Interaction Design

Chapter 6 (May 29th, 2013, 9am–12pm):
Laws of Interaction Design

Laws of Interaction Design

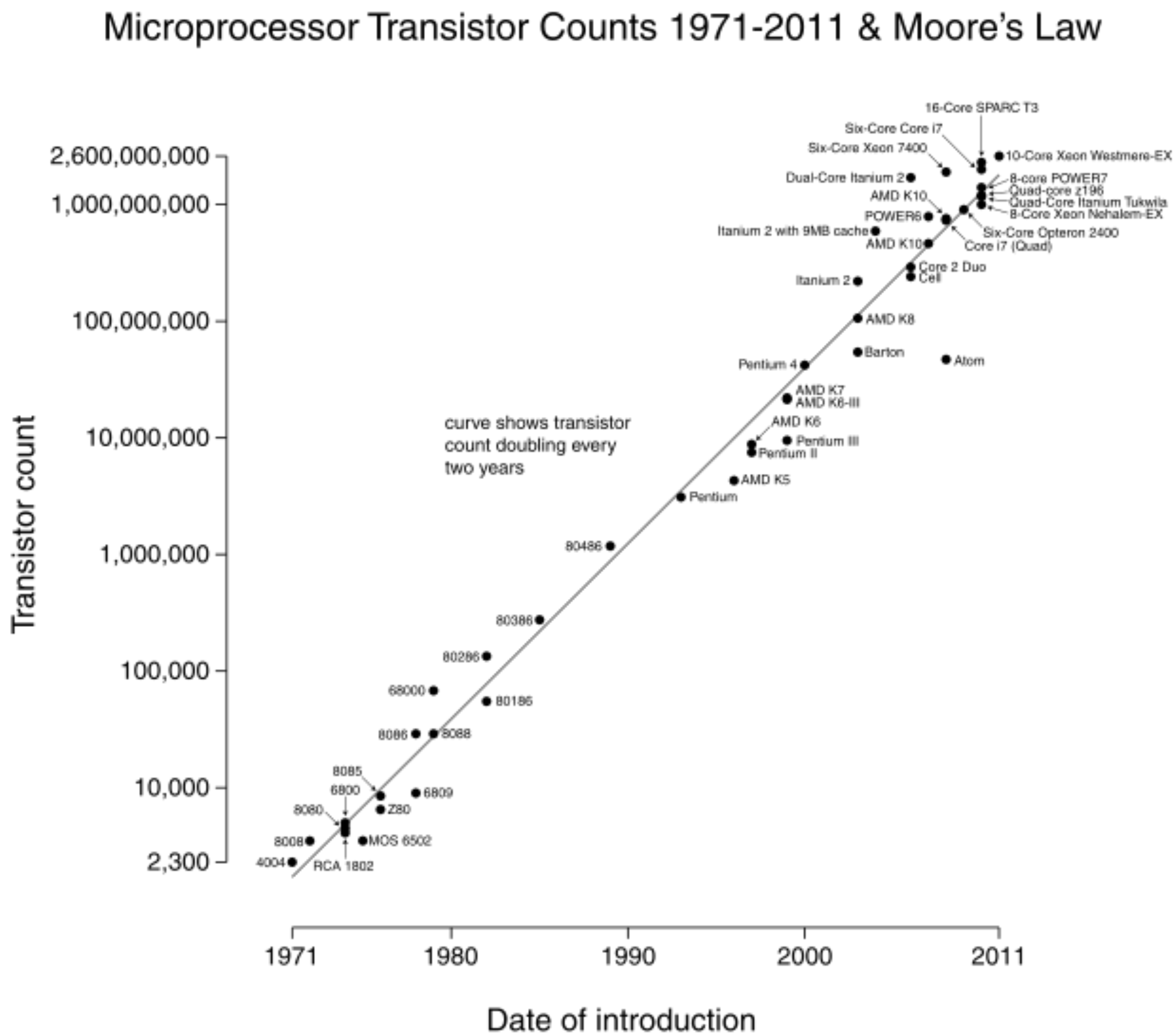
- Moore's law
- Buxton's law
- Fitts' law
- Steering law
- Guiard's Kinematic chain model
- Hick's law
- Law of practice
- Murphy's law

Moore’s law

“The complexity for minimum component costs has increased at a rate of roughly a **factor of two per year**…Certainly over the short term this rate can be expected to continue, if not to increase. Over the longer term, the rate of increase is a bit more uncertain, although there is no reason to believe it will not remain nearly constant for at least 10 years. That means by 1975, the number of com-ponents per integrated circuit for minimum cost will be 65,000. I believe that such a large circuit can be built on a single wafer.”

[Moore, Gordon E. (1965). "Cramming more components onto integrated circuits". Electronics, Volume 38, Number 8, April 19, 1965.]

Moore’s law illustration



Moore’s law implications

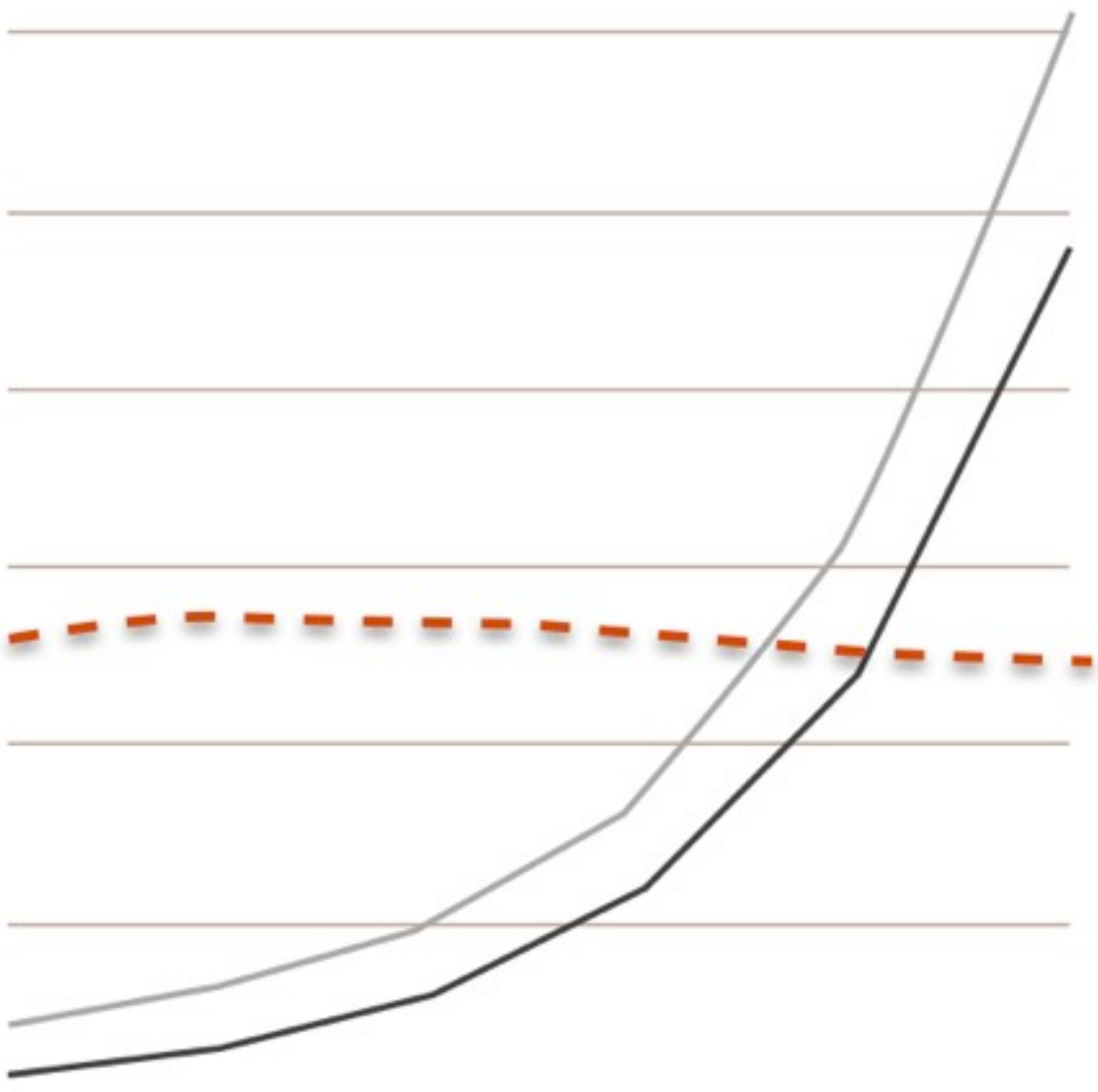
Don’t worry too much about:

- computing power
- storage capacity
- screen resolution
- device size
- weight
- battery life (?)

