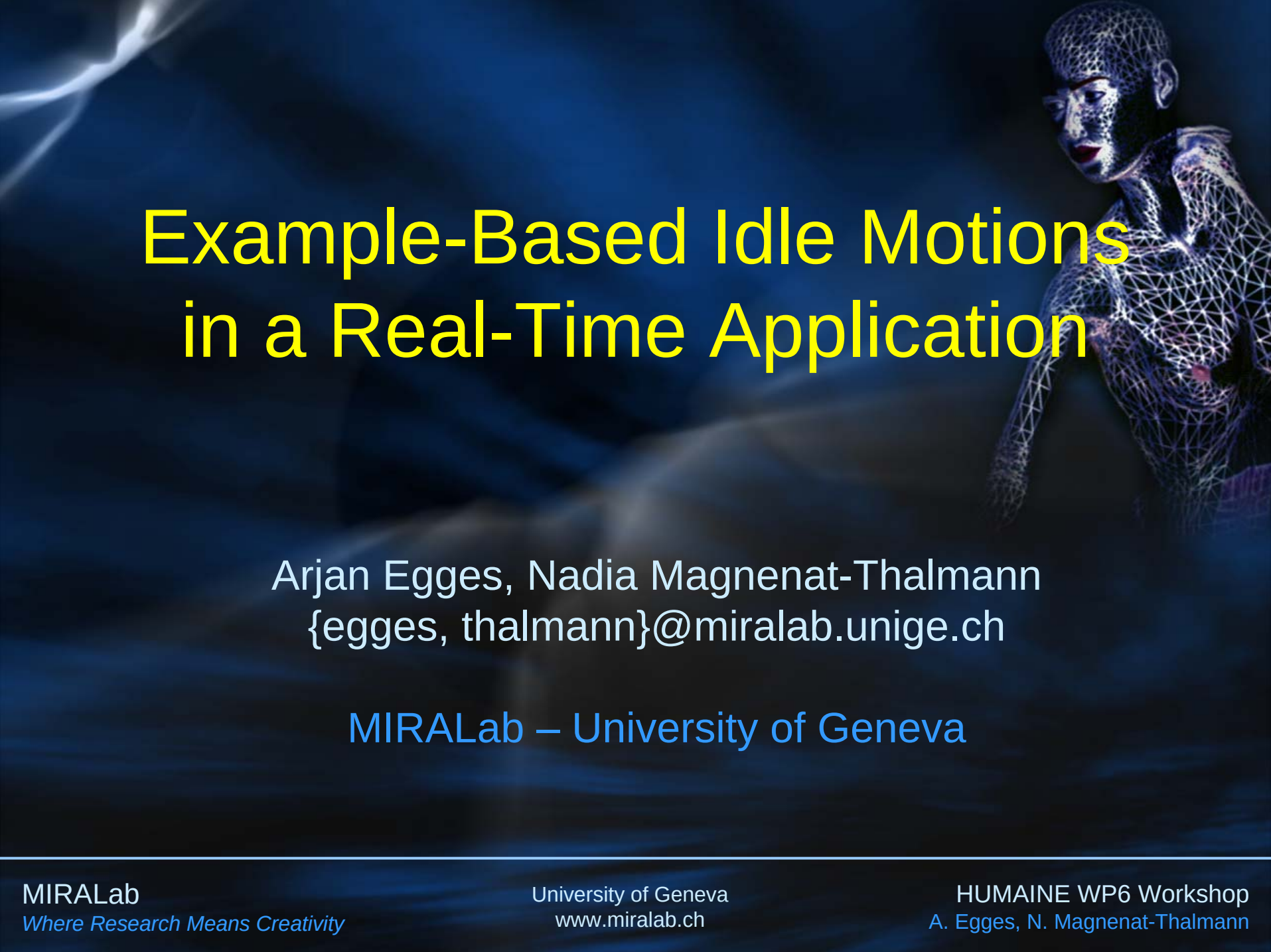

Example-Based Idle Motions in a Real-Time Application

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Introduction (1)

- When real humans are not making gestures, they are not in the H-Anim neutral position.

- Human beings are moving all the time!

