Human Abilities: Vision & Cognition

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Autumn 2023
October 18, 2023
Hall of Fame or Shame?

Create your Google Account

One account is all you need
A single username and password gets you into everything Google.

Take it all with you
Switch between devices, and pick up wherever you left off.

Name
James

Choose your username
james...landay@gmail.com
A fan of punctuation! Also, usernames can't have consecutive periods.

Create a password

You can't leave this empty.

Confirm your password

Birthday
Hall of Fame! (but still some issues…)

Clearly highlights error (red text & box)

Tells me what I did wrong/how to fix it

In user’s language
(but, be careful w/ humor)

Red may be an issue when used alone, more later…
Hall of Fame!

Create your Google Account

First name: James
Last name: Landay
Username: james...landay
@gmail.com

Sorry, your username cannot contain consecutive periods (.)
Use my current email address instead

Password: ********
Confirm: ********

One account. All of Google working for you.

Next

Clearly highlights error (red text & box)
Tells me what I did wrong/how to fix it
In user’s language (but, be careful w/ humor)
Red may be an issue when used alone, more later...

New version fixes these 2 problems
- adds caution icon & removes the humor
Hall of Fame or Shame?

Zappos.com - Email Us

Oh no! We're very sorry, please fix the following issues...

- Please ensure you included a proper phone number.

PLEASE FILL OUT THE FOLLOWING FORM TO EMAIL US

You can also check our Frequently Asked Questions section for help in finding an immediate answer to our most commonly asked questions.

NAME (FIRST AND LAST): James Landay
PHONE NUMBER (OPTIONAL): 1 206 651 4362
EMAIL ADDRESS: landay@gmail.com
CONFIRM EMAIL ADDRESS:
ORDER NUMBER (OPTIONAL): 115142675
MESSAGE SUBJECT LINE: didn't get credited for 1 pair returned

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Learn what inspires Zappos.com to provide the best service.

ZAPPOS FAMILY CORE VALUES:
10 Values We Live By

CUSTOMER TESTIMONIALS:
Customer Care

ENJOY FUN AND A LITTLE WEIRDNESS:
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UNIQUE CUSTOMERS:
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Customers in Training

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Careers

SHOP WITH CONFIDENCE
SHOPPING ON ZAPPOS.COM IS SAFE AND SECURE.
GuARANTEED

You'll pay nothing if unauthorized charges are made to your credit card as a result of shopping at Zappos.com.
Hall of Shame!

Like

- error message prominent with different color & shape

Wish

- where is the error?
- what’s wrong with it?
- parse & fix it yourself!
Hall of Shame!

Update (today)
- no longer have that form
  (uses phone, SMS, live chat)

Contact Information

Our Customer Loyalty Team is available 24/7 on all support channels for anything you need!

1. CALL the Zappos Customer Loyalty Team:
   1-800-937-7671

2. TEXT the Zappos Customer Loyalty Team:
   Text CHAT to 1-833-937-7671 to chat with the Zappos Customer Loyalty Team by text.

   By texting CHAT, you consent to receive text messages (including automated and marketing messages) from or on behalf of Zappos at your mobile number provided. Consent is not a condition of any purchase. Text STOP to end your chat. Message & data rates may apply.

3. CONNECT WITH LIVE HELP:
   Ask your question right now with a member of the Zappos Customer Loyalty Team.
   Go ahead - start a conversation now!

   Frequently Asked Questions: Answers to our most commonly asked questions: Frequently Asked Questions
   Haga click aquí para preguntas frecuentes en español

   ADDITIONAL INQUIRIES:
   Brand Inquiries:
   Feature your brand on the website! Please direct all brand inquiries via email to: merchinitiatives@zappos.com.

   Press Inquiries:
   Please direct all media inquiries via email to: pr@zappos.com
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Outline

- Human visual system
- Guidelines for design
- Team Break
- Models of human performance (MHP)
- Two in class experiments
- Memory
Why Study Color?

