

What makes a Virtual Human Alive ?

video2

1. Avatar & Autonomous Virtual Humans
2. The complexity of expressive movements
3. From artificial to real: the uncanny valley
4. Motion capture is part of the solution (offline)
5. Perception of real-time animation
6. Core real-time VH believability factors
7. Other R&D efforts & exercises

4. Motion capture is part of the solution for offline productions

High human-likeness can be recovered through motion capture provided that :

- Professional actors are hired for performance

- The actors learn text and performs as if they were filmed

- The actors are native speakers of the language

- Capturing **eye motions** is essential for the coherence of the synthesized behavior (<http://www.mocaplab.com/services/eye-mocap/eye-tracker/>)

Capturing **micro-expressions** is a must for the expression of emotions [as formalized by Psychologist [Paul Ekman](#)]

- The mocap session is also video recorded - from many viewpoints - to recover subtleties that cannot be measured through marker-based motion capture

Check the TV series “lie to me” & the ref on [micro-expressions](#)



[film «Renaissance»2006]

Very high mesh resolution is necessary for the micro expression deformation:

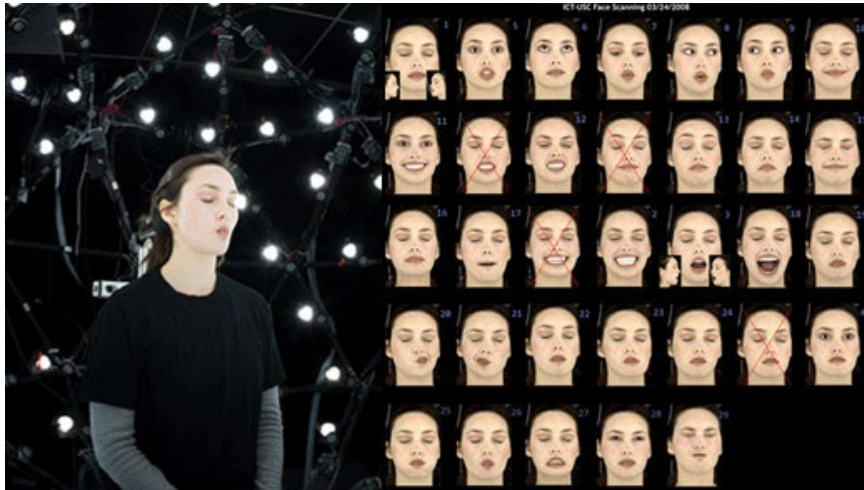


Micro-expressions:
02-03, 07-08, 11-12

4. Motion capture is part of the solution for offline productions (2)

- Alternate motion capture technology based on Computer Vision :
 - Interview presenting Image Metrics technology (2008) [youtube / Emily / Advertizement]

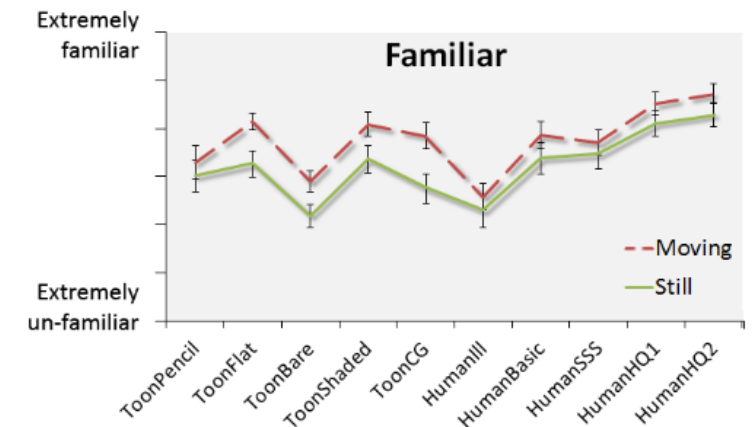
Building a DB of facial expressions under controlled lighting



offline pipeline synthetizing new facial animation sequences

http://www.youtube.com/watch?v=JF_NFmtw89g&feature=fvwrel

- Numerous studies to assess the influence of rendering [McDonnell[2012]:



No simple mapping between the degree of realism and appeal/familiarity/friendliness

4. Motion capture is part of the solution for offline productions (3)

However, a very high resolution of facial meshes is not compatible with real-time display in VR, such as the “*swing cam*” concept introduced by James Cameron at the shooting stage to design camera trajectories.



