Interaction Design

Chapter 5 (May 14th, 2014, 9am–12pm):

Laws of Interaction Design

Why laws? What for?

- There are 3 good reasons for laws in ID:

- **describe**: understand what is going on
- **predict** what will happen if…
- **generate** new alternatives

- We will learn laws about:

- **computers**
- **human motor skills**
- **human cognition**

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 components 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. "Cramming more components onto integrated circuits". Electronics, Volume 38, Number 8, April 19, **1965**.]

Moore's law illustration

Microprocessor Transistor Counts 1971-2011 & Moore's Law
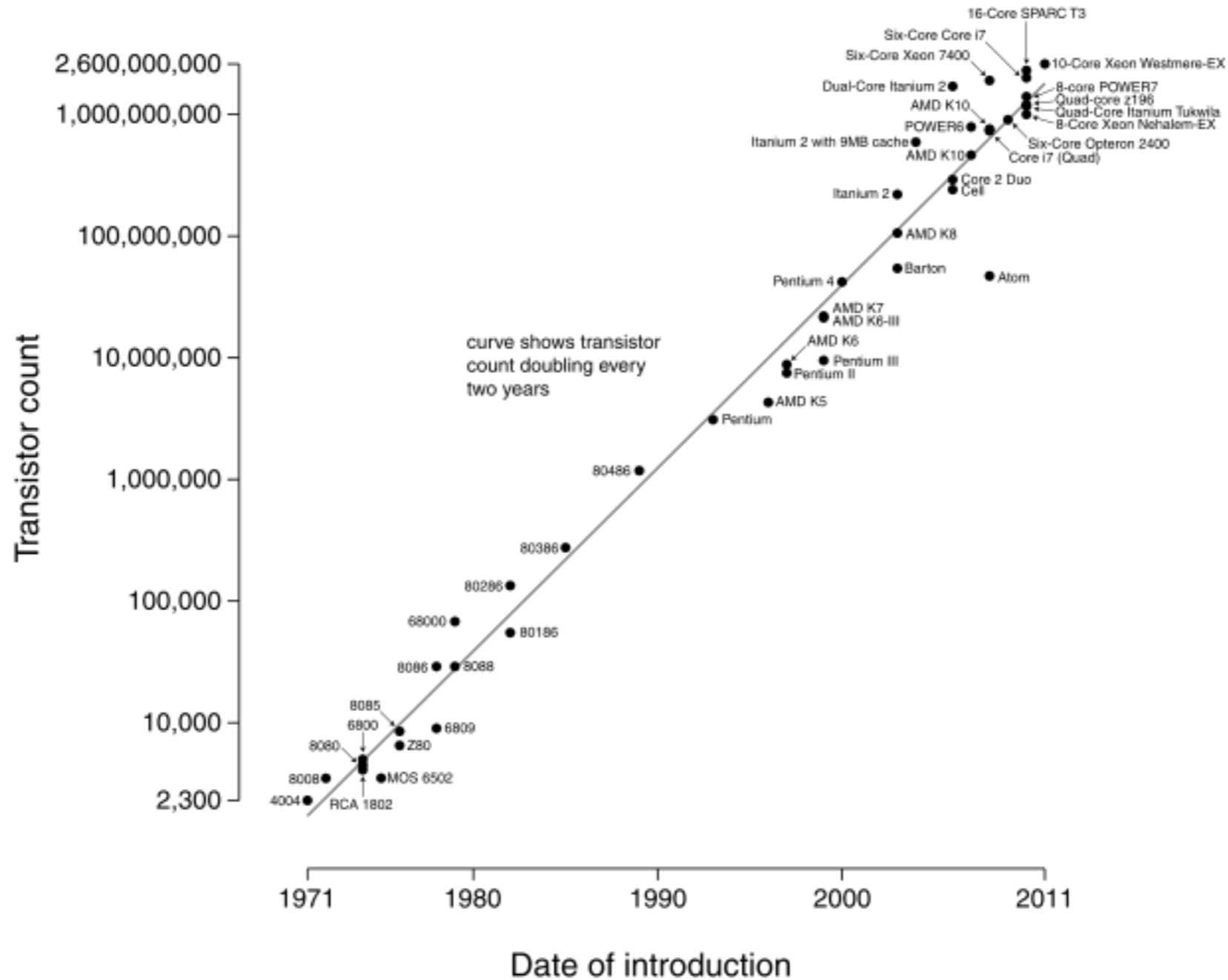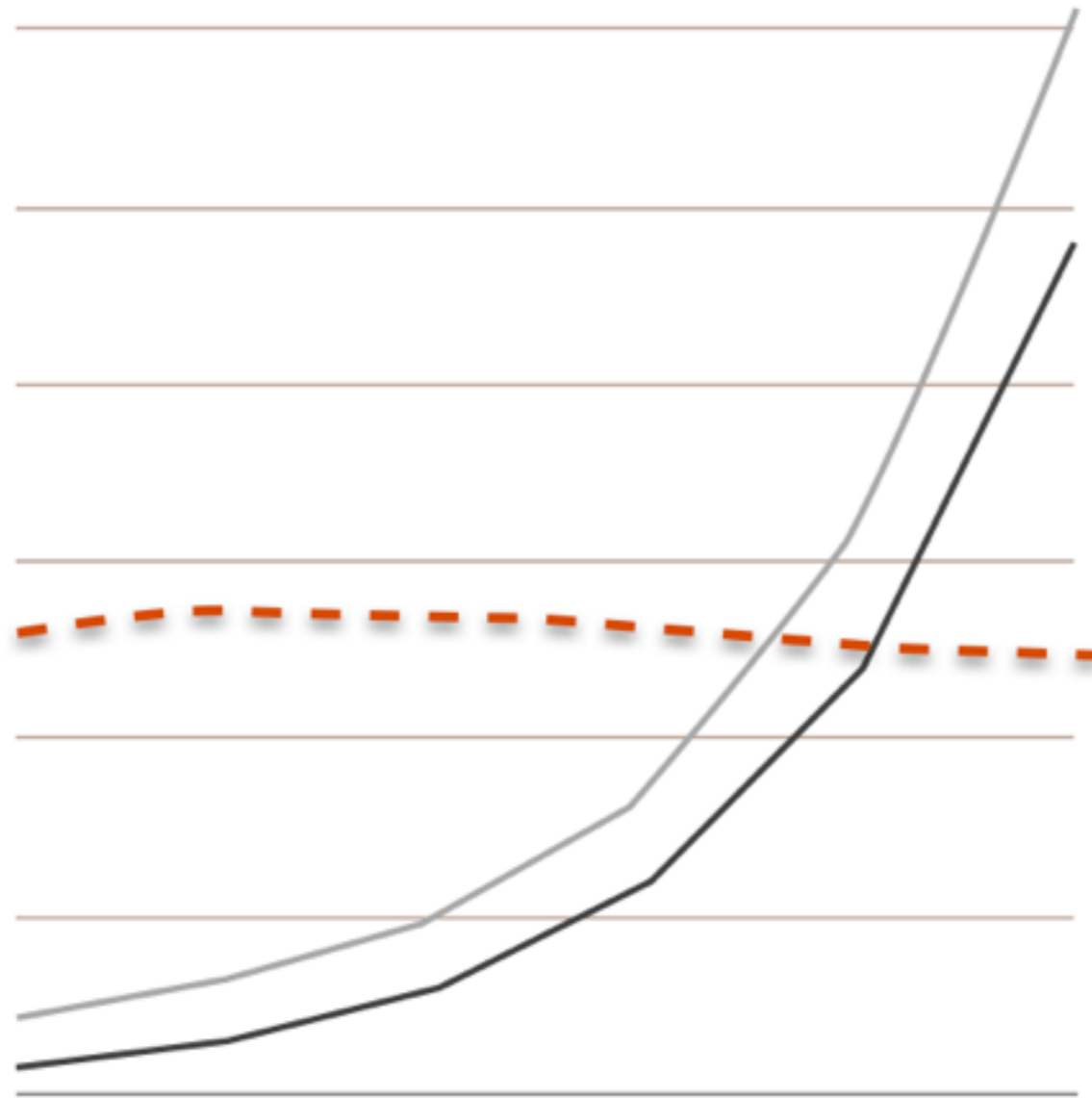
Moore's law implications