1) Color can be a powerful tool to *improve* user interfaces by communicating key information

2) Inappropriate use of color can severely *reduce* *the performance* of systems we build
Visible Spectrum

There is an order to the colors… ROY G. BIV

Do not use that ordering to order data!
(next lecture: example of how unusable a map is using this ordering for elevation)
Human Visual System

- Light passes through lens
- Focused on retina

Diagram showing the cross-section of a human eye with labels for various parts such as cornea, iris, lens, retina, inverted image of object, optical nerve, and electric signal.
Retina

- Retina covered with two types of light-sensitive receptors called?
  - rods
    - primarily for night vision & perceiving movement
    - sensitive to broad spectrum of light
    - can’t discriminate between colors
    - sense to intensity or shades of gray
  - cones
    - used to sense color

http://www.webexhibits.org/causesofcolor/1G.html
Retina

- Center of retina has most of the cones →
  - allows for high acuity of objects focused at center

- Edge of retina is dominated by rods →
  - allows detecting motion of threats in periphery
Color Perception via Cones

- “Photopigments” used to sense color
- 3 types: blue, green, “red” (really yellow)
  - each sensitive to different band of spectrum
  - ratio of neural activity of the 3 → color
- other colors are perceived by combining stimulation

http://www.webexhibits.org/causesofcolor/1G.html
Color Sensitivity

not as sensitive to blue

lots of overlap

http://archive.cnx.org/contents/d42c807d-a9fa-4e3d-83d0-0f7c745b51ad@4/color-and-color-vision#export-auto-id1844887
Color Sensitivity

http://archive.cnx.org/contents/d42c807d-a9fa-4e3d-83d0-0f7c745b51a0@4/color-and-color-vision#import-auto-id1844887
Distribution of Photopigments

- Not distributed evenly – mainly reds (64%) & very few blues (4%) →
  - insensitivity to short wavelengths (blue)

- Few blue cones in retina center (high acuity) →
  - “disappearance” of small blue objects you fixate on

- As we age lens yellows & absorbs shorter wavelengths →
  - sensitivity to blue is even more reduced

- Implication
  - don’t rely on blue for text or small objects!
Focus

• Different wavelengths of light focused at different distances behind eye’s lens
  – need for constant refocusing → ?
    • causes fatigue
  – be careful about color combinations
Focus

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  - need for constant refocusing → ?
    • causes fatigue
    - be careful about color combinations
- Pure (saturated) colors require more focusing than less pure (desaturated)
  - don’t use saturated colors in UIs unless you really need something to stand out

https://physics.info/color/
Focus

• Different wavelengths of light focused at different distances behind eye’s lens
  - need for constant refocusing → ?
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  - be careful about color combinations
• Pure (saturated) colors require more focusing than less pure (desaturated)
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Color Deficiency
(Also known as “color blindness”)

• Trouble discriminating colors
  – besets about 4.5% of population (≈8% men, ≈.5% women)

• Two main types
  – different photopigment response most common
    • reduces capability to discern small color diffs
  – red-green deficiency is best known
    • lack of either green or red photopigment →
      can’t discriminate colors solely dependent on Red & Green

• Key is to avoid single color distinctions

https://www.colorblindness.com/red-green-color-blindness/
Color Guidelines

Avoid simultaneous display of highly saturated, spectrally extreme colors
- e.g., no cyans/blues at the same time as reds, why?
  - refocusing!

- desaturated combinations are better → pastels
Use the Hue Circle

Pick non-adjacent colors
– opponent colors go well together

red & green
or
yellow & blue
Color Guidelines (cont.)

- Avoid pure blue for text, lines & small shapes
- Avoid adjacent colors that differ only in blue
- Blue makes a great background color
Administrivia

- Grading on Assignment #2: POV, HMW, Experience Prototypes
  A2 Group Presentation:  
  - -: 0% ✓ - -: 0% ✓ -: 5% ✓ : 68% ✓ +: 28% ✓ ++: 0%
  A2 Individual Presentation:  
  - : 0% ✓ - -: 0% ✓ -: 3% ✓ : 48% ✓ +: 48% ✓ ++: 3%

- Grading
  - buckets are weighed in the rubric so two minuses are not equal
  - note: each team member’s contribution will be assessed at the end of class & grades adjusted appropriately

- Figma workshop – tonight at 7:30 PM in 392 Gates
  - Design systems next week
Prototype #2: Risky Rewards

Key Assumption
People will give unfamiliar shows/movies a chance if they receive rewards in return

Methodology
Ask participant to...
- Watch a snippet of video content outside of usual repertoire for a chance to win a gift card
- Rate:
  - Enjoyment
  - Curiosity
  - How likely to continue watching
What worked

- People were willing to watch new/unfamiliar content for $
- Some reacted positively to the content

What didn’t work

- Most said they would not continue to watch the content
- Some types of content are inherently more intriguing
- One could watch without actually watching
One could find the short clip enjoyable and not want further interactions due to other priorities. Some mentioned they usually only have time for short clips.

Rewards facilitate action but not necessarily interest. Some revealed they would have done the task without reward.

