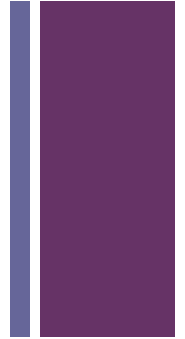


## Haptic control of Style IK

By Kendra Gibbons and Nancy Tsang

# + Outline

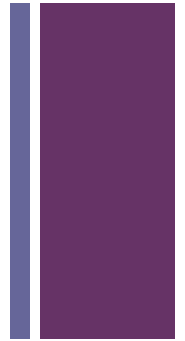


- Motivation
- Haptic Device
- Style IK
- User Interaction Survey
- Our Implementation
- Contributions
- Acknowledgements



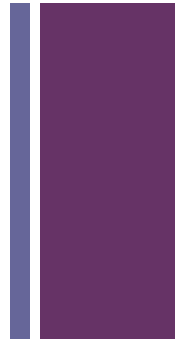
# + What is the problem?

- Why are we still using a 2D interface to manipulate a 3D environment?
- Address a new way of user interaction with 3D space and natural posing
- Improve the conversation between user and computer



# + What methods did you consider?

- Started with Alla and Liming's Motion Graph project
- Focus became more on haptic device
- Implemented portions of Style Based Inverse Kinematics
  - Considers user constraints
  - Used haptic force to keep the user within the likelihood function



# + Haptic Device

- “Haptic” means “To touch”
- SensAble OpenHaptics
- 6 degrees of freedom
- Velocity
- Forces
  - simulating touch
- Works with OpenGL



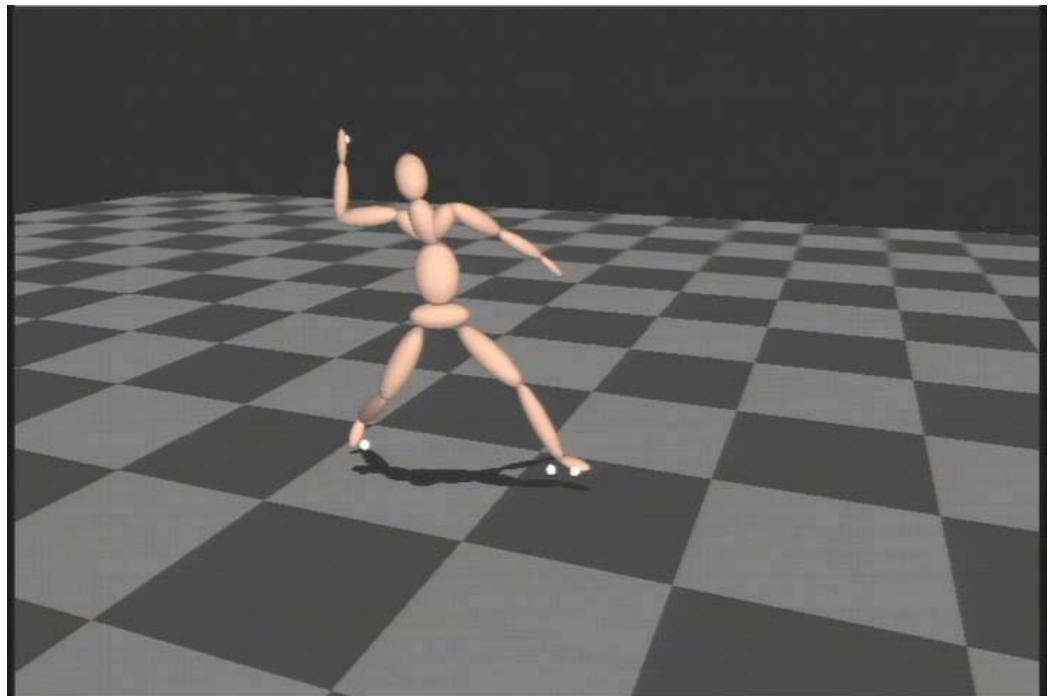


# Style-Based Inverse Kinematics

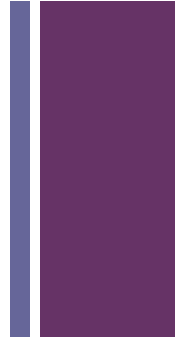
Keith Grochow   Steven L. Martin   Aaron Hertzmann   Zoran Popović