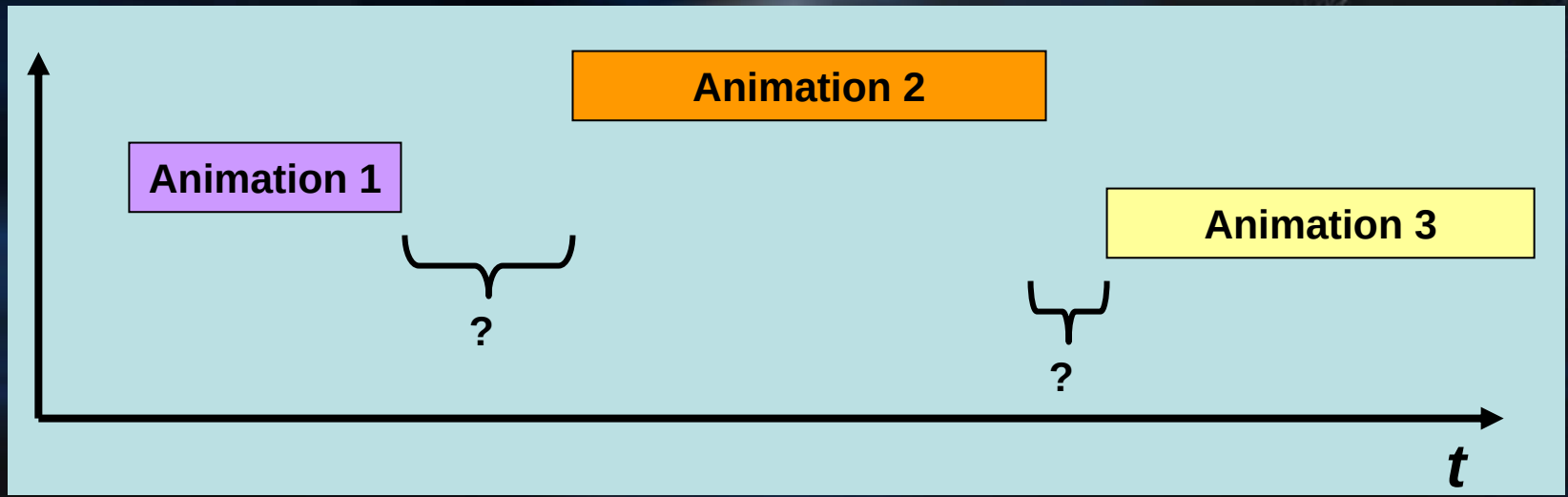
Introduction (2)

Problem 1:

What to do between different animation clips?

Possible solutions: playing one or a few ‘idle’ motions in a loop or noise limited to a few joints

No real method exists for modeling realistic idle motions



Introduction (2)

We have discovered that in 1 out of 3 cases, people can determine the person that is recorded from an idle motion animation.

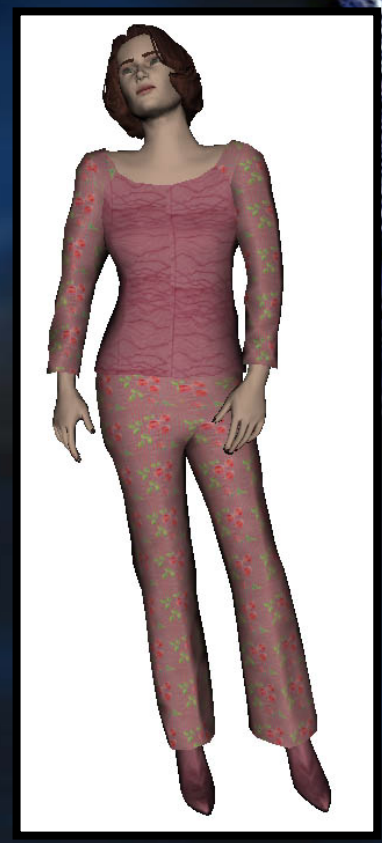
In 8 out of 10 cases, people can correctly identify the gender of the person that was recorded.

Problem 2:

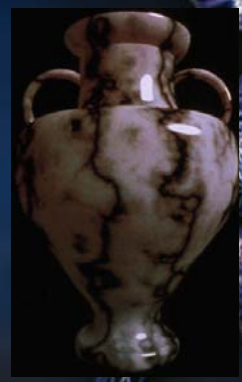
Can we isolate these properties from the animations and make animations as if they were performed by the recorded person?

Overview

- Idle motions
- Small posture variations
- Posture shifting
- Blending & Integration
- Evaluation
- Conclusions + Future Work



Idle Motions (2)



Background

- Perlin noise function on a few joints (Perlin, 1995)
- Motion synthesis from motion graphs (Kovar et al., 2002; Arikan & Forsyth, 2002; Arikan et al., 2003)

O. Arikan and D. Forsyth. Interactive motion generation from examples. In *Proceedings SIGGRAPH*, 2002.

O. Arikan, D. Forsyth, and J. F. O'Brien. Motion synthesis from annotations. *ACM Transactions on Graphics*, 22(3):392-401, 2003.

