5 Interface Laws Every Software Designer Should Know

By Kevin Hale
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Partner, Y Combinator
Models!

Metaphor
   Descriptive

Mathematics
   Predictive
1 Fitts’s Law
Fitts’s Law

\[ T = a + b \log_2 \left( 1 + \frac{D}{W} \right) \]

How humans point at things.
Bigger things are easier to point at.
\[ T = a + b \log_2 \left( 1 + \frac{D}{W} \right) \]

Shannon-Hartley Theorem

\[ C = B \log_2 \left( 1 + \frac{S}{N} \right) \]
Fitts’s Experiment
Fitts’s Experiment

Distance

Width

Time
Fitts’s Law

\[ T = a + b \log_2 \left( 1 + \frac{D}{W} \right) \]
Linear vs Log
10
Fitts’s Experiment
Fitts’s Law

\[ T = a + b \log_2 (1 + \frac{D}{W}) \]
\[ T = a + b \log_2(1 + \frac{D}{W}) \]
\[ T = \frac{D}{W} \]
\[
O = \frac{D}{W}
\]
Contextual Menus
Pie Menus
Infinite Target
Widths at Edges
Infinite Dimensions at Corners
Exposé & Spaces

Active Screen Corners

Exposé
Instantly access any open window with a single keystroke. Display all open windows as thumbnails, view windows of the current application or hide all windows to quickly locate a file on your desktop.

- All windows: F9
- Application windows: F10
- Show Desktop: F11

Dashboard
Dashboard is home to widgets: mini-applications that let you perform common tasks and provide you with fast access to information.

- Hide and show: F12

Hot Corners
High Velocity
Initial Movement

Deceleration
Final Movement
2
Steering Law
Steering Law / Accot-Zhai Law

\[ T = a + b \int_c \frac{ds}{W(s)} \]

How humans move in a tunnel.
Steering Law / Accot-Zhai Law
Steering Law / Accot-Zhai Law
Steering Law / Accot-Zhai Law

\[ T = \alpha + b \]

\[ \int_c \frac{ds}{W(s)} \]

Time

Constant

Path

Length

Constant

Width
Steering Law / Accot-Zhai Law

\[
\frac{d s}{d T} = \frac{W(s)}{b}
\]

- Instantaneous Speed
- Width of Tunnel
Steering Law / Accot-Zhai Law

How fast?
Steering Law / Accot-Zhai Law
Steering Law / Accot-Zhai Law

Wider Paths = Faster Movement
Nested Menu Optimizations

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>i</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>ii</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>iii</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>iv</td>
<td></td>
</tr>
</tbody>
</table>
Nested Menu Optimizations
Crossing Based Interfaces
WebOS
Hick’s Law
Hick's Law

\[ T = b \cdot \log_2(n + 1) \]
Hick’s Law

\[ T = b \cdot \log_2(n + 1) \]

It takes less time to identify an object from fewer things.
Hick’s Law

\[ T = b \cdot \log_2(n + 1) \]
Hick’s Law

\[ T = b \cdot \log_2(n + 1) \]
<table>
<thead>
<tr>
<th># of Choices</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>7</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Time</td>
<td>1</td>
<td>1.6</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Hick’s Law

\[ T = b \cdot \log_2 (n + 1) \]
Not for menu design.
Find the monkey.

<table>
<thead>
<tr>
<th>Humans</th>
<th>Animals</th>
<th>Robots</th>
<th>Monsters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dog</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monkey</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chicken</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humans</td>
<td>Animals</td>
<td>Robots</td>
<td>Monsters</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td></td>
<td>Cat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dog</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Monkey</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chicken</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bear</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Find the monkey.

- Humans
- Animals
- Robots
- Monsters

- Cat
- Dog
- Monkey
- Chicken
- Bear
Better for attention optimization.
Which animal is in trouble?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td></td>
</tr>
<tr>
<td>Monkey</td>
<td><strong>Red</strong></td>
</tr>
<tr>
<td>Chicken</td>
<td></td>
</tr>
<tr>
<td>Bear</td>
<td></td>
</tr>
</tbody>
</table>
Also great for helping users know what to do next.
## Entry Manager

This was the noblest Roman of them all.

Select an Entry from Below or Create a New Entry

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Last</th>
<th>Web Site</th>
<th>Email</th>
<th>Photo</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Godzilla</td>
<td></td>
<td><a href="http://godzilla.com">http://godzilla.com</a></td>
<td><a href="mailto:firemouth@godzilla.com">firemouth@godzilla.com</a></td>
<td>godzilla.jpg</td>
<td>Hibernating</td>
</tr>
<tr>
<td>5</td>
<td>Jessica</td>
<td>Alba</td>
<td><a href="http://jessicaalba.net">http://jessicaalba.net</a></td>
<td><a href="mailto:hot@jelba.com">hot@jelba.com</a></td>
<td>jessica.jpg</td>
<td>California</td>
</tr>
<tr>
<td>4</td>
<td>Chuck</td>
<td>Norris</td>
<td><a href="http://chucknorris.com">http://chucknorris.com</a></td>
<td><a href="mailto:kick@chucknorris.com">kick@chucknorris.com</a></td>
<td>chuck.jpg</td>
<td>Texas</td>
</tr>
<tr>
<td>3</td>
<td>Chris</td>
<td>Campbell</td>
<td><a href="http://particletree.com">http://particletree.com</a></td>
<td><a href="mailto:chris@wufoo.com">chris@wufoo.com</a></td>
<td>chris.jpg</td>
<td>Florida</td>
</tr>
<tr>
<td>2</td>
<td>Ryan</td>
<td>Campbell</td>
<td><a href="http://particletree.com">http://particletree.com</a></td>
<td><a href="mailto:ryan@wufoo.com">ryan@wufoo.com</a></td>
<td>ryan.jpg</td>
<td>Florida</td>
</tr>
<tr>
<td>1</td>
<td>Kevin</td>
<td>Hale</td>
<td><a href="http://particletree.com">http://particletree.com</a></td>
<td><a href="mailto:kevin@wufoo.com">kevin@wufoo.com</a></td>
<td>kevin.jpg</td>
<td></td>
</tr>
</tbody>
</table>
4. Miller’s Law
Miller’s Question

