Interactive Synthesis of Constrained Motion from Example Movements
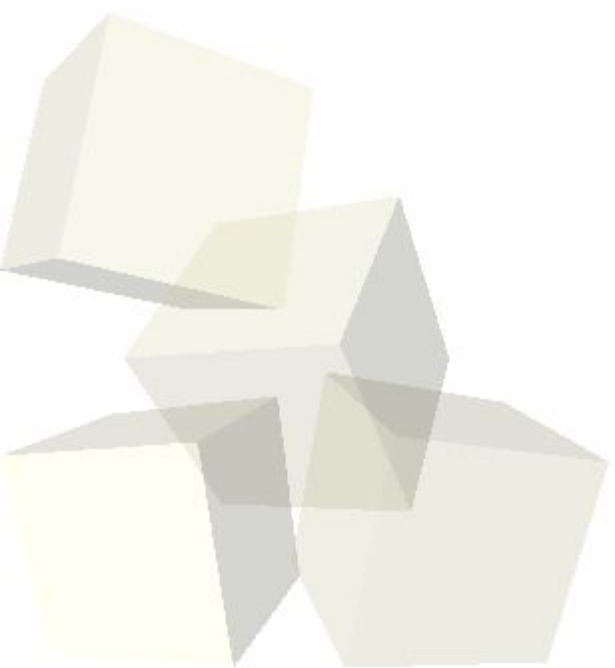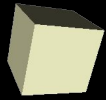
Jaroslav Semančík, Josef Pelikán, Jiří Žára

Charles University in Prague
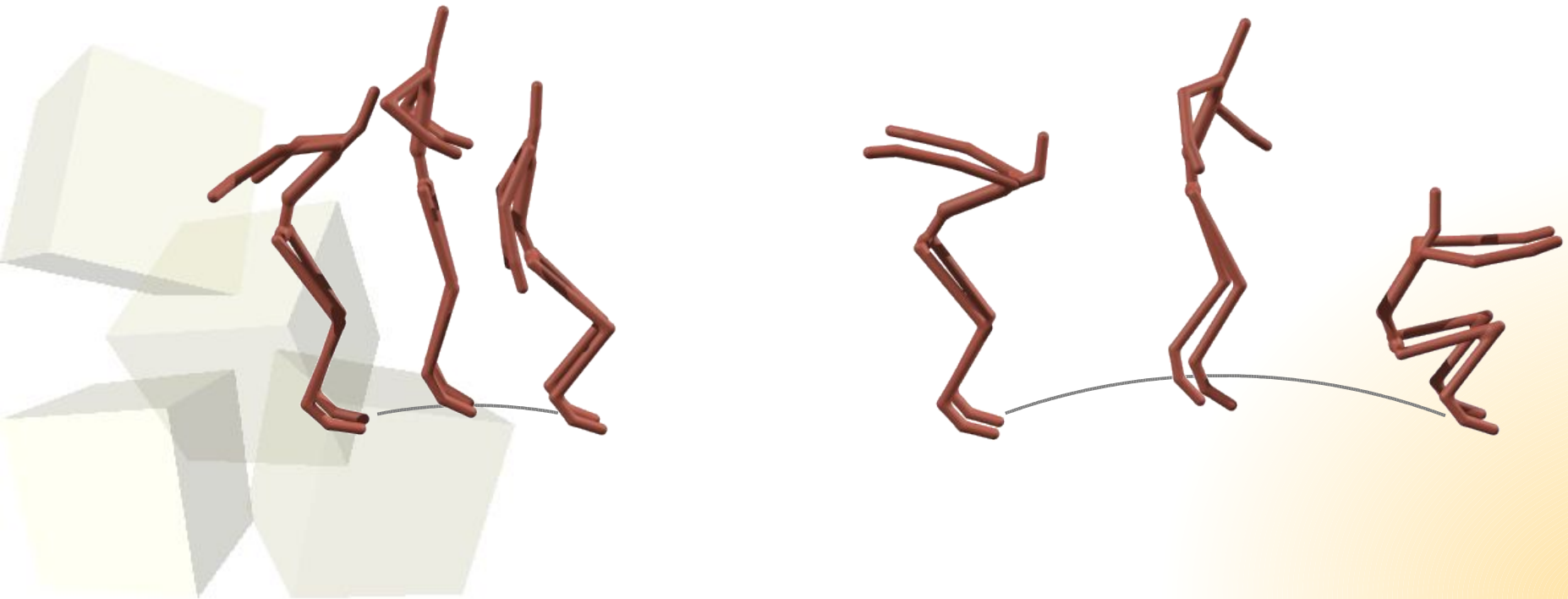Czech Republic

