Lecture 15
Design Principles #2

Design principles
> **Stimulus intensity**
> **Proportion**
> **Screen complexity**
> **Resolution/closure**
> **Usability goals**

Heim, Chapters 6.7-6.11

Learning Objectives

- To be able to apply design principles in the context of user interface design tasks
- To understand the role of intensity in perception of content
- To be able to assess the relative complexity of screen designs

Other Principles of Perception - *Stimulus Intensity*

• We respond first to the intensity of a stimulus and only then do we begin to process its meaning.

1	3	**9**	7
4	8	**6**	2
5	7	**1**	3
2	4	**8**	6
7	9	**3**	1
6	2	**8**	4
7	1	**3**	9

Stimulus versus cognition

• In general, the 'hard wired' responses to stimulus will be processed quicker than those that require processing of coded information

Other Principles of Perception – *Proportion*

• Proportion can be used to represent logical hierarchies

Heading Level 1
Heading Level 2
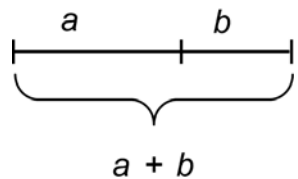### Heading Level 3
Heading Level 4
Heading Level 5
Heading Level 6

Other Principles of Perception – *Proportion*

• **Golden Ratio** - The golden ratio expresses the relationship between two aspects of a form such as height to width, about 1.618
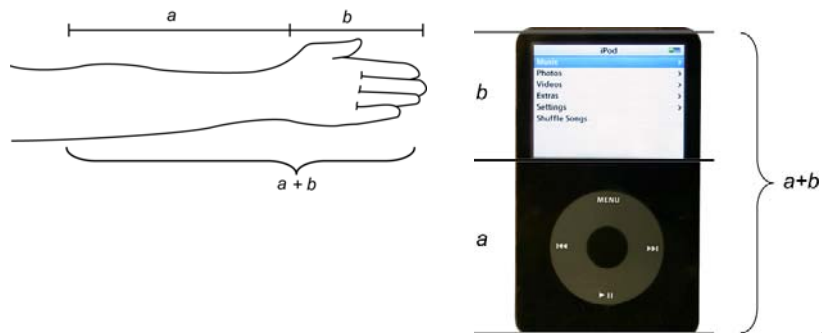
– Actually (1+sqrt(5)) / 2

$$\frac{a + b}{a} = \frac{a}{b}$$

Other Principles of Perception – *Proportion*

• **Golden Ratio**
  – Occurs in nature, common in architecture
  – Widely believed to be inherently pleasing
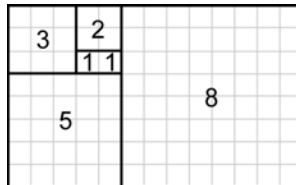

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Other Principles of Perception – *Proportion*

• **Fibonacci -** A sequence of numbers in which each number is the sum of the two preceding numbers.
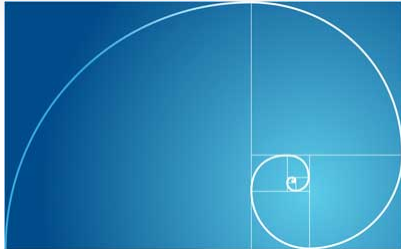 – The relationship between the numbers in the Fibonacci series is similar to the golden ratio

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, …

1-8

4

Golden ratios & Fibonacci

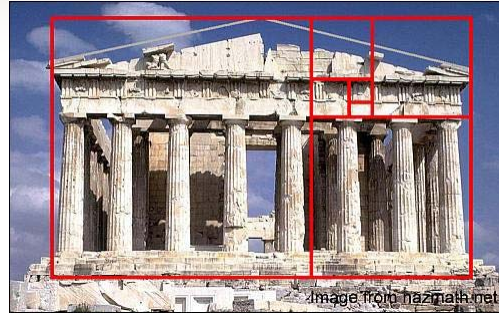www.mathsisfun.com

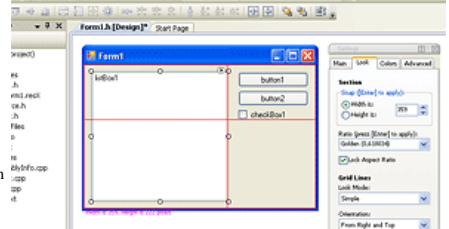Image from hazmath.net

journalofcosmology.com

www.atrise.com

Other Principles of Perception - *Screen Complexity*

• The measure of complexity developed by Tullis (1984) can be used to calculate the relative complexity, and therefore the difficulty, of a design.

   – This measure of complexity uses information theory (Shannon & Weaver, 1949)

$$C = -N \sum_{n=1}^{m} p_n \log_2 p_n$$

Other Principles of Perception - *Screen Complexity*

• Formula for calculating the measure of complexity

$$C = -N \sum_{n=1}^{m} p_n \log_2 p_n$$

C, complexity of the system in bits

N, total number of events (widths or heights)

m, number of event classes (number of unique widths or heights)

p_n, probability of occurrence of the nth event class
    (based on the frequency of events within that class)

Half time entertainment

• Bit to close to Novapay for comfort?

