

What makes a Virtual Human Alive ?

- video1*
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

1. Avatar & Autonomous Virtual Human

- **Avatar** : [W]
 - (from sanskrit): is a term used in Hinduism for a material manifestation of a deity
 - (computing): the graphical representation of a user. In VR the avatar movement is expected to be partially or completely driven by the user body movement

- **Autonomous/Intelligent Virtual Human**
 - for the evaluation of a Virtual environment (e.g. Pedestrian from a crowd in an emergency simulation)
 - For training purpose: the VH takes an active part in a scenario, e.g. coach, instructor, assistant, or audience in a public speaking to overcome such a phobia, etc...

2. The complexity of expressive movements

- Human expression is multi-modal:
 - Gestures should be considered to be “full-body” even if they seem to involve only the hands and arms.
 - Gestures production always includes some balance control
 - The body movement is linked to the gaze & facial expression
 - Verbalization & emotions animate the mouth and eyes
 - The vocal prosody reflects intentions and emotions
 - The tongue makes complex movements when speaking
 - Cloth, accessory, hairs, sweat, tears, human tissue dynamics can be important *secondary movements*
- Analysis tools are necessary to understand part of these subtle interactions [K 2011]:
 - ANVIL (open source project) <http://www.anvil-software.org>



ANVIL [K2011-17]

Video image analysis

The screenshot shows the ANVIL 4.7.8 interface. The main window displays a video of two men in suits. A gesture is being tracked with a red line connecting points 1 and 2 on the hands. The 'Track: gesture.phase' window on the right lists attributes such as lexeme (Calm), handedness (2H), path (straight), and various joint angles. The bottom of the window shows playback controls and a 'Current specification' field.