7. September 2004, Marbella

- Realistic motion of a human figure

- Motion capture
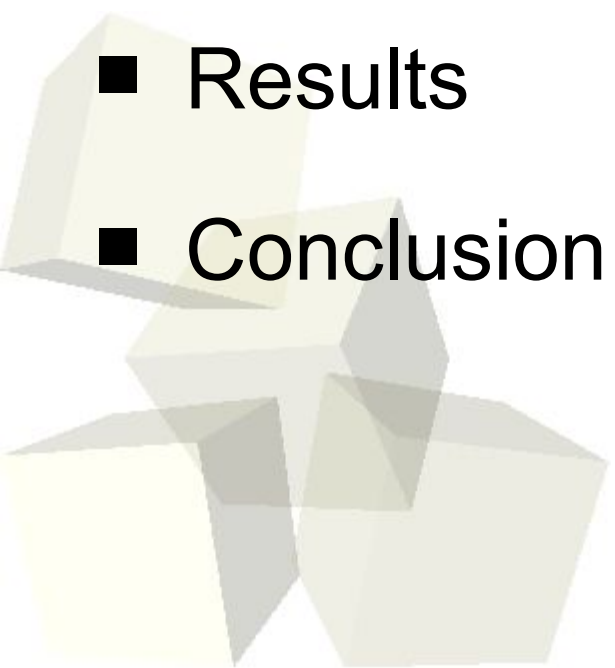
- Interactive virtual environments

- Motion library

- Constraints – imposed by terrain or by user

- Parameterized movements

- How to generate realistic parametrized motion in real-time?