Laws of Interaction Design

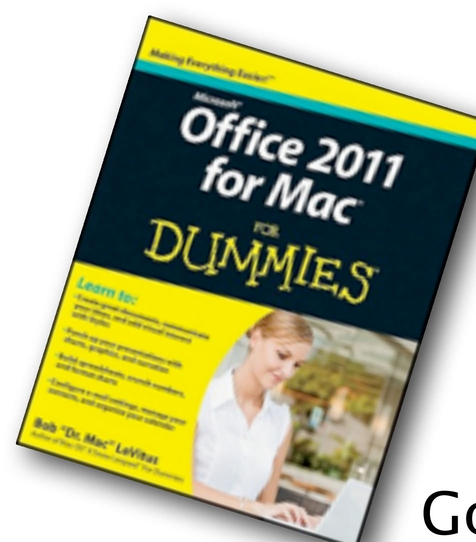
- Moore’s law
- Buxton’s law
- Fitts’ law
- Steering law
- Guiard’s Kinematic chain model
- Hick’s law
- Law of practice
- Murphy’s law

Buxton's law



Moore's law

Buxton's law



God's law

http://www.billbuxton.com/LessIsMore.pdf

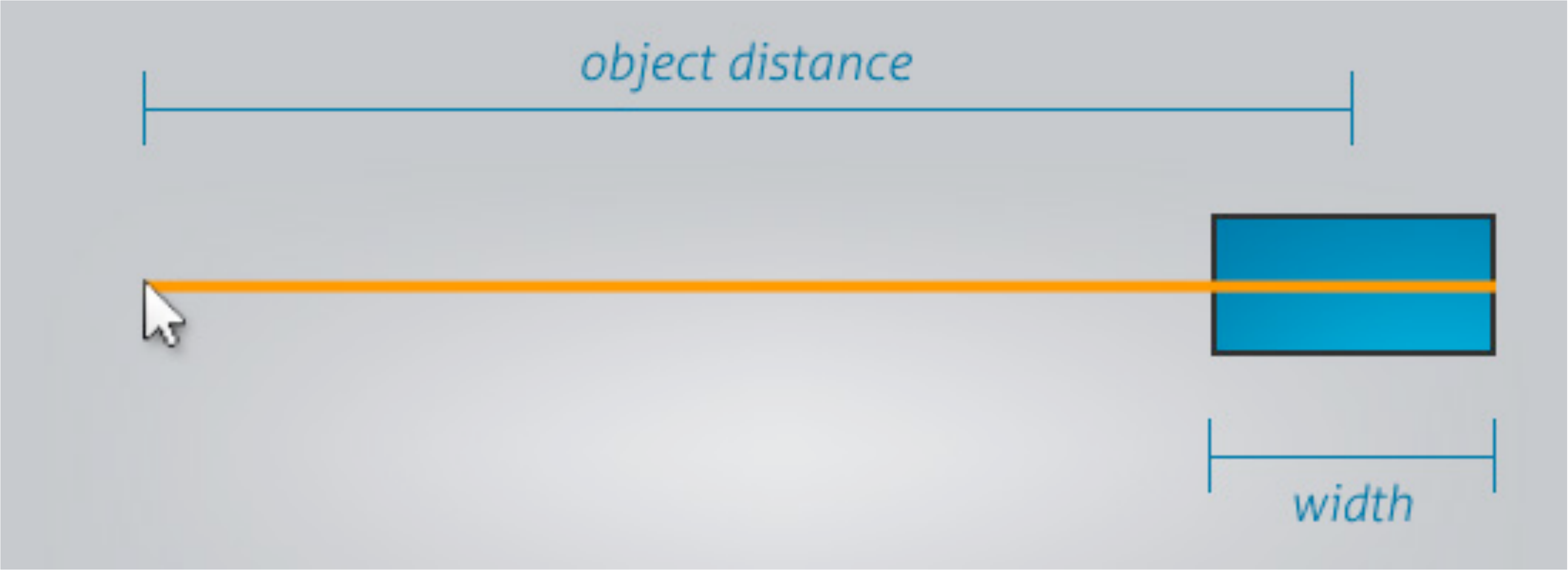
Laws of Interaction Design

- Moore’s law
- Buxton’s law
- Fitts’ law
- Steering law
- Guiard’s Kinematic chain model
- Hick’s law
- Law of practice
- Murphy’s law

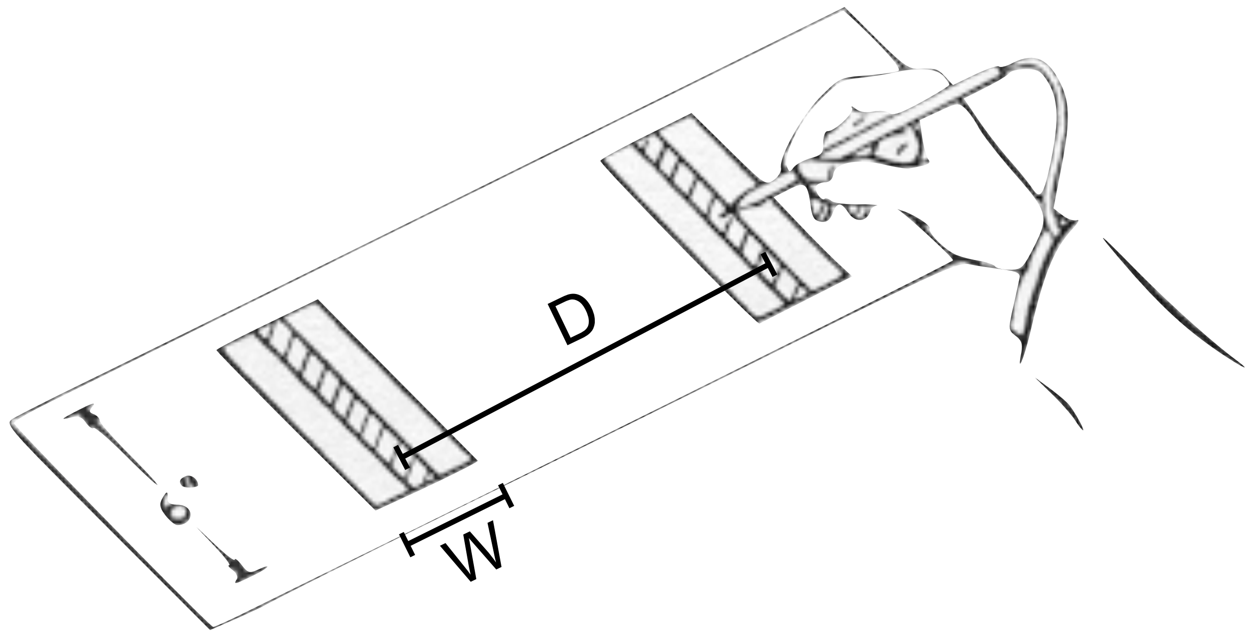
Illustration from http://sixrevisions.com/usabilityaccessibility/improving-usability-with-fitts-law/

Fitts' law

The time to acquire a target is a function of the distance to and width of the target.



