Lecture 4, Part 2

Fitts' Law

UNIVERSITY OF AUCKLAND

COMPSCI 705 / SOFTENG 702

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Notes from:

Heim, S. (2007) The Resonant Interface, Section 7.6.1, Addison Wesley

https://www.nngroup.com/articles/fitts-law/

https://www.asktog.com/columns/022DesignedToGiveFitts.html

Learning objectives

- Comprehensive understanding of Fitts' Law
- Implications of Index of Difficulty and Movement Time
- Limitations of Fitts' Law

Performance Measurements

- An *analytical* performance measurement that can be extracted directly from the interface as compared to an *empirical* performance measurement observed in a usability study
  - Fitts' Law is the classic performance measure for time to complete the task of pointing at an object
  - Hick–Hyman Law time taken to make a decision (e.g., *that* is the object I want!)
- There are other more comprehensive models we won't cover here
  - KLM – keystroke-level model
  - GOMS – goals, operators, methods and selection rules

Fitts' Law

- Fitts' Law is the classic performance measure.
  - Time to target depends on target width (*w*) and distance to move pointer (*D*)

$$T = a + b \log_2 \frac{2D}{w}$$

- Paul Fitts, a psychologist, understood that human error is attributable to poor design
  - Studied airplane cockpits

- What is the implication for design for usability?

Fitts' Law

- The constants *a* and *b* vary
  - Unique to every user
  - Unique to every device
  - Unique to different types of software
  - Unique to different modes of pointing

- Yikes! But
  - Can average over a population, or user group
  - Can average for a particular device
  - Etc.

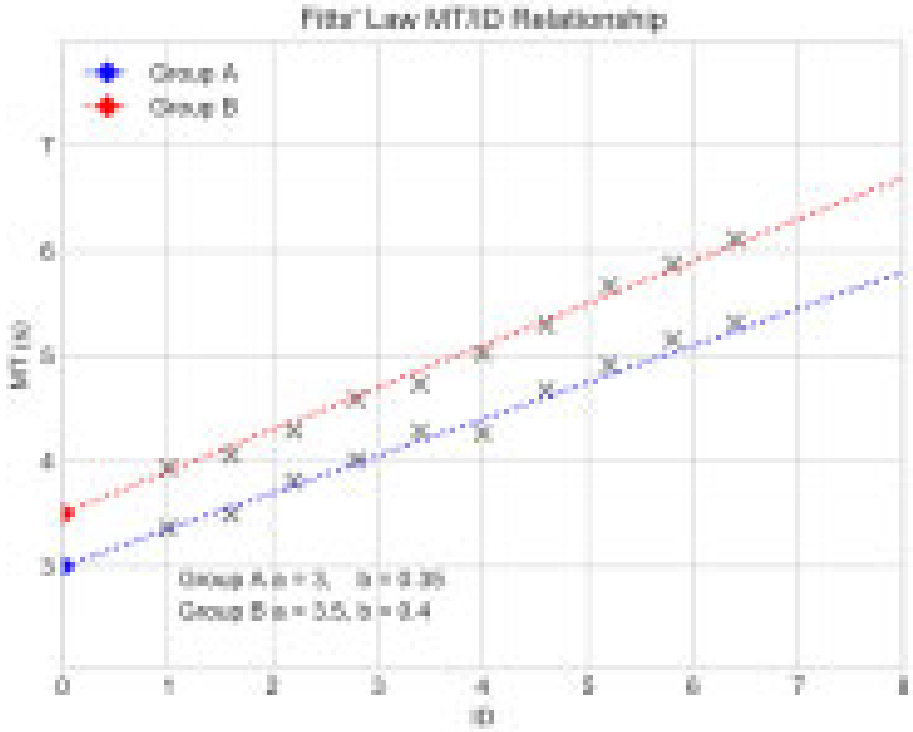
Fitts' Law

- $\log_2$ component is the Index of Difficulty (ID)

