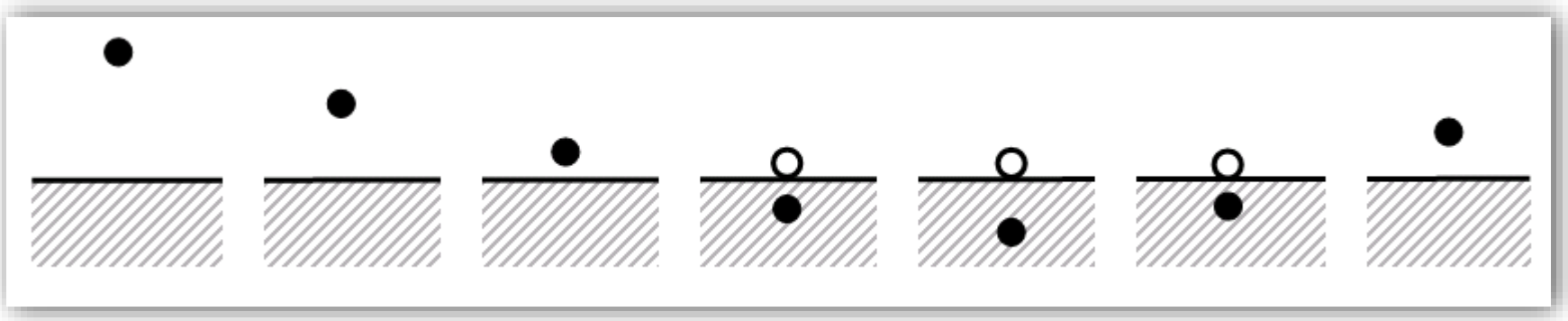
Motion Capture for full-body interaction

1. Background on full-body motion capture
   - Example of a film production
   - Example of real-time interaction
2. Posture reconstruction
   - Analytic IK
   - Jacobian-based IK
3. Collision avoidance
4. Other examples of full-body interaction

video3

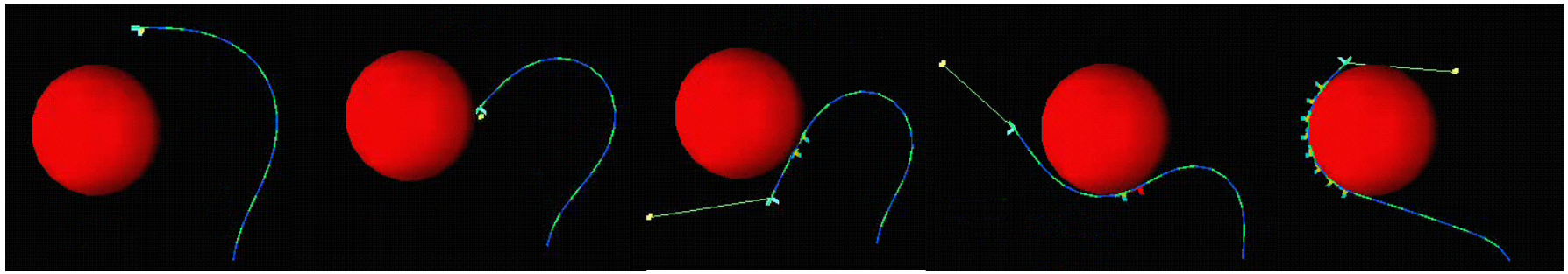
3. Collision avoidance

- Usual approach with proxy / god-object:
  - Rubber-band method (cf Haptic interfaces)

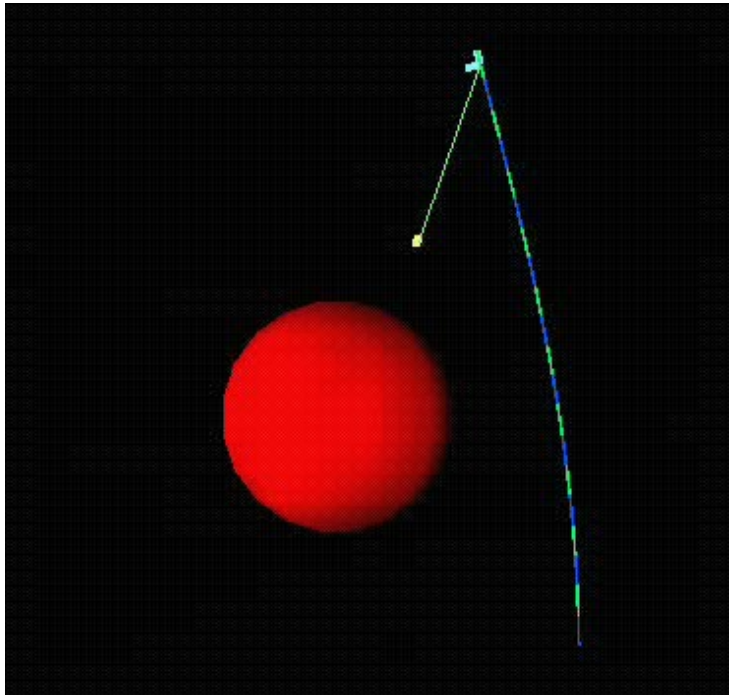


- Downside: visual-proprioceptive discrepancy
  - But worthy anyway [B 2006]

