

Facial Capture: Introduction to Face Capture Technology

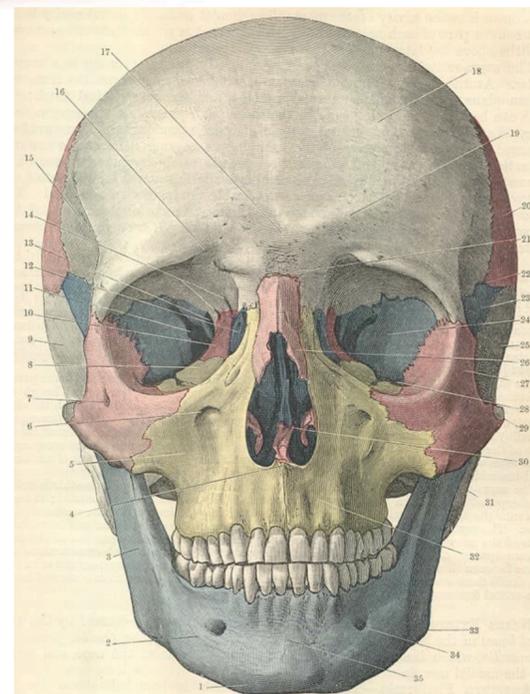
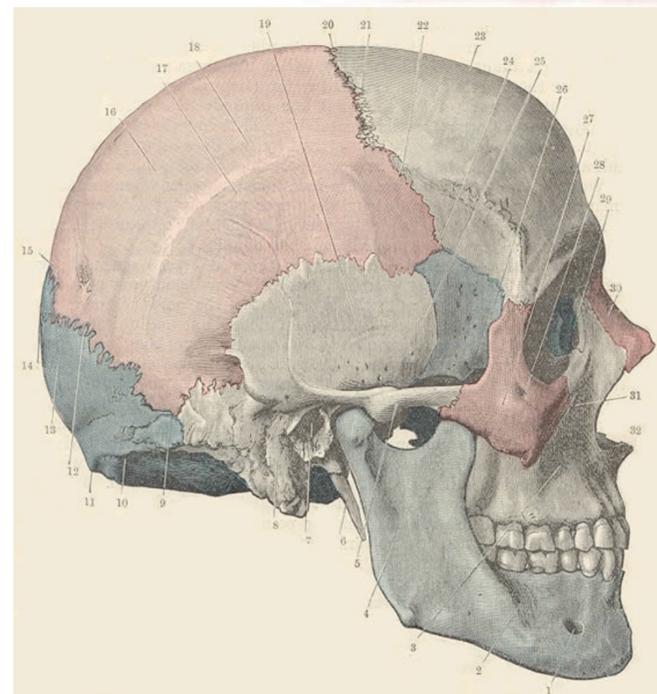
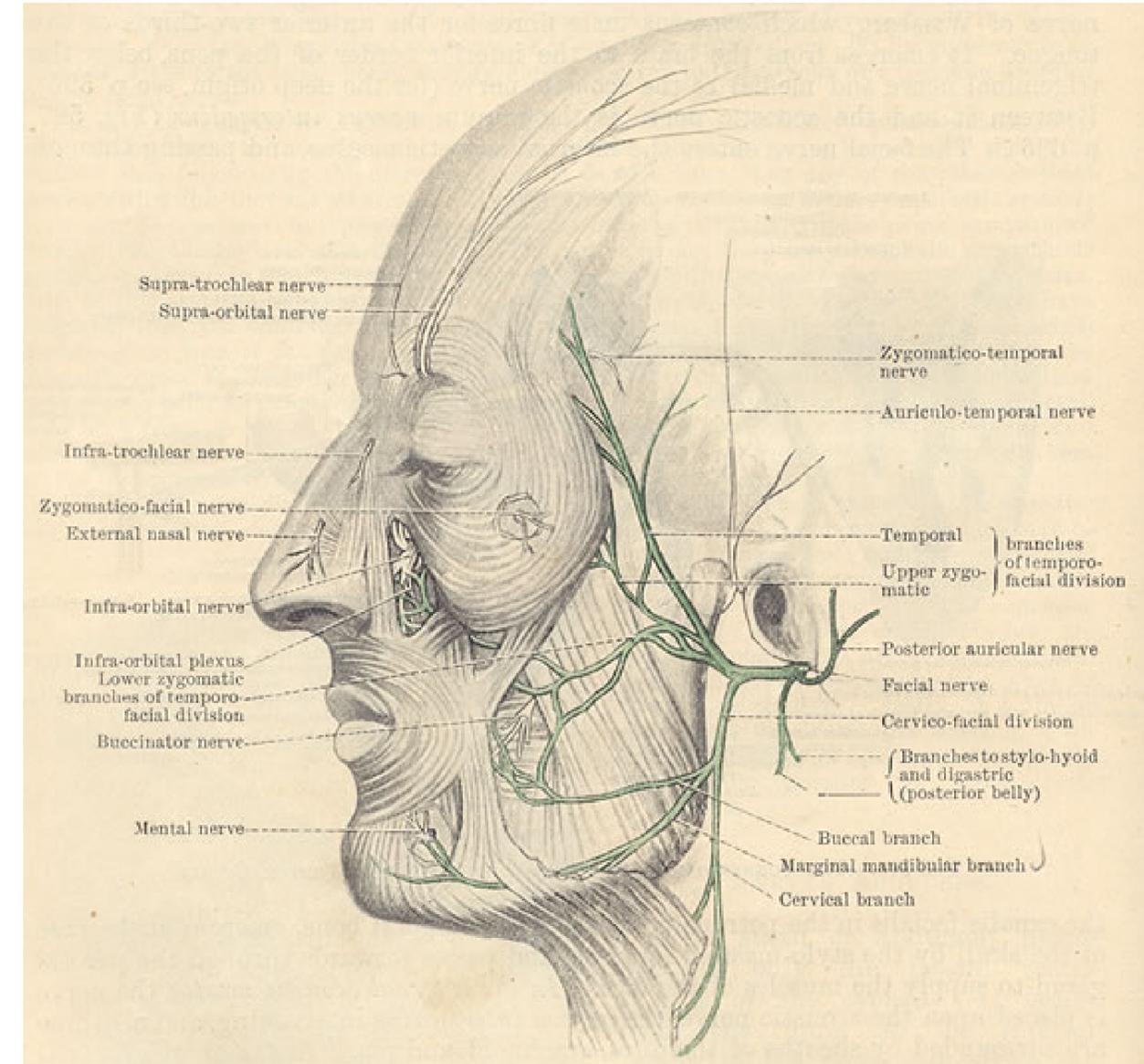
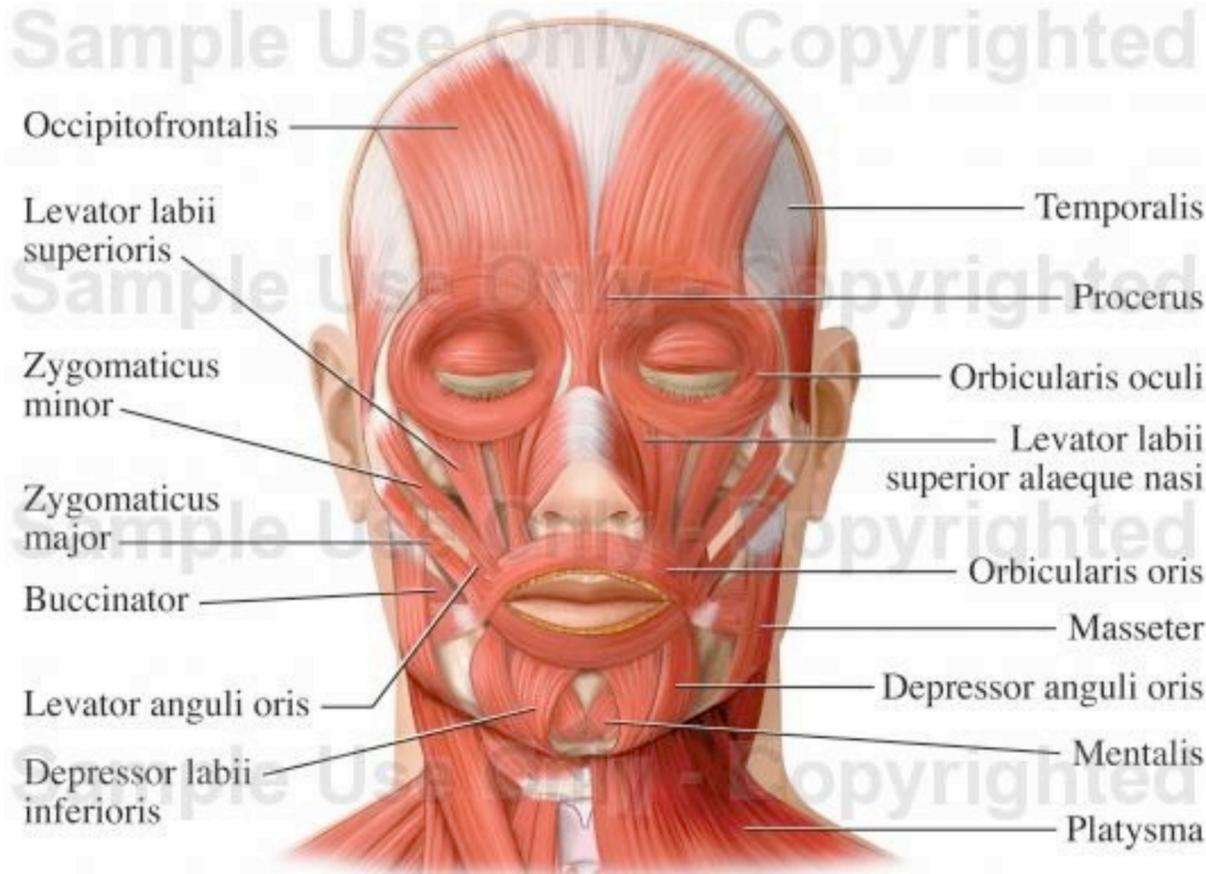
Iain Matthews