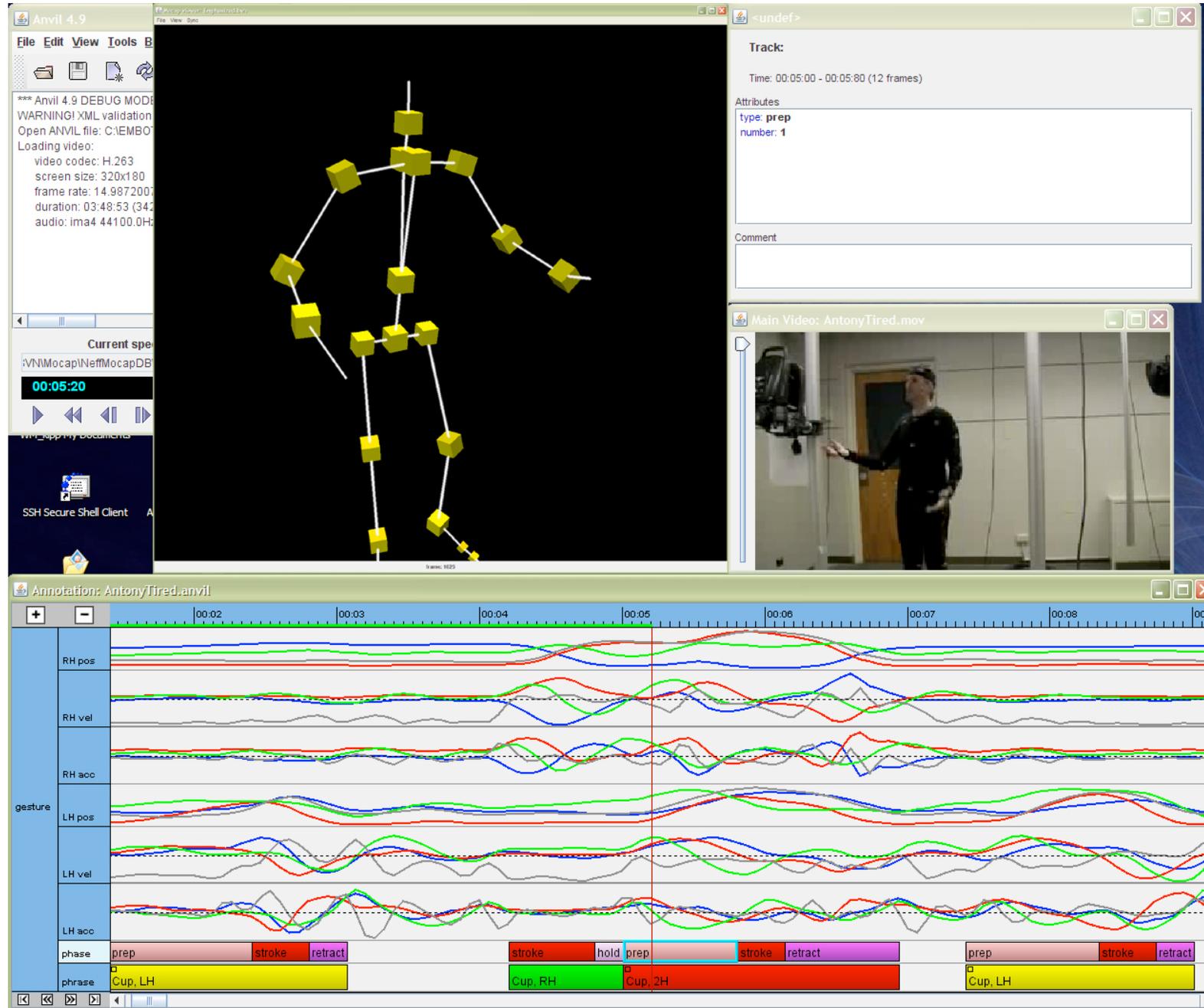
Audio track analysis

Words timing



Gestures timing

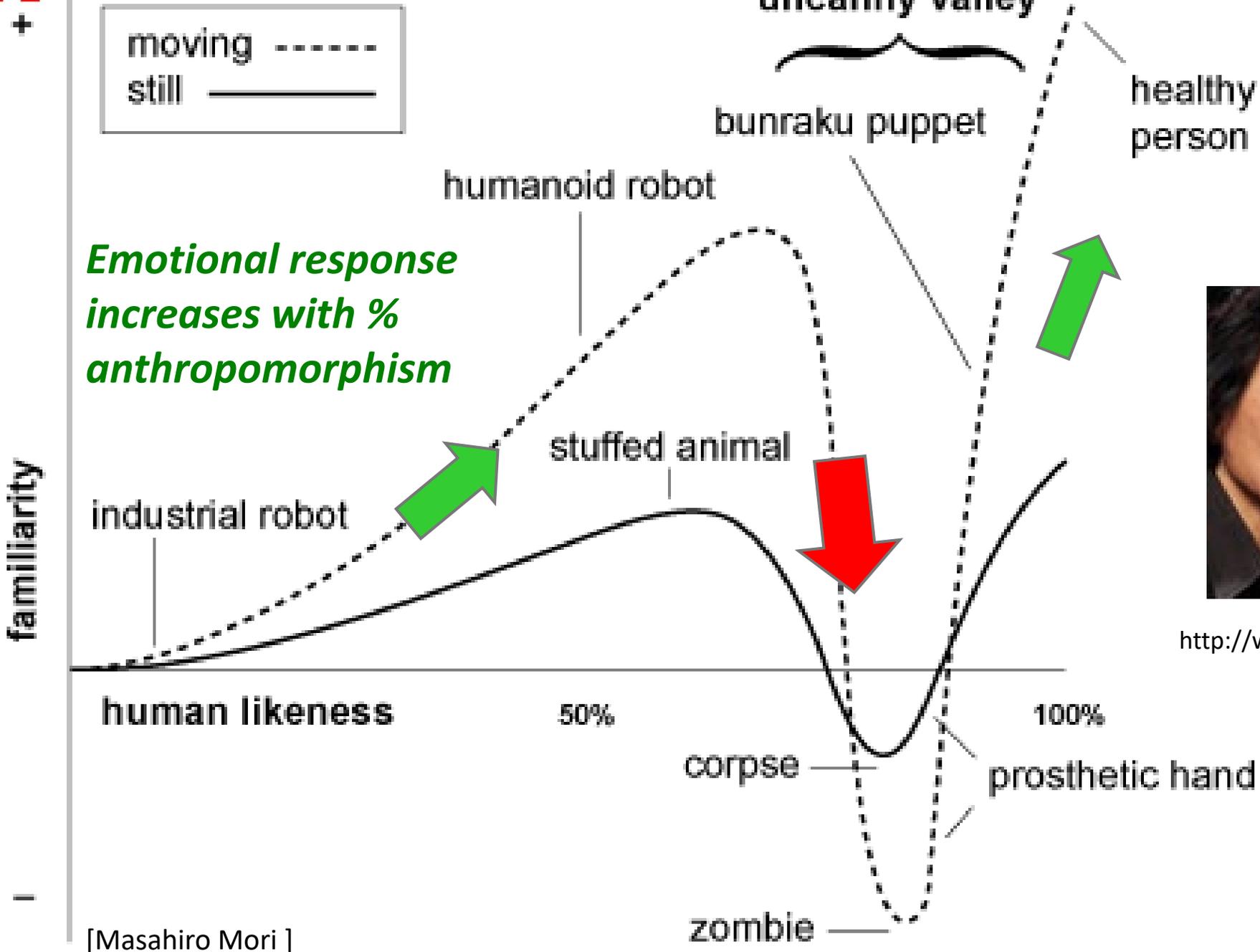
The screenshot shows the 'Annotation: ML_test.anvil' window. It features a timeline from 00:21 to 00:32. The top track is a waveform. Below it is a pitch contour. The main track shows a word list with colored boxes indicating timing: 'das', 'Gemälde', 'die', 'Eidechsen-geschic...', 'w.', 'damit', 'gespielt', 'wi...', 'da', 'hat', 'ei..', 'zweiten', 'Boden', 'das ist', 'garni', 'flach', 'u.', 'simpl', 'd.', 'stimmt', 'ab..', 'poetisch', 'bezog', 'ich', 'au...'. Below the words are tracks for 'ling' (rst, theme-rheme, discourse), 'audience' (face, posture), and 'gesture' (phase, phrase, unit, other). The gesture track shows phases like 'stroke', 'retract', 'prep', 's.p.', 'stroke', 'prep', 'stroke', 'pre.', 's.', 'hold' and phrases like 'on, RH', 'PointingSelfPerson, RH', 'Beat, 2H', 'Progressive, 2H', 'Calm, 2H', 'Wipe, 2H'. A URL <http://www.anvil-software.org> is visible at the bottom right.