What is the capacity of working memory?
Miller’s Law

$7 + \frac{1}{-2}$

Chunks
Bits vs Chunks
1970’s Model of Working Memory

Visuo-Spatial Sketchpad

Phonological Loop

Central Executive

Long Term Memory
Phonological Loop
2 Seconds of Sound
Miller’s Law

7 digits  6 letters  5 words
Processing Time

Reciprocal of Memory Span (item$^{-1}$)

- Colors
- Letters
- Digits
- Shapes
- Words
- Random Forms
- Nonsense Syllables
Hard to Remember

17373542783

fbibbbcibmirs
Chunks and Context Make it Easier

+1 (737) 354-2783

fbi bbc ibm irs
1. A GitHub page.
2. The repository path is `bos/text`.
3. The repository page shows code, network, pull requests, issues, wiki, and stats & graphs sections.
4. Description: An efficient packed, immutable Unicode text type for Haskell, with a powerful loop fusion optimization framework. — Read more.

   `http://bitbucket.org/bos/text`

5. Download options include SSH, HTTP, Git Read-Only, and Read+Write access.
6. Branch: master
7. Latest commit:
   - Added tag 0.11.2.0 for changeset 1d2c6fa9092c
   - Authored by bos 11 hours ago
It’s easy to chunk!

<table>
<thead>
<tr>
<th>Format</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>1,234</td>
</tr>
<tr>
<td>No Format</td>
<td>1234</td>
</tr>
<tr>
<td>Rounded</td>
<td>1,234</td>
</tr>
<tr>
<td>2 Decimals</td>
<td>1,234.56</td>
</tr>
<tr>
<td>Scientific</td>
<td>1.23E+03</td>
</tr>
<tr>
<td>Currency</td>
<td>$1,234.56</td>
</tr>
<tr>
<td>Currency Rounded</td>
<td>$1,234</td>
</tr>
</tbody>
</table>
Rule Builder
Men at some time are masters of their fates

Here are the rules for Choose your own adventure!

Holy anarchy! This form doesn't have any rules!

Create a Field Rule
Here are the rules for **Choose your own adventure!**

After the form is submitted, override the default action based on these rules.

1. **If** Message **contains** billing
   - **Show Message**
   - **Redirect to Web Site**
   - **Send Email**
     - Send notification to email **billing@wufoo.com**

2. **If** Select a Choice **is** Challenge to a duel
   - **Show Message**
   - **Redirect to Web Site**

Then meet us on the front lawn at dawn!
After the form is submitted, override the default action based on these rules.

**The Condition**

If Name is Kevin

**The Action**

Send notification email to kevin@wufoo.com.
Notification Settings
My words fly up, my thoughts remain below.

Send Notifications from Wufoo Customer Interview ...

**to My Inbox**
- Your Email Address
- Set Reply To:
  - No Reply To

Send Me Emails About:
- New Entries
- New Comments

**to My Mobile Device**
- Your Cell Phone Number
- Your Carrier

Send Me Text Messages About:
- New Entries
- New Comments

**to Another Application**
- Add Integration

Save

Subscribe to RSS Feeds
Example Bug Report
This is my report. View it in all its glory!

- **Assigned To**
  - Pie chart showing distribution of assigned to categories.

- **Severity**
  - Pie chart showing distribution of severity levels.

- **Operating System**
  - Table showing percentages and counts for different operating systems.

- **Browser Breakdown**
  - Table showing percentages and counts for different browsers.

- **Total**
  - Summary of bugs: 1,234

- **Open**
  - Summary of open bugs: 1,234

- **Closed**
  - Summary of closed bugs: 1,234

---

Click or Drag to add a widget to a zone.
Report Builder
And thus I clothe my naked villany
5 Power Law of Practice
Power Law of Practice

\[ RT = a P^{-b} + c \]

- **RT**: Repeated Task
- **P**: Trial Number
- **α**: Constant
- **P^{-b}**: Negative exponent
- **c**: Constant

**Completion Time** → **Constant**

**Trial #** → **Constant**
Power Law of Practice

\[ T_n = T_1 n^{-0.4} \]

- **Completion Time**
- **Trial #**
- **noob Time**
- **Constant**
Power Exponential Law of Practice

\[ RT = a e^{-b(P-1)} + c \]

Completion Time

Trial #
Focus on repeat performance.
Different UIs for noobs and pros.
Untitled Form
This is my form. Please fill it out. It's awesome!

← No Fields! You should add a field.
This is a live preview of your form. Currently, you don't have any fields. Use the buttons under the Add a Field tab on the left to create inputs for your form. Click on the fields to change their properties.

NEW! Try one of our HTML Templates from the Wufoo Form Gallery!
Untitled Form

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NEW! Try one of our HTML Templates from the Wufoo Form Gallery!
Are you sure you want to delete Contact Form?

Deleting a form means that all data collected by the form will be deleted immediately. Additionally, all files uploaded to the form and all reports referencing the form will no longer be available. Because this action cannot be undone, you might want to consider exporting your data first. If that all sounds kosher, let us know.

Yes, I am sure. Please delete this form.  

Cancel.
The conversation has been moved to the Trash. Learn more Undo
Review

1 2 3 4 5

Fitts  Steering  Hicks  Miller  Practice
High 5 and thanks!

@ilikevests