- Addresses the problem of inverse kinematics being underconstrained
- Uses a motion capture clip as a means to “learn” new natural poses



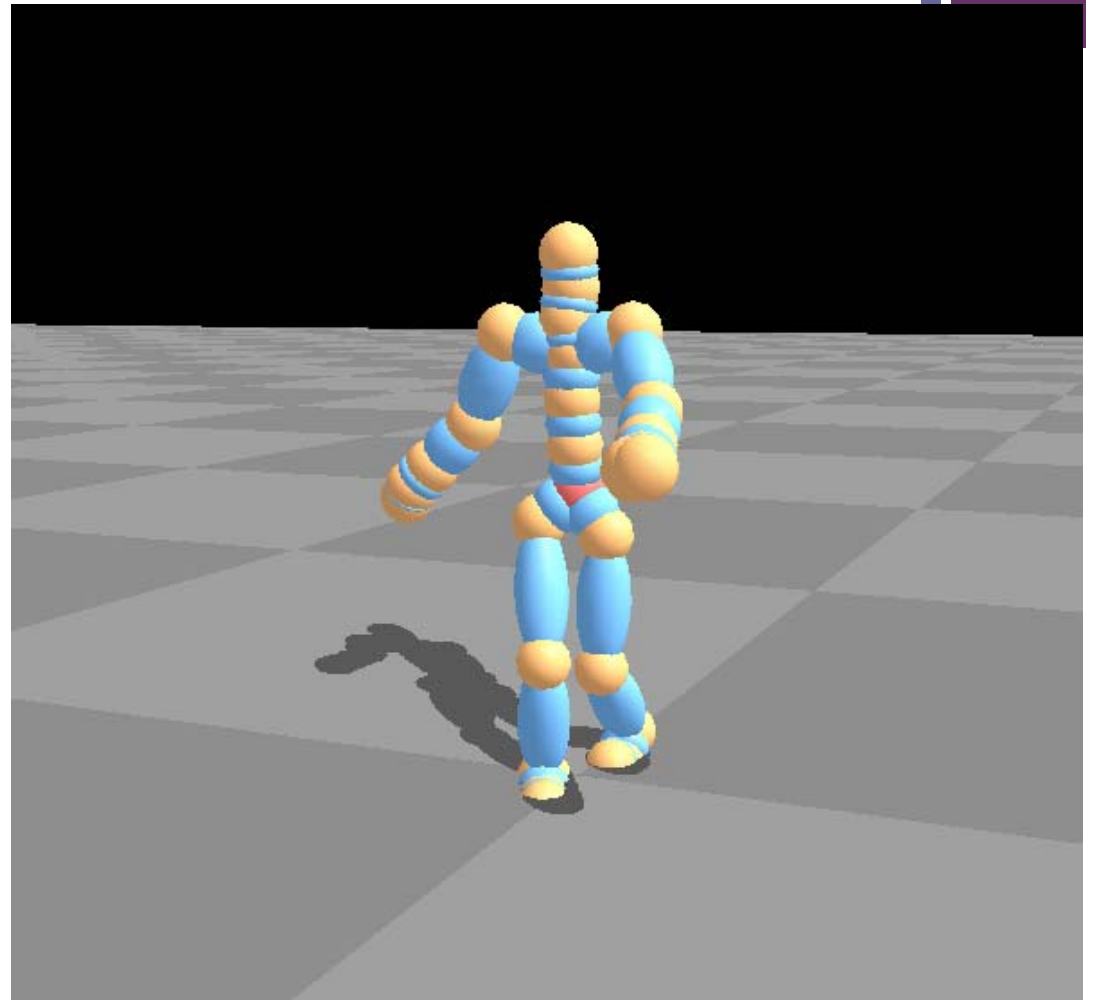
# + Why Style Based IK



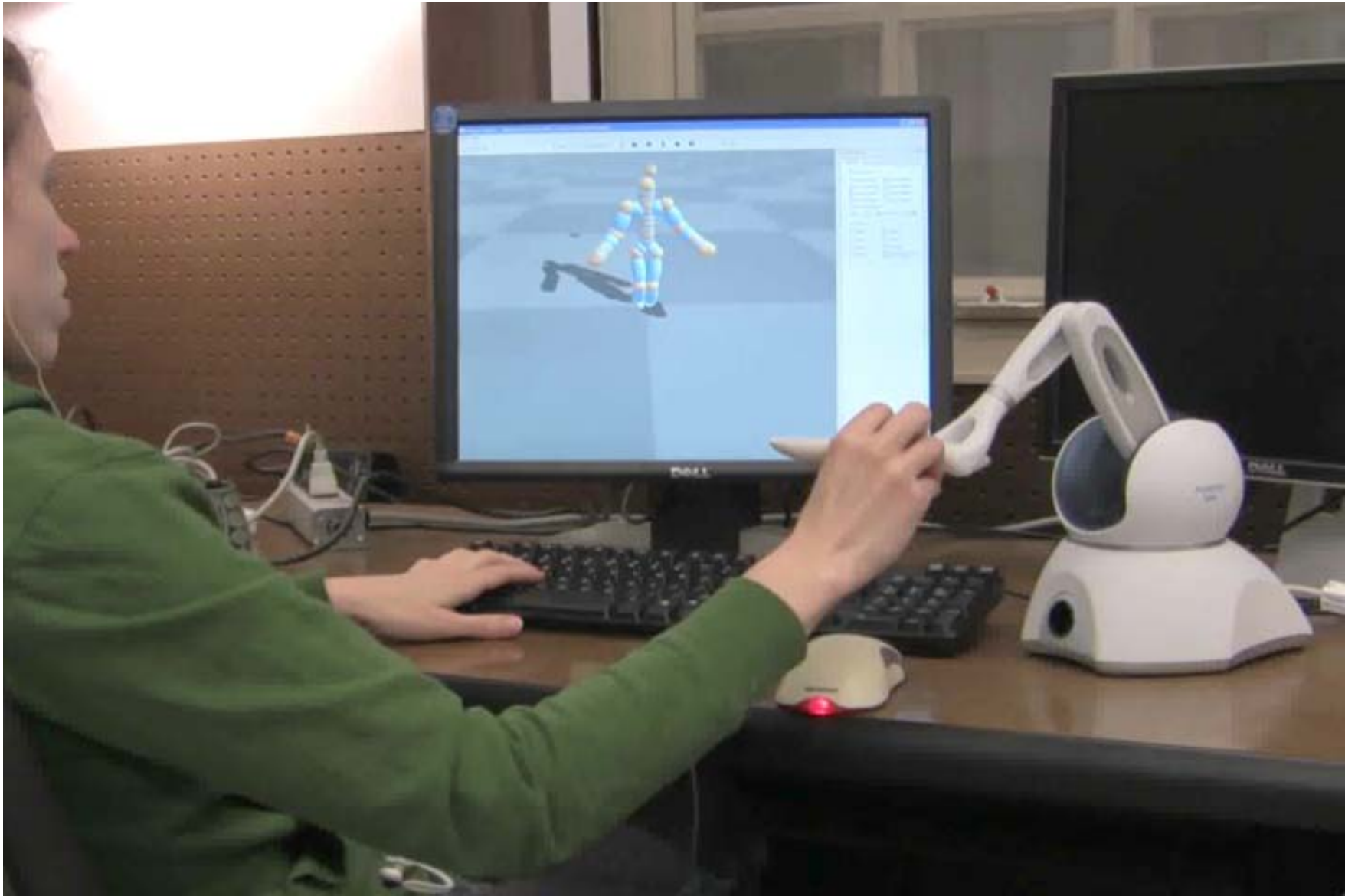
- Allowed us to continue working with IK
  - Although we missed Liming's code terribly
- A way to use the unique characteristics of a haptic device to help pose a character
- Accessible to non animators
  - In line with our goals for using a haptic device