9/26/2012



What is a Face?

Facial Anatomy



CN VII

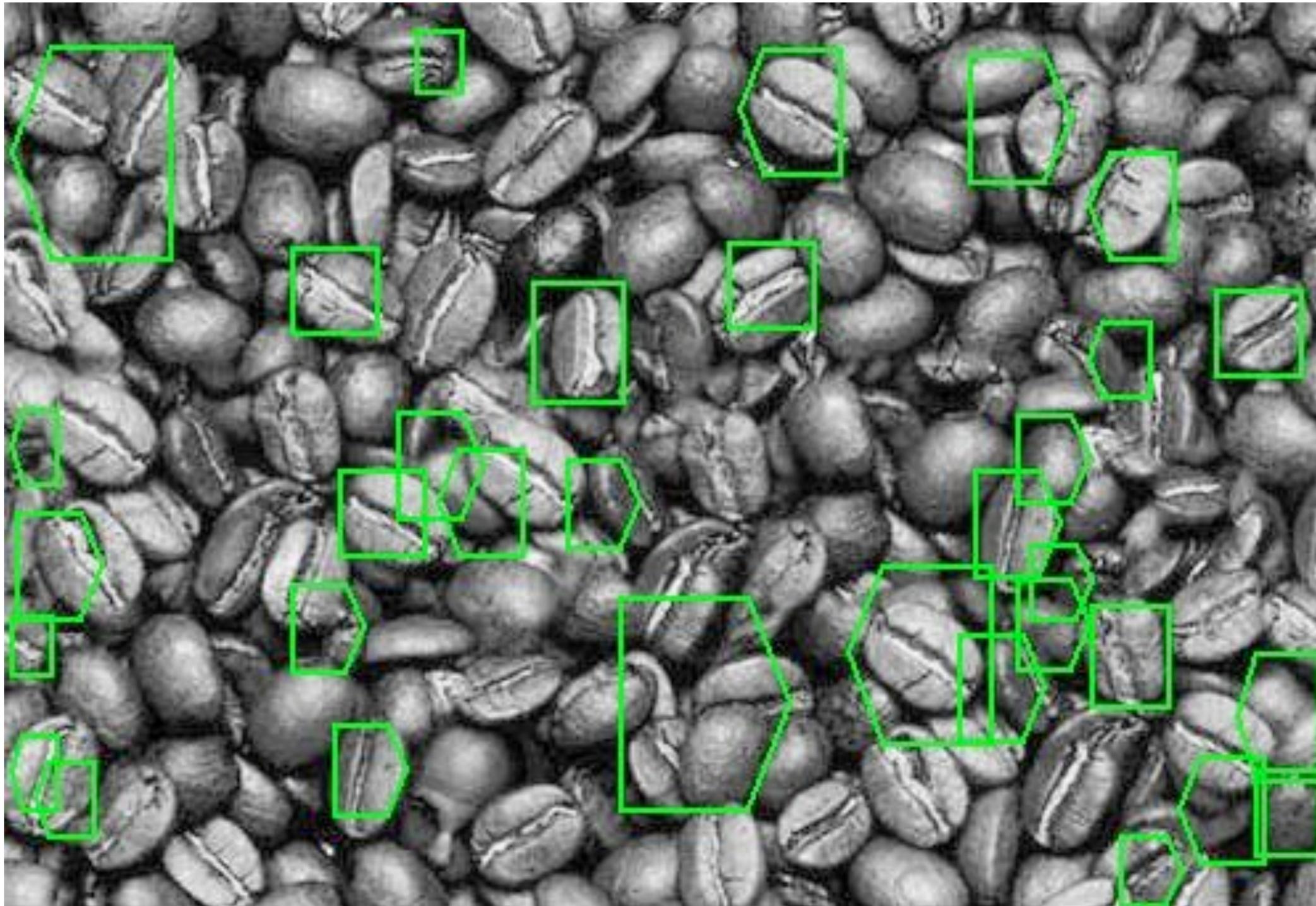
Facial Anatomy



Face Detection Test



Machine Results - <http://demo.pittpatt.com>



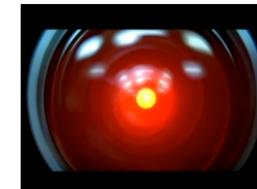
We Do Much More Than Detection...

- We know where the facial features are:
 - Eyes, iris, eyebrows, nose, forehead. Infer the mouth...
- We know the gender?
- We know the gaze direction?