Fitts' law



Distance

$$T = a + b \cdot log_2 \left(2 \frac{D}{W}\right)$$

Time

Coefficients
a: Intercept
b: Slope

Width

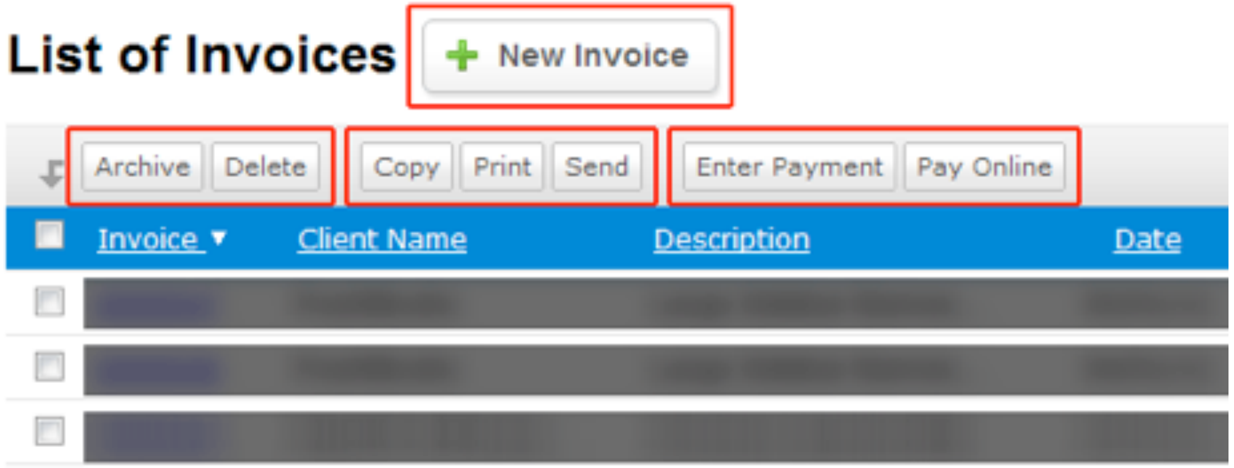
Fitts task:

http://www.youtube.com/watch?v=kly2QA1bFc8

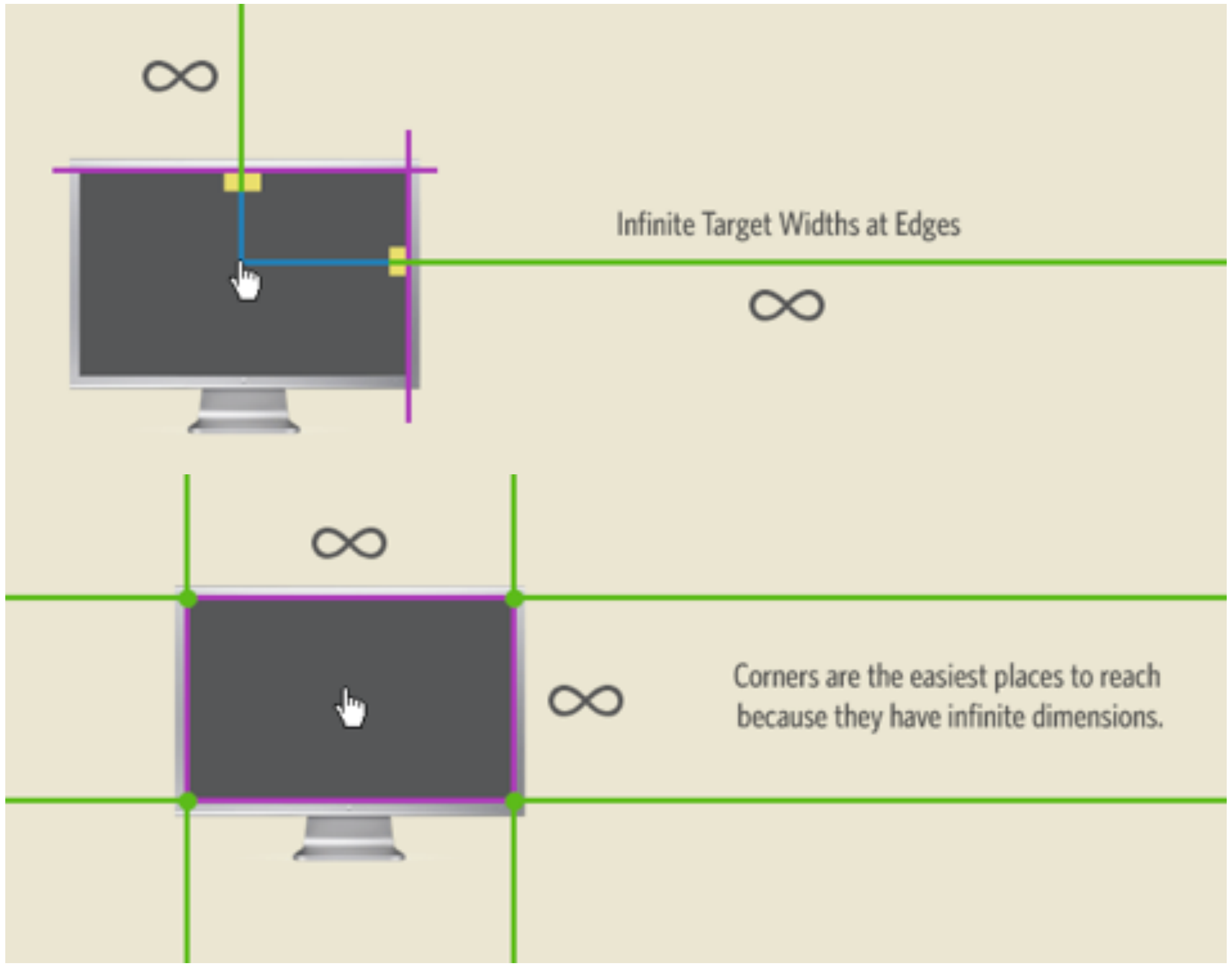
Illustration from http://particletree.com/features/visualizing-fittss-law/

Implications of Fitts' law

Larger targets are easier to hit
-> maximize button size



Movement time increases (logarithmically) with distance
-> minimize distances
-> no movement is even better!