- Motion capture and blending

- Parameterized motion library

- Movement synthesis

- Continuous motion

- Results

- Conclusion and future work

- Real motion of a human body is recorded

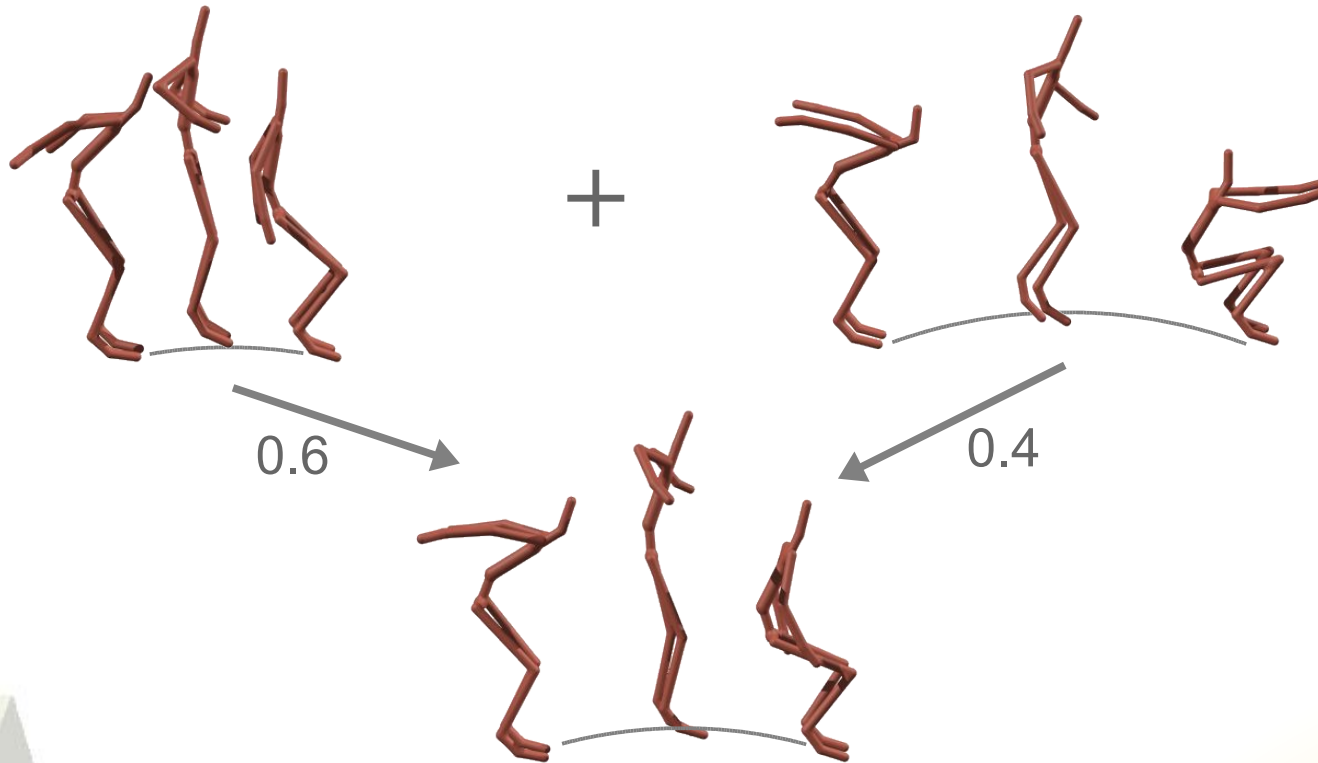- Source of the most realistic motion

- Set of marker trajectories

    ┊ postprocessing
    ↓

- Motion of a virtual skeleton

- Only a record of a motion planned in advance
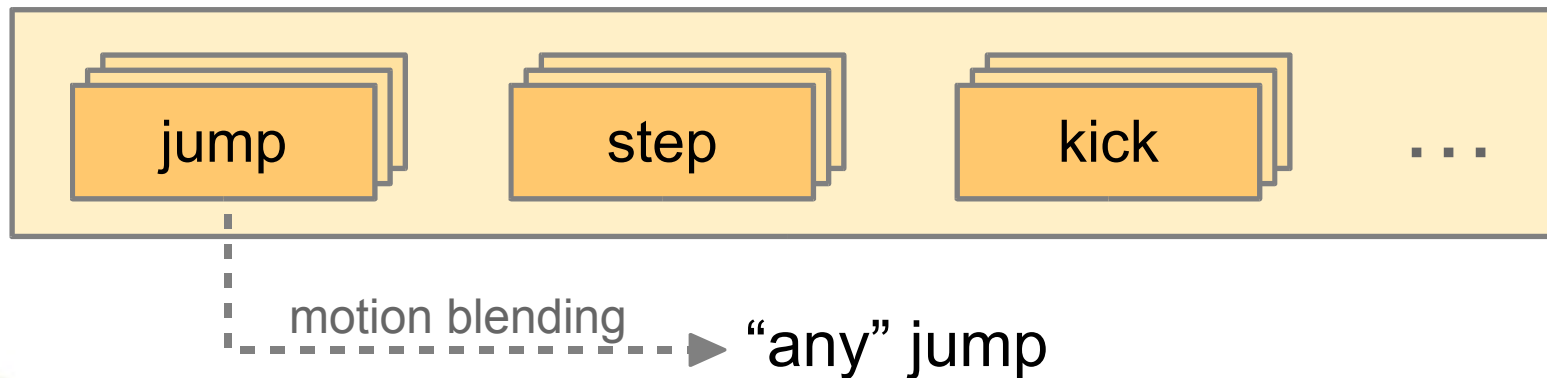
- New variations as a weighted sum