Don't worry too much about:

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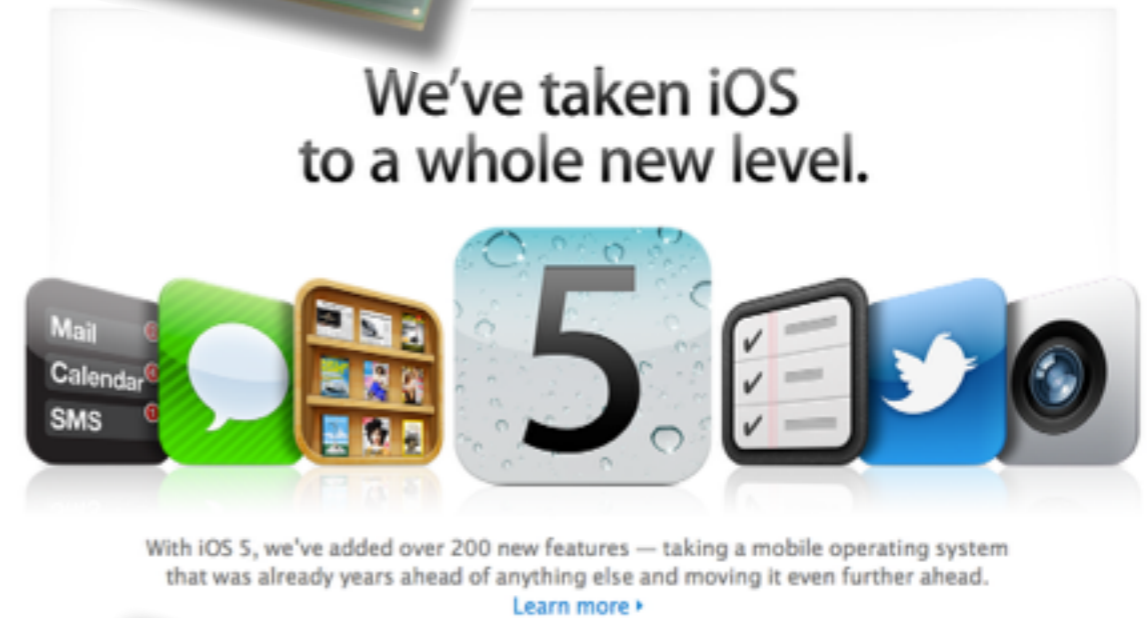- ‣ battery life (?)

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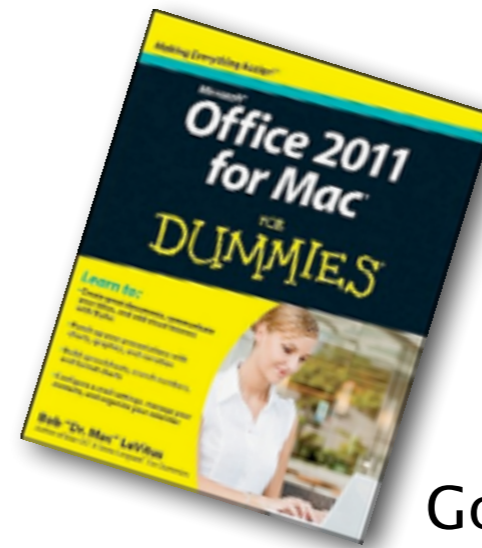
- Hick's law

- Law of practice

- Murphy's law

Buxton's law

Moore's law

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With iOS 5, we've added over 200 new features — taking a mobile operating system
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Buxton's law

Office 2011
for Mac
FOR
DUMMIES

God's law

http://www.billbuxton.com/LessIsMore.pdf
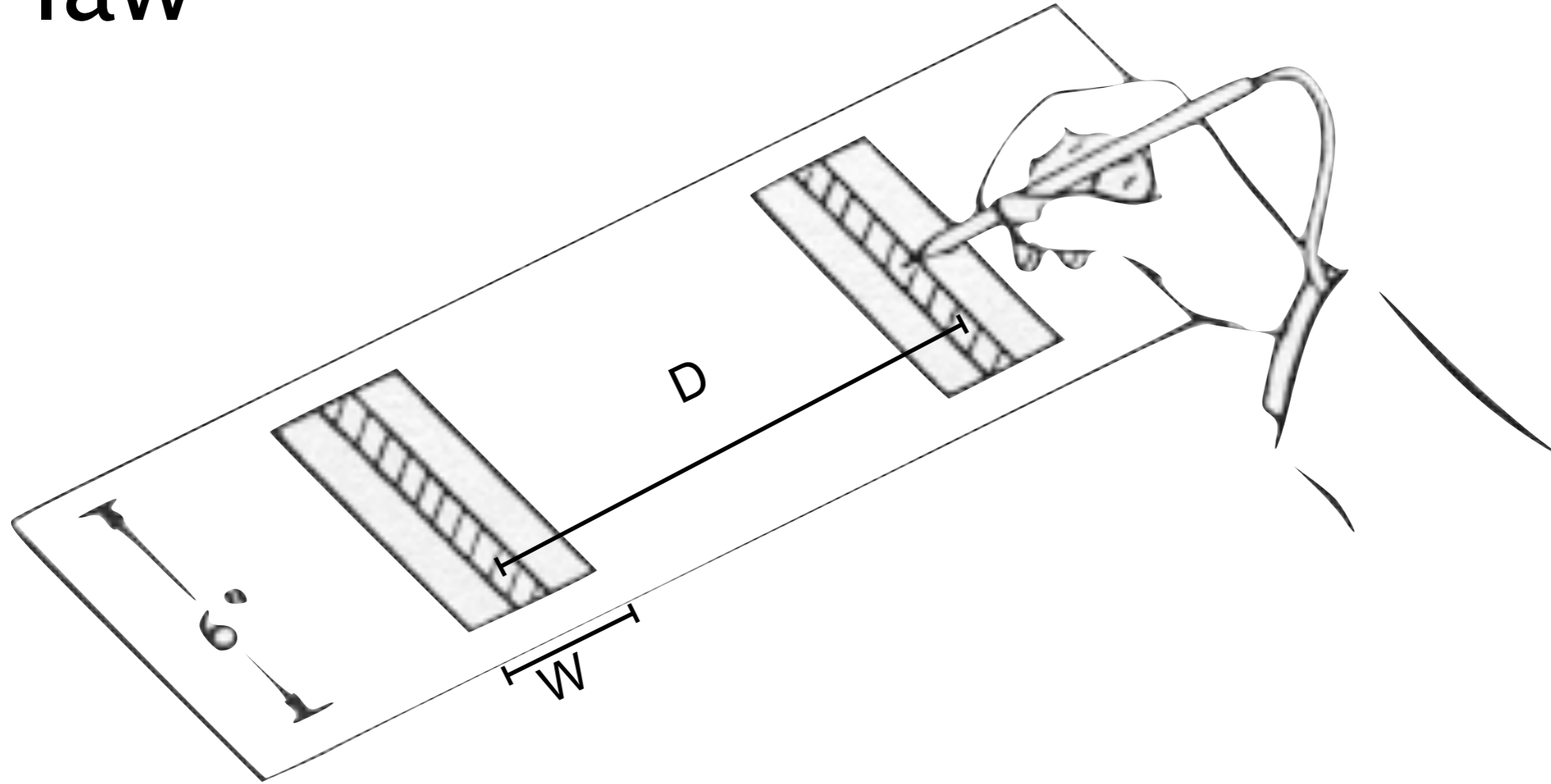
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Fitts' law

