

Lecture 23 – Interacting with Visualizations

Video games as visualizations



Video games as visualizations



**The Legend of Zelda
(NES, 1986)**

- Major differences exist in hardware between the two time periods.
- Despite advances in technology, video game play operates under essentially the same principles in 2022 as it did in 1986.



**The Legend of Zelda: Breath of the Wild
(Nintendo Switch, 2022)**

Data Selection and Manipulation Loops

- How do you physically interact with a visualization?
 - The hardware options:
 - Keyboard
 - Mouse
 - Touchscreen
 - Joystick (4 degrees of freedom)
 - Accelerometer (6 degrees of freedom)
 - Custom hardware
 - The options for motion:
 - keystrokes
 - mouse movements/locations
 - mouse clicks
 - screen touches
 - joystick movements
 - device movement



Flower (Playstation 4, 2009)

Data Selection and Manipulation Loops

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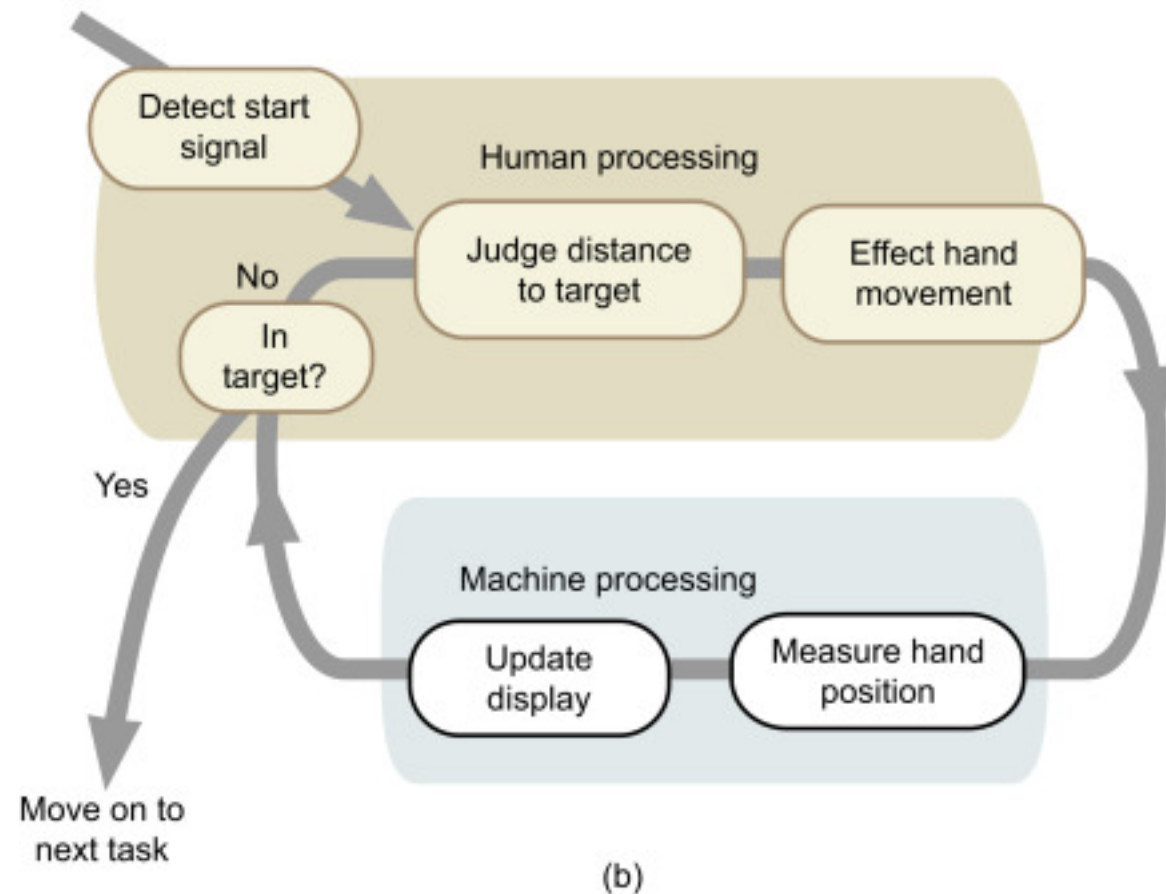
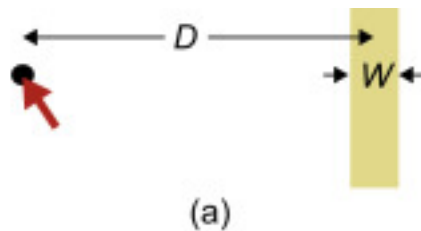
Data Selection and Manipulation Loops

<https://informationisbeautiful.net/visualizations/worlds-biggest-data-breaches-hacks/#bysensitivity>

- How can you physically interact with this visualization?
- What interactions produce effects? With what motion options?

Reaction times

- Carefully consider the reaction times for specific actions. Too fast and your user will be confused; too slow they will be frustrated.



Ware Fig 10.1

- There are several models for estimating reaction times based on the type of task.

For 2D positioning:

$$\text{Selection time} = a + b \log_2(D/W + 1)$$

- Vary based on task: choice reaction, positioning and selection, hover queries, path tracing
- Tuning these will help present info efficiently and quickly!

For the data breaches visualization, are the reaction times good?