$$ID = \log_2 \frac{2D}{w}$$

  - Measured in bits

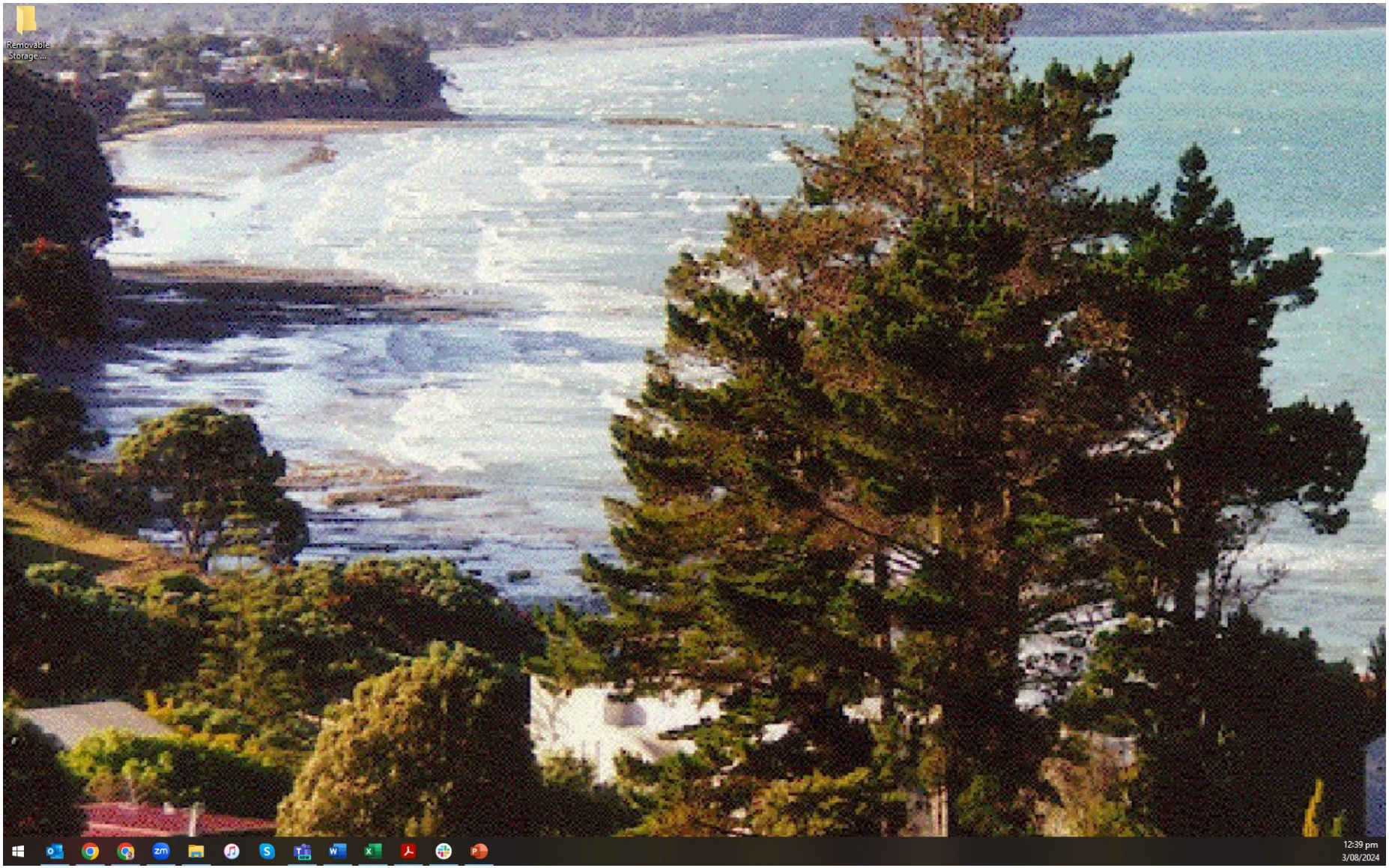
  - As ID increases,
    time to reach target
    increases



Fitts' Law

- Prime pixel
  - Point where the user will carry out their action
  - Initially estimated to be the centre of the screen
    - E.g., Google search screen
  - Will be updated as the user performs actions
    - E.g., when they press the login button
- Magic pixels
  - Four corners of the screen (for mouse movement)
    - Can be acquired at great speed
    - Rule of the infinite edge
    - Microsoft *Start* button at bottom left
    - Microsoft/Apple icons and menus across the top and bottom of the screen