L. Kovar, M. Gleicher, and F. Pighin. Motion Graphs. In *Proceedings SIGGRAPH*, 2002.

K. Perlin. Real time responsive animation with personality. *IEEE Transactions on Visualization and Computer Graphics*, 1(1), 1995.

Idle motions

There are 3 kinds of idle motions:

1. Small posture variations (Perlin)
2. Posture shifts (Scheflen, 1973) (Cassell, 2001)
3. Supplemental idle motions

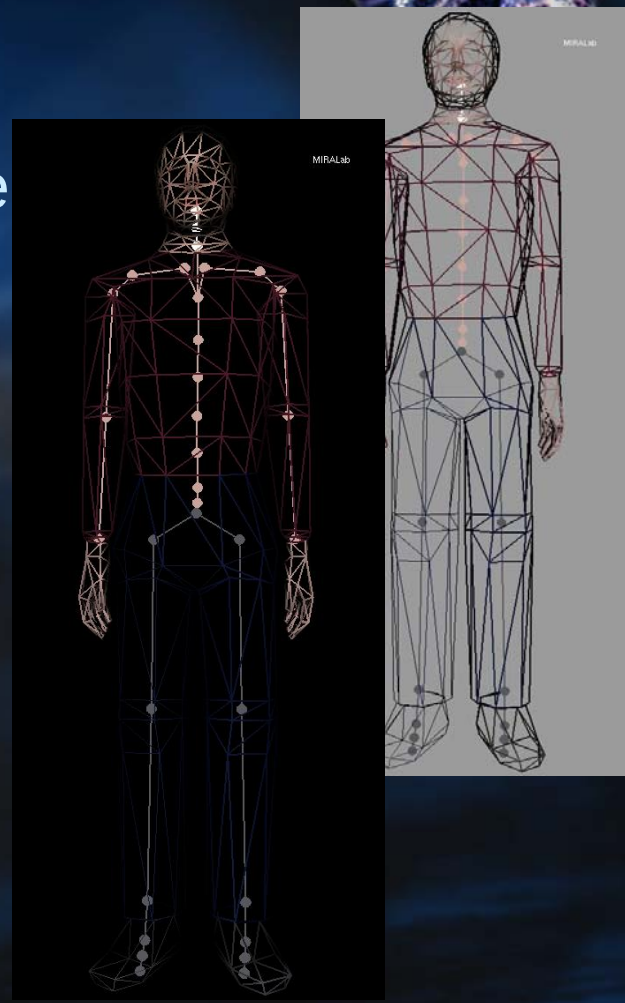
REA System by Cassell et al.

A. Scheflen. *Communicational structure*. Bloomington: Indiana University Press, 1973.

Justine Cassell, Yukiko I. Nakano, Timothy W. Bickmore, Candace L. Sidner, and Charles Rich. Non-verbal cues for discourse structure. In *Proceedings Association for Computational Linguistics Annual Conference (ACL)*, pages 106–115, July 2001.

Small Posture Variations (1)

- Influence all joints & retain joint dependencies, while keeping real-time constraint.
- To capture dependencies in data we use Principal Component Analysis.
- Since PCA only works in linear space, rotations are expressed using the exponential map (Alexa et al., 2000)
- 25 joints (H-Anim) + 1 root translation value.
- Total: 78 parameters per posture.



M. Alexa and W. Mueller. Representing animations by principal components. *Computer Graphics Forum*, 19(3):411–418, 2000.

Small Posture Variations (2)

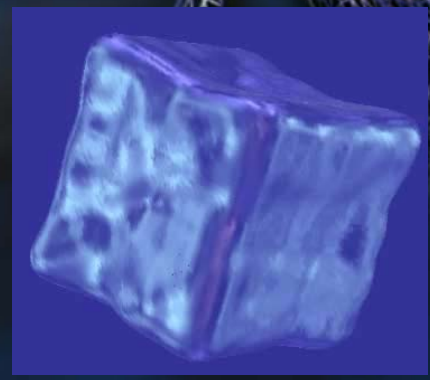
- The small posture variations are created as follows:

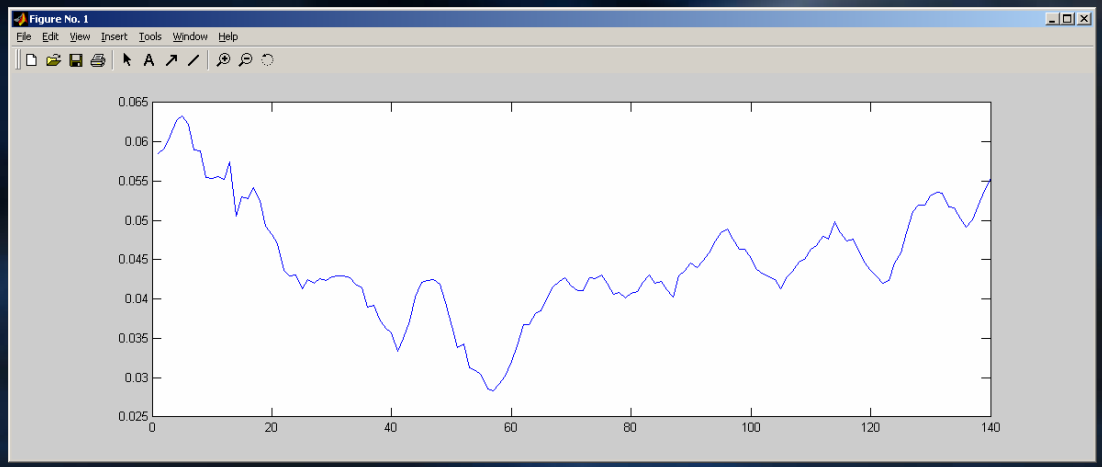
1. Convert rotation matrix to exponential map
2. Convert exponential map to PC representation
3. Apply noise function on subset of PC values
4. Convert PC representation to exponential map
5. Convert exponential map to rotation matrix

Small Posture Variations (3)

Noise functions:

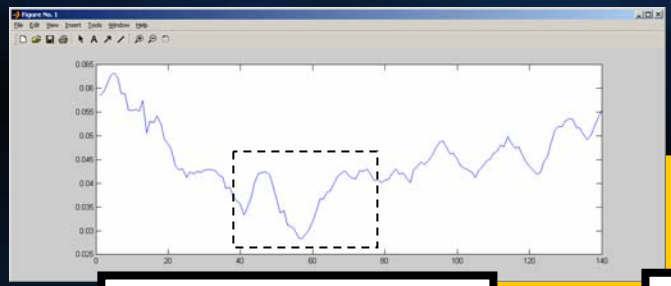
1. Perlin Noise (Perlin, 1985)
2. Similar-Curve Noise



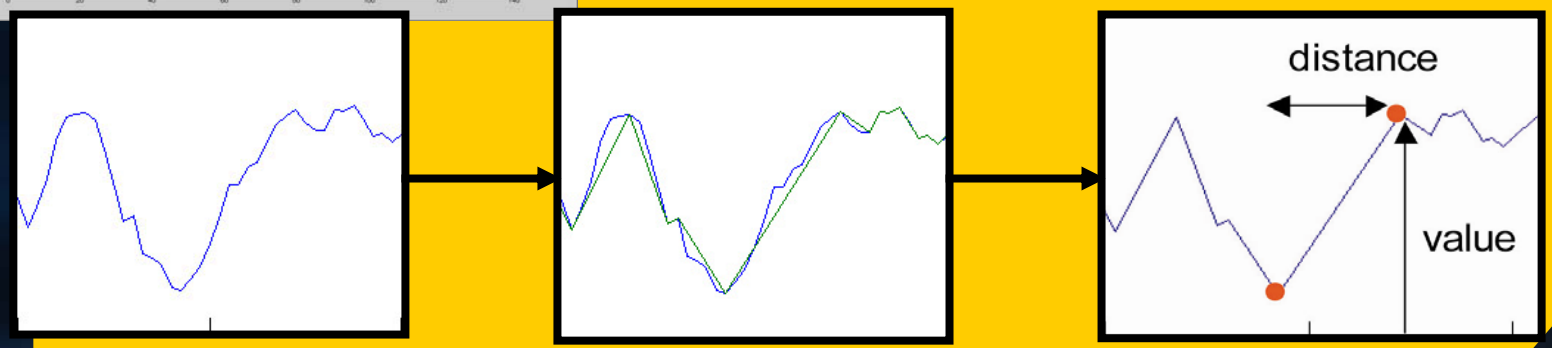


K. Perlin. An image synthesizer. In *Proceedings of the 12th Annual Conference on Computer Graphics and Interactive Techniques, pages 287-296. ACM Press, 1985.*

Small Posture Variations (4)