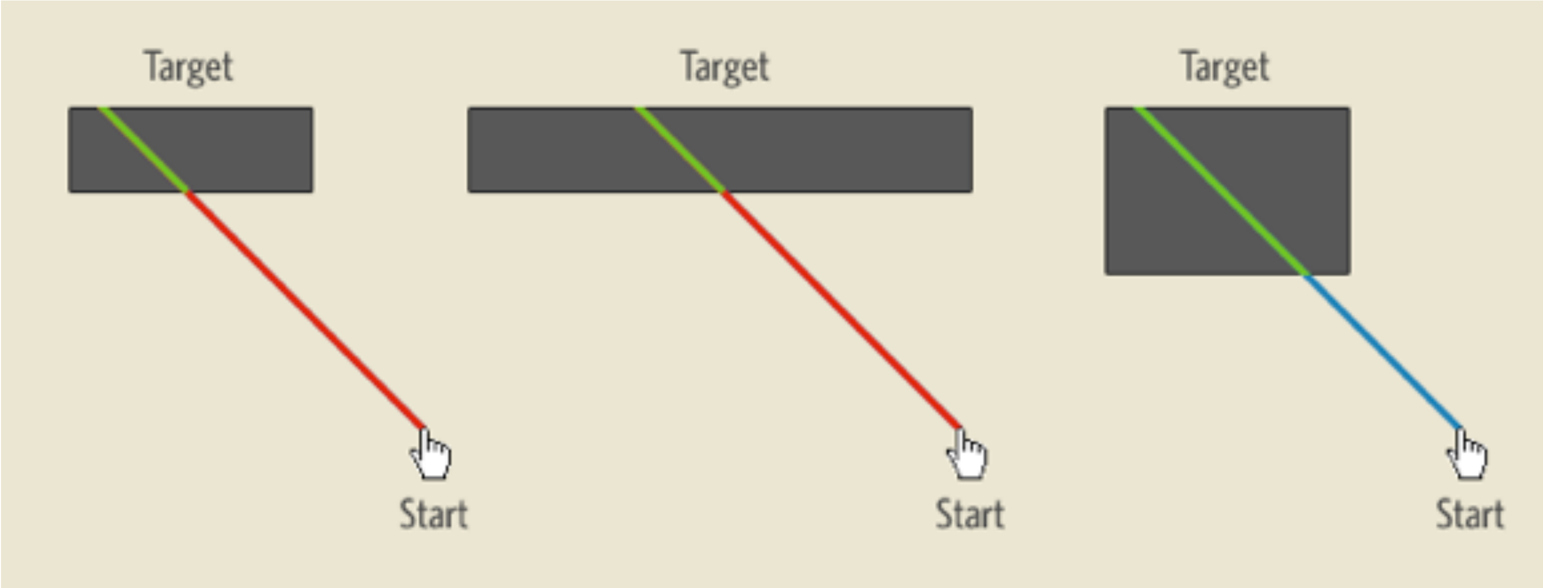


Infinite targets:
-> leverage screen borders
-> leverage corners

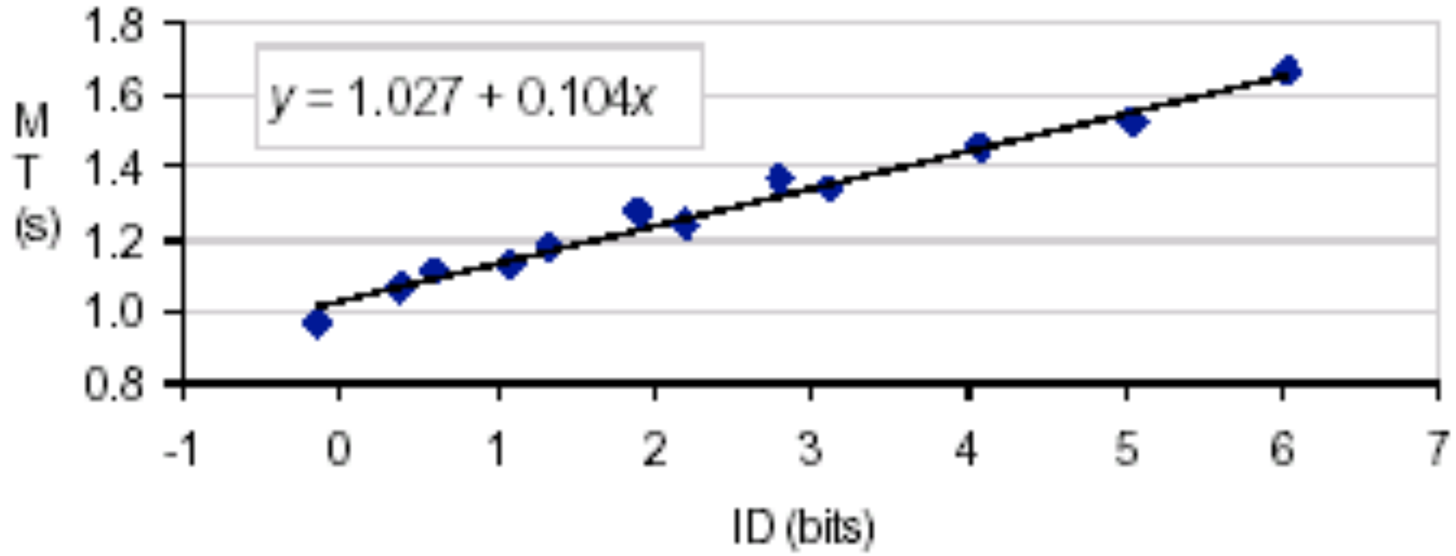
Illustration from http://particletree.com/features/visualizing-fittss-law/

