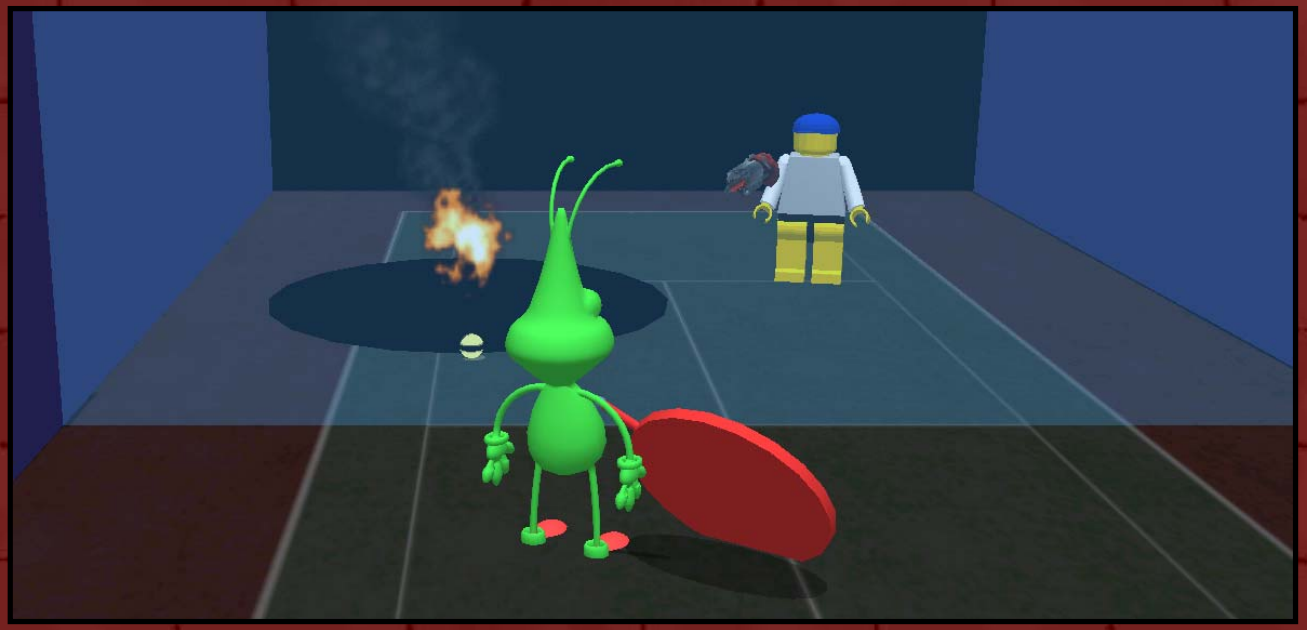
Haptic Battle Pong: A Networked Haptic Game



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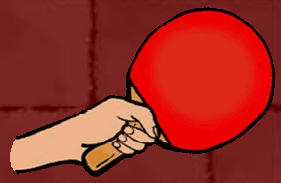


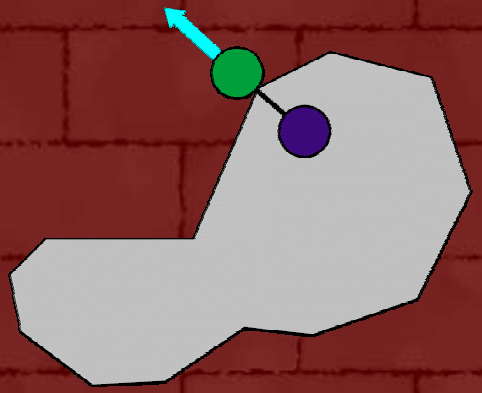
What do we mean when we say "haptic game"

- You've played with consumer force-feedback game devices…
  - "Open loop" feedback, provides information about game events, usually optional
- We're talking about "closed-loop" haptics…
  - Force feedback is integrated with game physics
  - Player's hand is an essential part of the physical simulation

