PERCEPTION: H.A.M.

FACE PERCEPTION
FALL 2021

ROADMAP FOR TODAY

FACES
TESTS
CHALLENGES

FACES:
PRETTY IMPORTANT, VERY COMPLEX

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PRETTY IMPORTANT, VERY COMPLEX

RIGID OBJECT
NON-RIGID OBJECT
PROCESSING STAGES: A REMINDER OF Q'S AND A'S

DETECTION
IS SOMETHING THERE?

DISCRIMINATION
DO THINGS DIFFER?

RECOGNITION
PREVIOUS ENCOUNTER?

IDENTIFICATION
WHAT/WHO IS IT?

VISION CAN DO ALL OF THEM

BUT WHICH PROCESS IS ENGAGED DEPENDS ON OUR NEEDS/GOAL

OFTEN MORE THAN ONE PROCESS IS CALLED UPON AND THEY CAN COLLABORATE

WHY SINGLE OUT FACES?

WE'VE LOOKED AT:

COLORS
GRATINGS
NOISE
MOTION
FIXATIONS
OBJECTS
SPECTRA
ORIENTATION

AREN'T THOSE ENOUGH???

WHY DO FACES NEED SPECIAL ATTENTION???

FACE PERCEPTION NOT LIKE PERCEPTION OF OTHER STIMULI

Pawan Sinha (MIT)

RECOGNITION GOOD IN EXTREMELY LOW RESOLUTION
PARTICULAR PARTS ESPECIALLY IMPORTANT
INTERNAL AND EXTERNAL FEATURES BOTH MATTER
GEOMETRIC DISTORTION RELATIVELY MINOR
VERTICAL INVERSION HAS BIG EFFECT
PIGMENTATION MATTERS —INVERSION
CHANGES IN EXPRESSION MATTER
PASSAGE OF TIME (AGING) MATTERS
VISION "STARTS" WITH PREFERENCE FOR FACE-Y THINGS
MEMORY FOR FACES IS SURPRISINGLY (?) POOR
SURPRISE BREAKOUT

START WITH BASICS

I SEE SOMETHING, BUT IS IT A FACE??
WHAT STIMULUS PROPERTIES TRIGGER “FACE” RESPONSE?

START WITH BASICS

SUPPOSE YOU KNOW THE LIGHT LEVEL AT EACH POINT ON THE RETINA.
THESE NUMBERS ARE THE LIGHT LEVELS.
WHAT DO YOU LOOK FOR IN THE NUMBERS TO FIGURE OUT WHETHER THE EYE’S OWNER IS LOOKING AT A FACE?
OTHER WORDS: WHAT DEFINES A FACE??

FACE RECOGNITION

HUMANS ENCOUNTER MANY DIFFERENT CHALLENGES RECOGNIZING A FACE
MACHINES DO, TOO
FOR CLUES, CONSIDER ERRORS
SYSTEM CAN FAIL (SEVERAL WAYS)

IT CAN FAIL TO DETECT A FACE WHERE THERE IS ONE. HOW?

BUT IT CAN ALSO DETECT A FACE WHERE THERE IS NONE. HOW?

SEEING FACES?

PAREIDOLIA

CAMERA SAYS “I SEE YOU”

WHAT’S IT DOING?
SIMPLE VERSION (FOR NOW.)
Human faces share some similar properties. These regularities can be extracted by a machine using particular set of feature tests.

These common properties include:
(i) eye regions darker than the upper cheeks
(ii) the nose bridge region brighter than the eyes.

Once found, these matchable facial features can define the location and size of eyes, mouth, bridge of nose.

First two classifiers

Cascade of 32 classifiers

PAWAN SINHA (MIT)

RECOGNITION GOOD IN EXTREMELY LOW RESOLUTION
EDGES ALONE MAY NOT SUFFICE
PARTICULAR PARTS ESPECIALLY IMPORTANT
INTERNAL AND EXTERNAL FEATURES MATTER
GEOMETRIC DISTORTION RELATIVELY MINOR
VERTICAL INVERSION HAS BIG EFFECT
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VISION 'STARTS' WITH PREFERENCE FOR FACE-LIKE
MEMORY FOR FACES IS SURPRISINGLY POOR

Recognition works even with very blurred images —particularly with top-down help

PAUL VIOLA-MICHAEL JONES
CASCADE ALGORITHM (2001)
Vertical inversion dramatically reduces recognition performance.

Inverting contrast polarity substantially impairs recognition performance, possibly due to compromised ability to use pigmentation cues that we rely on ordinarily.
CHALLENGES

Both internal and external facial features are important.

OVERCOME CONSIDERABLE DEGRADATION AND DISTORTION, PARTICULARLY WITH FAMILIAR FACES

PROSOPAGNOSIA

Word combines two roots

Prosopon, ancient Greek for face
Agnosia, ancient Greek for ignorance

Term “agnosia” introduced by Sigmund Freud in 1891 to describe inability to recognize objects

Put the two roots together, and you have face ignorance.

SIGNS SOMETHING’S WRONG

You have failed to recognize a close friend or family member, especially when you weren’t expecting to see them.

When you meet someone new, you try to remember their hairstyle or distinctive feature rather than their face.

You confuse characters in movies or on television more so than other people do.

You have trouble recognizing yourself in photographs.

When someone casually waves or says hello in the street you more often than not don’t know who they are.

When someone gets a haircut you may not recognize them when you see them again.

Do you have difficulty recognizing neighbors, friends, coworkers, schoolmates when they are out of context?
Prosopagnosia (also known as ‘face blindness’) is a severe deficit in recognizing familiar people from their face. Acquired and development origins.

While some people report a selective impairment that only influences the recognition of faces, others find the deficit extends to the recognition of other stimuli, such as objects, cars, or animals.

Many people also report deficits in other aspects of face processing, such as judging age or gender, recognizing certain emotional expressions, or following the direction of a person’s eye gaze.

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FFA may have been first, but it does not do the job all on its own.

OFA: Low-Level Properties
FFA: Complex Properties
(Gender, Trustworthiness, Similarity among Faces)

FFA Results with FMRI