Bigger Is Not Always Better

Movement direction to target



Logarithmic improvements with size

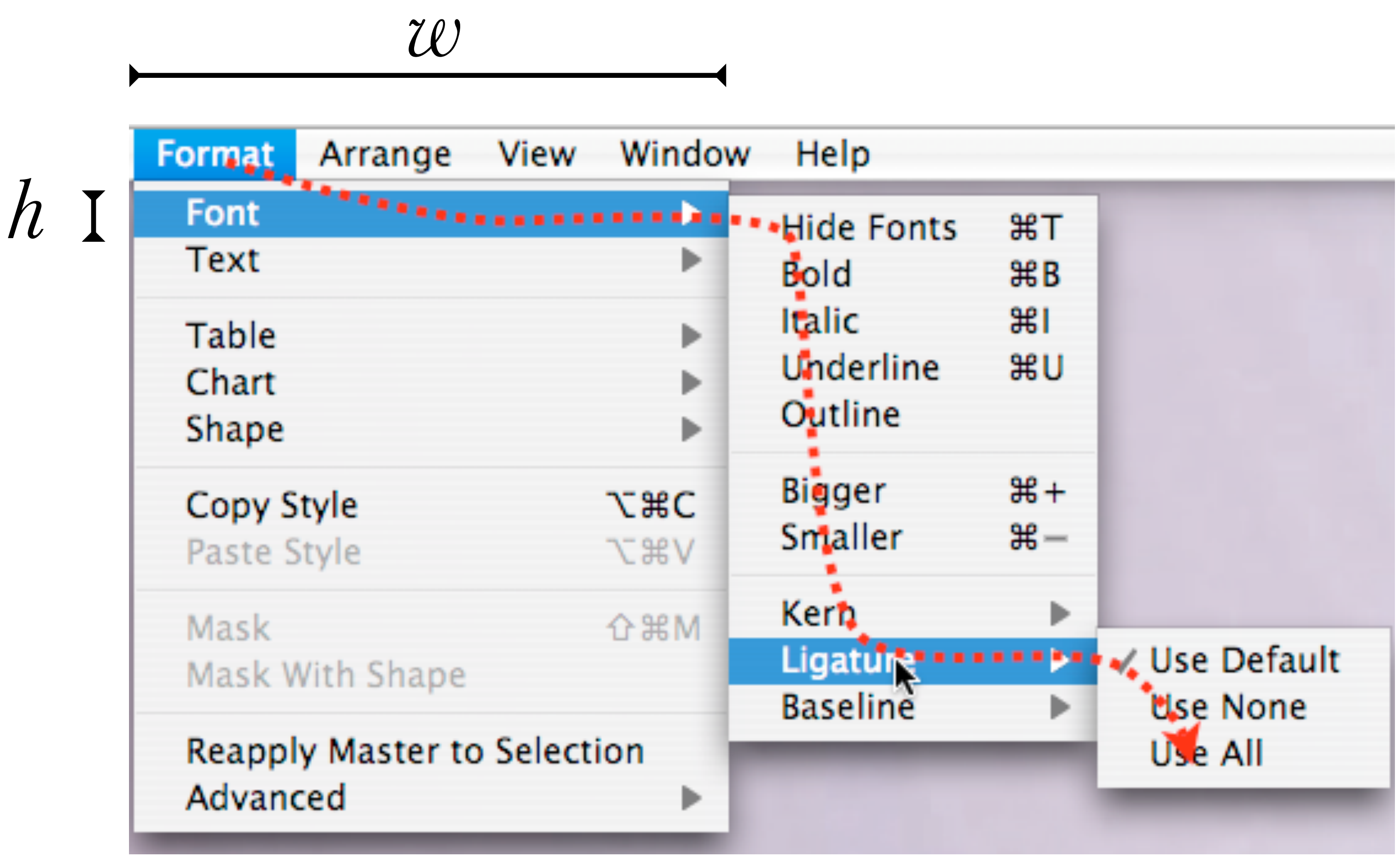


MacKenzie revaluation of Card's Fitts' Experiment for text selection

Laws of Interaction Design

- Moore’s law
- Buxton’s law
- Fitts’ law
- Steering law
- Guiard’s Kinematic chain model
- Hick’s law
- Law of practice
- Murphy’s law

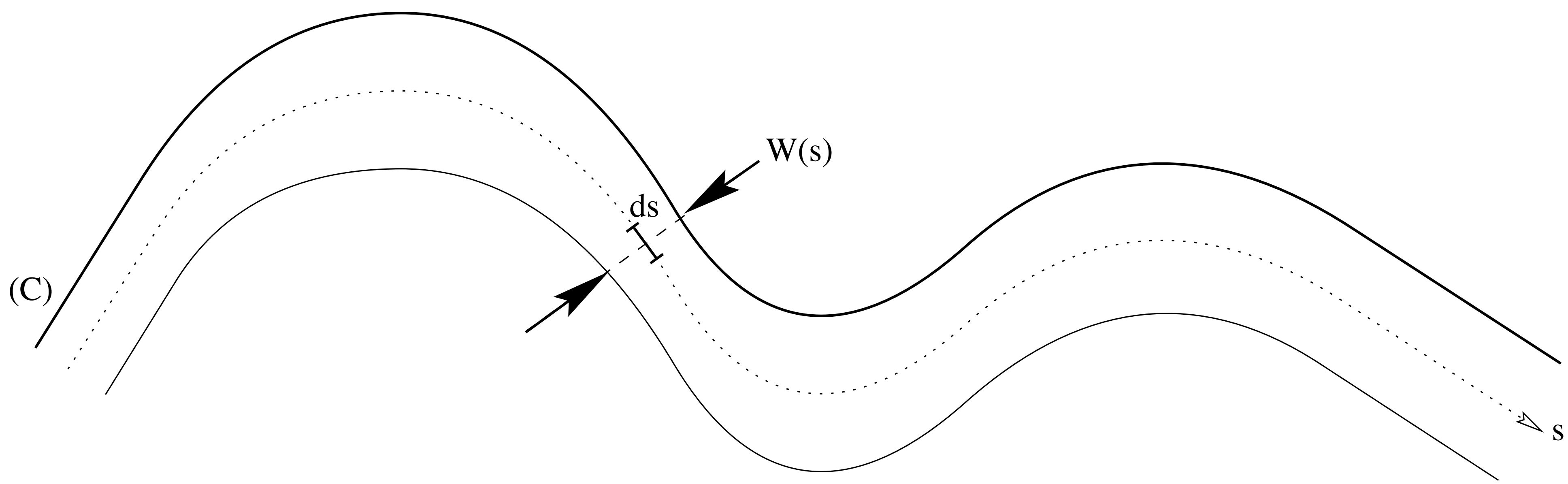
Steering law



$$
\begin{aligned}
T_n &= \overbrace{a + b\frac{nh}{w}}^{\text{Vertical}} + \overbrace{a + b\frac{w}{h}}^{\text{Horizontal}} \\
&= 2a + b\left(\frac{n}{x} + x\right) \quad \text{with:} \quad x = \frac{w}{h}
\end{aligned}
$$

Steering law on curved paths

C is the path parameterized by s:



average time to navigate through the path

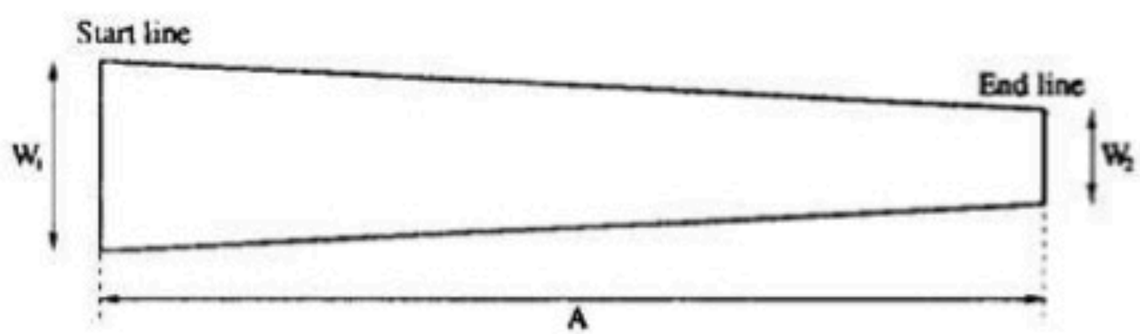
$$T = a + b \int_C \frac{ds}{W(s)}$$

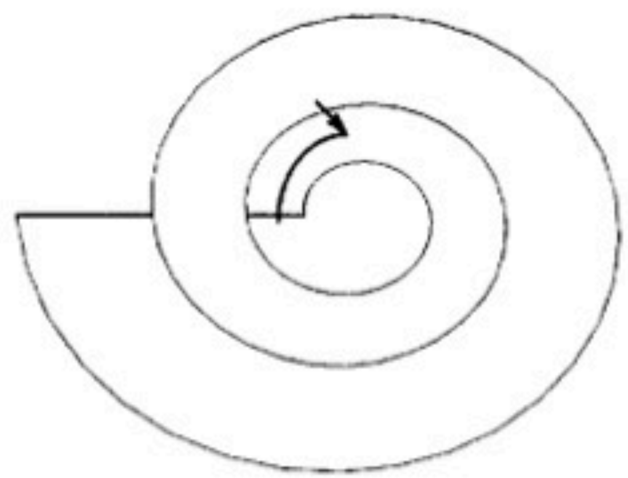
width of the path at s

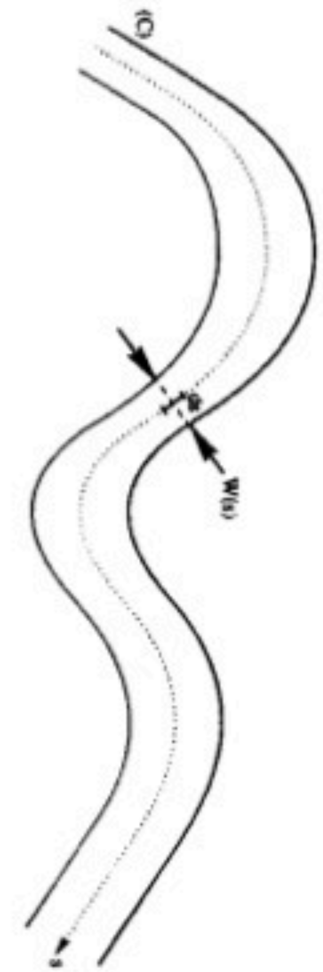
experimentally fitted constants

Steering Law applications

- Early work focused on car driving scenarios and models with straight tunnels
- Various example tunnel shapes have been explored