5. Perception of **real-time** animation

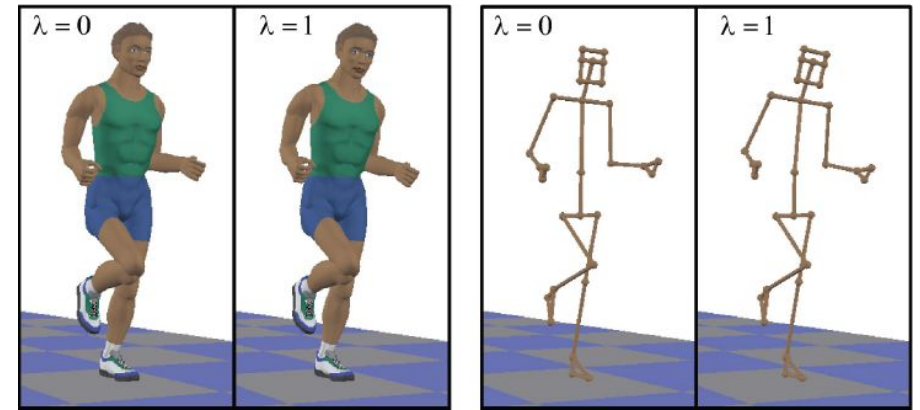
The purpose of perception studies is to determine two tradeoffs regarding CPU/GPU use.

Context: a few **ms** to update the state of Virtual Humans

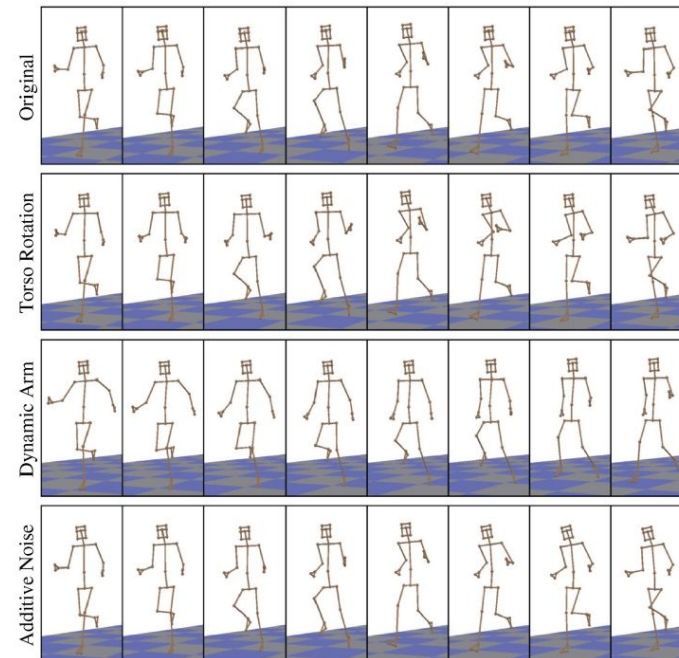
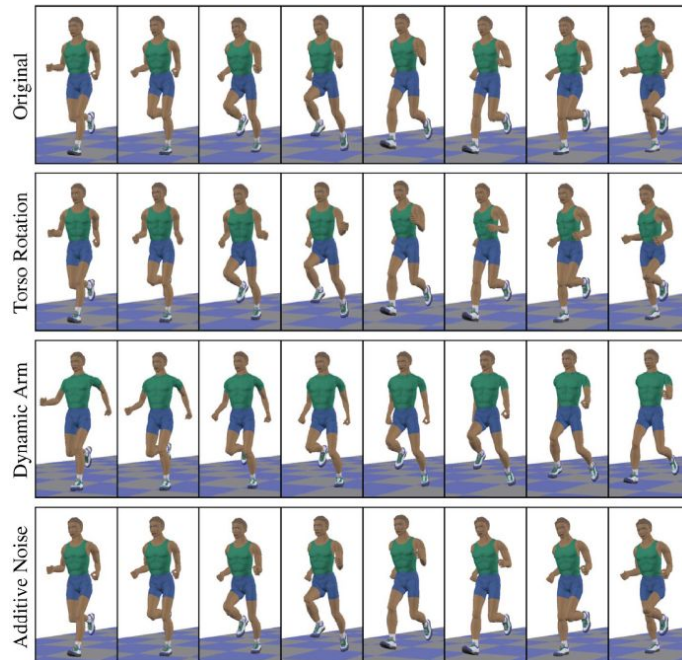
- **Uncanny valley**: matching animation quality with mesh resolution
 - Rationale: use only a VH degree of realism that can be supported by the available animation resources.
 - Don't add mobile accessories if they cannot be animated, such as long hairs, ear rings, floating pieces of cloth, etc...
- **Compute what you see**:
 - Rationale: do NOT compute what is NOT perceived.
 - Levels of Details: decrease the resolution of human graphical models as distance increases to reduce display cost and simplify the movement to reduce animation cost.