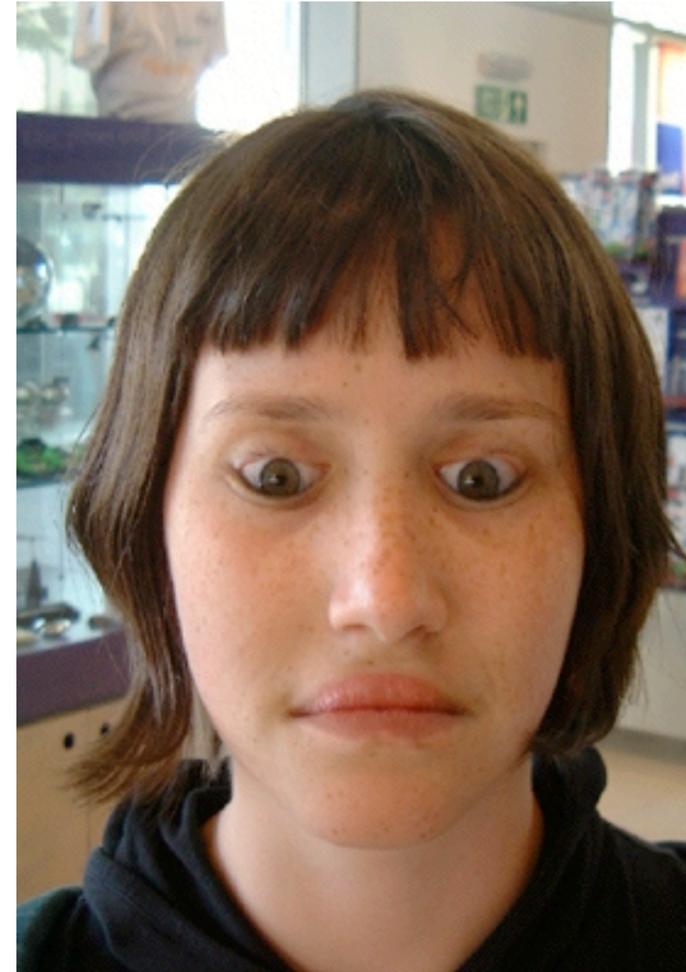


Faces are Perceptually “Special”

- Faces convey a lot of information
 - Expression
Emotional state: happy, sad, bored, etc?
Are you sleepy, distracted, watching something?
 - Communication
Visual speech: McGurk effect
Conversational rules
 - Identity
Prosopagnosia - the inability to recognise faces
- A chunk of your brain is dedicated to faces?
- What is a Face? :-)

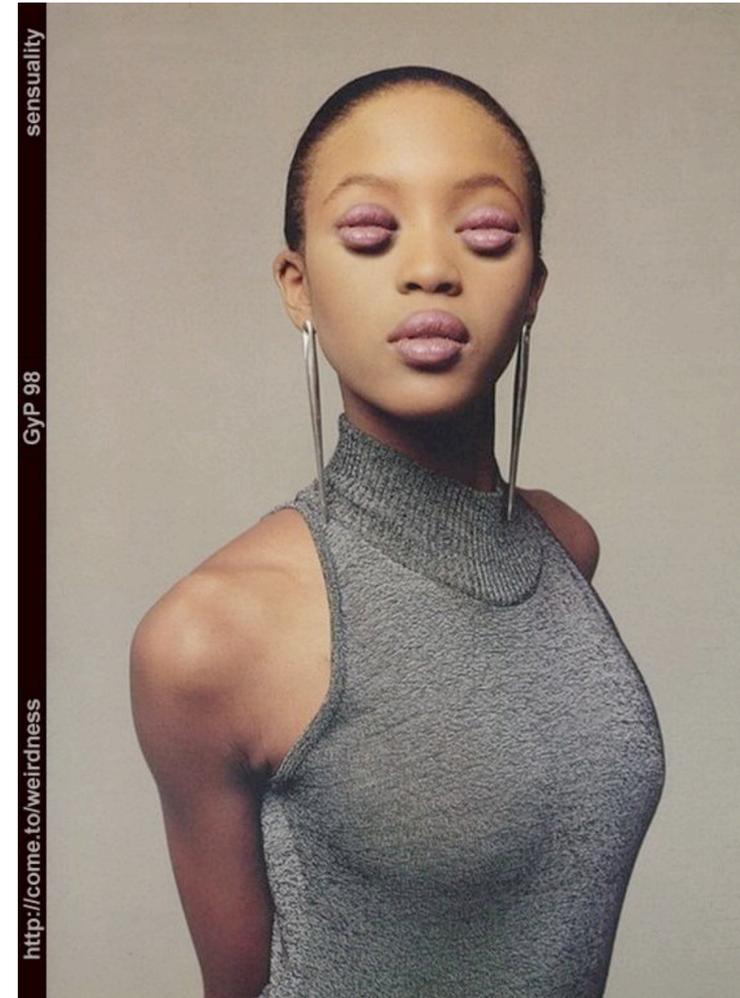






<http://www.youramazingbrain.org.uk/supersenses/upsidedown.htm>

Thompson, P. (1980) "Margaret Thatcher: a new illusion." Perception. 9(4):483-4



Moving Faces Are Special

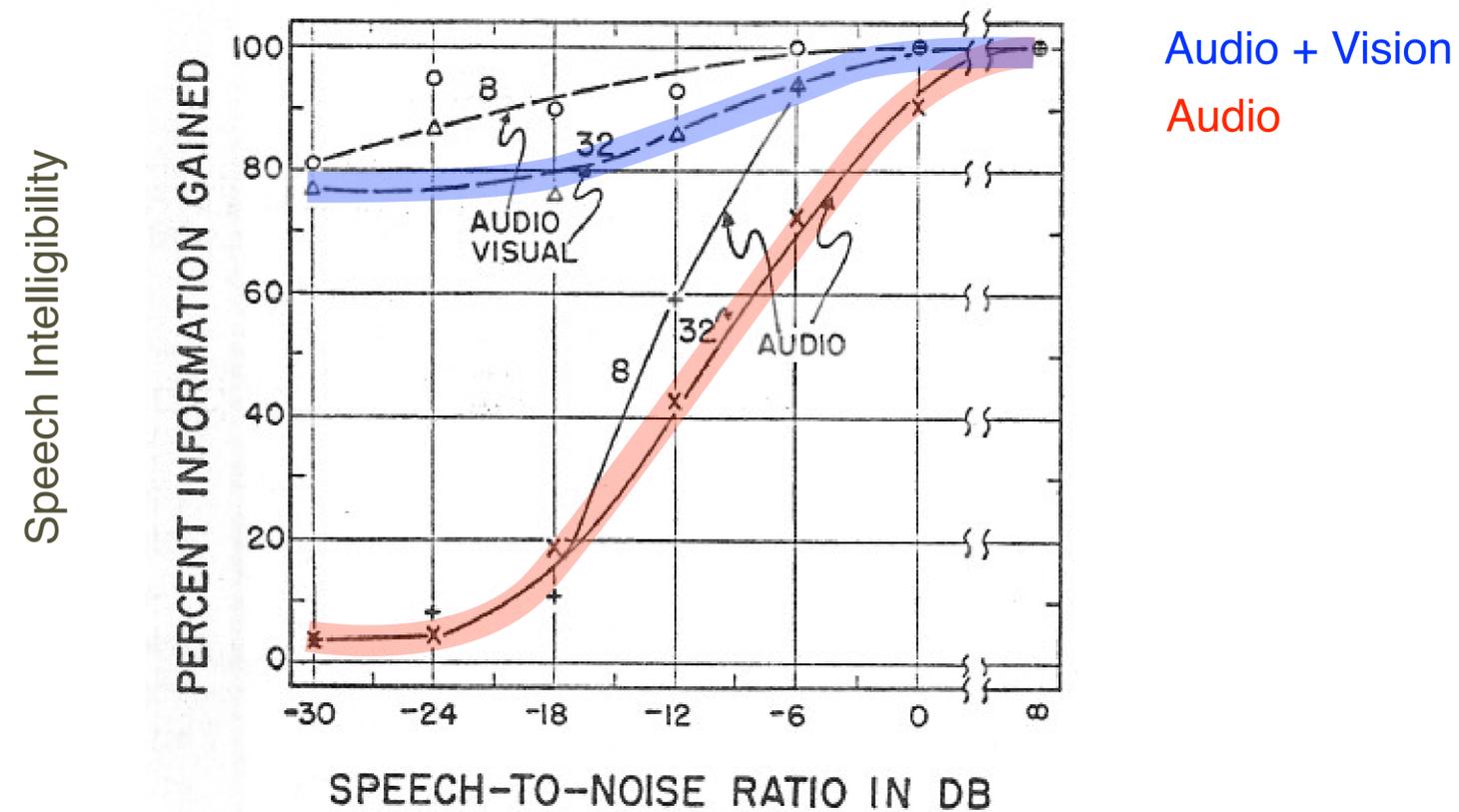
- **Static face:** Identity, context, emotion?