Results

Surprises

- Some revealed they would have done the task **without reward**
- Some mentioned they usually only have **time** for **short** clips

New Learnings

- Rewards facilitate **action** but not necessarily **interest**
- One could find the short clip **enjoyable** and not want further interactions due to **other priorities**

Validity ✅

**Revised Assumption:**

Reward is effective for short term motivation but not for building lasting passion and openness for new content.
An app that connects local cultural hosts to language learners for immersive stays.
Which of these assumptions, if false, would cause the idea to fail?

1) Staying with a host would help a language learner feel more connected to a target culture.
2) Staying and interacting with a host would benefit the mastery of dialects, vernaculars, and accents attributed to a specific language.
3) The host will create a schedule to help their language learner gain an immersive experience into their culture.
4) A person of a specific culture would be willing & enthusiastic about hosting someone for a specific period of time.
5) Language learners will want to interact with more local yet unfamiliar people of a target culture.
6) The language learner has enough money to afford the experience and cover local transportation.
7) A person would enjoy an experience with a host to understand their culture.
8) A person will take initiative to advance his language mastery by utilizing locally hosted experiences.
9) Both the host and language learner will have the time to coordinate an experience.
10) There's enough trust on both sides to make an experience happen, from coming into someone's house and sharing meals with their family.
11) It's possible to make a quick and easy system for language learners to select from available experiences offered by different hosts.

Staying with a host would help a language learner feel more connected to a target culture
ASSUMPTION

Our experienced users, people who are very familiar or native in a specific language & culture, would be willing and enthusiastic to host someone for a specific period of time.

EXPERIENCE PROTOTYPE

**Props:** The Musalla (prayer room) at Old Union, pre & post-survey asking both host & user about their experience

**Actors:** Find someone who is interested in learning about Middle Eastern & Islamic Culture + is learning Arabic. Find another person who is a native Arabic speaker and passionate about speaking about culture & Islam. Have the person interested in learning shadow an Islamic prayer and halaqa discussion with their host.

**Data:** Have participants complete a questionnaire before and after asking them how they felt, their overall relationship and understanding with the specific language and culture, and how engaging the experience was.
Description: We hosted a **30-minute** language and culture learning experience, pairing a language learner with a passionate teacher.

Participants: Gautham (**Intermediate**-level speaker) & Rifat (**Advanced**- speaker); Language & cultures of interest: **Sudanese Arabic + African & Islamic culture**

What Worked:

➔ **Gautham:** Understanding of the language + culture = 1 → 3 (*1 = little, 3 = moderate)

➔ **Rifat:** Passion for having more experiences teaching others about their language + culture 4 → 4 (*4 = strong preference)

What Didn’t: **Gautham** felt like he was intruding on cultural practice at times; **Rifat** wants Gautham's interests beforehand for a tailored experience

Assumption: Validated, user felt knowledge improve & host generally enjoyed the experience.
Administrivia

- Assignment #5 – Low-fi Prototype & Pilot Usability Test
  - 10-15 rough sketches of 3 different design realizations
    - everyone on team contributes
    - use different modalities (e.g., visual, speech, watch) or different visual UIs input techniques (gestures, taps, etc.)
  - will start this in studio this week
Administrivia

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    - everyone on team contributes
    - use different modalities (e.g., visual, speech, watch) or different visual UIs input techniques (gestures, taps, etc.)
  - will start this in studio this week
  - pick top 2 realizations & storyboard/task flow more
  - pick best realization & add details to task flow
  - build low-fi prototype of the best & test it w/ at least 1 target (non-Stanford) participant/team member (e.g., four)
TEAM BREAK
The Model Human Processor

Developed by Card, Moran & Newell (’83)
- based on empirical data

- Model can help us test understanding & make predictions
- Underlies other usability techniques
  - GOMS, KLM, tools, etc.
The Model Human Processor

- Long-term Memory
  - Working Memory
    - Visual Image Store
    - Auditory Image Store

- Perceptual Processor
- Motor Processor
- Cognitive Processor

Sensory buffers: Eyes, Ears, and Fingers, etc.
MHP Basics

- Parameters
  - processors have cycle time \( (T) \sim 100 \text{ ms} \)
  - memories have capacity, decay time & type
What is missing from MHP?

Long-term Memory

Working Memory

Visual Image Store

Auditory Image Store

sensory buffers

Eyes

Ears

Perceptual Processor

Motor Processor

Cognitive Processor

Fingers, etc.
What is missing from MHP?