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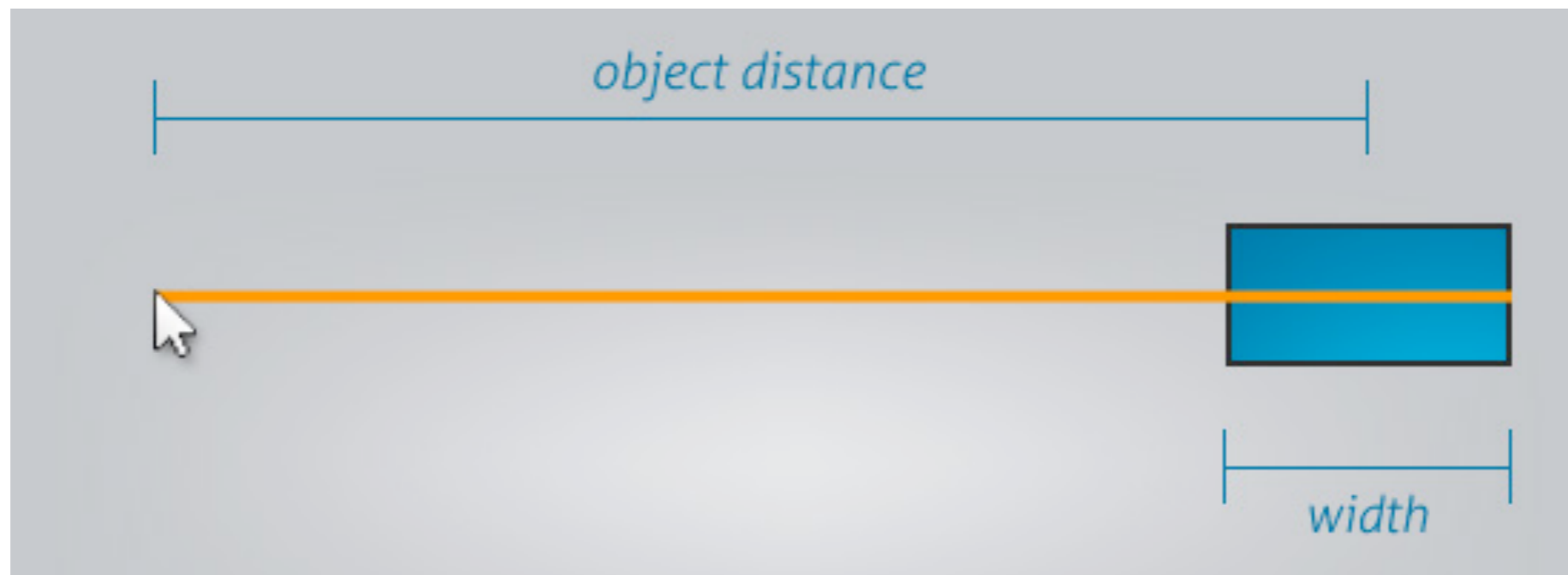
Fitts' law

$$MT = a + b * ID = a + b * \log_2(\frac{D}{W} + 1)$$

Distance

Width

Coefficients
a: Intercept
b: Slope

Movement Time
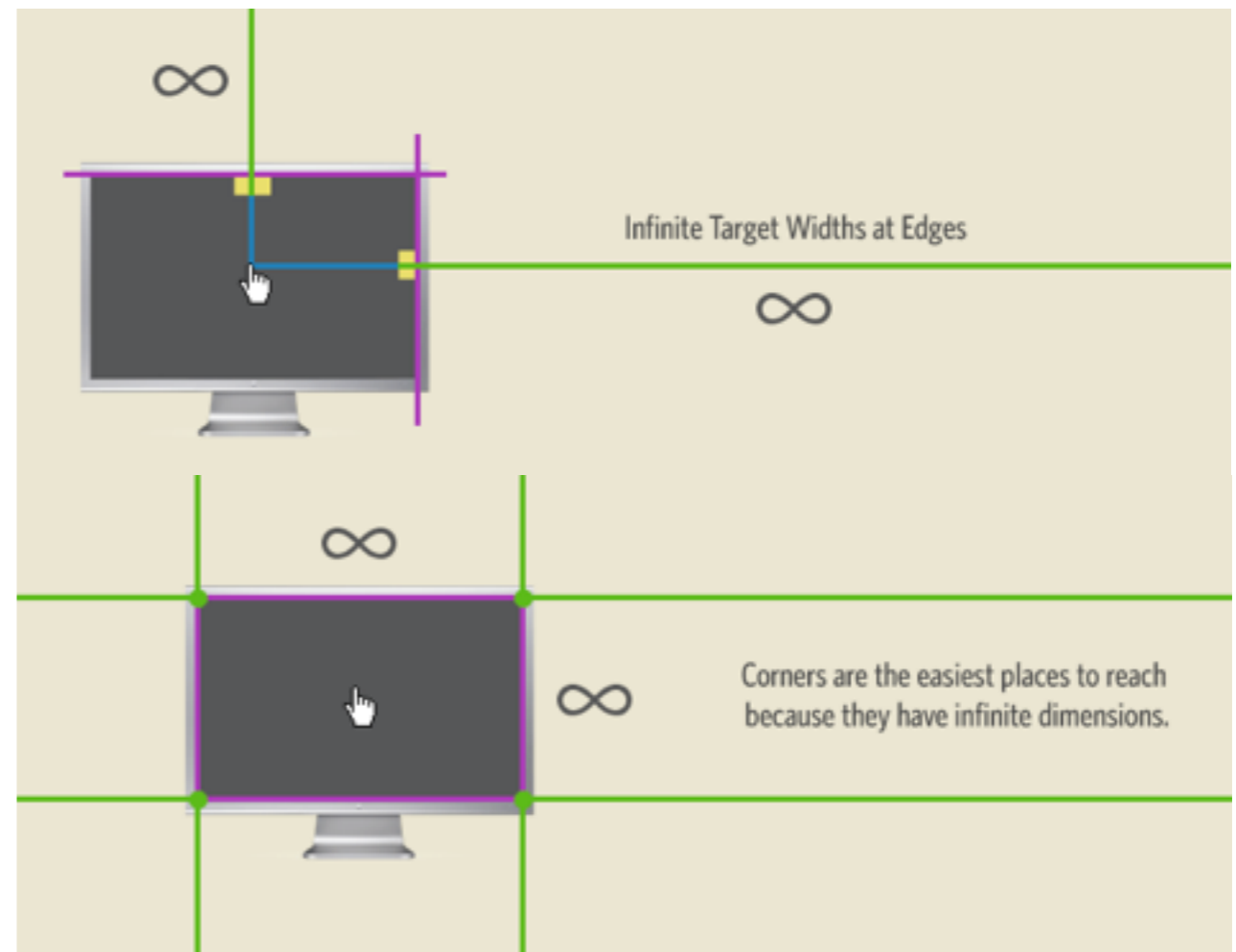
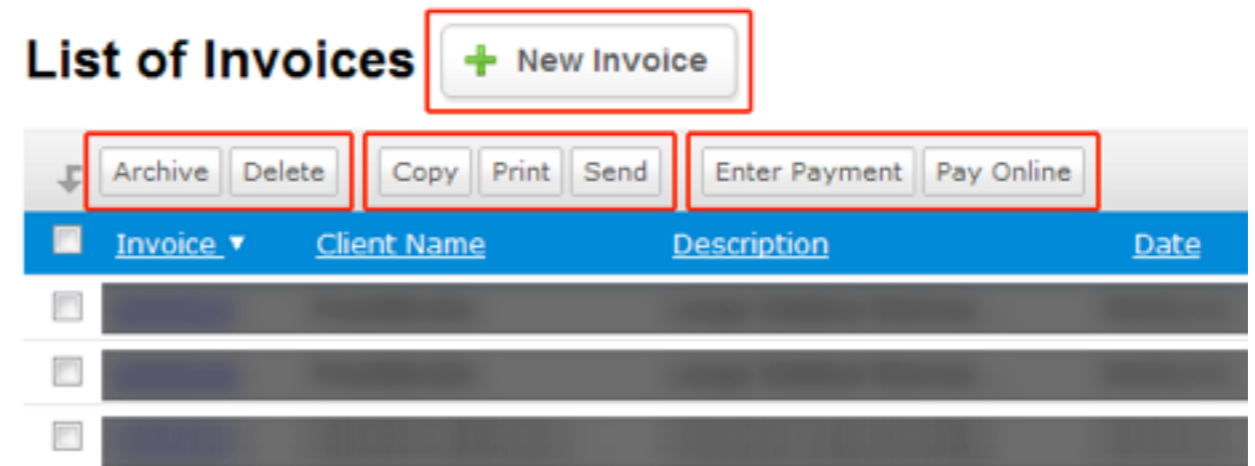# Speed–accuracy tradeoff:

Implications of Fitts' law

Larger targets are easier to hit
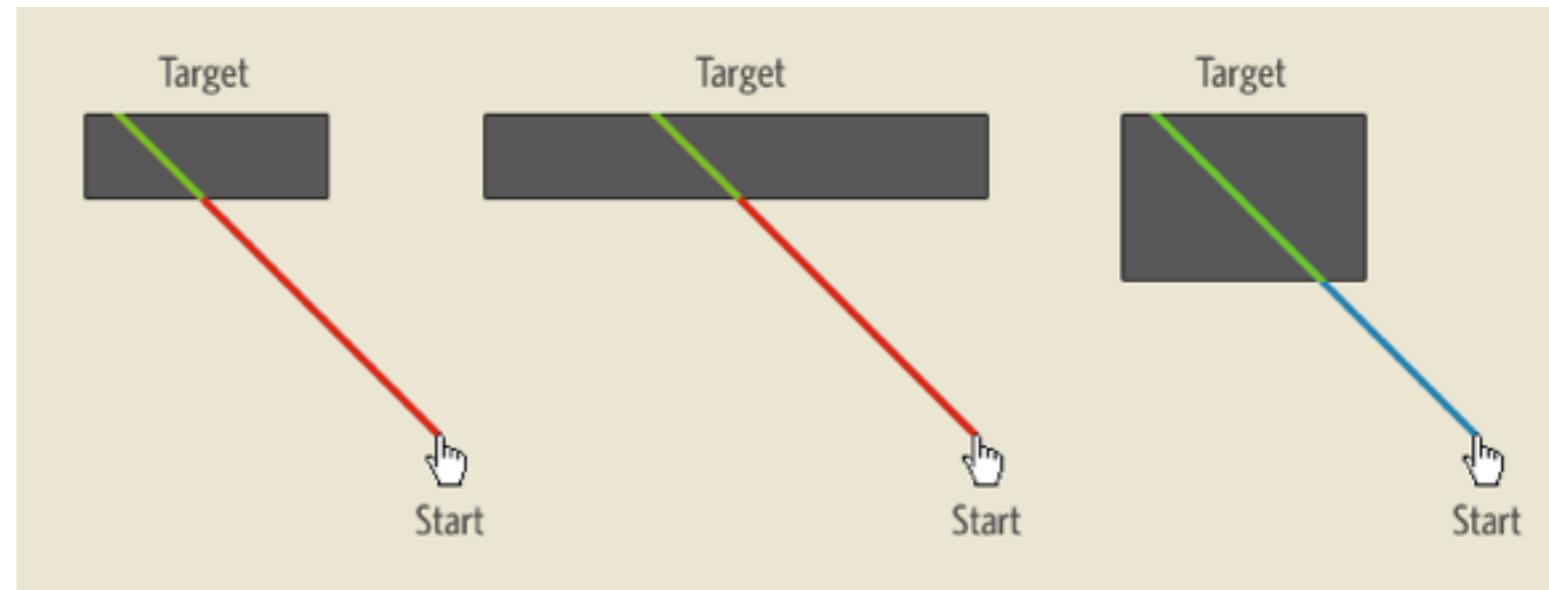-> maximize button size

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

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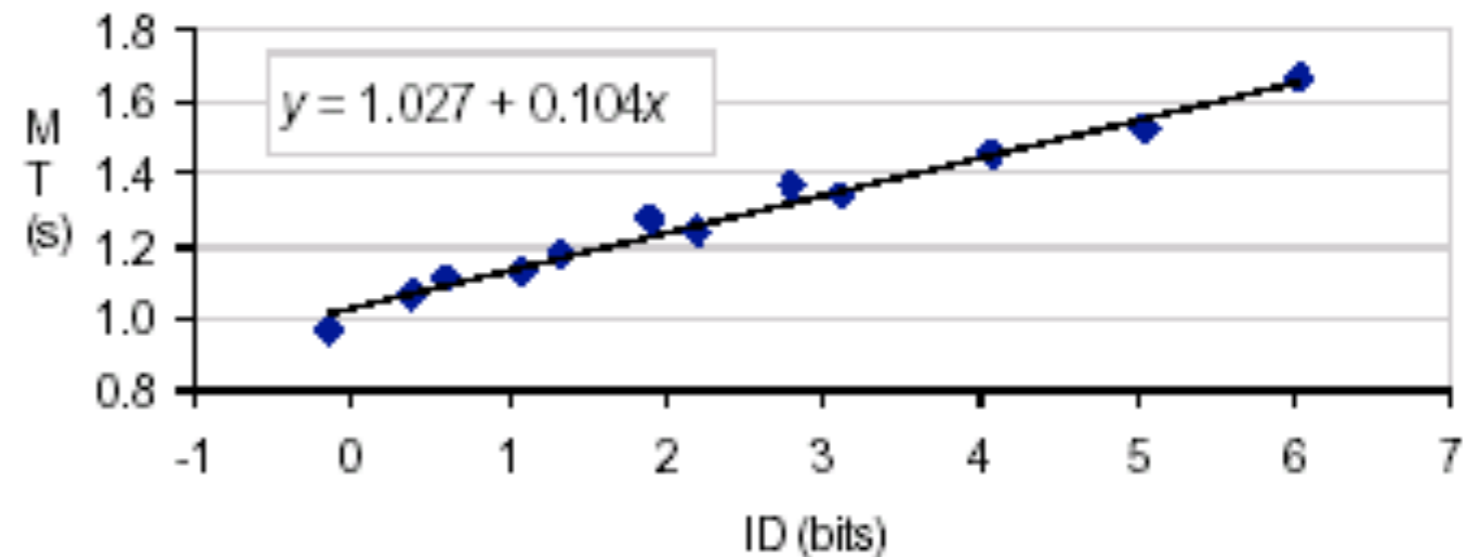-> leverage screen borders
-> leverage corners

Bigger Is Not Always Better

Movement direction to target

Logarithmic improvements
with size

$y = 1.027 + 0.104x$

MacKenzies reevaluation of Card's Fitts' Experiment for text selection

Stu Card

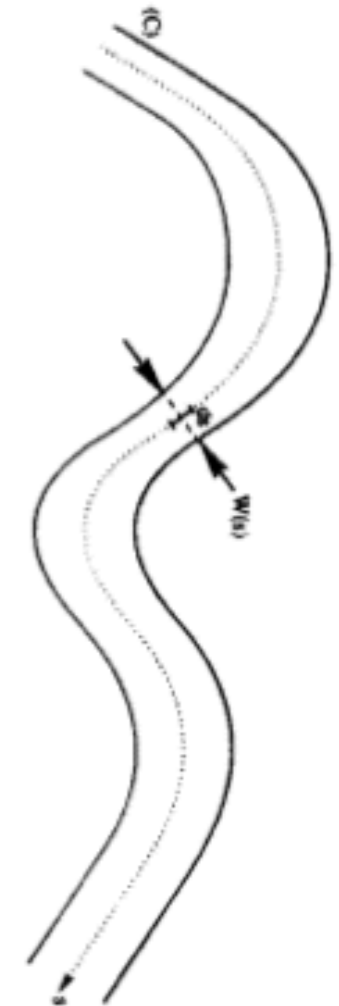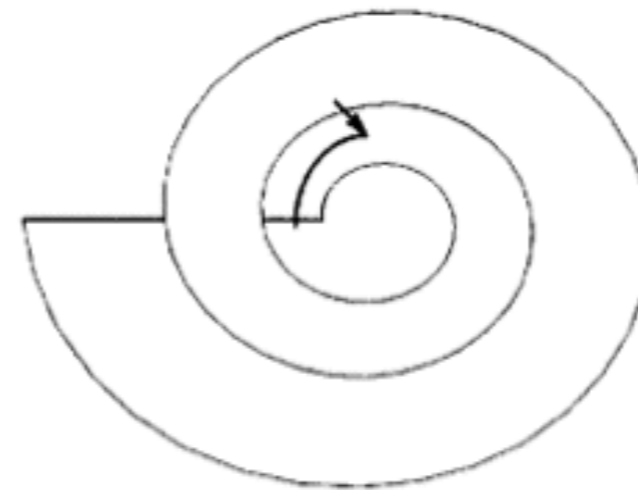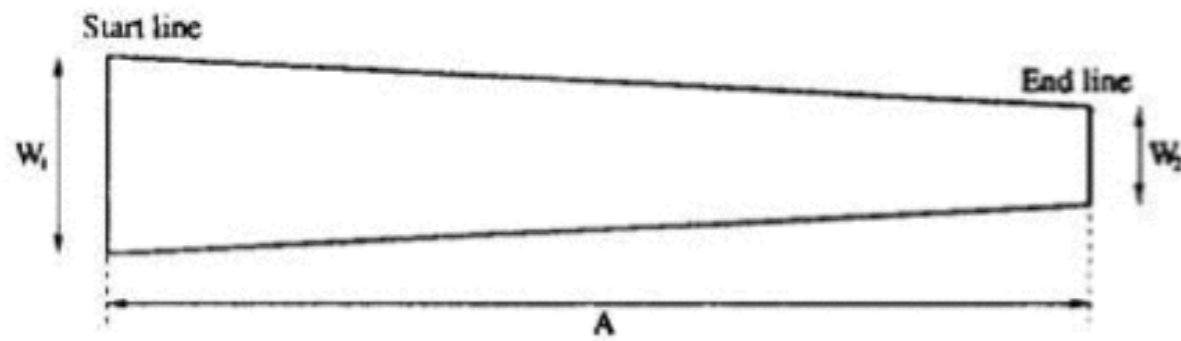A Supporting Science