Moving Faces are Special

- **Static face:** Identity, context, *emotion*?
- **Moving faces:** emotion, speech, information



W. H. Sumby and I. Pollack. Visual contribution to speech intelligibility in noise. *Journal of the Acoustical Society of America*, 26(2):212–215, Mar. 1954.

McGurk Effect



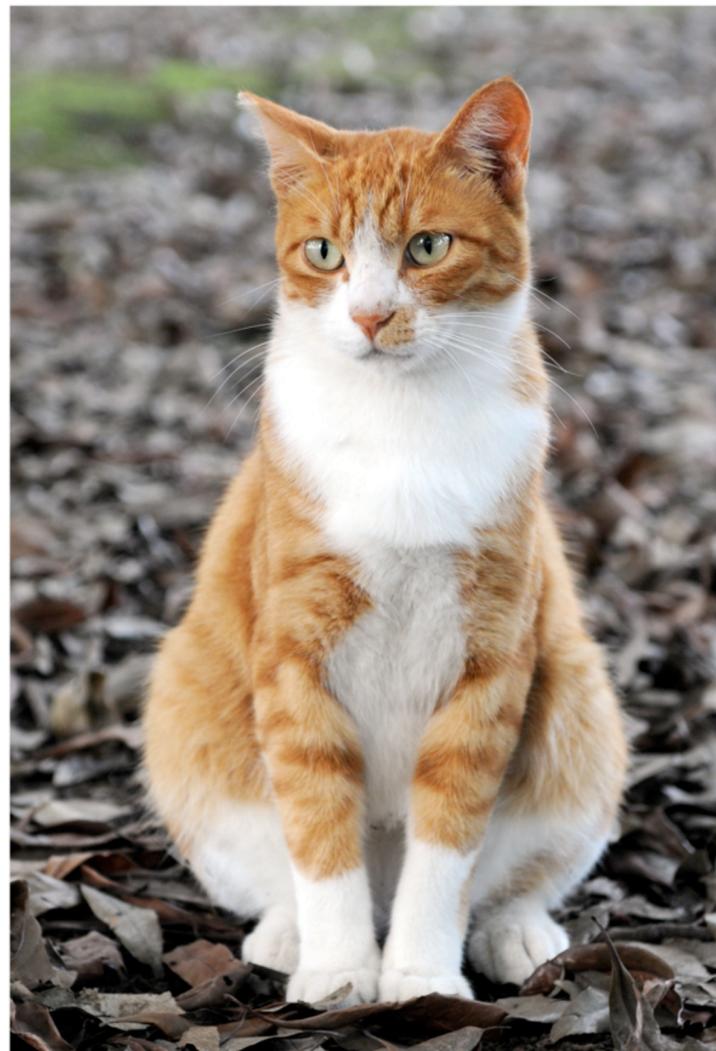
McGurk Effect



McGurk Effect

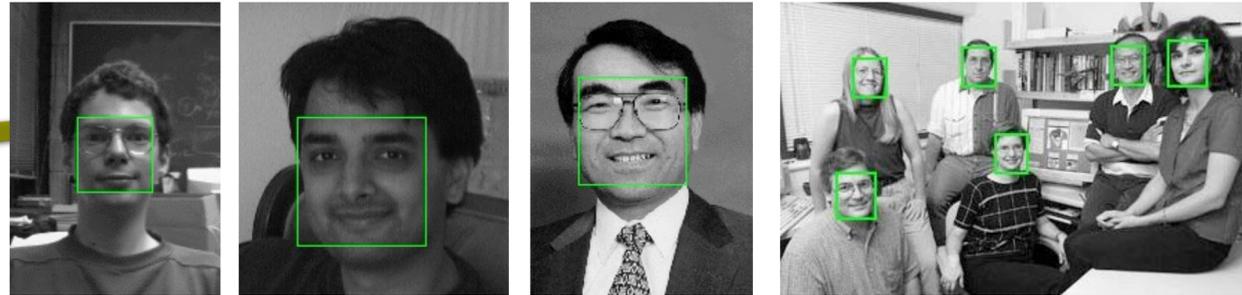


Auditory: "ba" **Visual:** "ga"



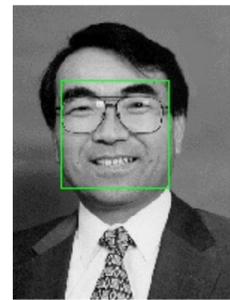
Faces in Computer Vision

- Face Detection



Location: Where is the face?

- Face Classification



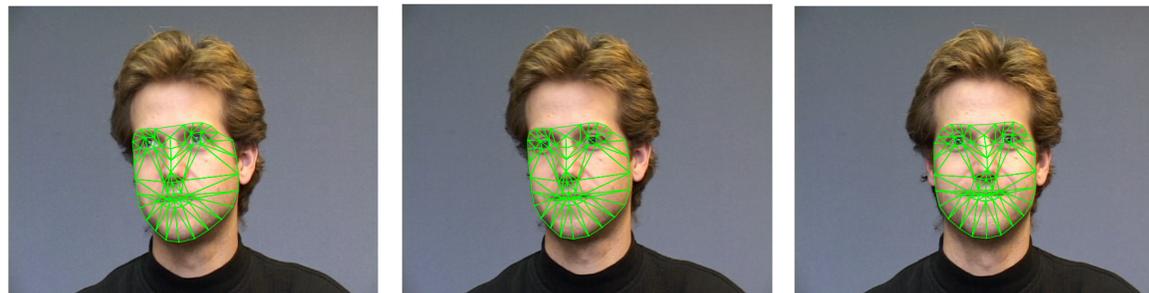
Takeo Kanade



Several years ago

Property: Who does it belong to?

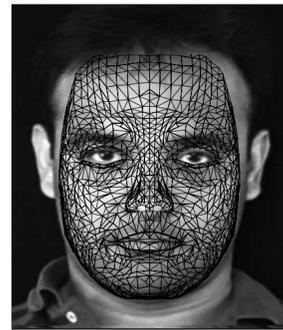
- Face Tracking



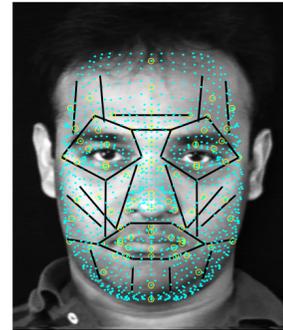
Dynamics: What are they doing?