5. Perception of **real-time** animation (2)

In 1998; Hodgins et al showed that the geometric model type used to represent the human affected people's ability to **perceive the difference between two human motions**.

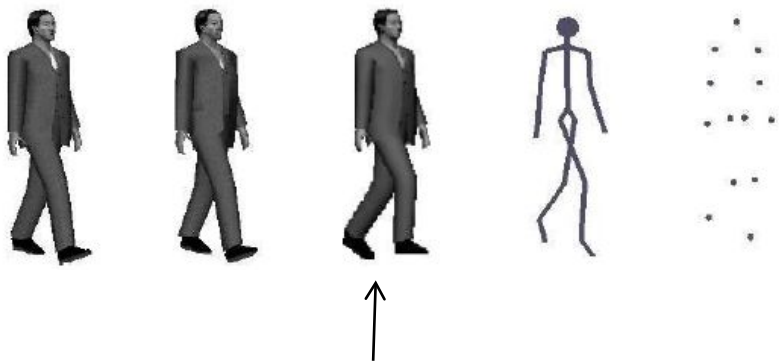


Subjects were more able to tell the difference between 2 motions when they were displayed on the polygonal character.

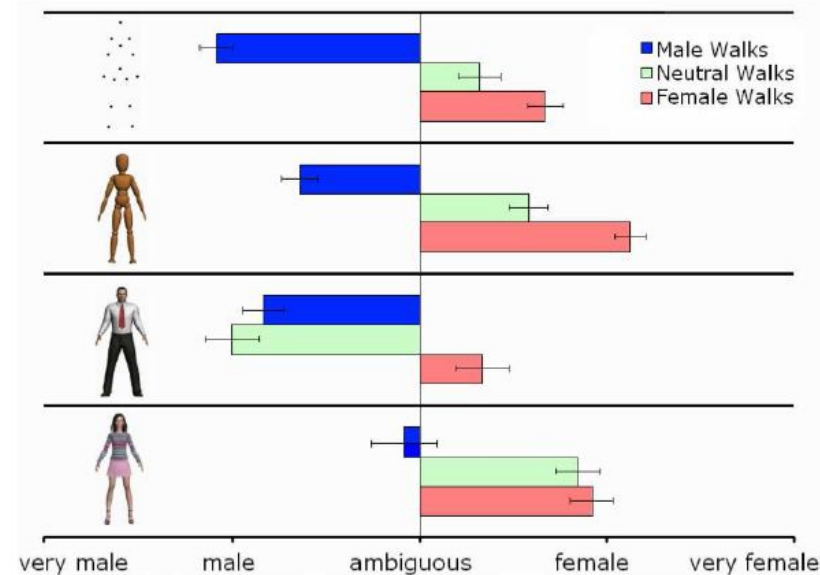


5. Perception of **real-time** animation (3)

- People are most sensitive to differences in human motions for high-resolution geometry (2022 pol) and *impostor* (i.e., image based rendering) representations, less sensitive for low resolution geometry (800 pol) and stick figures, and least sensitive for point-light representations [M 2005].



Impostor = 17x8 precomputed texture from high resolution geometry



Hodgins, O'Sullivan, Newell, McDowell found that:

- The graphical model may alter the perception of walking style (e.g. neutral).
- Gender-specific style should not be used for the other gender.