Interview March 2002

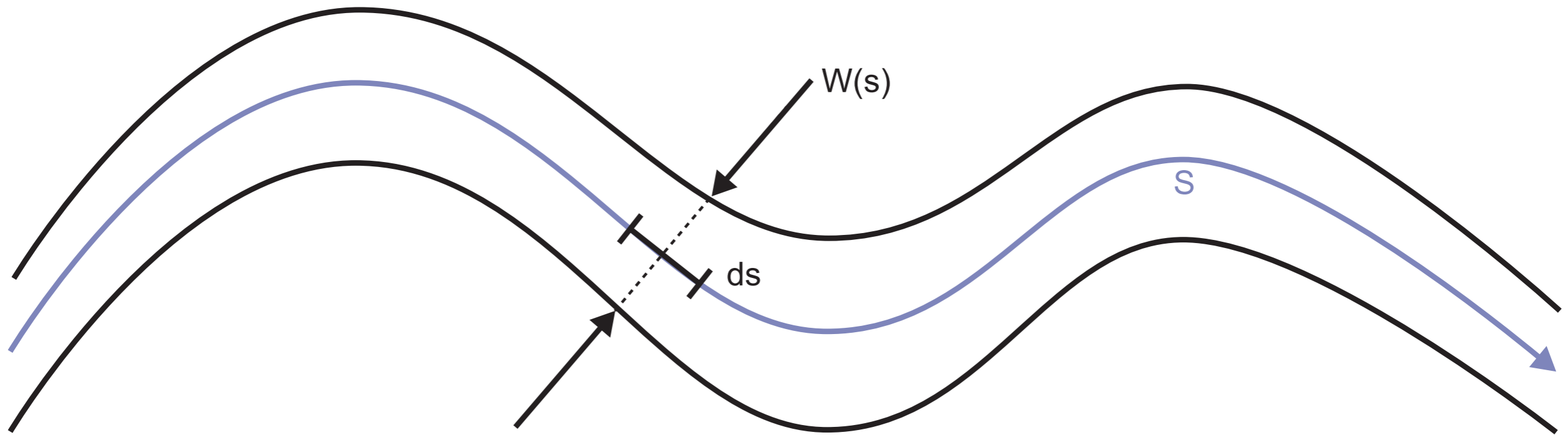# Laws of Interaction Design

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Why is it called Steering Law??

- Early work focused on car driving scenarios and models with straight tunnels

- Various example tunnel shapes have been explored
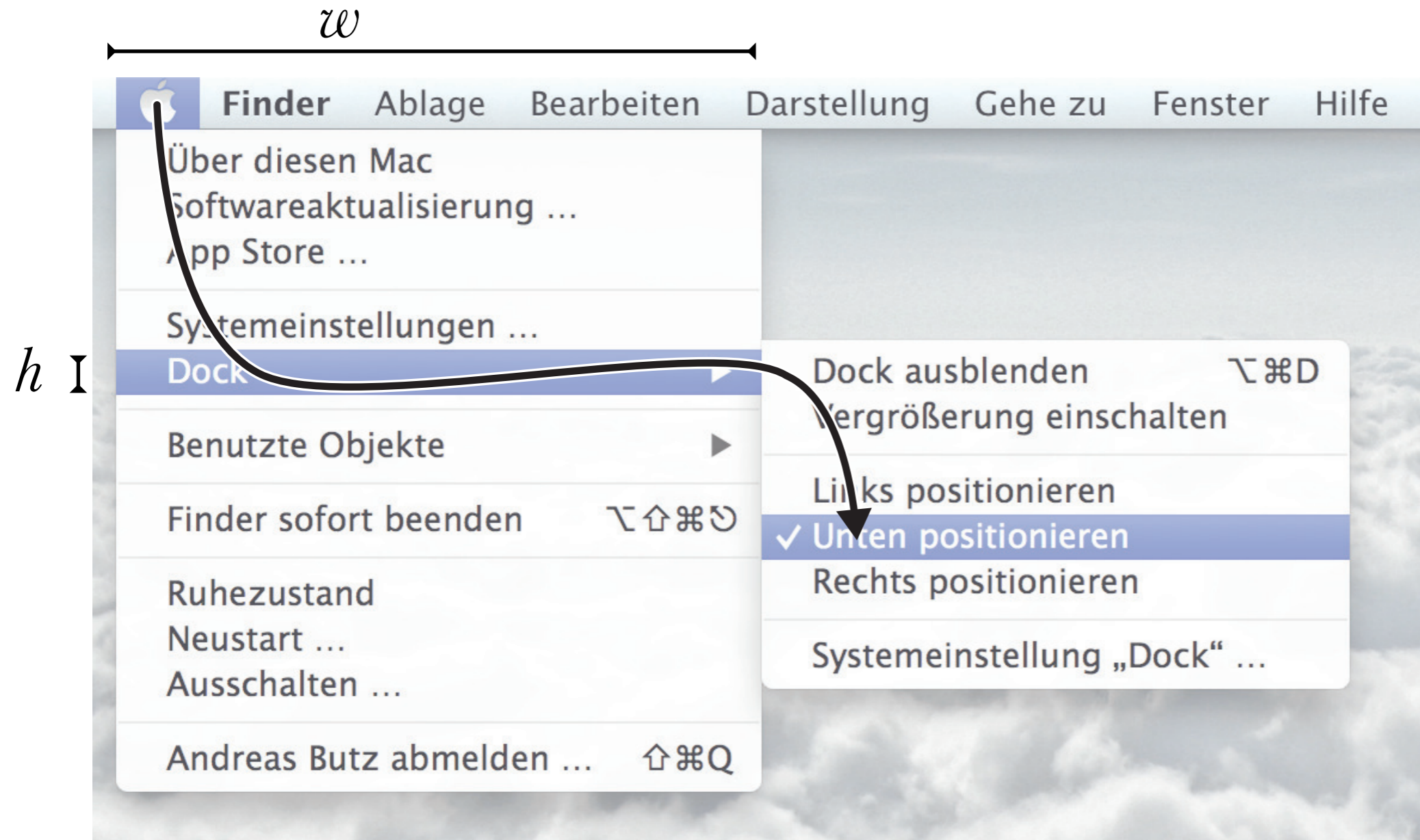
Steering law on curved paths

average time to navigate through the path

$$T = a + b * \int_S \frac{1}{W(s)} \, \mathrm{d}s$$

experimentally fitted constants

width of the path at s

Example application of the steering law

$$T = \boxed{a_1 + b_1 * \log_2(\frac{nh}{h} + 1)} + \boxed{a_2 + b_2 * \frac{w}{h}} + ...$$

vertical: Fitts' law   horizontal: steering law

Mini-discussion

How can we use fitts' law and steering law to make a computer game more challenging?