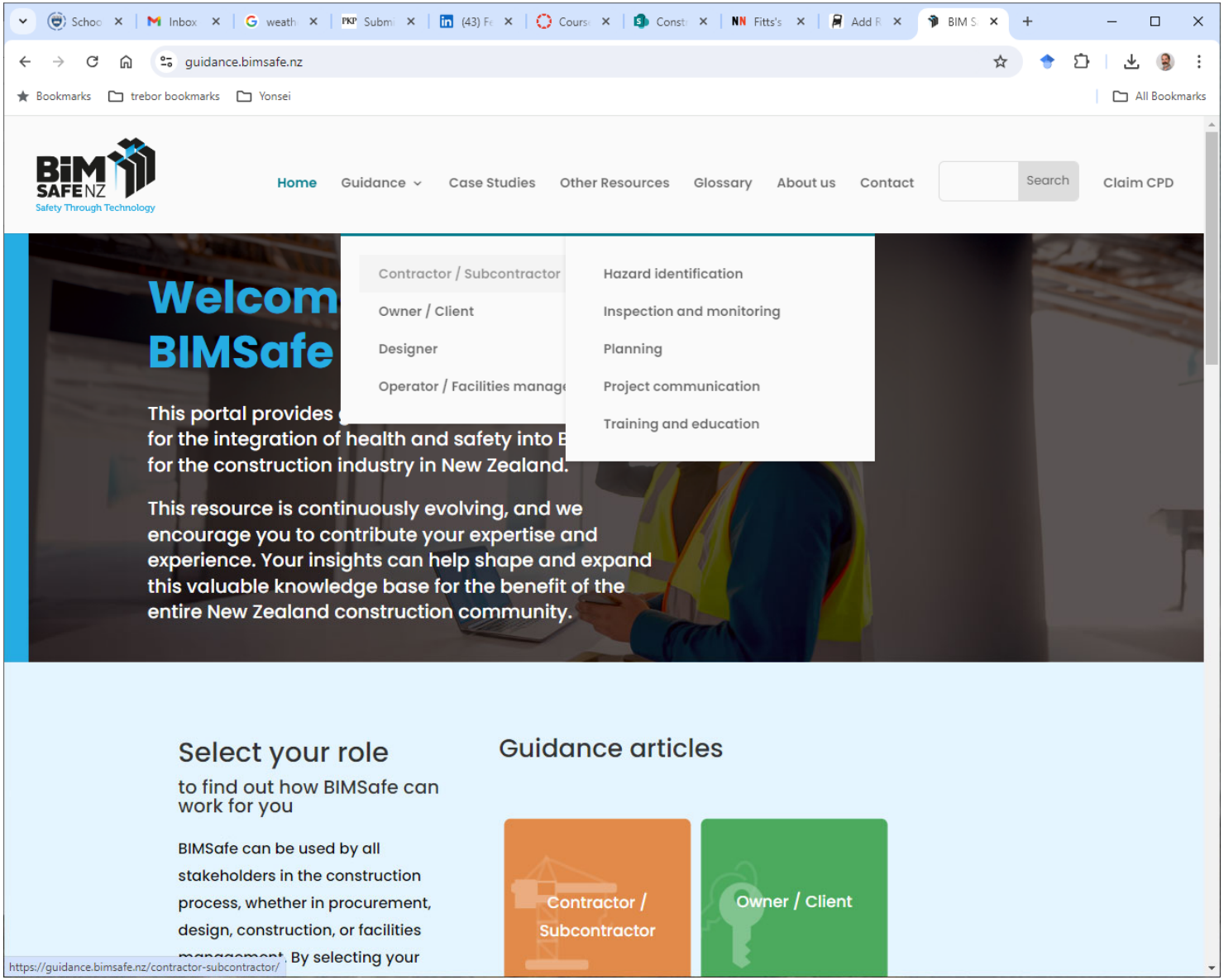
Fitts' Law



Fitts' Law

- Influences
  - Short dropdown lists
    - Important/frequently used items first
  - Right-click pop-up menu
  - Pie menu rather than dropdown list
  - Large targets
    - Increase size until error rate drops off
  - Add labels to icons
  - Related targets close together
    - E.g., *Submit* button close to last form element
  - Minimise distance from attention area

Fitts' Law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Fitts' Law

- Influences
  - Infinite targets along edges (for mouse movement)
  - Crowded targets can be problematic
  - Padded targets aren't identifiable
  - Make items you don't want accessed small

- Limitations
  - Models continuous movements
  - Doesn't cover 2-handed operations
  - Differences with flexor and extensor movements

Fitts' Law

- Calculations
  - Maintaining the same time to target?
    - ID needs to stay the same
    - Double *w*, then you need to double *D*
    - Double *D*, then you need to double *w*
    - 3 x *D* ?
  - Find *a* and *b*
    - ID = 0 to find *a*, or
    - Simultaneous equation