Full-body Body
motion capture
& analysis

3. From artificial to real : the uncanny valley

- **uncanny** : (*Merriam-Webster*)
 - a : seeming to have a supernatural character or origin : EERIE, MYSTERIOUS
 - b : being beyond what is normal or expected : suggesting superhuman or supernatural powers
- In the 70s Masahiro Mori studied in Robotics the emotional response effect to increasing human-like appearance of still or moving entities.
 - His key article (in Japanese) has been translated by McDorman

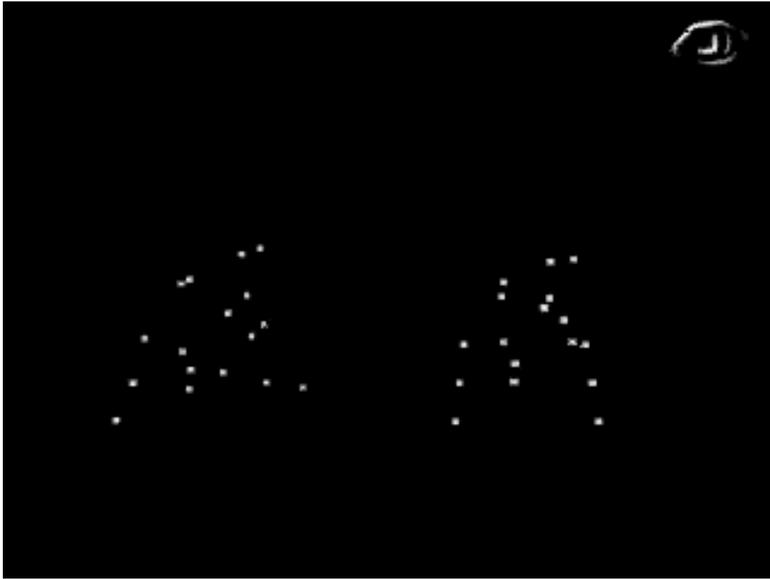


Hiroshi Ishiguro

<http://www.youtube.com/watch?v=uD1CdjlrTBM>

[Masahiro Mori]

3. From artificial to real : the uncanny valley (2)



High Human sensitivity to human motion perception

Turing test for computer-generated movement (Hodgins et al ~1997-98)

Question: which one is synthesized from a model vs motion captured ?



Differences between the left and right movements :

- Variety:
 - temporal, style, texture, ...

- Coherence of the behavior:
 - Synergy of the whole body involved in the behavior

3. From artificial to real : the uncanny valley (3)

- The paper from Masahiro Mori is questioned regarding its scientific validity (empirical experience rather than rigorous experimental protocol)
- However the concept of uncanny valley has been adopted (and extended) in the field of Computer animation to adjust the human-likeness of a character's design to maximize public acceptance

- *Very realistic human appearances are now feasible in terms of shape, cloth, hairs, skin texture and lighting*



Unsuccessful tradeoffs
(films)

2001: Final Fantasy (Square)

- *BUT the quality of the associated animation/behavior must match the **expected** quality level for that level of verisimilar appearance*



Soon on the
market (NEON
real-time Virtual-
Human, CES2020)

Successful
tradeoffs
(films)



2010: Avatar (J. Cameron)

[References]

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

[K 2010] Kipp, M. , Multimedia Annotation, Querying and Analysis in ANVIL. In: Multimedia Information Extraction, M. Maybury (ed.), IEEE Computer Society Press, in press

[Web References]

<http://www.anvil-software.org>

<http://spectrum.ieee.org/robotics/humanoids/hiroshi-ishiguro-the-man-who-made-a-copy-of-himself>

[W] [http://en.wikipedia.org/wiki/Uncanny_Valley]