- Haptic memory
  - for touch
- Moving from sensory memory to WM
  - attention filters stimuli & passes to WM
- Moving from WM to LTM
  - elaboration
“I'm having trouble with my short term memory... ... I'm here b'coz of my short term memory... ... I 'd like to talk to you about my short term memory...”
Memory

- **Working memory** (short term)
  - small capacity (7 ± 2 “chunks”)
    - 6174591765 vs. (617) 459-1765
    - NBCIBMGMGC vs. NBC IBM GMC
  - rapid access (~70ms) & decay (~200 ms)
    - pass to LTM after a few seconds of continued storage

- **Long-term memory**
  - huge (if not “unlimited”)
  - slower access time (~100 ms) w/ little decay
MHP Principles of Operation

• Recognize-Act Cycle of the CP
  - on each cycle contents in WM initiate actions associatively linked to them in LTM
  - actions modify the contents of WM
MHP Principles of Operation

• Recognize-Act Cycle of the CP
  - on each cycle contents in WM initiate actions associatively linked to them in LTM
  - actions modify the contents of WM

• Discrimination Principle
  - retrieval is determined by candidates that exist in memory relative to retrieval cues
  - interference by strongly activated chunks
Experiment

- **Task:**
  Quickly tap each target 50 times accurately

- **Conditions:**
  - Two ½” diameter targets 6” apart
  - Two ½” diameter targets 24” apart
  - Two 2” diameter targets 24” apart
  - Two 2” diameter targets 24” apart (no accuracy required)

- Turn to neighbor: discuss what will happen
Experimental Results (2023au)

- **Task:** Quickly tap each target 50 times accurately
Experimental Results (last year)

- **Task**: Quickly tap each target 50 times accurately
Experimental Results (pre-covid)

• Task:

Quickly tap each target 50 times accurately
If we plot the data...

Index of Difficulty: $ID = \log\left(\frac{D}{W}\right) + 1$

$D =$ distance to target, $W =$ width of target (or size)
Run This Experiment On Your Own

http://simonwallner.at/ext/fitts/
Principles of Operation (cont.)

Fitts’ Law

- moving hand is a series of microcorrections
  - correction takes $T_p + T_c + T_m = 240 \text{ msec}$
- time $T_{pos}$ to move the hand to target size $S$, which is distance $D$ away is given by:
  $$T_{pos} = a + b \log_2 (D/S + 1)$$

- summary
  - time to move the hand depends only on the *relative precision* required
Fitts’ Law Example

Which will be faster on average?
- pie menu (bigger targets & less distance)
Pie Menus in Use Today

The Sims

Rainbow 6

Firefox

Maya
Apple Watch Is a Negative Fitts’ Law Example
Apple Watch Is a Negative Fitts’ Law Example
Volunteer for Experiment

https://faculty.washington.edu/chudler/java/ready.html
Volunteer for Experiment

Stroop Effect
- interference in your working memory

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Memory Interference in Action: Cultural
Memory Interference in Action: Cultural

The current date and time is Tuesday, October 27, 2015 at 3:20:21 PM.
Memory Interference in Action: *Labels/Terms*

- **LOA Fiscal Year:** 2010
- **LOA Name:** VX9200 HMA19
- **Agency / Editor:** VO / Project
- **Project:** 51VX920000
- **Task:** HMA19
- **Expenditure Type:** 21000
- **Expenditure Org:** T81

Buttons:
- SubmitLOA
- OverrideLOA
- Return
Memory

• Interference
  – two strong cues in working memory
  – link to different chunks in long term memory

• Why learn about memory?
  – know what’s behind many HCI techniques
  – helps you understand what users will “get”
  – aging population of users
Design UIs for Recognition over Recall

- **Recall**
  - info reproduced from memory
  - e.g., command name & semantics

- **Recognition**
  - presentation of info provides knowledge that info has been seen before
    - e.g., command in menu reminds you
  - easier because of cues to retrieval
    - cue is related to item or situation learned in
    - e.g., hints, icons, labels, menu names, etc.
Human Abilities Summary

• Color can be helpful, but pay attention to
  – how colors combine
  – limitations of human perception
  – people with color deficiency

• Model Human Processor
  – perceptual, motor, cognitive processors + memory
  – model allows us to make predictions

• Memory
  – three types: sensory, WM & LTM
  – interference can make hard to access LTM
  – cues in WM can make it easier to access LTM

• Key time to remember from MHP: \(~100\text{ ms cycle time \& memory access time}\)
Further Reading
Vision and Cognition

- **Books**


- **Applying Fitts’ Law to Mobile Interface Design** by Justin Smith
Next Time

- Lecture
  - Visual Information Design

- Watch Scott Klemmer’s HCIOnline lectures:
  - 6.1 Visual Design (7:37)
  - 6.2 Typography (10:47)
  - 6.3 Grids & Alignment (17:33)

- Studio
  - Concept Videos
  - Start sketching out design ideas
Exit Ticket


Due Thursday at 3:30 PM