- Generally $M = \sum_i w_i M_i$

- Library of motion captured examples

- Several variations of each movement

| jump | step | kick | . . . |

motion blending ┈┈► "any" jump
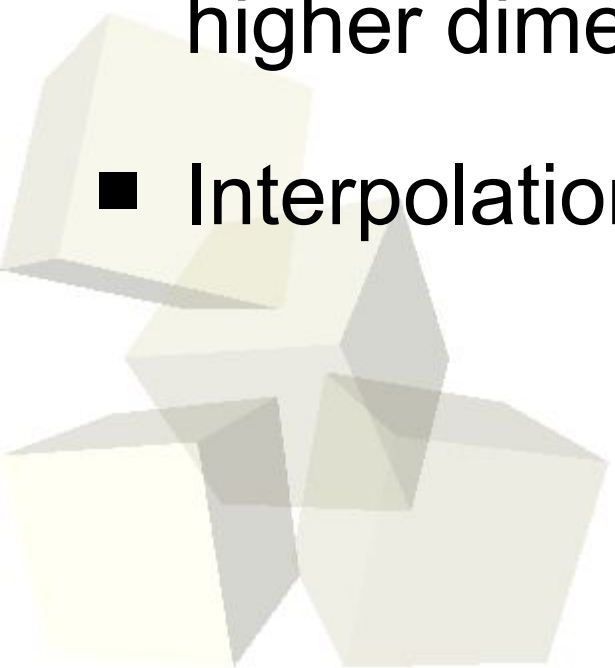
- How to specify a movement to create?

- ~~By weights~~ / by parameters
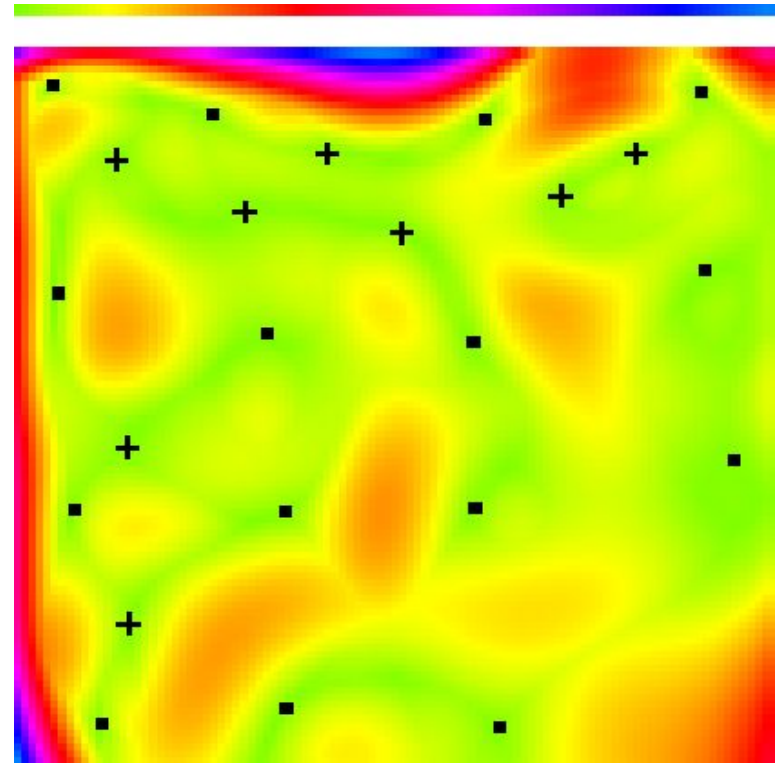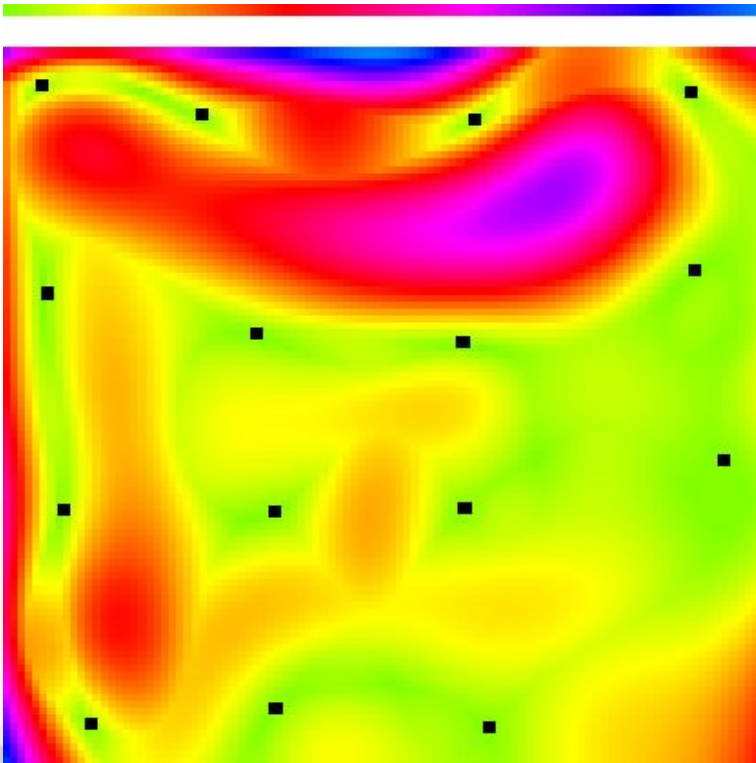
- Task: Calculate weights for blending from given parameters.