Concept of proxy for an articulated chain



- *Single effector*
  - *Chain tip*



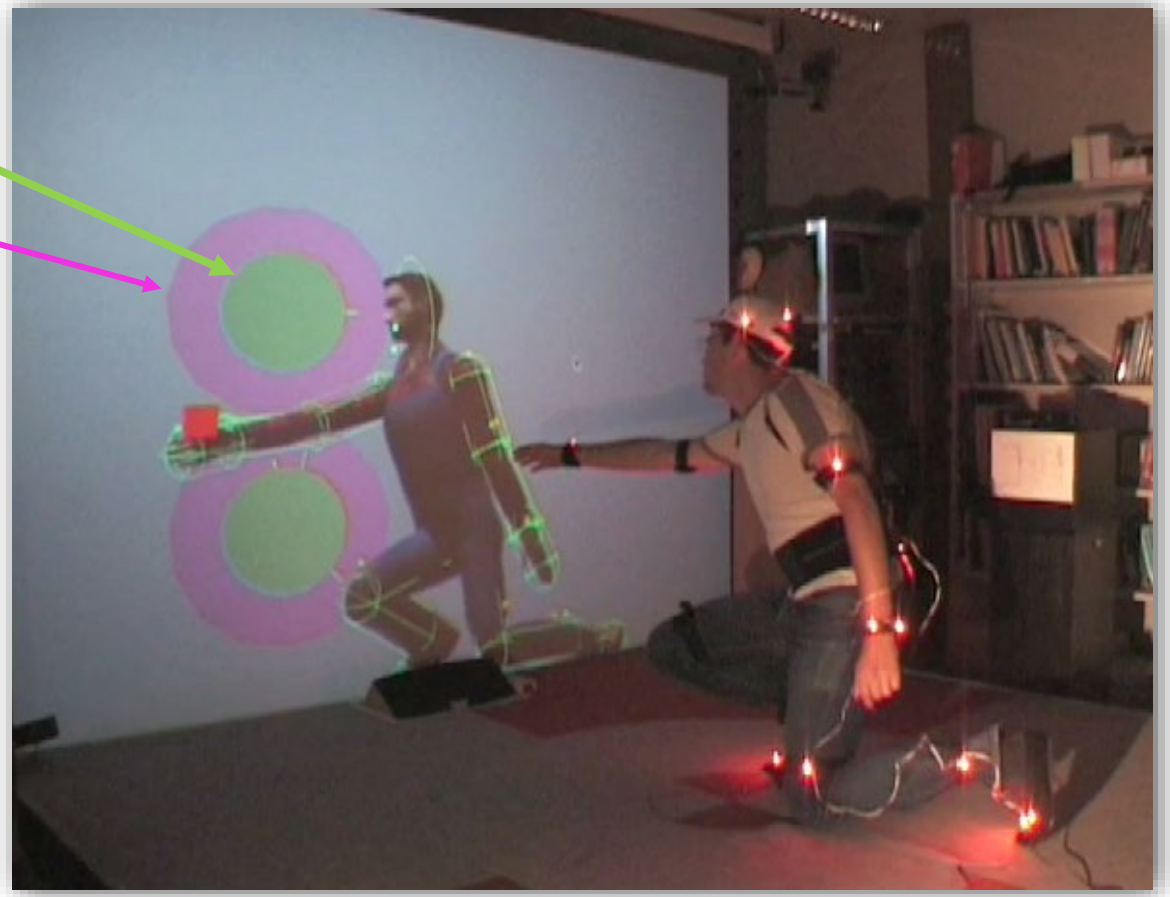
- *Dynamically created 1D repulsion effectors with higher priority*
  - *may prevent the chain tip effector to reach its goal*