Curve Analysis



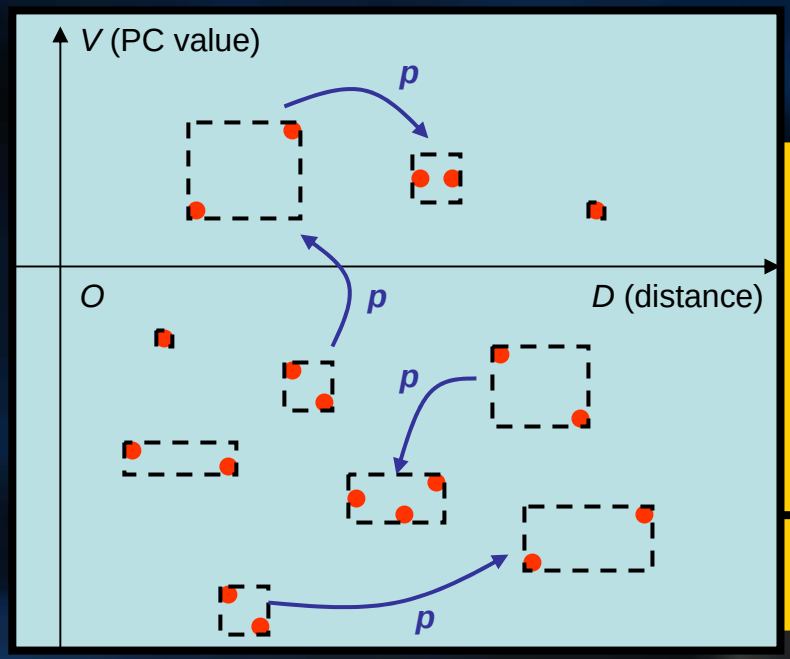
Estimate **maxima/minima**

Create **distance/value pairs**

Similar-Curve Noise I

Small Posture Variations (5)

Minimal Spanning Tree Clustering



Curve Analysis

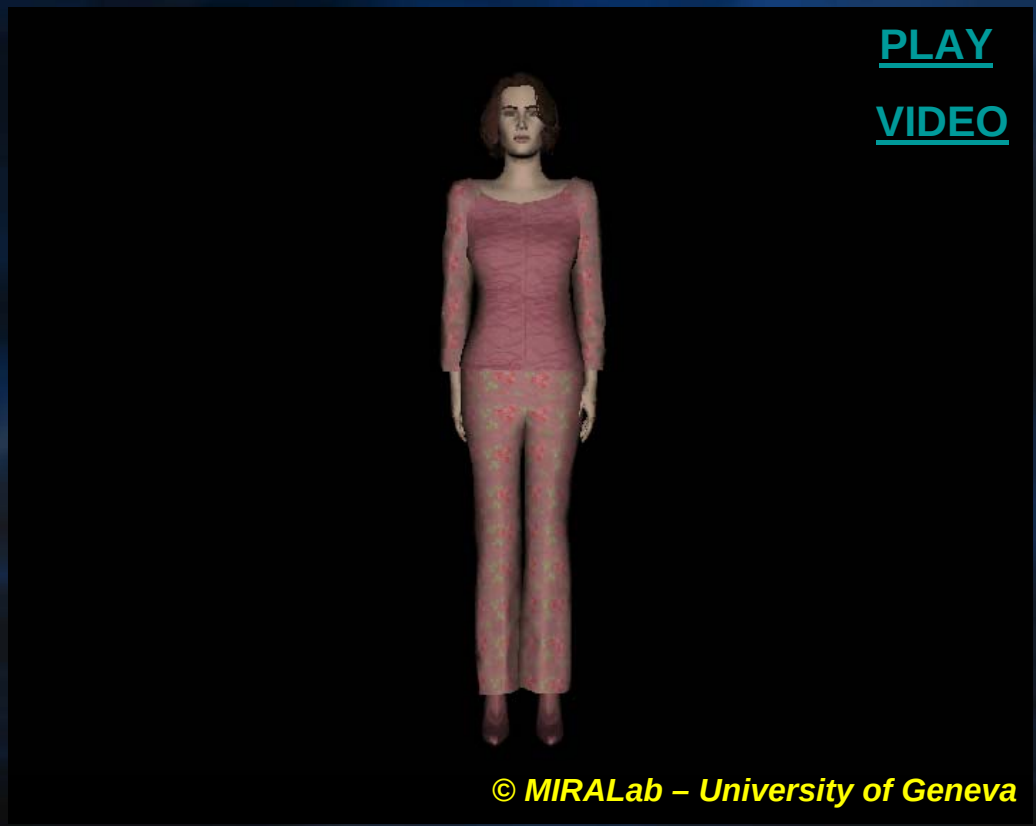
$$\begin{bmatrix} 0 & 0.35 & 0 & 0.65 \\ 0.05 & 0.1 & 0.8 & 0.05 \\ 0.25 & 0.48 & 0 & 0.27 \\ 0.7 & 0.07 & 0.2 & 0.03 \end{bmatrix}$$