Laws of Interaction Design

- Moore’s law
- Buxton’s law
- Fitts’ law
- Steering law
- Guiard’s Kinematic chain
- Hick’s law
- Law of practice
- Murphy’s law

A human capability

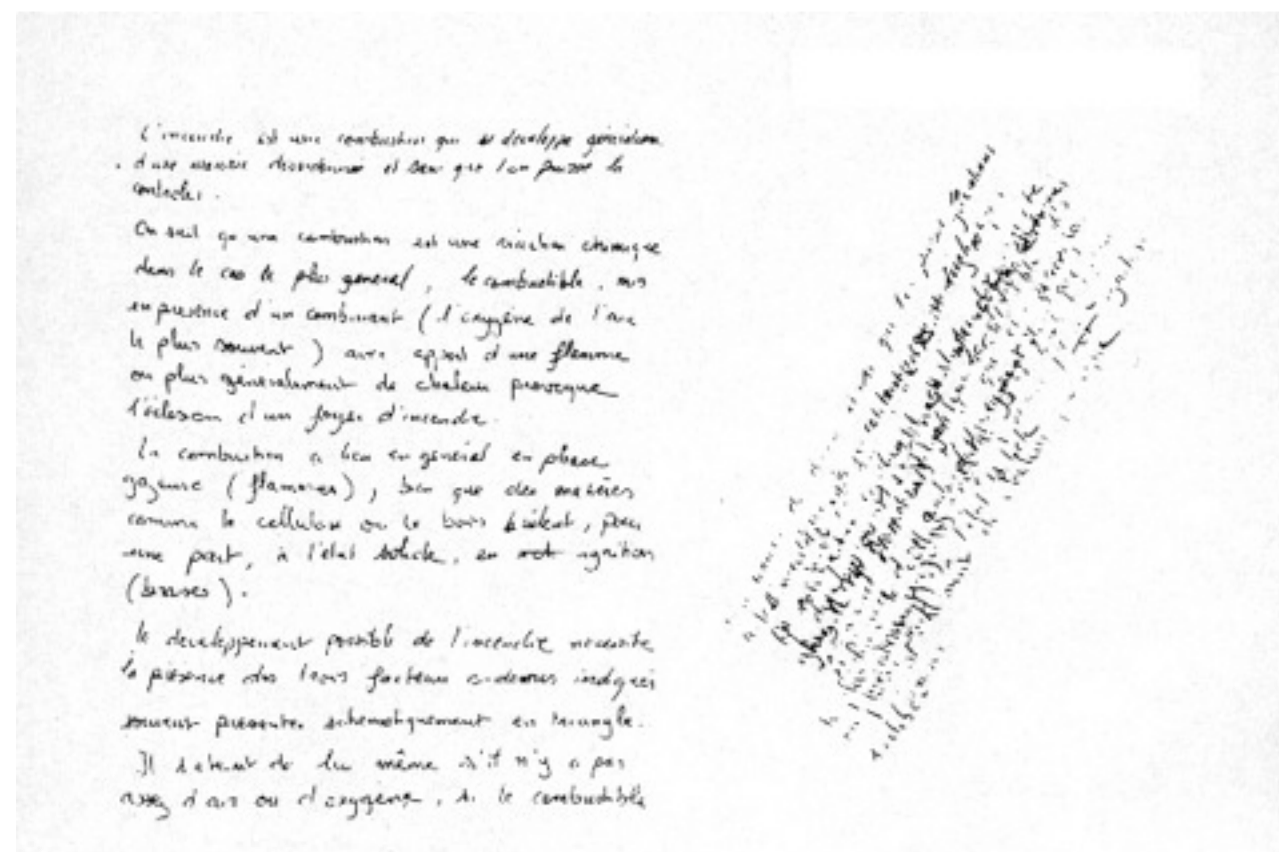
From The Two-Handed Desktop Interface: Are We There Yet? [MacKenzie & Guiard, 2001]

Guiard’s Kinematic Chain

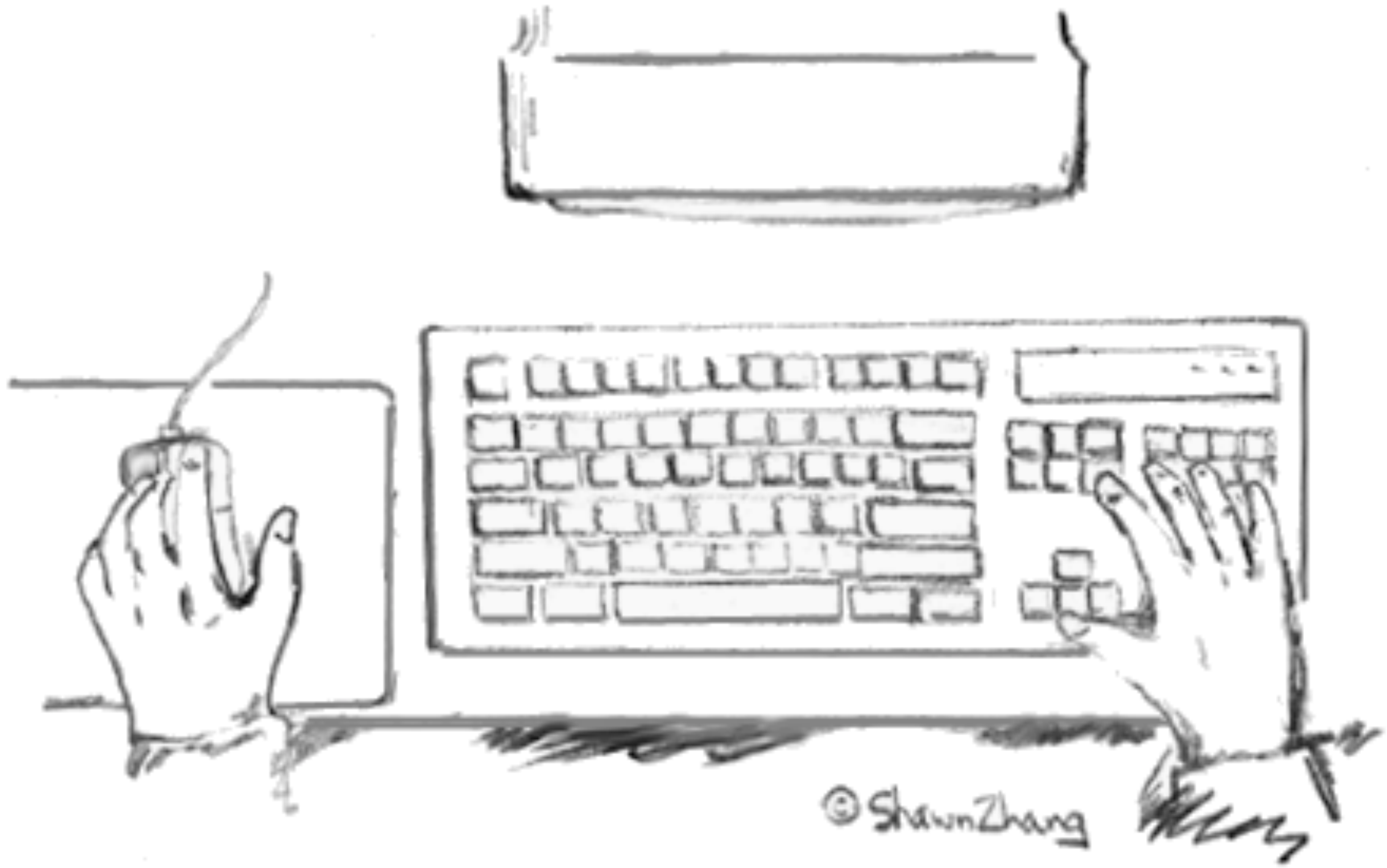
“Under standard conditions, the spontaneous writing speed of adults is **reduced** by some **20%** when instructions **prevent the non-preferred hand** from manipulating the page”