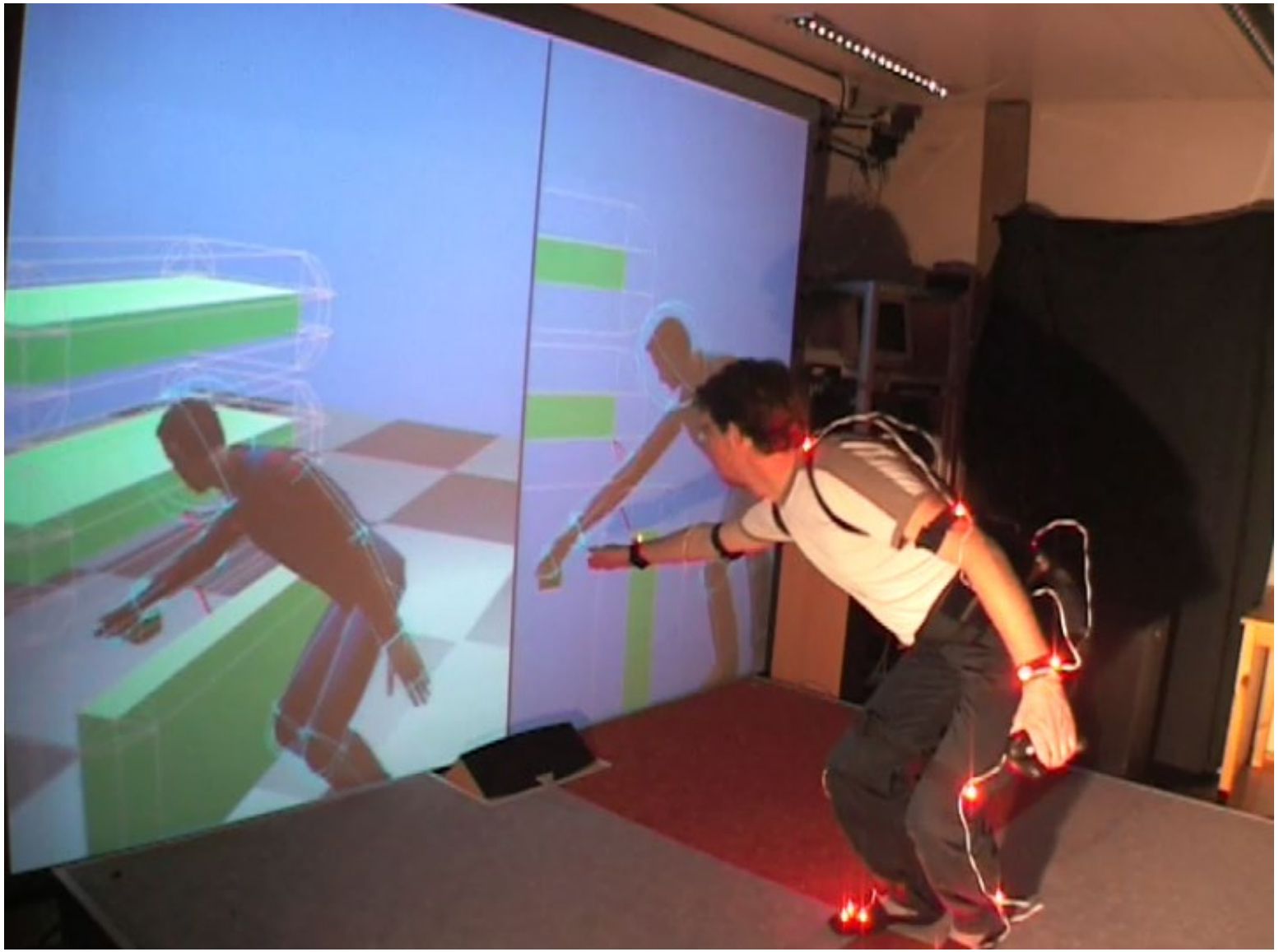
3 Collision anticipation and approaching movement damping

- *BUT in human behavior, a collision is anticipated and prevented …*
- *… rather than addressed through sliding over the obstacle*

- *To reflect such a behavior, obstacles can be inflated with a safety zone*

- *Whenever a body segment enters this one, an IK task slows down only movements TOWARDS the obstacles without altering the tangent movement component.*
- *The IK task priority increases as the body segment is getting closer to the obstacle*





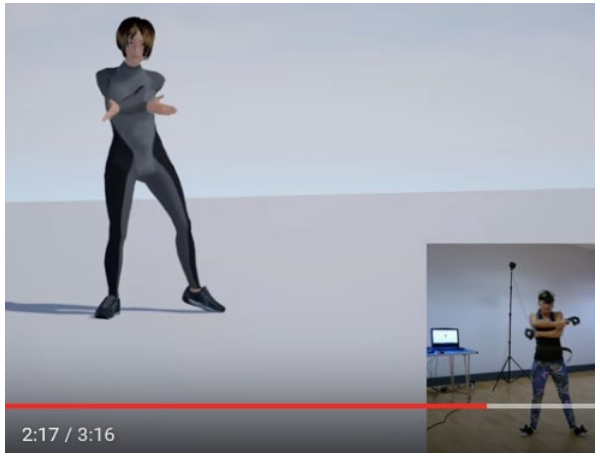
Ex: movement towards obstacles are damped along the temporary red lines