Faces in Computer Graphics

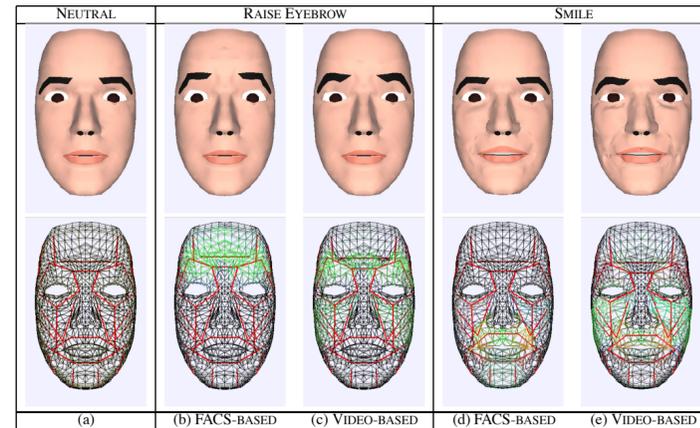
- Face Models



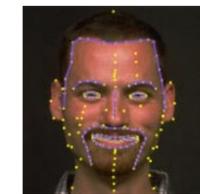
(a) Mesh



(b) Muscles



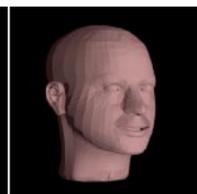
(a)



(b)



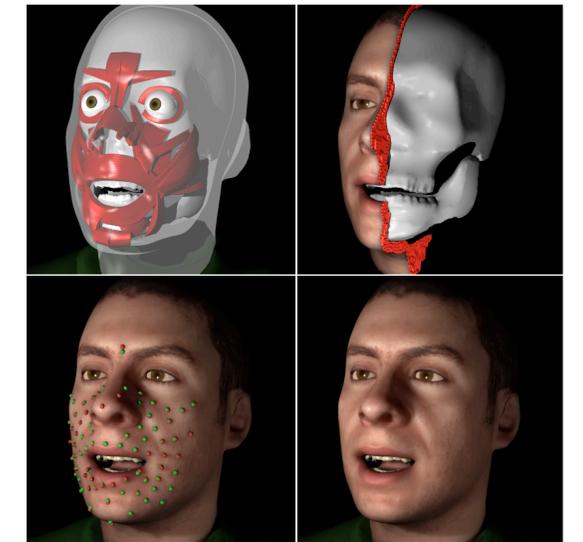
(c)



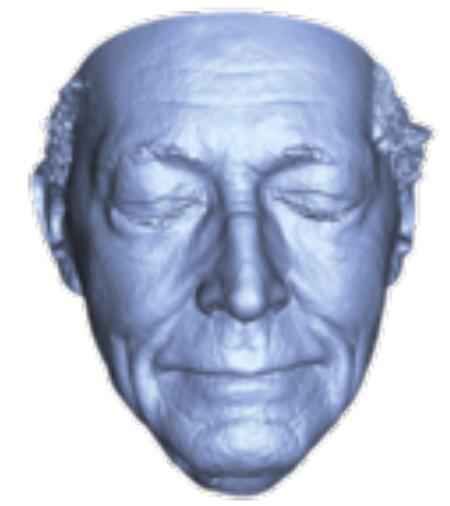
(d)



(e)