- Multidimensional scattered interpolation in parameter space

- Using radial basis functions – well scalable to higher dimensions

- Interpolation error
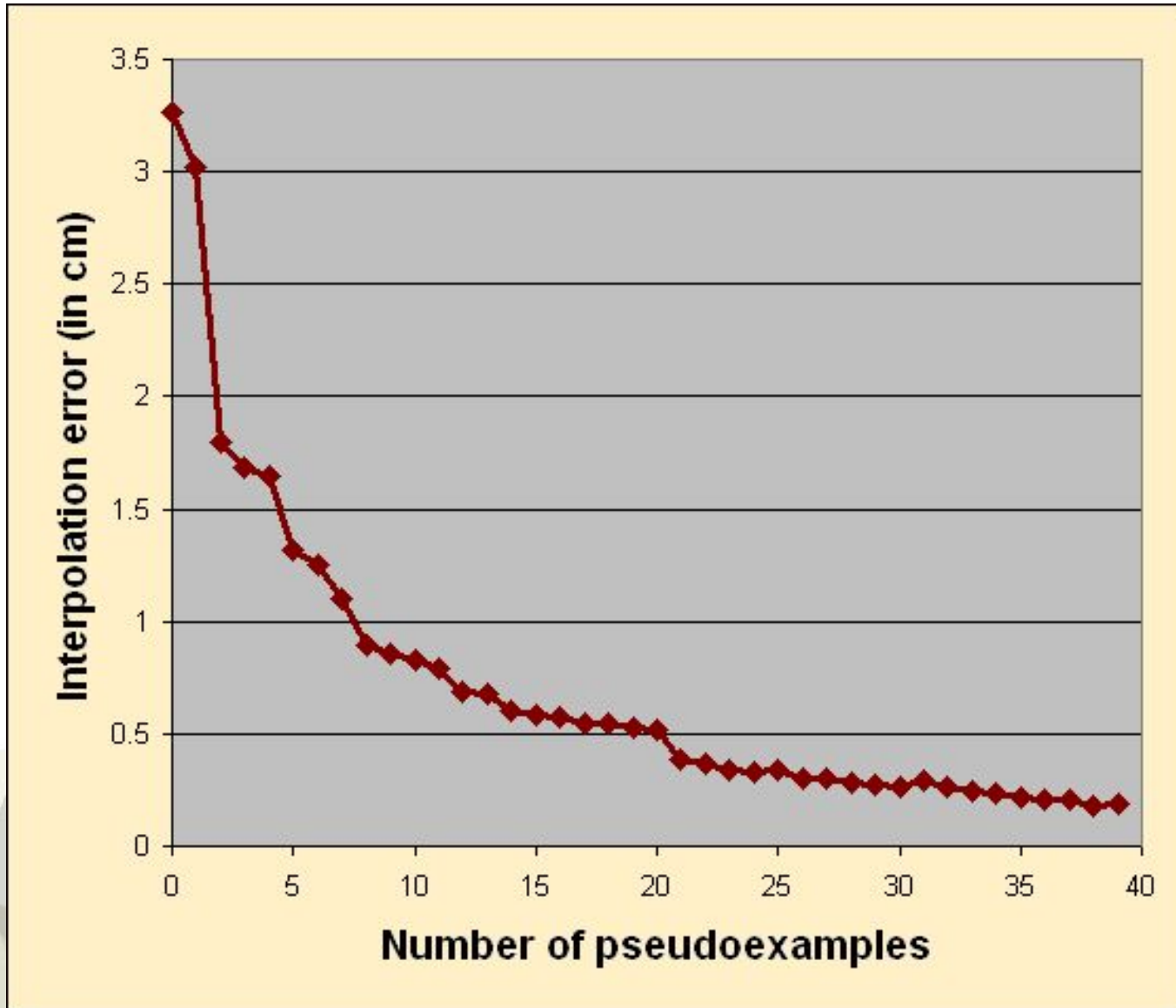
Reduction of Interpolation Error