Category Transition Matrix

Similar-Curve Noise II

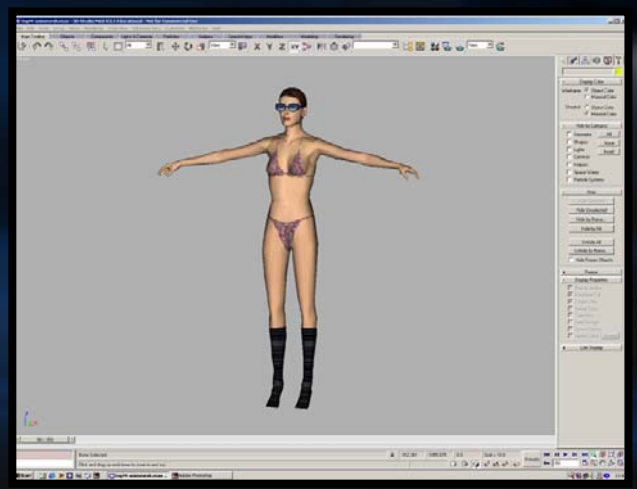
Small Posture Variations (6)

Posture variations on H-Anim neutral position:

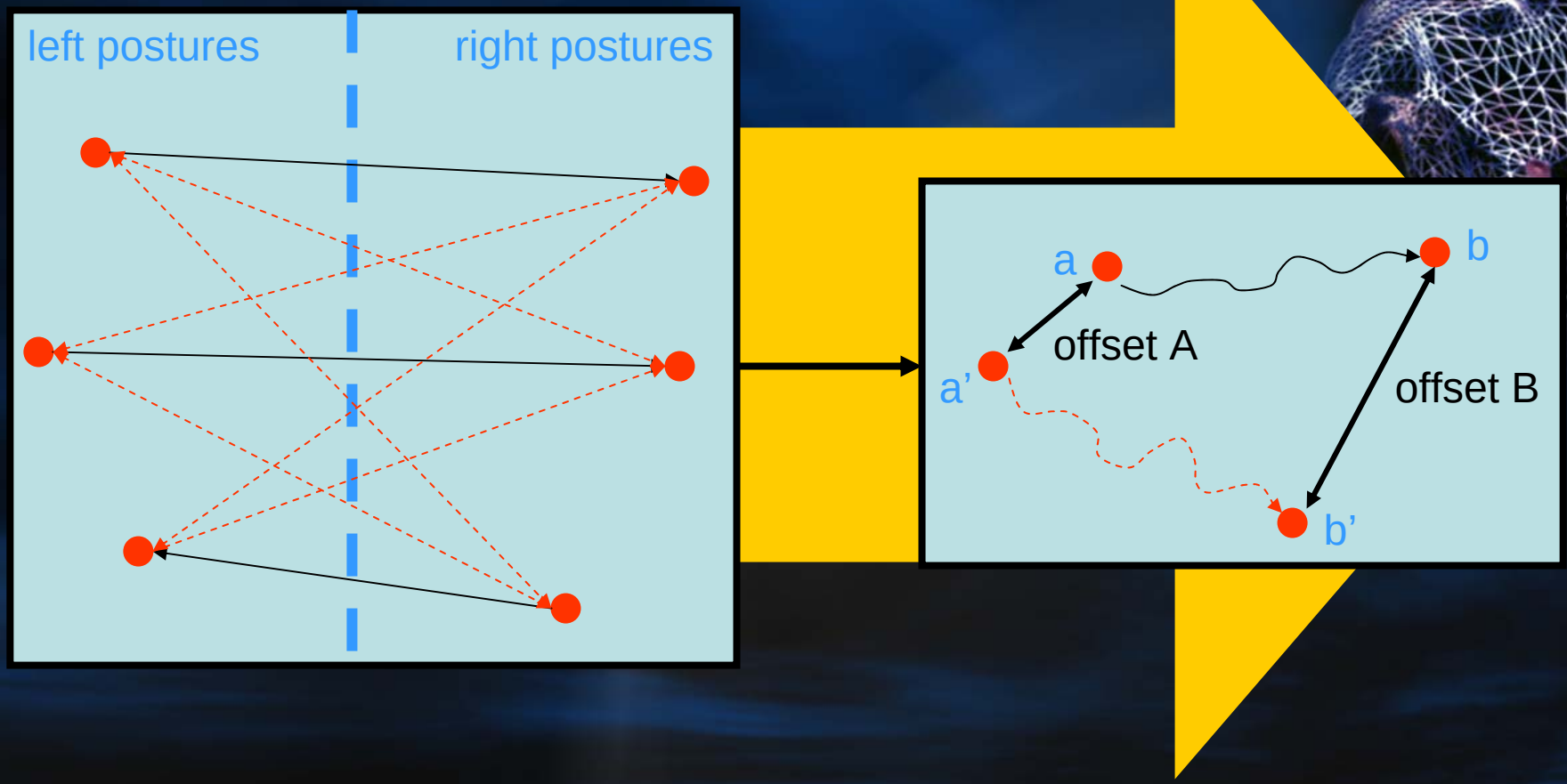


Balance Shifts (1)

- Recorded animations are cut into segments of posture shifts
- These shifts are then used to construct new animations



