**Fitts’s Law**  P. Fitts, 1954

- $MT = C_1 + C_2 \log_2 (A / W + 1)$
- $MT = \ldots + C_2 ID$
  - $C_2$ = slope
  - Higher $C_2$ means steeper curve, corresponding to lower IP ($1/C_2$)
- $MT = C_1 + C_2 ID$
  - $C_1$ accounts for intercept offset from 0

![Graph showing the relationship between MT and ID](image-url)
Fitts’s Law  P. Fitts, 1954

- First applied to HCI by Card, English, and Burr, 1978
- Later adapted for asymmetric targets by MacKenzie and Buxton, 1992, who got better results than using $W$ with two models
  - SMALLER-OF model: $W$ is replaced by $\min(W, H)$
  - $W'$ model: $W$ is replaced by $W'$ = extent of target along approach vector

Fitts’s Law  P. Fitts, 1954

- Applied to menus in Windows vs. Mac OS
  - MacOS menu bar is at top of screen
    - Acts as if it has infinite $H$ or $W'$ → Faster to target!
Fitts’s Law  P. Fitts, 1954

- Applied to corners in Mac OS
  - “Active screen corners” invoke Exposé
    - Act as if they have infinite $H$, $W$, or $W'$ → Faster to target!

Fitts’s Law  P. Fitts, 1954

- Note complications when Fitts’s Law is to be applied over a large range of $A$ and $W$
**Steering Law**  J. Accot and S. Zhai, CHI 97  
( generalizing earlier work )

- How quickly can the user steer through a 2D tunnel (free-hand tracing, sketching, constrained motion)?
- Harder than a Fitts’s Law task, since the cursor must remain in the tunnel!
- \( MT = a + b \left( \frac{A}{W} \right) \)
  - For a straight tunnel of fixed width, where
    - \( A \) is path length
    - \( W \) is path width
    - \( a \) and \( b \) are constants
- Can be generalized for more complex tunnels (varying width, trajectory)

How fast can a user move from the left to the right side of a rectangle of width \( W \) and length \( A \), staying within the rectangle?

**Steering Law**  J. Accot and S. Zhai, CHI 97  
( generalizing earlier work )

- Modeling interacting with a hierarchical walking menu
  - Sum of vertical and horizontal steering tasks

\[ MT_n = a + b \left( \frac{nh}{w} \right) + a + b \left( \frac{w}{h} \right), \]

- \( n \) is number of submenu (\( n^{th} \) submenu)
- \( w \) is width of (sub)menu
- \( h \) is height of (sub)menu item
- \( MT_n = 2a + b \left( \frac{nh}{w + w / h} \right) \)

Note: This is an approximation, assuming same coefficients \( a, b \) for horiz/vert
A Composite Interaction Task for Locator Devices: Snap Dragging
E. Bier and M. Stone, SIGGRAPH 86

- Extends basic idea of *grids*
- **Automatic generation** of **alignment objects**
  - *Gravity-active* points, lines, circles
- Generation based on
  - User hints
  - Heuristics about editing behavior

http://www.youtube.com/watch?v=7L8RT3M8Yeo

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Heuristically Generated Alignment Lines in PowerPoint 2010

- Dragging object (circle) creates an alignment line when its bounding box edge/center lines up with the bounding box edge/center of another object (rectangle)
- Also, smart guides (Adobe Illustrator), dynamic guides/alignment guide (CorelDRAW),...
Grid (aka Design Grid)

- A system of intersecting lines used to constrain position and size of content
  - Typically vertical and horizontal
  - Often arranged in repeating modules
Grid (aka Design Grid)

- http://www.thegridsystem.org/
- http://www.responsivegridsystem.com/