Non-dominant hand provides a frame of reference for the dominant hand

- Non-dominant hand operates at a coarse temporal and spatial scale;
- Dominant hand operates at a fine temporal and spatial scale



Two handed-interaction at the desktop



From The Two-Handed Desktop Interface: Are We There Yet? [MacKenzie & Guiard, 2001]

Laws of Interaction Design

- Moore’s law
- Buxton’s law
- Fitts’ law
- Steering law
- Guiard’s Kinematic chain
- Hick’s law
- Law of practice
- Murphy’s law

Hick's law

Given **n** equally **probable choices**,
the average reaction **time** T required
to choose among them is:

binary search strategy

$$T = b \cdot log_2(n + 1)$$

Time

Coefficient

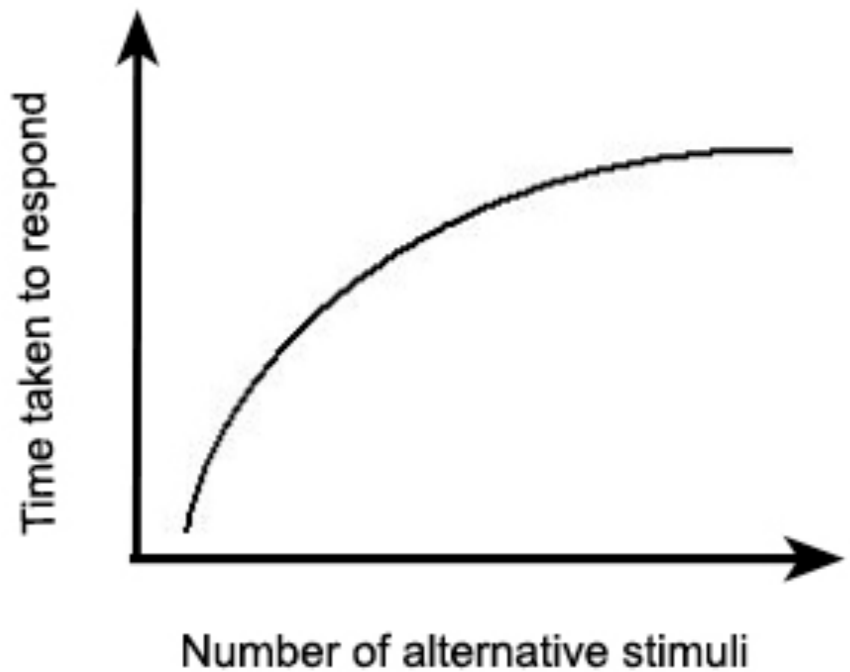
Choices

Hick Law Examples

http://www.hier-luebeck.de/wp-content/uploads/2010/09/StartMenueWindows7.jpg

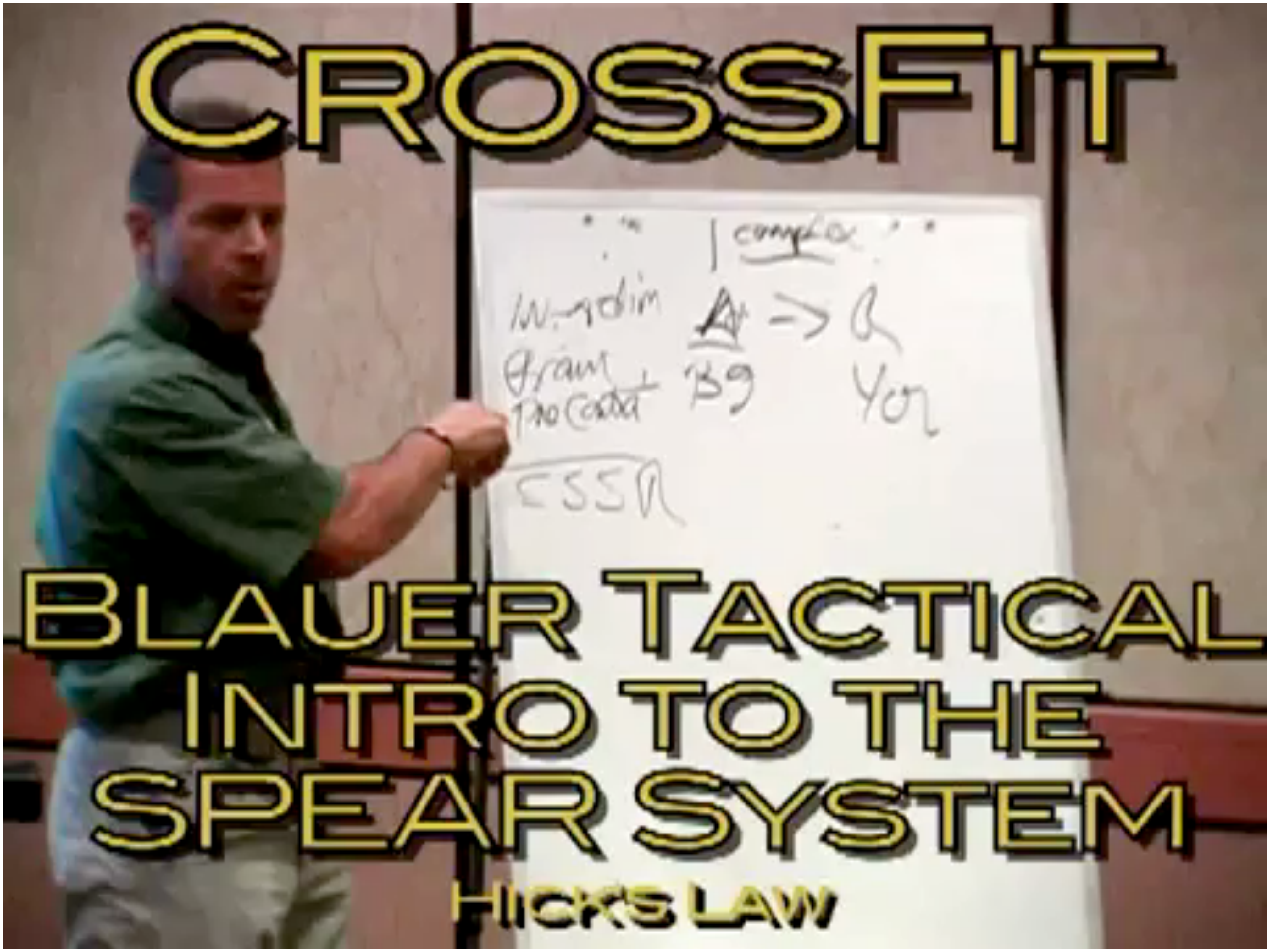
http://www.photosophic.com/iphone_screen

Hick's law



$$T = b \cdot \log_2 (n + 1)$$

In another context, and slightly wrong ;-)...