- **Refinement by pseudoexamples**

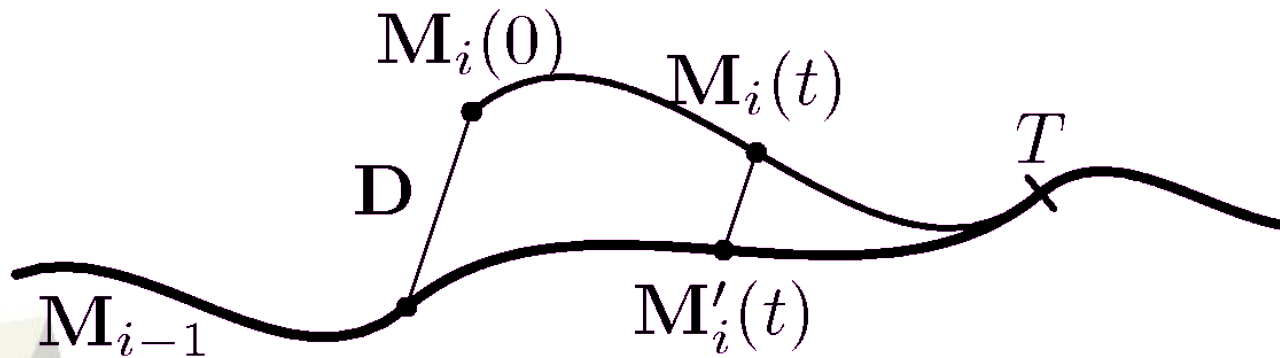Interpolation error in parameter space, original vs. with added pseudoexamples.
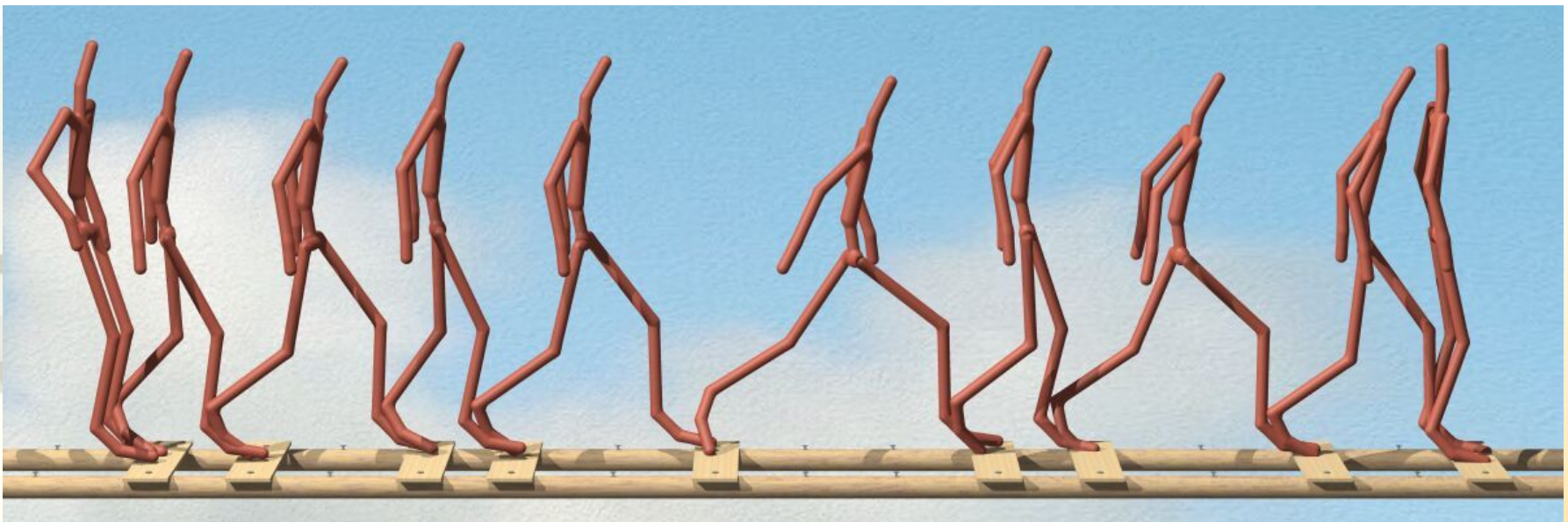
(2) Reduction of Interpolation Error