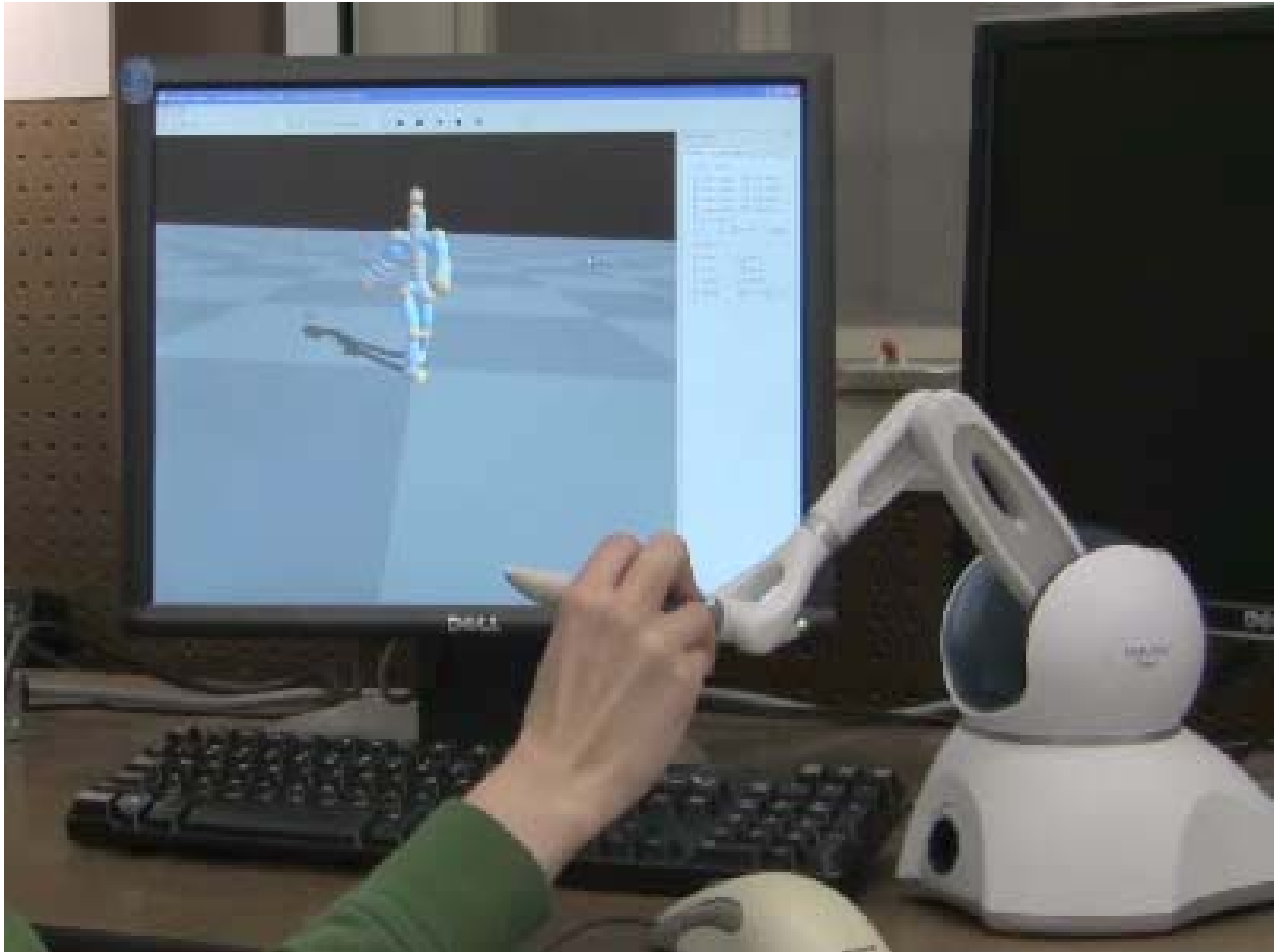
# + Features

- Gravitation towards selectable joints
- Ability to constrain rotation to x, y, z axes
- Zooming with consideration to velocity
- Forces that guide user toward more natural poses