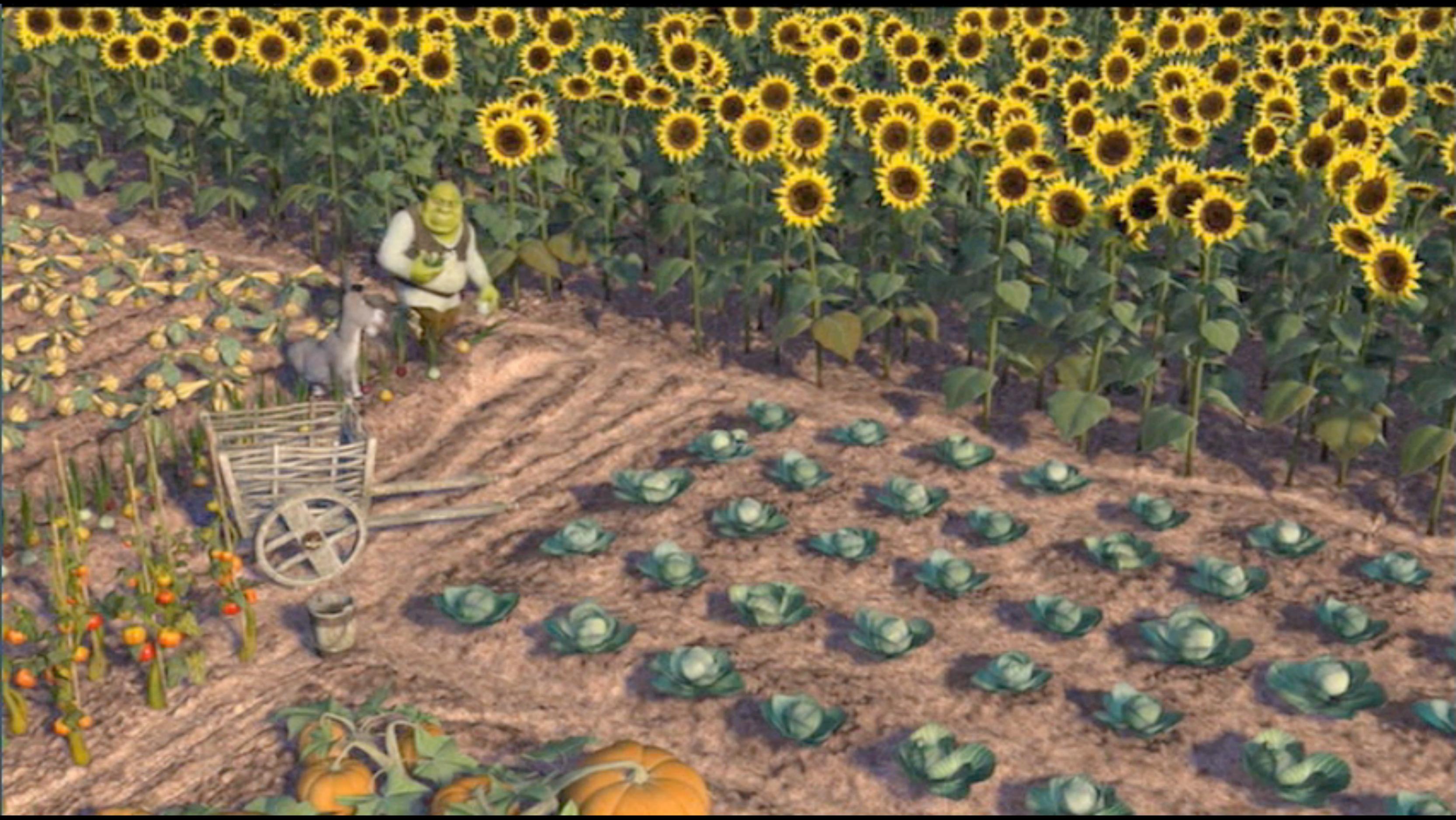


- Face Scanning

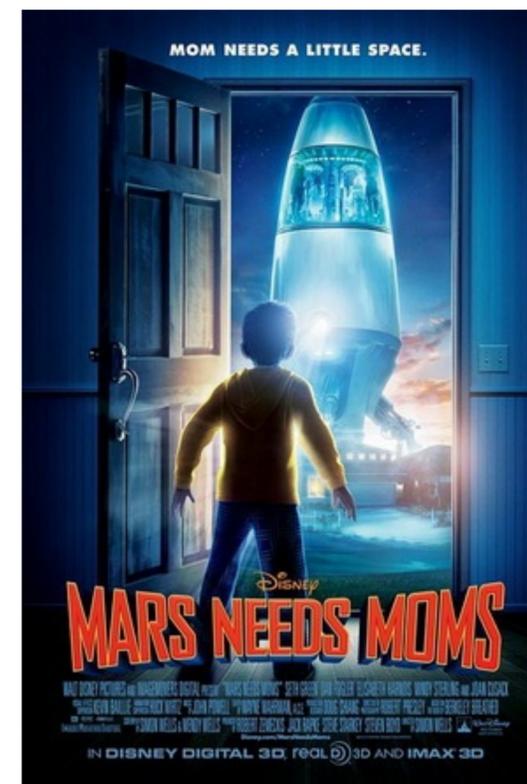
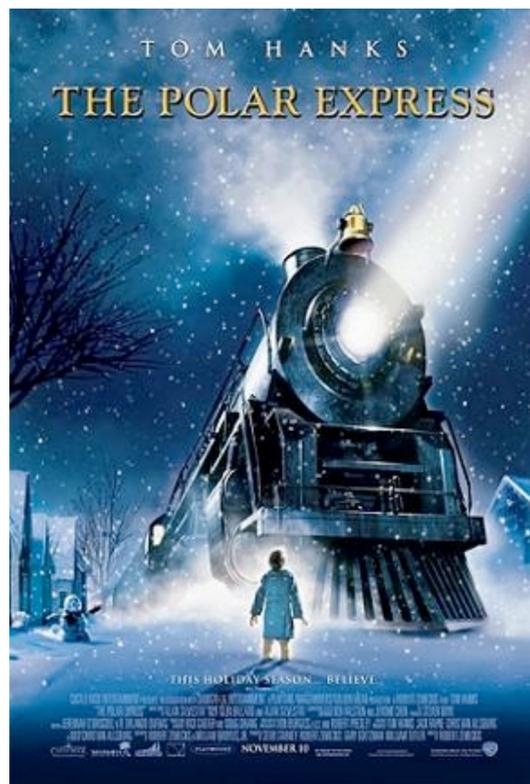
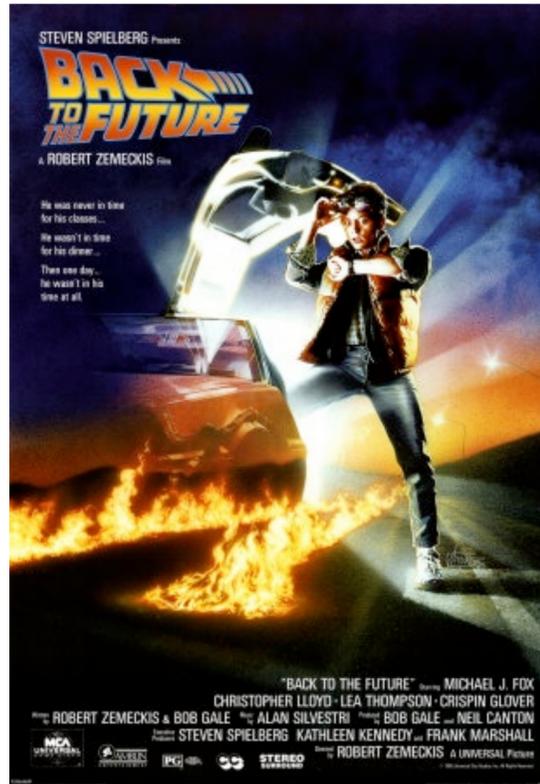


Faces in Animation



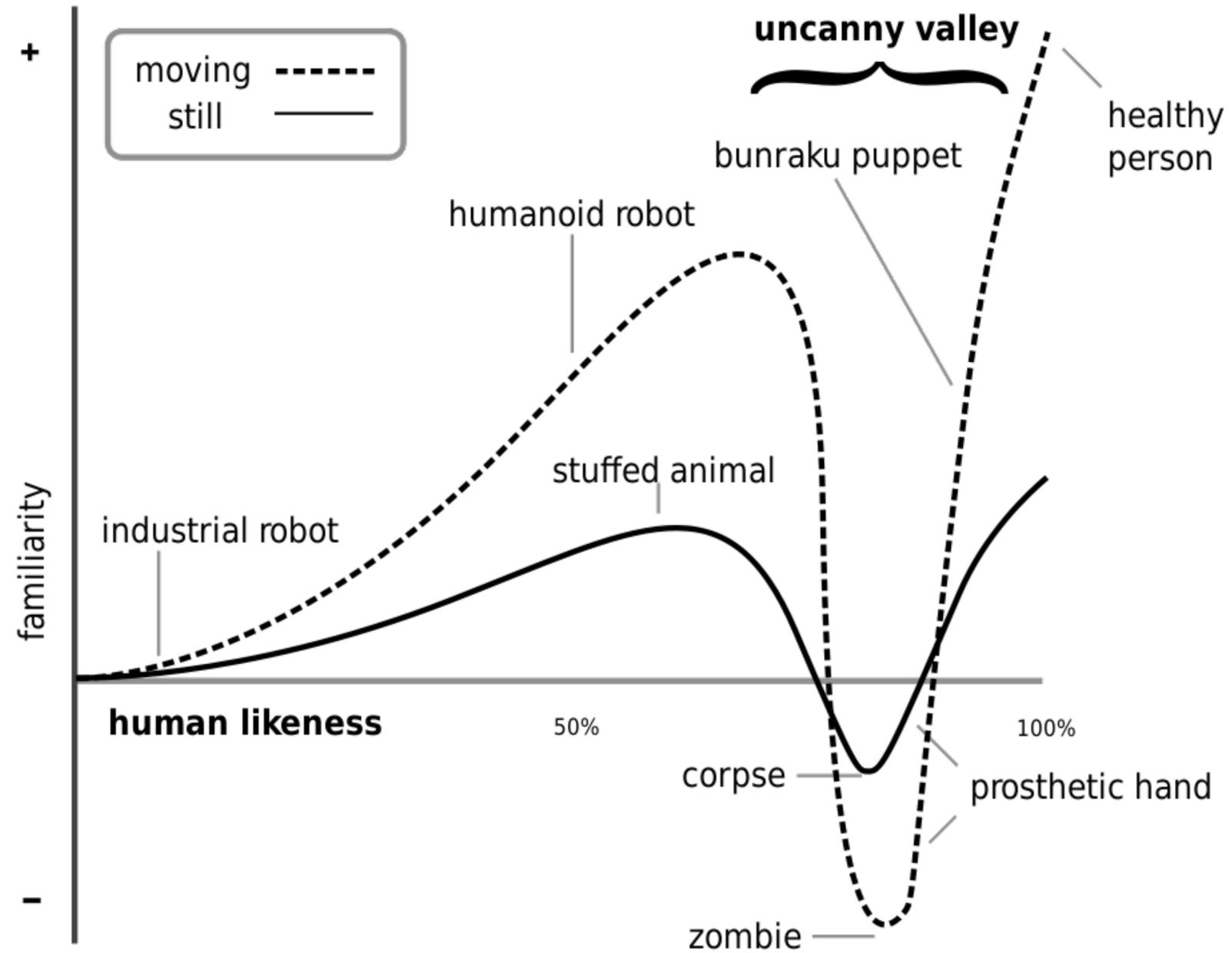


Faces in Animation



ZemECKIS needs job...

Uncanny Valley



Uncanniness



Facial Motion Capture

Senior Artists **ADAM BRADLEY, TIM CHENG, JIM CROASDALE, PAUL EVERITT, CHRISTINE SETH F. MILLER, TROY RAMSEY, BRAD SELKIRK, PHIL VAN DER REY**

MOTION CAPTURE DEPARTMENT

Motion Capture Pipeline Engineer **JOHN CURTIS** • Motion Capture Production Manager **...**
 Motion Capture Stage Manager **JAKE BOTTING** • On-Set Facial Technician **RAYMOND L. MASSA** • Motion
 Motion Capture Software Developer **NEBOJSA DRAGOSAVAC** • Motion Capture Engineer **SEAN SNYDERS** • M
 Motion Capture TD **GARY MARSHALL** • Production Assistants **CLINT SPILLERS, JASON CHEN** • Senior
 Motion Capture Pipeline Manager **JOHN ABERDEIN** • Motion Capture Studio TD **JAMES**
 Motion Capture Editor **CORRADO IANIRI** • Facial Motion Capture AD **MARC ASHTON** • Facial Alignment
 Motion Capture Software Developer **J.P. LEWIS** • Code Facial Set-up **IAIN MATTHEWS** • Motion Capture C
 Lightstage Facial Scanning **PAUL DEBEVEC, WAN-CHUN "ALEX" MA, ABHIJE**