Balance Shifts (2)

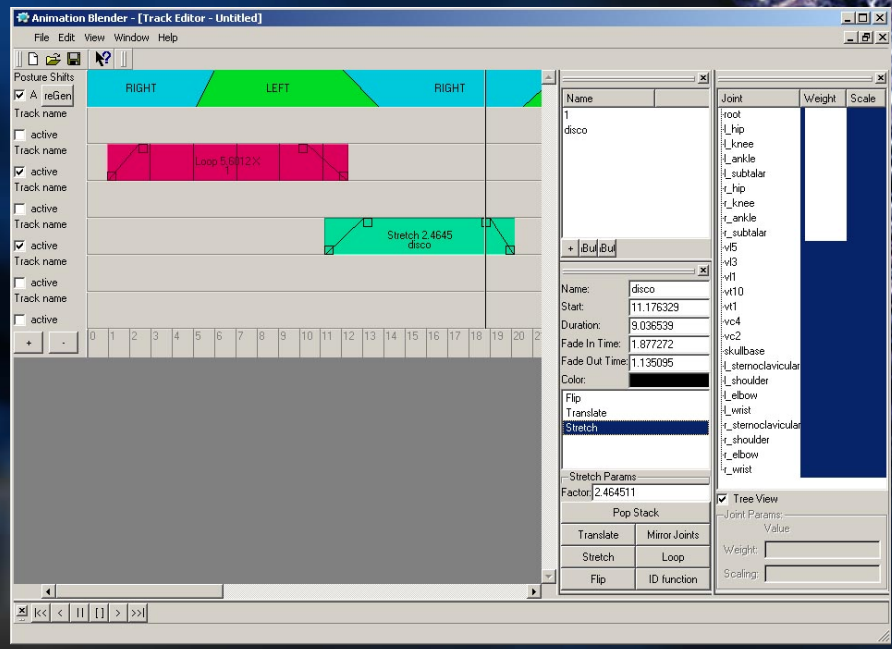


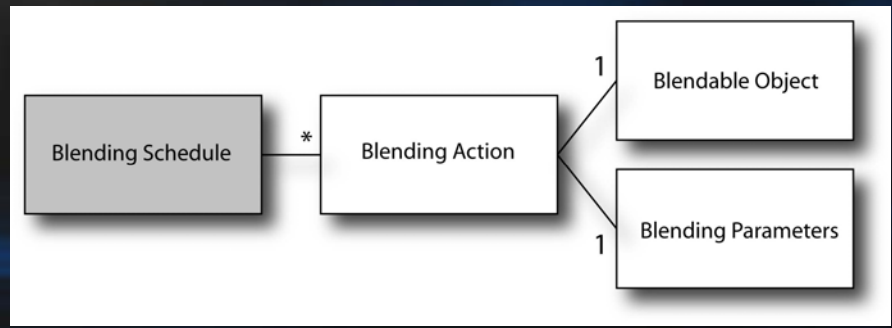
Balance Shifts (3)

- Databases from different persons are used to generate personalised idle motions.

Blending & Integration (1)

- Idle motions are blended with other animations to create natural motions.