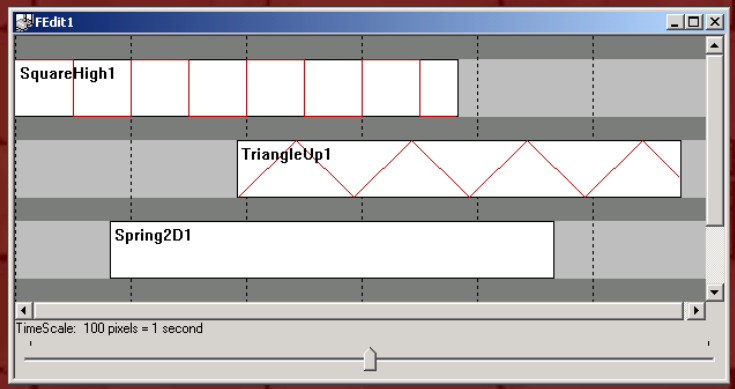
VS.

Programming Model

- Device API typically provides the raw necessities: getPosition(x,y,z), setForce(x,y,z)
- Dramatically different from the DirectInput FF model: "device, please run the following effect"

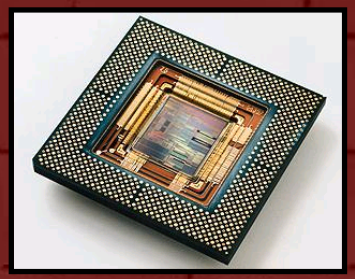
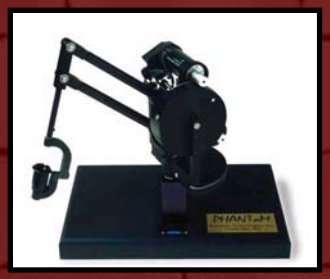


VS.



What's Hard About Haptics?

- Update rate requirements typically about 1kHz
- Places significant demands on the CPU, especially if you need to do collision detection and dynamics at haptic rates
- Dual CPU configurations and RT OS's are popular in research haptics

2 x  +  = 

What's Hard About Networked Haptics?

- Hard to deliver 1ms updates if you're interacting with an object that lives 100ms away
- For the game we're demo'ing today, we prevent concurrent physical interaction
  - So it works fine over the Internet…
- For other applications we work on at Stanford, we allow you to do whatever you want, but you're connected over a local switch
- The general case – direct haptic interaction over the Internet – is still a hard problem

What's Hard About *Playing* a Haptic Game?

- Having to operate six degrees of freedom is hard
- Having to really get depth right is hard
  - Stereo is okay, but it has the usual problems that come with stereo
  - Good lighting and shadows will be important
- For HBP, we introduced a tutorial mode in which the ball is constrained to a plane

Haptic Battle Pong

- Classic pong theme: keep the ball on the other side or you lose
- But the paddle is controlled with 6-dof input
- And you can use your paddle as a rocket launcher
- And you can place "haptic mines" in your opponent's court
- So really it's more "haptic battle" than "pong"

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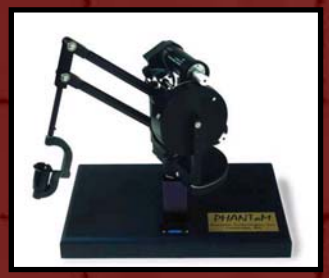

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Conclusion

- Haptics in the mass market
  - Will take a big increase in volume
- Progress in high-level libraries for haptic rendering will simplify things for developers
  - Several commercial libraries exist

    Novint's eTouch, SensAble's Ghost
  - Stanford is developing an open source library, CHAI3D, which should be released later this week
- Sense of immersion is vastly increased with haptics, so its entry into the gaming community seems inevitable.

http://techhouse.brown.edu/~dmorris/haptic.battle.pong/