- Motion = sequence of movements

- Smooth movement transitions

- Postures in successive movements may differ

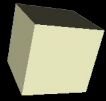$\mathbf{M}_i(0)$ $\mathbf{M}_i(t)$ T $\mathbf{D}$ $\mathbf{M}_{i-1}$ $\mathbf{M}'_i(t)$
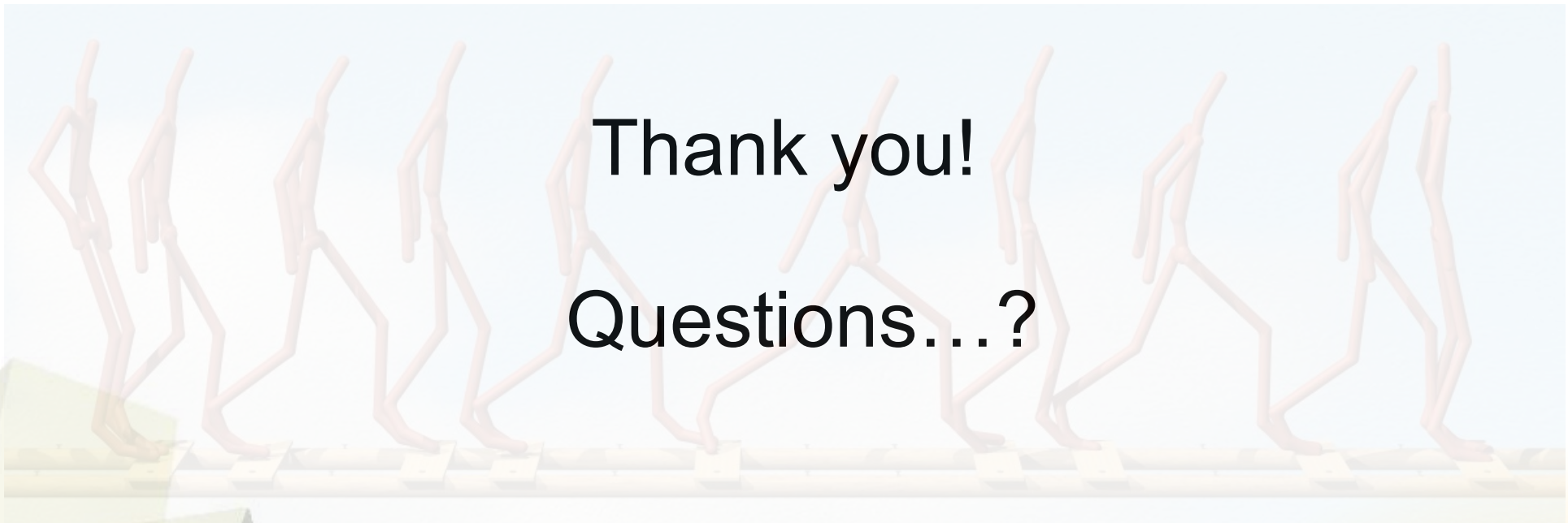
- Adjustment by eased-out "difference posture"

- Walk with variable length of a step

- 15 examples, library size ~320 KB

- Error <1cm, thousands of steps /sec.

- Foot sliding

- **Realistic parameterized motion**

- **Extremely high real-time performance**
  $\rightarrow$ **videogames**

- **Constraints on end-effectors needed**

- **Future work**

  - Automatic choice of represenative movement variations

Thank you!

Questions…?