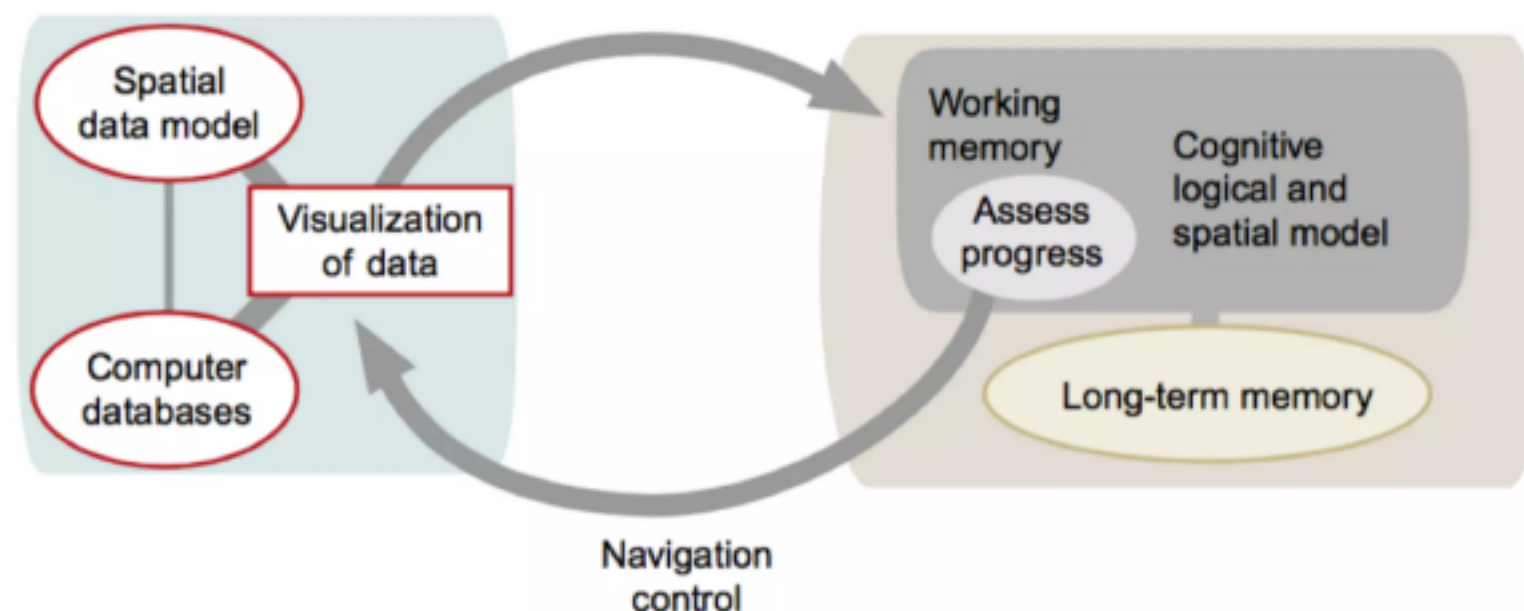
Learning

- Humans learn complex tasks and concepts by chunking, as previously covered.
 - Complex motions can be chunked together and recalled quickly.
 - Chunking can lead to drastically reduced reaction times and more efficient information transfer.
 - Computers should give rapid, clear, and consistent feedback to the user about results of interactions.
 - Starting level of most video games have a consequence-free learning space for users to interact with the game and begin the process of chunking their way to success!
 - Subsequent levels can be more difficult when chunks are in place



Exploration and Navigation of Space

- Exploration and navigation of a space is integrated with our existing model of how we interact physically with the world.
 - Beware of *control compatibility*. Stimulus-response compatibility can profoundly affect your user's ability to navigate your visualization!
 - Up is up and down is down, don't reverse these
 - Altering angles, viewpoints in systematic way is ok
 - Control compatibility is about leveraging our natural understanding of the world!



Ware Fig 10.3

Exploration and Navigation of Space

- Navigation metaphors are a way of leveraging natural models of the world to help a user navigate and explore a space intuitively
 - World-in-hand: manipulation of hardware manipulates 3D model of environment. Moving viewpoint closer moves environment closer.
 - Eyeball-in-hand: manipulation of hardware manipulates the view of the 3D model, user manipulates their own camera view.
 - Walking/flying: manipulation of hardware manipulates the view of the 3D model.



Exploration and Navigation of Space

<https://watershednavigator.org/>

- What navigation metaphor does the Tualatin River Watershed project use?
- In what ways can you interact with the visualization?
- How are you expected to learn? Are there any penalties?
- Are the reaction times well-balanced with navigation through the space?

Exploration and Navigation of Space

<https://informationisbeautiful.net/visualizations/worlds-biggest-data-breaches-hacks/#bysensitivity>

- What navigation metaphor does the Data Breaches visualization use? How does this encoding of position differ from Tualatin Watershed's?
- In what ways can you interact with the visualization?
- How are you expected to learn? Are there any penalties?
- Are the reaction times well-balanced with navigation through the space?

Take away from games and interactive visualizations

- The success of video games as interactive visualizations isn't about fancy graphics, unique user interfaces, or computational speed and power. It's about the *story*.
- Be sure to design your interface so it ***doesn't get in the way*** of what you're trying to say with the data.
- Design it in a way that interactions still produce a ***guided narrative*** for the user.
- Be sure to give the user ***space to learn*** how to effectively navigate the visualization.