5. Perception of **real-time** animation (4)

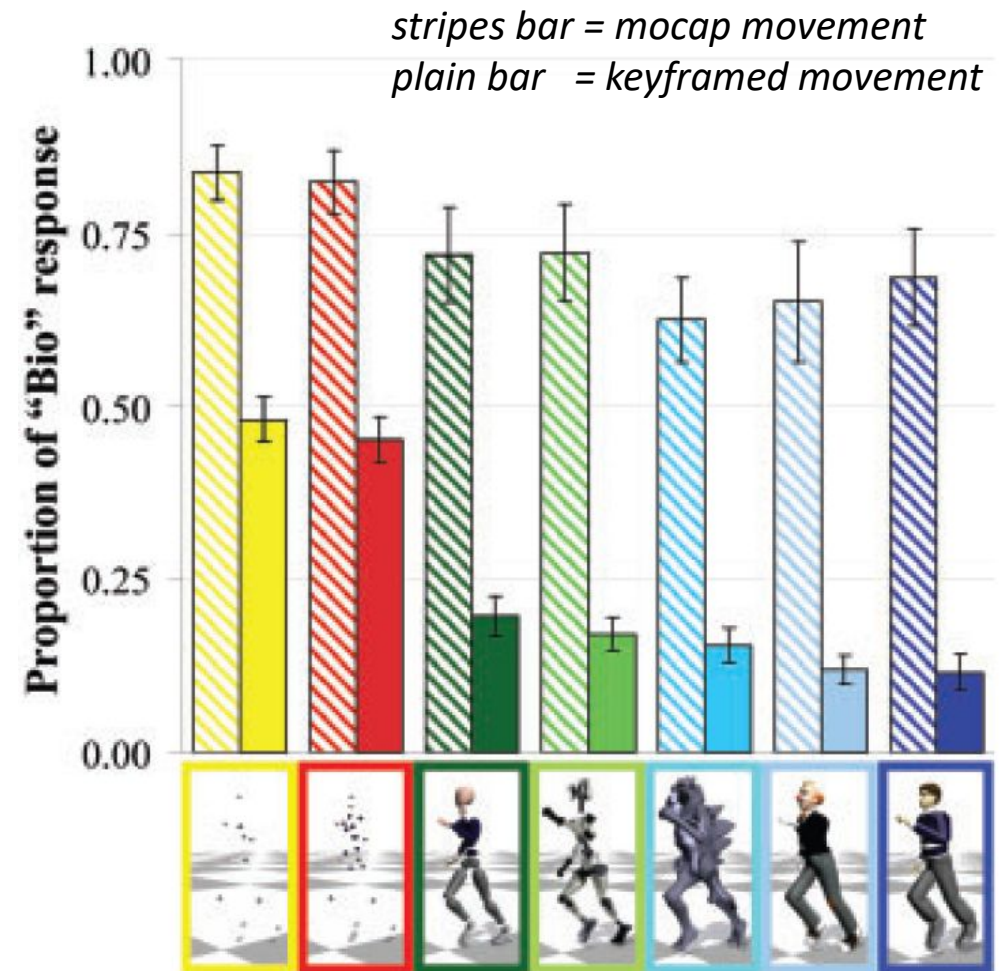
In [C2007], Chaminade et al. investigated how the appearance of computer animated characters influenced the perception of a running movement.

Task: indicate whether a running motion is **biological** or **artificial**

Setup: 4 sessions (7 minutes) x 7 characters x 6 motions (1 s)

Results:

- **Bias:** subjects are more inclined to perceive a **biological** motion for simplified characters.
- Motion rendered with anthropomorphic characters are perceived as less natural.
- Emotion is not involved (fMRI)



[References]

[C2007] T Chaminade, J Hodgins, M Kawato - [Anthropomorphism influences perception of computer-animated characters' actions](#), Social cognitive and affective neuroscience, 2007

[H 1998] Hodgins et al.: Perception of Human Motion With Different Geometric Models, IEEE Transactions on Visualization and Computer Graphics, 4(4), 307-316

[M 2005] R. Mc Donnell, S. Dobbyn, C O'Sullivan Optimising and Evaluating the Realism of Virtual Crowds: Perceptual Experiments and Metrics, in EG07 tutorial on crowd animation.

[M 2012] McDonnell, R., Breidt, M., Bühlhoff, H. 2012. Render me Real? Investigating the Effect of Render Style on the Perception of Animated Virtual Humans. ACM Trans. Graph. 31 4, DOI = 10.1145/2185520.2185587

[P 1995] K. Perlin, “Real Time Responsive Animation with Personality,” IEEE Trans. Visualization and Computer Graphics, vol. 1, no. 1, pp. 5-15, Mar. 1995

[TRV 2006] Traité de Réalité Virtuelle, Ed. P. Fuch, vol 2, chap 17, Eds A. Berthoz & J.L. Vercher

[W 2009] van Welbergen, H., van Basten, B.J.H., Egges, A., Ruttkay, Z., Overmars, M.H.: Real Time Animation of Virtual Humans: A Trade-off Between Naturalness and Control. In: Eurographics - State of the Art Reports, Eurographics Association, pp. 45–72 (2009)

[Web References]

http://en.wikipedia.org/wiki/Lie_to_Me : with Prof. Paul Ekman as consultant.

Doc on microexpressions : <http://www.youtube.com/watch?v=k2rb7pAP7hk>

Image Metrics: http://www.youtube.com/watch?v=JF_NFmtw89g&feature=fvwrel

Web site of Prof. Ken Perlin: <http://www.mrl.nyu.edu/~perlin/>

[PerlinNoise] : http://freespace.virgin.net/hugo.elias/models/m_perlin.htm