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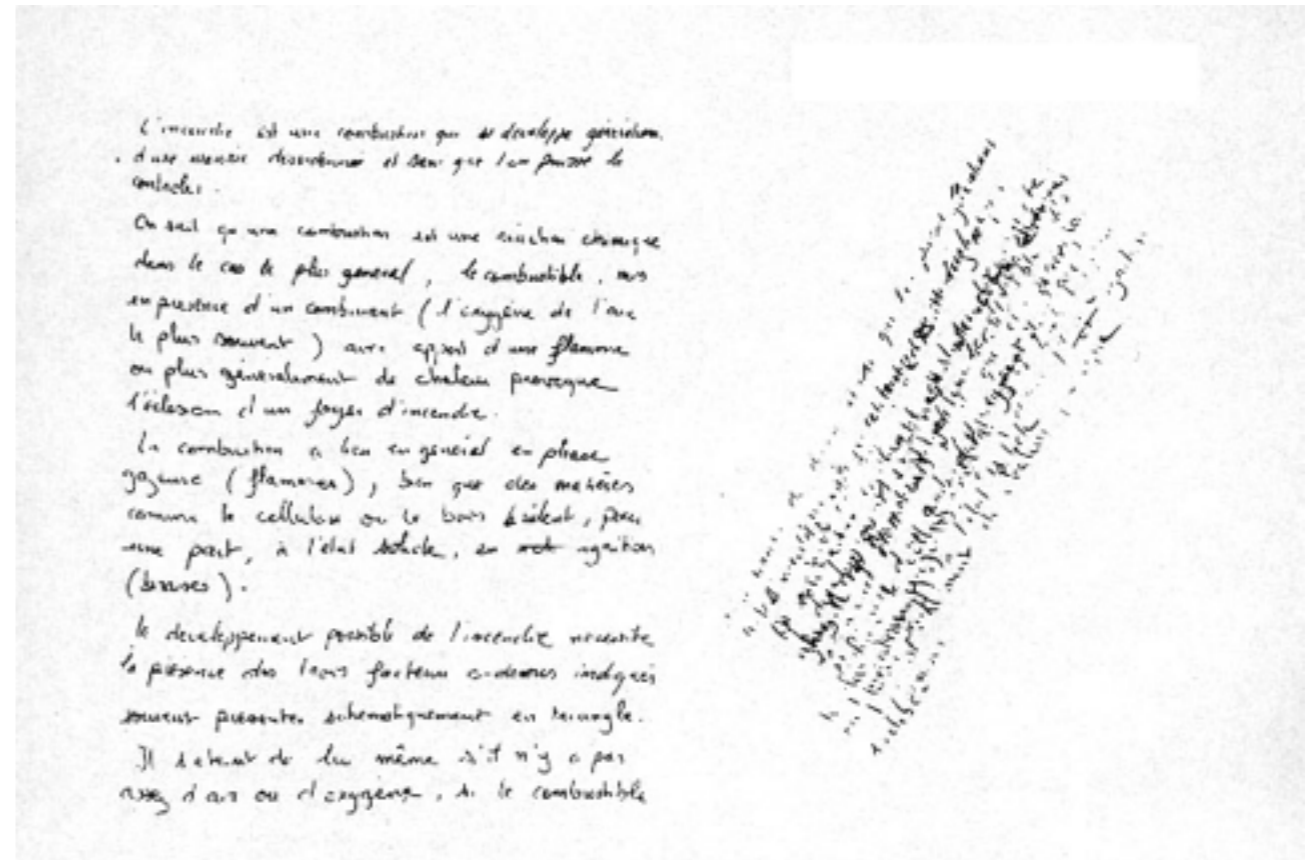
- Murphy's law

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

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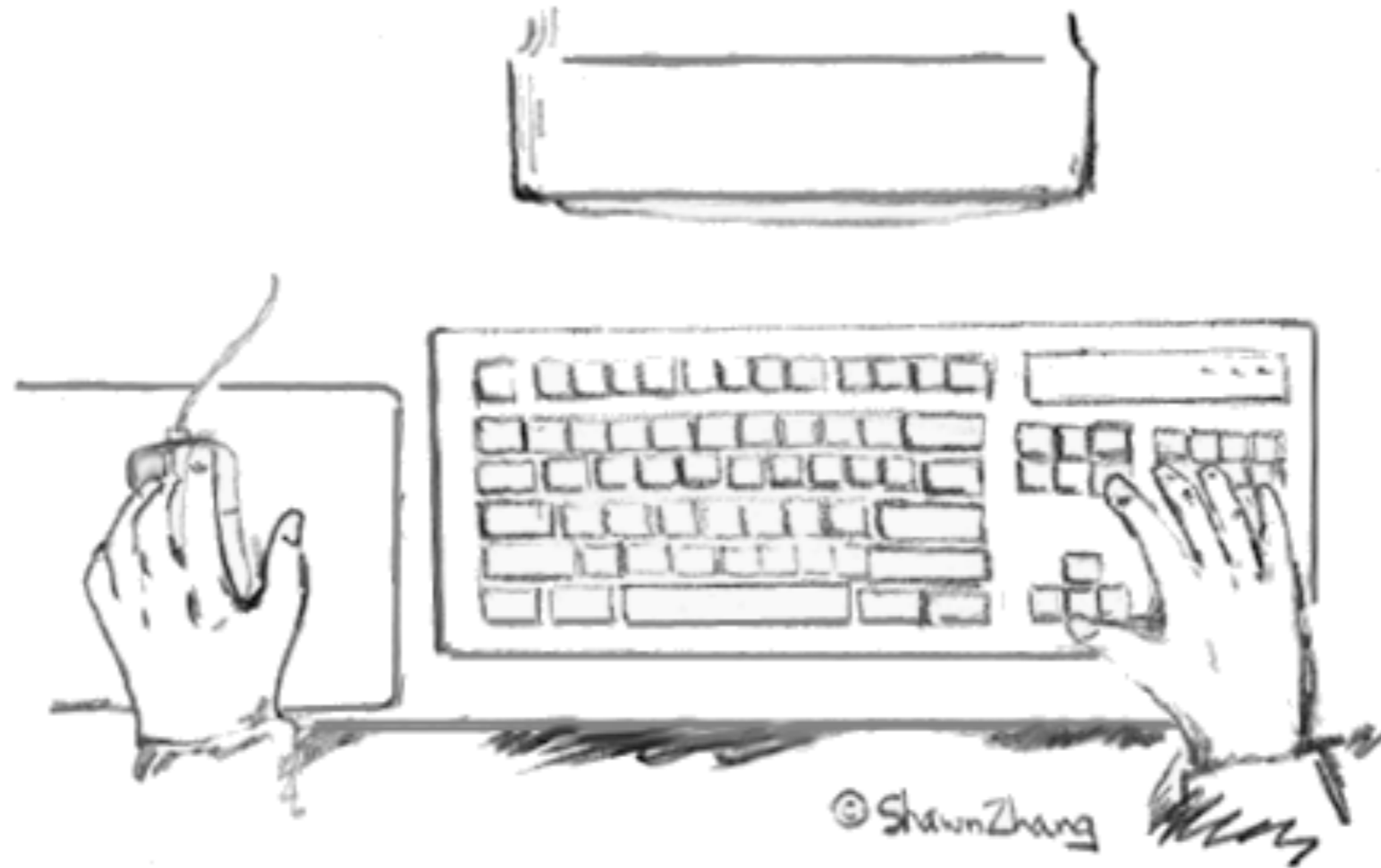
From The Two-Handed Desktop Interface: Are We There Yet? [MacKenzie & Guiard, 2001]