MOTION EDIT DEPARTMENT

Lead Motion Editors **BASSIM HADDAD, TOM HOLZINGER** • Facial Motion Editor Manag
 Senior Motion Editors **HANS BUTLER, LUISMA LAVIN PEREDO, JACOB LUAMANUVAE-SU**
 Motion Editors **JEFFREY BAKER, BENJAMIN BRENNEUR, MARIO DE DIOS BARBERO, ROD FRANSHAM**
MARK L. HOLMES, MALIK JAYAWARDENA, SIGTOR KILDAL, KI-HYUN KIM, MATTIAS LINDKVIST, S
CHRYSTIA SIOLKOWSKY, GAVIN WILLIAMS • Lead Facial Motion Editors **TERESA BAR**
 Facial Motion Editors **CLARE ASHTON, TAMARA BOGDANOVIC, COREY DIMOND, JADE LORIER, CH**
NANDO SANTANA, ADAM SMITH, ILEANA STRAVOSKIADI, MALINO SUZUKI • Facial Motion Edit Assista
DAVID LUKE, CHLOE McLEAN, EMILY PEARCE, PAUL SEYB, ETEUATI T

SOFTWARE DEVELOPMENT

Senior Software Developers & Engineers **RICHARD ADDISON-WOOD, OLIVER CASTLE, SHANE COOPER,**
JACK GREASLEY, PETER HILLMAN, PHILIP HUNTER, MARCUS NORDENSTAM, JACOPO PANTALE
 Software Developers & Engineers **KEVIN ATKINSON, ANTOINE BOUTHORS, PRAVIN BHAT, JACK ELDER, JON HERTZIG, SUSAN HOWARD,**
DAVID ...



SPOT-ON EMOTIONS

Remember what was said before about the dots on the black leotards to pick up body motion? You're probably wondering how they capture the actor's expressions. You're also probably wondering why they're wearing strange-looking cycling helmets with mini cameras pointing at their faces.

I asked Weta Digital Animation Supervisor Jamie Beard to explain what the dots were all about.

When the actor emotes, the dot motion is picked up by a camera attached to the helmet they're wearing. This information is fed into a piece of facial-tracking software which is piped into our computer-generated character's digital face. This digital face has the same muscle groups as the actor, so whatever the actor's face does, our digital model face does too.

Right and below: Actor Andy Serkis pulls a variety of expressions inspired by original Hergé panels. These are then applied to a rough digital model of Captain Haddock.

Jamie Beard
Weta Digital Animation Supervisor



The process of making the original panel art Tintin into a three-dimensional believable character that can perform (while still being recognisable as Tintin) has been the most challenging part of this film. But it's also been the most interesting and enjoyable part too — just trying to explore all the options until we come up with a character we would believe as Tintin if you were to see him in a three-dimensional world.

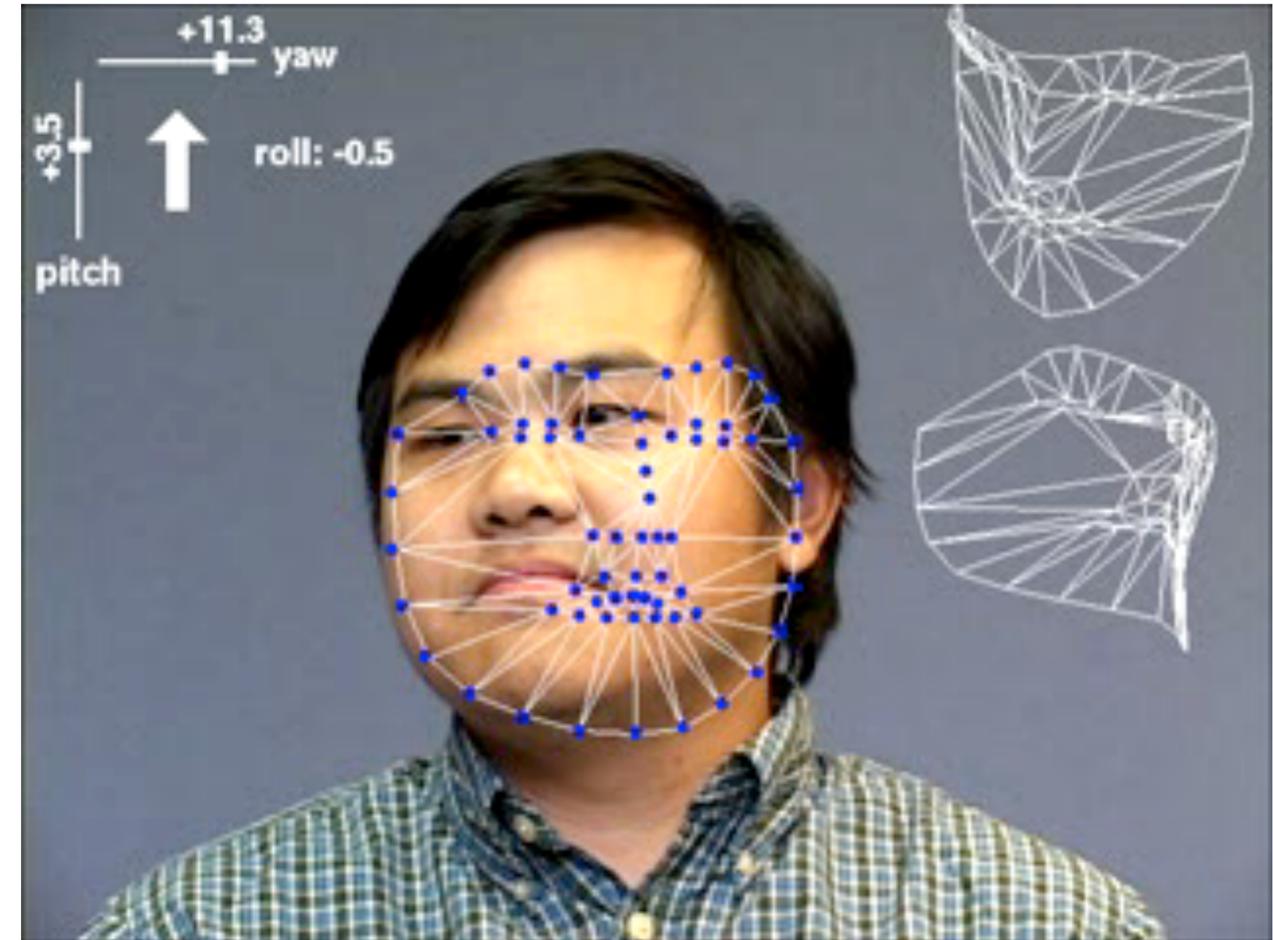
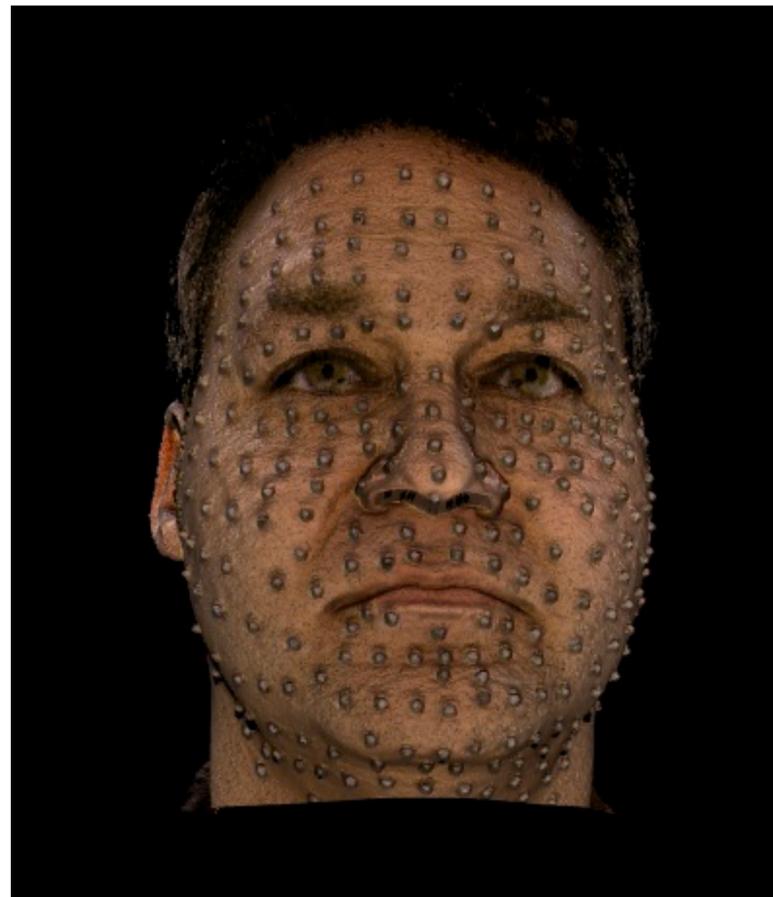
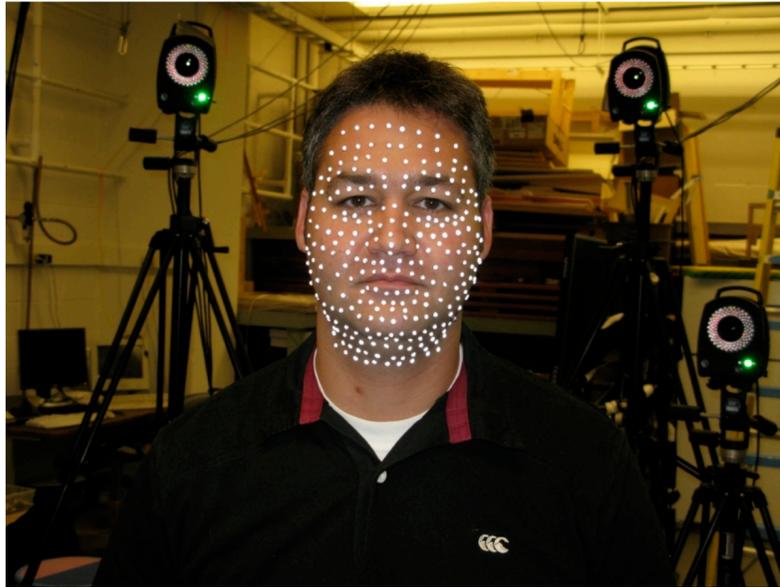
Joe Letteri
Weta Digital Senior Visual Effects Supervisor