• https://www.youtube.com/watch?v=eXbje3Czh4k

Other Principles of Perception - *Screen Complexity*

- More practical (approximate) way to calculate the measure of complexity for a particular screen, do the following:
    1. Count the number of elements
    2. Count the number of columns (horizontal alignment points)
    3. Count the number of rows (vertical alignment points)
    4. Sum up these three counts for a complexity score

1-13
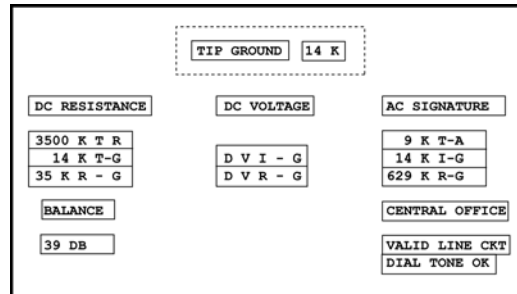
Other Principles of Perception - *Screen Complexity*

1-14

7

Other Principles of Perception - *Screen Complexity*

• Redesigned screen


```
            ┌─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
            ┊    TIP GROUND    14 K   ┊
            └─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘

  DC RESISTANCE       DC VOLTAGE        AC SIGNATURE

  3500 K T R                              9 K T-A
   14 K T-G          D V I - G           14 K I-G
   35 K R - G        D V R - G           629 K R-G

   BALANCE                             CENTRAL OFFICE

   39 DB                              VALID LINE CKT
                                      DIAL TONE OK
```

- Original had 22 elements + 6 horizontal alignment points (columns) + 20 vertical alignment points (row) = 48 complexity
- New design has 18, 7 and 8 respectively = 33 complexity (31% reduction)
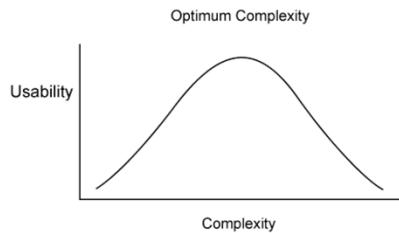

About screen complexity

• More important as a heuristic than as a precise quantity

- Higher complexity places more 'load' on the eye, and hence the brain
- Gives a good indication of the relative complexity of alternative designs

Other Principles of Perception - *Screen Complexity*

• **Complexity vs. Usability**

   – Comber and Maltby (1997) found that both overly simple and overly complex screens were low in usability

   – This could, for instance, be due to lack of opportunity to form logical groupings in very low complexity designs

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Other Principles of Perception - *Screen Complexity*

• Comber and Maltby found tradeoffs between usability and complexity:

   – As complexity decreased, predictability increased.

   – As complexity decreased, it became harder to differentiate among screen objects; the screen became artificially regular.

   – Decreased complexity meant that there were fewer ways to group objects.

   – Excessive complexity made screens look artificially irregular.

   – Increased complexity could occur from increased utility.

Complexity and usability

- In general, use layout as a code
  - If you have something to say, then do things that add complexity such as indenting a group, putting a box around it, or having some groups shorter than others
  - If there's no 'message' intended, keep it simple with uniform margin and working across as well as down where screen width permits
- However
  - If you find yourself with large undifferentiated areas (e.g. a huge grid of captions and entry fields), the user will glaze over
  - Find some logical groupings to add meaning (anybody try to census form recently? – very thoughtful!)

1-19

Complexity and usability (contd.)

- KISS (keep it simple, stupid)
  - Obviously, if you need less screen components, then the screen will be simpler
    - And faster both for user comprehension as well as actual user work if you can eliminate an input field!
- Notice an interaction with 'progressive disclosure' here
  - Can show a simpler screen and only confront user with more complexity if they ask for it

1-20

Other Principles of Perception - *Resolution/Closure*

- Resolution/Closure - Relates to the perceived completion of a user's tasks.
  - When the user's objective is satisfied, he or she will consider the task complete and move on to the next goal
- It's good to create closure in the dialog structure
  - Frees the user's attention
  - Satisfying to give feedback

Caution on closure

- Be sure the task is really completed before your user moves on
  - A problem with ATM machines is that the user may walk away when they've gotten their cash, and leave their card in the machine!
    - They went for cash: cash = closure
  - Textbook suggests to swipe (or insert and withdraw) card so it gets put away in advance of closing step
    - Actually a lot of machines (e.g. PackNSave self-serve fuel pump) do this, although my WestPac ATM instead just beeps at the end of the transaction (no matter how quickly I retrieve my card – Arg!)
    - And lots of people forget their receipt at the PackNSave pump (prints after they got their fuel! [probably didn't want it anyway])

Putting usability goals into effect

- User-centred design (UCD) puts the focus on the user's tasks and goals
- Generally-accepted goals for an interface are that it be:
  - Understandable
  - Learnable
  - Effective / useful
  - Efficient / usable
- Hard to argue with that! But how do we run a project such that usability goals are achieved?

Usability Goals – Principles - Guidelines

- **One approach is to articulate key project-specific pathways from goals, to principles to guidelines for the development team – for example…**
- **Usability Goal—**Easy to use
  - One of the most important goals of user-centered design is to make things easy to use. Let's say we're confident that this is very important to our users.
- **Design Principle—**Simplicity
  - Simple things require little effort and can often be accomplished without much thought. If interaction designs are guided by the principle of simplicity, they will be easier to use.

Usability Goals – Principles – Guidelines (contd.)

- **Project Guideline—**All dialogue boxes should present only the basic functions that are most often used and that other, less used functions can be accessed using an expandable dialogue with a link for "More Options."

- This is something that could be communicated to even a large team and used as a design guideline and checked in heuristic evaluations and walkthroughs

1-25

Summary

- Intensity is perceived before semantics
- Consider classically pleasing proportions
- Aim for simple interfaces, but not simplistic
    - Complexity can be measured and contrasted across alternative designs
- Understand and plan for where your interface creates closure
- Projects (esp. when large) should choose focus usability goals and related principles to formulate guidelines

1-26