

# CSM49: Lab and Field Work

Experimental Research (Hypotheses)

Dr Max L. Wilson

# Last week's reading

- The field study
- The lab study
- The WiP study

# Scenario

Survey

Interviews

Natural  
Observation

How people enter  
information into phones

Lab study

System  
Logging

Focus group

# But which question?

- These all will help answer different questions you have about entering information into phones
- So before all that, we have to decide the question

# Hypotheses

- A precise problem or statement **that can be directly tested**
- Usually smaller than a theory about something
- Directs which methods you choose
- And how you analyse the results

# Theory vs Hypothesis

- Fitts' Law - is a theory about movement, space, and targets
  - *The time to acquire a target is a function of the distance to and size of the target.*
- Can be applied to lots of systems
- hypotheses can be made about such theories
- e.g. target acquisition is faster and more accurate with multi-touch systems than when using a mouse.

# Hypothesis Types

One-tailed	Multi-touch will be faster than mouse-oriented target acquisition
Two-tailed	There is a difference in speed between multi-touch and mouse-oriented target acquisition
Null	There is <b>no</b> difference between multi-touch and mouse-oriented target acquisition

# Hypotheses are perspectives

- H1 - Multitouch will be faster than mouse for target acquisition
- H2 - Multitouch will be more accurate than mouse...
- H3 - Multitouch will be **easier** than mouse...
- H4 - People will be happier with multitouch than mouse
- H5 - Multitouch does not degrade with age less than mouse
- H6 - Disabled people will find multitouch easier than mouse

# Activity

- Did the papers you found list any hypotheses?
- Then
- Google have released Google Instant
- Make a series of hypotheses - in their one-tailed, two-tailed, and null variations.

# Hypotheses » Experiments

- One experiment might cover 5 hypotheses
- You design experiments to make sure they will tell you your hypotheses
- Your hypotheses tell you what you will **measure** during your study

# Hypotheses » Variables

- Independent - you control this - its what you think causes the difference in something
- Dependent - is what you measure - its the difference you think would be caused

# Activity: Independent vs Dependent

Multi-touch will be faster than mouse-oriented target acquisition

# Activity

- In your papers - what were the IVs and DVs?

# Independent Variables in HCI

- different systems
- different designs of one system
- different environmental contexts
- different user groups

# Dependent Variables in HCI

1. Efficiency
2. Accuracy
3. Subjective Satisfaction
4. Ease of Learning
5. Physical or Cognitive Demand

# Experiments - 5 parts

- Treatments - or conditions
- Units - or Participants (typically people)
- Assignments - or how units are allocated to treatments
- Tasks - what you want them to do
- Instruments - what they do it on/with

# Significance Tests

- You can easily say that the average time for multitouch was 5s and the average for mouse was 5.5s
- but is this important
- is this significant or is it marginal?
- was it by chance (e.g. another 10 people and it would be different)
- etc

# Sample bias

- Results might be biased to your sample too - did you study computer scientists who are typically good with mice?
- We have to talk a sample of everyone in the world - so we need to choose that carefully.
- if we only pick mice experts, rather than the average mice users, we are getting a strange sample.
- stats tell us **how confident we are** that the difference was important

# Error types

- Type I error - we reject the null hypothesis by mistake  
e.g. we decide that multitouch is better, when it isnt really  
  
to avoid - we hope that the p-value of a test is  $p < 0.05$
- Type II error - we dont reject the null hypothesis - by mistake  
e.g. we decide that multitouch is no better than mouse  
  
to avoid - we use a large sample size

# Activity

- SPAM judgements
  - what is a Type I error?
  - what is a Type II error?

# Limitations of Experiments

## Confounding variables

- You have to make sure that what you measure is because of your conditions
- e.g. your DV is because of your IV
- common mistakes are experience during study » better results
- some tasks are easier than others
- there are usability problems with prototypes

# Limitations of Experiments

## Ecological Validity

- It can be hard to make studies 'realistic'
- Tasks have to feel real, and people must feel realistically motivated
- Its no use studying tasks that are not actual tasks for the type of system being studied.

# Limitations of Experiments

## Hawthorne Effect

- being observed leads to unnatural behaviour, where people temporarily try harder, or feel pressure etc.
- Although - HCI is different to when hawthorne effect was studied (short, low pressure, studies etc)
- But people still behave differently if being watched to real life.

# For next week

- Please read the hand out:
- A paper submitted to CHI
- Make notes to yourself.