Laws of Interaction Design

- Moore’s law
- Buxton’s law
- Fitts’ law
- Steering law
- Guiard’s Kinematic chain
- Hick’s law
- Law of practice
- Murphy’s law

The Power Law of Practice

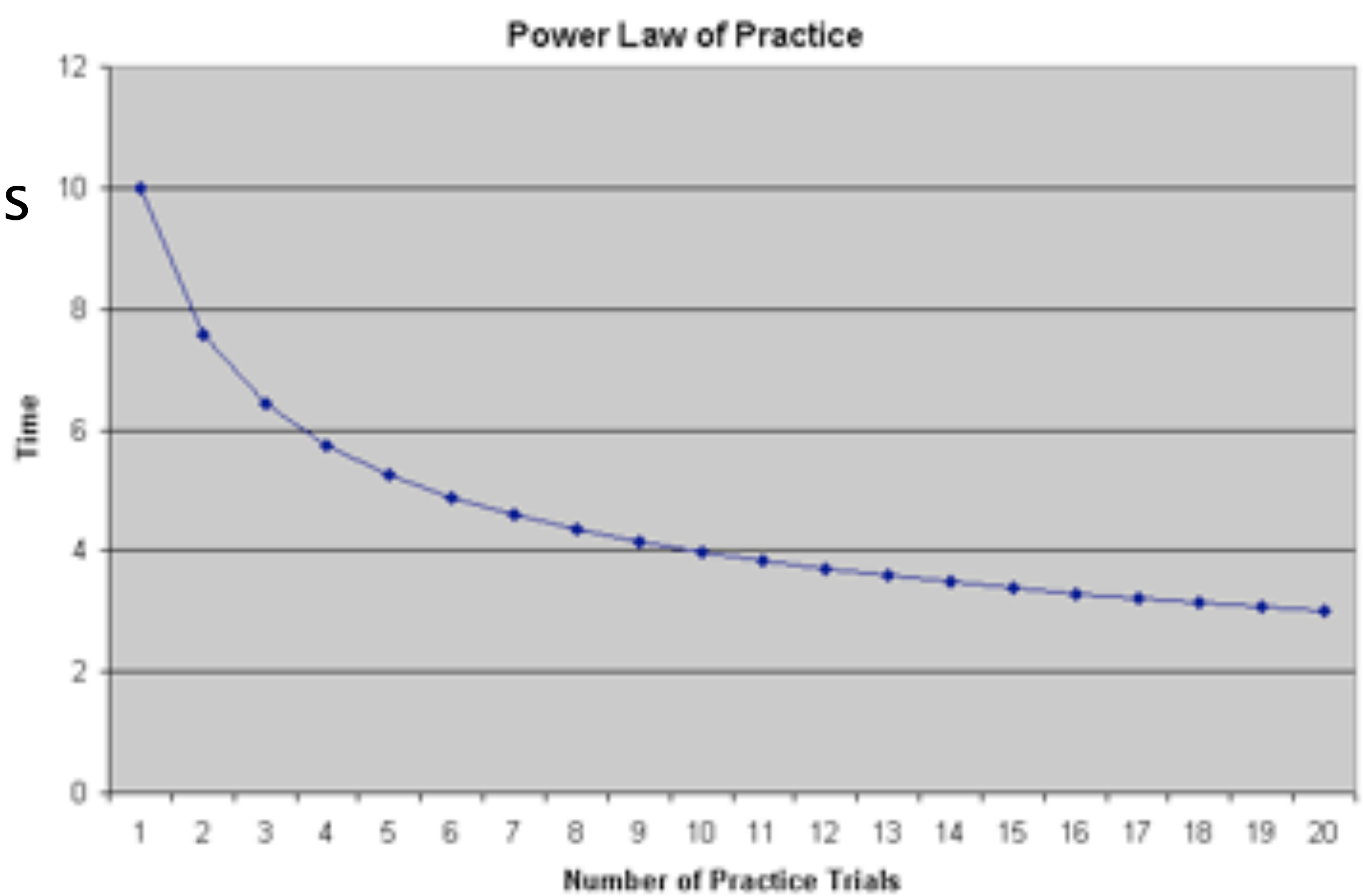
- When performing a task based on practice trials, people improve in speed at a decaying exponential rate.
- The time needed for a particular task decreases in proportion to the number of practice trials taken raised to a power of about a = –0.4
- The logarithm of the time needed for a particular task decreases linearly with the logarithm of the number of practice trials taken (this formulation is for the math geeks... ;-)

Completion time for trial n

Constants

$$T(n) = T(1)\, n^{a} + c$$

Completion time for trial 1



Laws of Interaction Design

- Moore’s law
- Buxton’s law
- Fitts’ law
- Steering law
- Hick’s law
- Guiard’s Kinematic chain
- Law of practice
- Murphy’s law

Murphy’s law

“Whatever can go wrong, will go wrong.“

[Edward Aloysius Murphy Jr., 1949]

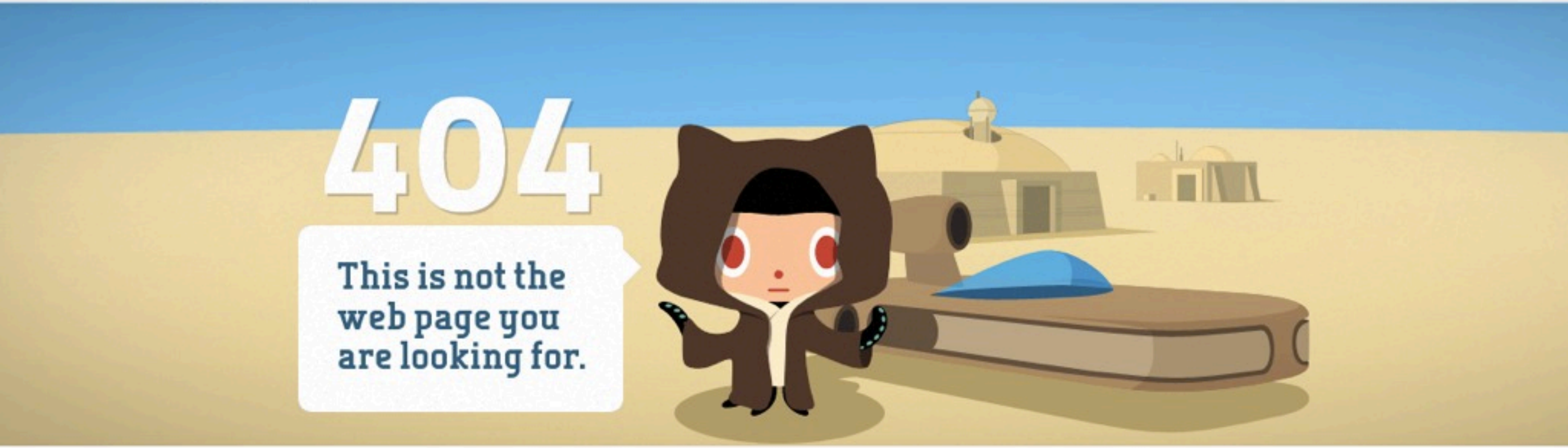
“If there's more than one possible outcome of a job or task, and one of those outcomes will result in disaster or an undesirable consequence, then somebody will do it that way.“

Implications of Murphy's law

- Prepare for human errors, wrong input etc.
  - do sanity checks in dialogs
  - provide useful defaults
  - make serious mistakes hard

- When building stuff, provide extra time for:
  - mistakes in manufacturing
  - non-functioning tools
  - faulty material
  - misunderstandings

github Search... Explore Gist Blog Help aurelient



GitHub
- About
- Blog
- Features
- Contact & Support
- Training
- GitHub Enterprise
- Site Status

Tools
- Gauges: Analyze web traffic
- Speaker Deck: Presentations
- Gist: Code snippets
- GitHub for Mac
- GitHub for Windows
- Issues for iPhone
- Job Board

Extras
- GitHub Shop
- The Octodex

Documentation
- GitHub Help
- Developer API
- GitHub Flavored Markdown
- GitHub Pages

github SOCIAL CODING

Terms of Service Privacy Security

Powered by the Dedicated Servers and Cloud Computing of Rackspace Hosting®

Anti Fitts law