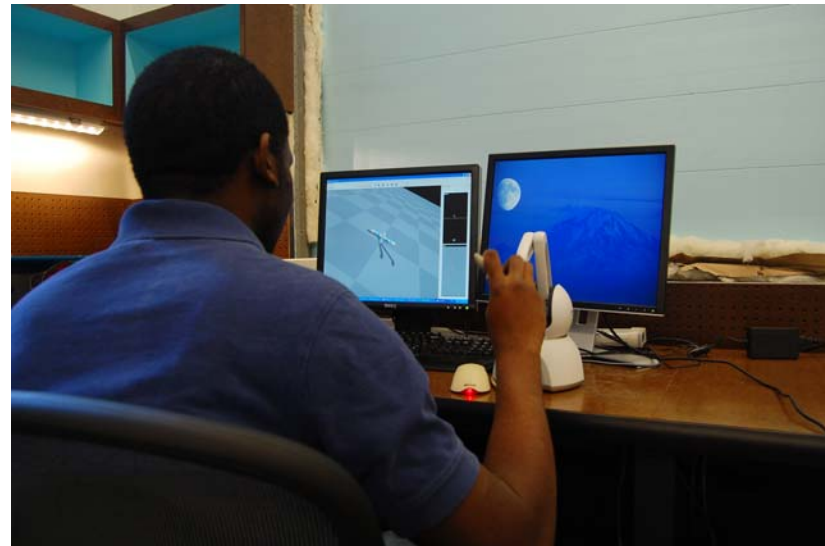




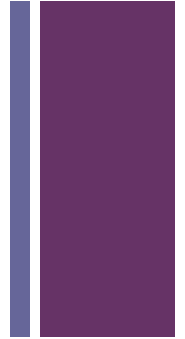


# + Haptic device controls

- 6 degrees of freedom
- But how do users intuitively use the haptic device to:
  - pan?
  - rotate?
  - zoom?
- Survey!
  - 13 participants



# + Sample questions



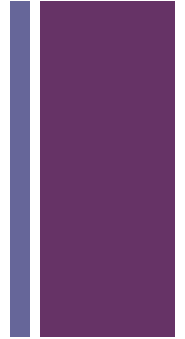
Before beginning the experiment we asked:

- Do you have previous experience with 3D software?
- What motions do you expect to cause rotation, panning, and zooming?

After they finished we asked:

- What haptic control motions were unintuitive?
- Were any of the motions uncomfortable to make?

# + Survey results and observations



- Most people initially tried to use the haptic device like a mouse
  - i.e. horizontal, linear motions for rotation
- Zooming was the most intuitive motion
- Panning motion was intuitive for some, but comfortable for all
- Rotation was the most difficult to understand and control



**Our implementation based on  
survey results**

# + Haptic Rotation

## ■ Our Solution

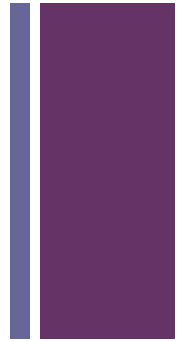
- Treat the haptic sphere like a hand that can grab and rotate the world space
- Wanted to exploit 3D interface capabilities

## ■ Other rotation methods

- Pen orientation
- Mimicking 2D mouse movements



# + Haptic Zoom



- Pen movement inwards and outwards
- Velocity determines zooming
  - Fast/slower movement results in more/less zooming
- Most intuitive feature





# + Haptic Pan

- Rotating the pen in different directions pans the camera in the respective directions
- Pointing the pen in a particular direction moves the camera continuously
  - The more extreme the angle of the pen, the faster the movement
  - Has pros and cons...
- Possible solutions
  - Get rid of extreme angle to extreme movement
  - Slow down the speed up

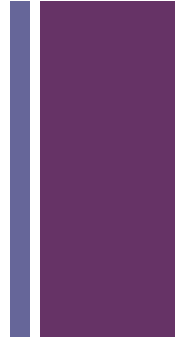


## + Haptic Joint Selection

- When within a certain radius of a joint, forces subtly attract the haptic cursor to it
- Selecting and dragging also produces feedback force that gently pushes the user's hand (goal position) toward a more natural pose
  - The forces are not strong enough to disallow the user from generating unnatural poses

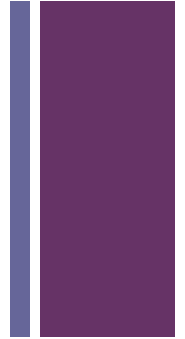


# + Contributions



- The haptic device becomes a teaching guide
  - Interaction with a likelihood function as opposed to a virtual object
- We use the haptic device to perform functions that a computer mouse wishes it could do

# + What did we learn

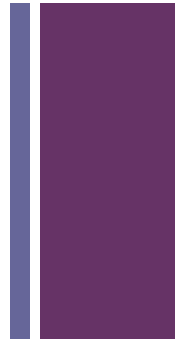


- Haptic Device
- Should have had a clear idea of what we wanted to accomplish
- Pay attention in math class (especially about the matrices and the vectors)
- Way more research before starting
- Start earlier

# + Future Work

... for someone else

- More robust world manipulation
- Add forces to prevent the cursor from going through objects (character and ground)
  - Allow the user to toggle this feature
- Try different haptic devices



# + Thank you

- Liming & Alla
- Amy
- Joe
- Jan
- Ben, Pengfei, Skiz & Katherine