I was at least six or seven years old when I first encountered Tintin by watching the French Canadian TV production on Sunday afternoons. Even as a kid I could tell it was beyond just a cartoon. It was just so different from the rest of the animations on television. Here was this guy called Tintin taking on all sorts of topical and political issues. It demanded your full attention as a viewer and I really enjoyed it for that reason.

Jamie Bell
Actor — Tintin

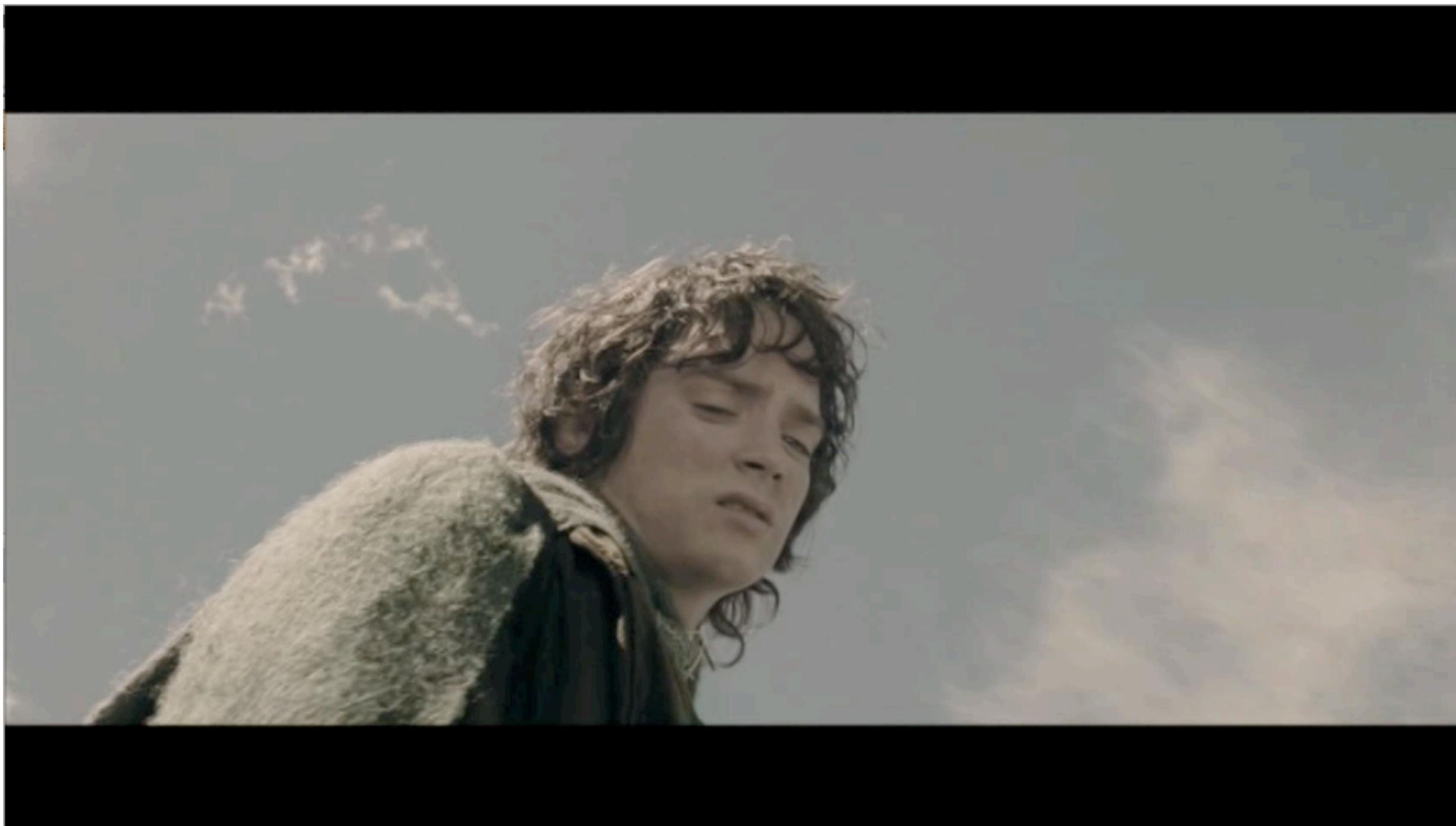


Facial Motion Capture





Faces in Movies



Faces in Movies



Faces

- Statically and **Dynamically** convey lots of information
- Facial expression is just one aspect (but over emphasised?)
- We all lipread all the time!
- Visual speech can alter your audio perception
- Social cues include expression, pose and gaze changes
- We are all experts => “Uncanny Valley”
- Uncanny Valley is just Computer Graphics getting it wrong?

High Quality Passive Facial Performance Capture using Anchor Frames

Thabo Beeler, Fabian Hahn, Derek Bradley, Bernd Bickel, Paul Beardsley,
Craig Gotsman, Robert Sumner, Markus Gross

Faces

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Summary

- Human faces are non-rigid and highly articulated
- Measurement vs. Dynamics tradeoff in most capture systems
- We are all experts that are super sensitive to errors
- Person specific vs. generic representation?
- How to model and describe: statically and dynamically?