing: The “chimeric face effect”

Aligned face halves give strong impression of a new face.

Difficult to recognise either “donor” face.


Evidence for existence of featural processing:

Recognition can still be achieved from features alone (e.g. in scrambled faces, and from isolated features).
The chimeric face effect:

Upright (but not inverted) faces are processed in an integrated “holistic” way, that prevents easy access to their constituent features.

Face superiority effects:

Features are recognised better if they are presented within a whole face than if presented in isolation or within a scrambled face (Tanaka and Farah 1993).

Other aspects of structural encoding:

Haig (1986): people are very sensitive to the precise location of the facial features, especially the eyes and mouth.

Negative faces are poorly recognised - representation of shape from shading is important for recognition.

Computer-generated caricatures:

- caricatures -
  (a) compare face to an average (norm) face
  (b) exaggerate all of the discrepancies by a certain percentage.

- anti-caricatures -
  (a) compare face to an average (norm) face
  (b) reduce all of the discrepancies by a certain percentage.

Caricatures are rated more like the person than a veridical drawing.
Same is true (to a lesser extent) with photographic-quality computer-generated caricatures (Benson and Perrett 1991).

Benson and Perrett (1994):

Photographic-quality caricatures:
“Best likeness” for highly-familiar faces: 4% caricature.
“Best likeness” for personally-familiar faces: 0%.

Quickest RT for highly-familiar faces: 19%.
Quickest RT for personally-familiar faces: 0%.

Line-drawn caricatures:
Best likeness: 16%
Quickest RT: 50%.

Big differences between faces: more distinctive faces need less caricature.

What does configurational processing involve?
Hole et al (2003): effects of various affine transformations on familiar-face recognition:
Vertical stretching
Horizontal stretching
Shearing
Inversion

Valentine’s “Multidimensional Face Space”

Distinctive (big nose, close-set eyes)
Distinctive (small nose, widely-set eyes)

Nose length
Eye separation

Typical
Short
Wide

Mean RT (msec)

0 500 1000 1500 2000 2500 3000

Normal shear
Vstretch Hstretch
Inversion

Normal shear
Vstretch Hstretch
Inversion
Conclusions:

Configurational processing tolerates *linear* and *global* distortions of input.

Involves either –

Something sophisticated (e.g. ratios of facial metrics);

Or

A normalisation process (using a prototypical face template?)

(a) Transform input to match prototypical template ("normalisation");

(b) Transform template to match input ("deformable template" theories, e.g. van der Malsburg 1993);

The relationship between configurational and featural processing: parallel routes to recognition?

*Collishaw and Hole* (2000):

Investigated effects of disruptive manipulations in isolation and in combinations:

- **Blurring** impairs processing of local features more than processing of global configuration (Costen et al. 1994)

- **Scrambling** and **inversion** impair configural processing more than featural processing (Valentine, 1988)

If featural and configurational processing are parallel routes to recognition, then:

(a) Any *single* manipulation (scrambling, inversion or blurring) will lead to *some* but not *total* impairment.

(b) Combinations of manipulations that affect the *same* process will produce no more impairment than the same manipulations singly (scrambling + inversion same as scrambling or inversion).

(c) Combinations of manipulations that affect *different* processes will severely impair recognition (scrambling + blurring or inversion + blurring = chance performance.).
Recognising famous faces:

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<tr>
<th>Study</th>
<th>1 Normal</th>
<th>2 Normal</th>
<th>3 Normal</th>
<th>4 Normal</th>
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Is configural processing unique to faces?:

Probably not -


Rhodes and MacLean (1990): caricature effects with birds.

Gauthier and Tarr (1997): inversion effects with greebles.

Are faces "special"?:

Yes in the sense that they require fine-grain within-class discriminations between category exemplars (e.g. individual faces).

This type of processing may not be unique to faces; may be used with any stimulus class that requires subtle within-class discriminations (Bruce and Humphreys 1994).

Gauthier: = general-purpose object-recognition mechanisms, which are most often used with faces. Bentin: = face-specific mechanisms which can be adapted for use with other stimulus classes, given experience.

Overall conclusions:

Faces can be recognised by either configural or featural processing (though using both is probably best).

Configural processing of upright faces is automatic and involuntary (chimeric face effect).

Configural processing involves more than extraction of simple facial metrics (distortion studies).

Faces are "special" in involving a type of processing used mainly (but not exclusively) with faces.