Mini-brainstorming

Which tasks in daily life follow a similar distribution of roles between the hands?
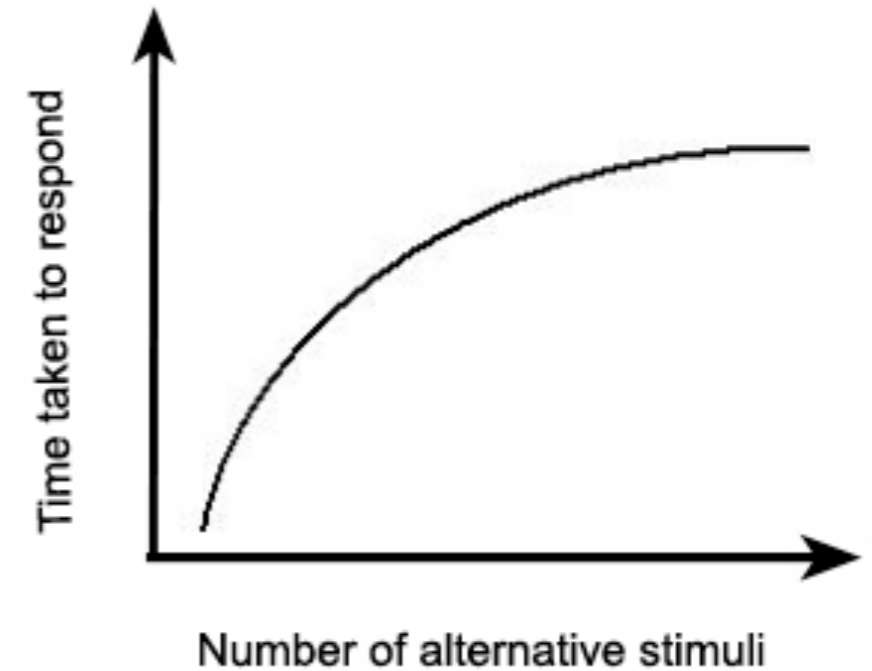
Which ones don't ???

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Hick's law

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

Time taken to respond / Number of alternative stimuli

binary search strategy

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

Coefficient   Choices

Hick's Law Examples (really? let's discuss!)

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

http://www.photosophic.com/iphone_screen

In another context, and slightly wrong ;–)...
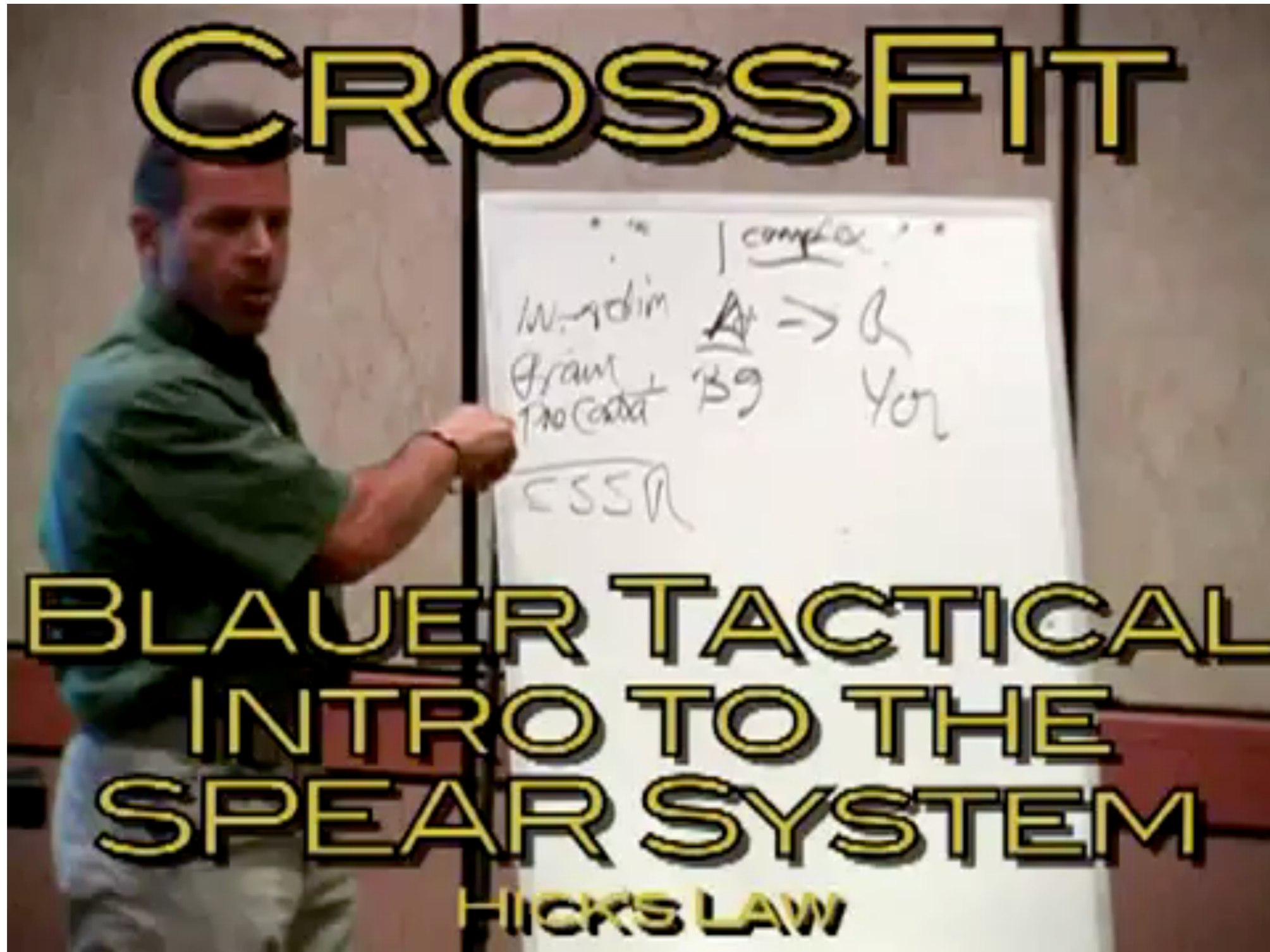
https://www.youtube.com/watch?v=w0hJveJ8Hp0

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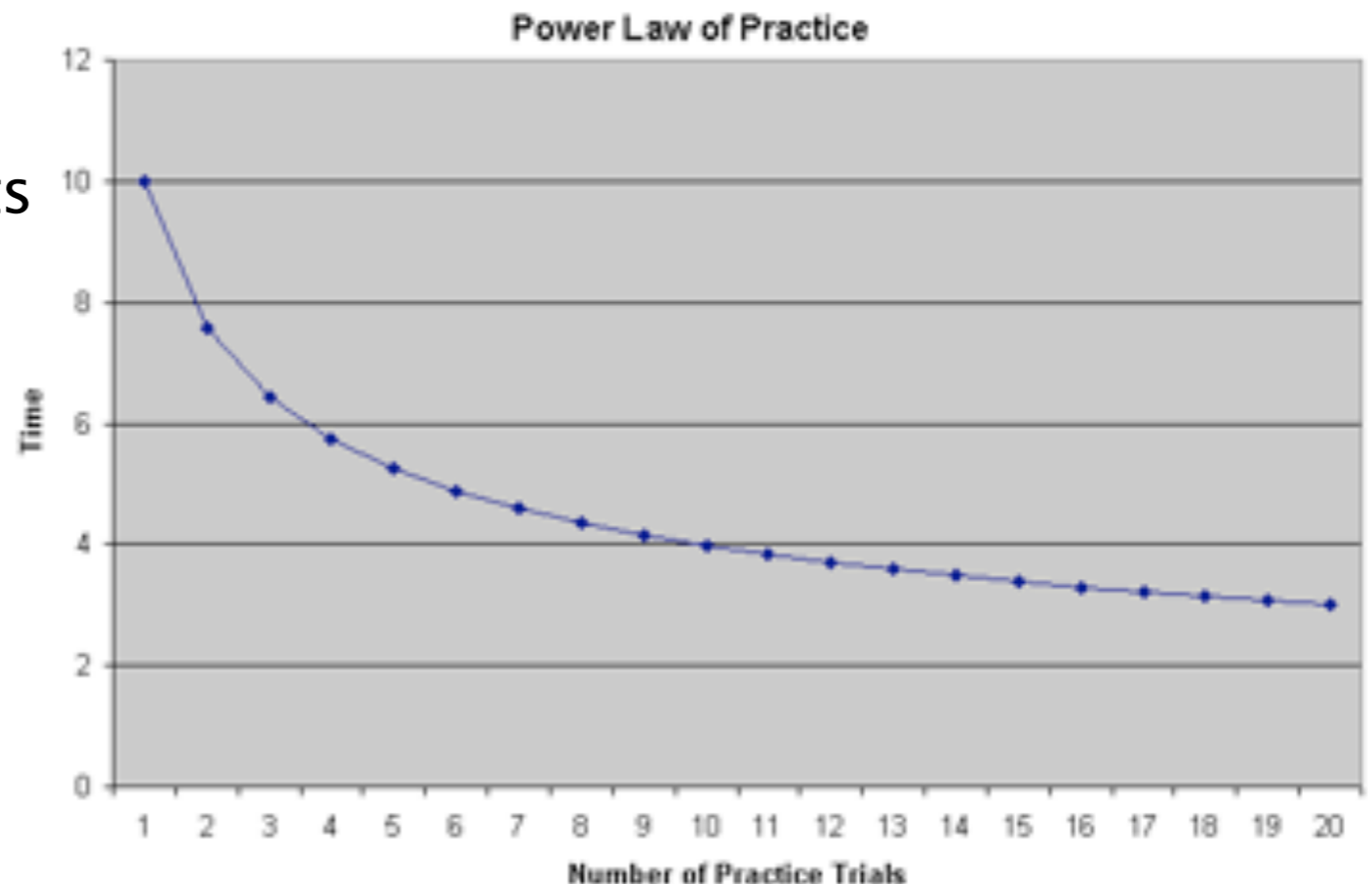- Murphy's law