4. Other examples of full-body interaction (1)

- Ikinema Orion project with HTV Vive HMD

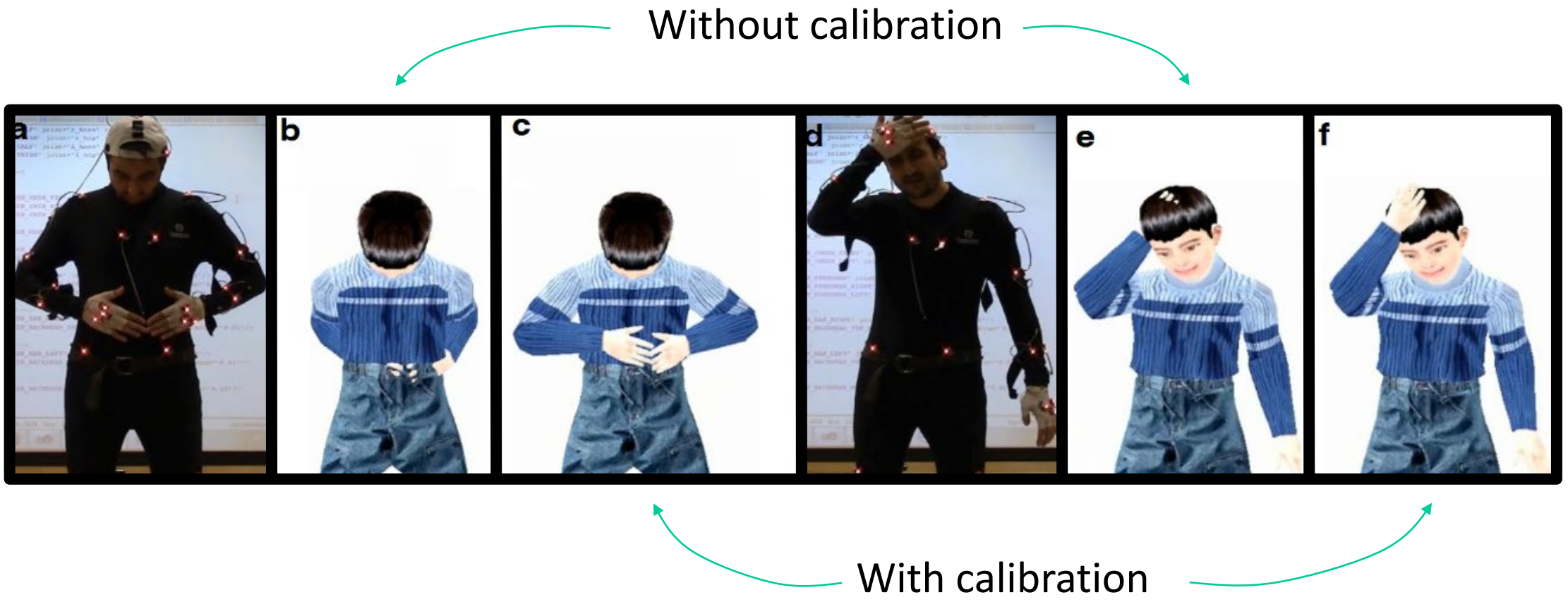
  and 5 trackers

- Originated from a speedup of a Jacobian-based IK approach[P2008]
- Fluid movements
- Still a few self-collisions or gaps instead of self-contacts despite a claim of automatic calibration



4. Other examples of full-body interaction (2)

- Eray Molla online retargeting (Analytical IK)
  - Requires a skeleton and body surface calibration [Molla2016, M2018]



Future of full-body interaction

- Need of a faster user calibration to ensure correct embodiment
- Need a correct retargeting to impersonate a broader character range
- Integrate finger-level interaction
- Speed-up convergence of numeric IK with priority owing to GPU [H2016]

- Consider collaborating with virtual human on complex tasks

[References]

[[Harish et al 2016] Pawan Harish, Mentar Mahmudi, Benoît Le Callennec, and Ronan Boulic. 2016. Parallel Inverse Kinematics for Multithreaded Architectures. ACM Trans. Graph. 35, 2, Article 19 (February 2016), 13 pages. DOI=http://dx.doi.org/10.1145/2887740

[M2018] E. Molla, H. Galvan-Debarba and R. Boulic "Egocentric Mapping of Body Surface Constraints", published online in IEEE Trans. Vis. Comput. Graphics, July 2018, 24(7), DOI: 10.1109/TVCG.2017.2708083. In Open Access.

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