Blending & Integration (2)

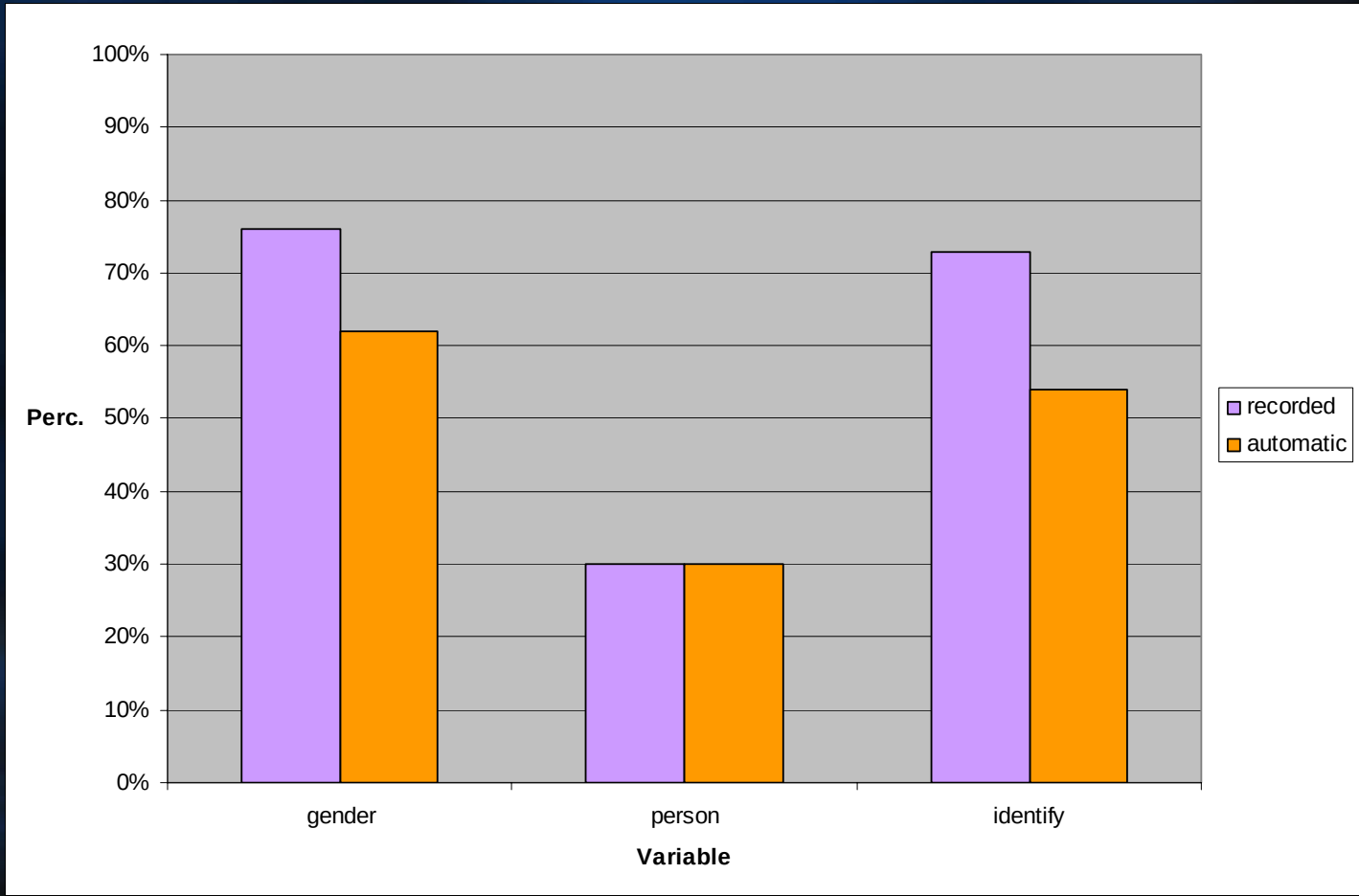
PLAY

MOVIE

Evaluation (1)

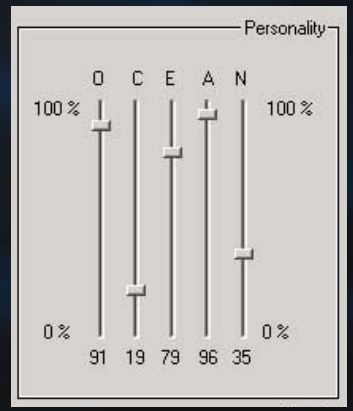
- 8 different personalities
- 8 movies of recorded idle motions, 8 movies of synthesized idle motions.
- User test (15 subjects):
  - What is the gender of the person?
  - Who does the animation belong to?
  - Is it a recording or a automatically generated idle motion?

Evaluation (2)



Conclusions & Future Work

- System works in real-time on standard PC (2.0 GHz)
- Still some translation artefacts → constraints
- Supplemental idle motions
- Link between personality & motion could be conceptualized? (OCEAN)
- Principal Components for other applications?
- More evaluation and analysis



Geneva Tram Stop Demo