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

Power Law of Practice

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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

404

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GitHub

About
Blog
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Contact & Support
Training
GitHub Enterprise
Site Status

Tools

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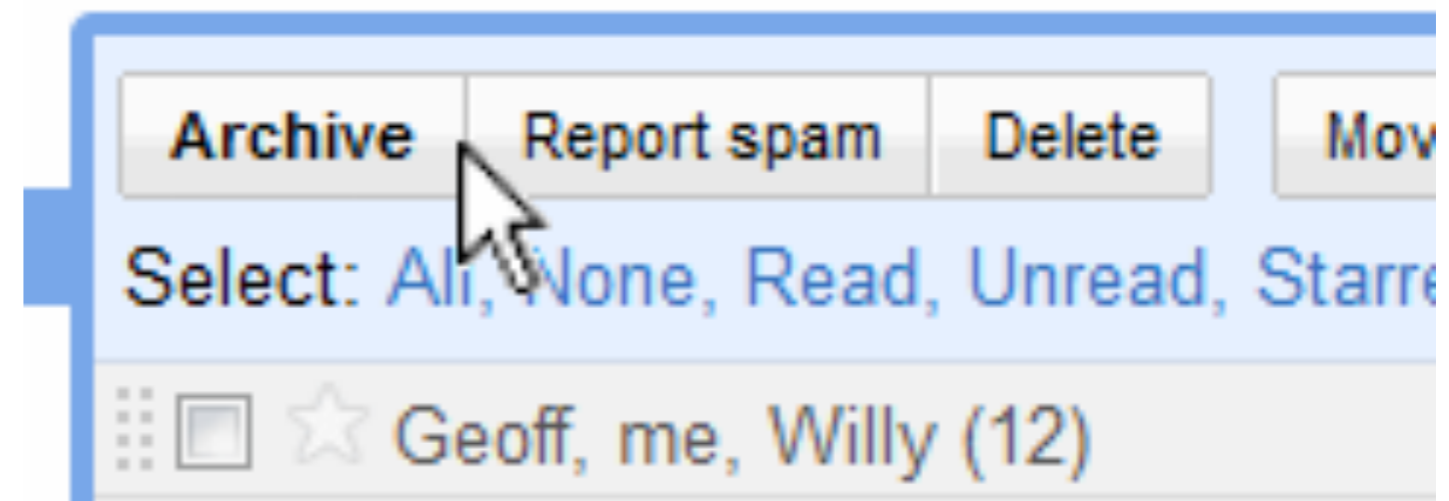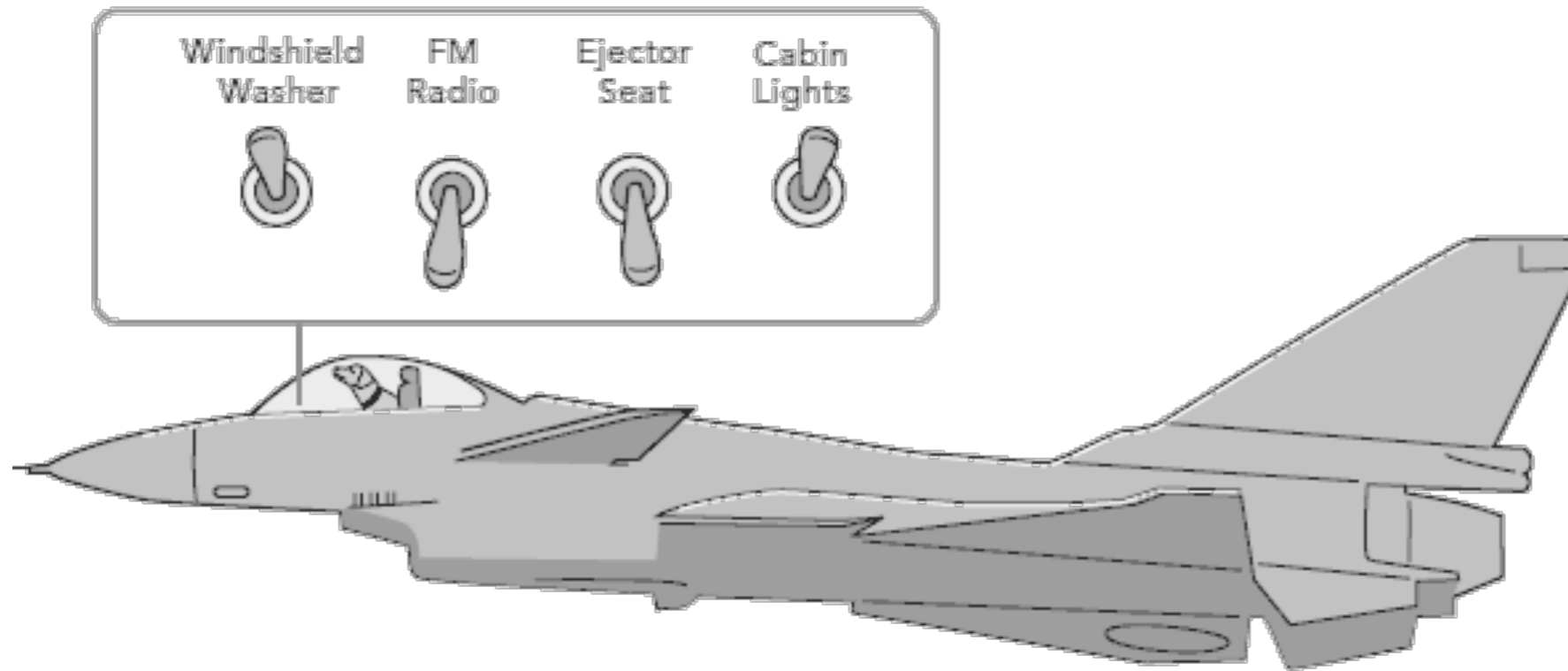GitHub for Mac
GitHub for Windows
Issues for iPhone
Job Board

Extras

GitHub Shop
The Octodex

Documentation

GitHub Help
Developer API
GitHub Flavored Markdown
GitHub Pages

Anti Fitts law

What have we learned today?

about computers:

Moore's law

Buxton's law

about human motor skills:

Fitts' law

Steering law

Guiard's Kinematic chain model

about human cognition:

Hick's law

Law of practice

Murphy's law