Lecture 7: Evaluating interactive systems

Approaches to evaluation in systems research and engineering
Overview of the course

- Theory driven approaches to HCI
- Design of visual displays
- Goal-oriented interaction
- Designing efficient systems
- Designing smart systems (guest lecturer)
- Designing meaningful systems (guest lecturer)
- **Evaluating interactive system designs**
- Designing complex systems
Reminder: Controlled experiments from Lecture 5

![Graph showing number of observation trials vs. time taken to send tweet. New method is faster.](image-url)
Randomised Control Trial (RCT)

- Commonly used in medicine e.g. drugs trials
- What you need to run an RCT:
  - A performance measure
  - A representative population sample + informed consent
  - A task
- Results
  - Effect size, correlations, significance measures
- Difficulties
  - Overcoming natural variation needs large samples
  - Little understanding as to why a change occurred
  - Does the effect generalise?
  - Number of studies/orthogonality of variables
Commercial product evaluation

- RCTs are little used for design research in commercial products
- Performance measure is usually profit maximisation
  - Sales/Profit are often hard to measure with useful latency
- Typically use proxy measures instead
  - 1 day active, 7 day active, 28 day active

Often used as *summative* evaluation
Formative vs Summative

- Formative
  - Evaluates and refines design ideas

- Summative
  - Tests and evaluates systems
Internal vs External validity

• Internal Validity
  • Reproducibility, Scientific integrity, Refutability
  • “Was the study done right?”

• External Validity
  • Generalisability
  • “Does the study tell us useful things?”
Cognitive Walkthrough

Analytical (Theoretical)

Qualitative (words)

Cognitive Dimensions (Lecture 8)

KLM/GOMS

Quantitative (numbers)

Empirical (Observed)

Interviews (From Part 1A)

Think Aloud

Analytics/Metrics
Analyzing qualitative data

- Categorical coding (answers ‘closed’ questions)
  - Create a coding frame of expected categories of interest
  - Segment the text data
  - Assign each segment to a category

- Grounded theory (asks ‘open’ questions)
  - No prior expectation or theoretical assumption
  - Read data closely, looking for interesting stuff (‘open coding’)
  - Collect fragments, writing ‘memos’ to capture your own insights
  - Organise emerging themes using ‘axial coding’
  - Constantly compare memos, themes and findings to original data
Case study: Interpreting product feedback

Tinkercad Community Forum -> General Discussion

“Anything we didn't cover in other topics” (so could contain anything at all)

https://support.tinkercad.com/hc/en-us/community/topics/200160948-General-Discussion
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I was able to log in yesterday. Today, I can login and see my projects but when I click TINKER NOW (or whatever it says) I get "Oops! 410 - The requested page has expired". When I try to log in again, I'm stuck in a loop and can't log in.

This has been frustrating for me. It's probably something so simple that no one describes how to do it. I've been trying to use Tinkercad on a laptop with a trackpad. I've been unable to pan around the screen. I could zoom to the center and back out but not actually move the point of zoom off of the center. I looked for the keyboard shortcuts but there's nothing there about panning. It turns out to appear to be computer, browser, or filtering related. This is affecting this student's ability to continue with the lesson and is falling behind what the rest of the class is able to accomplish. We have tried logging in using this account on several different computers and browsers, all with the same error message. I have tried submitting a ticket to Support (four tickets actually, but now one has yet to respond after about two weeks. Despite having checked the 'stay logged in' box, I keep getting logged out after a short period of inactivity. Very frustrating!

I was wondering if it was possible to animate the 3D creations you make in Tinkercad, and if it is possible if someone could explain it to me.

I'm working on a file that I found on Thingiverse. I'm just trying to customize it the way I want to use. The final shape is as in the STL file I'm going to share. But I'm also sharing an image file where I'm showing 3 different sides and on these sides, marked some spots where I don't get rid of misalignment. No matter what I do here, It's never all right. Can anybody help me? Would it be difficult for you to just open the file on tinkercad and try if you can fix those sides? I'd be very appreciated.

I'm trying to make a cookie cutter. I succeeded in converting the outline to an svg file and then importing into Tinkercad, but I can't seem to figure out how to increase the width of the actual outline. It was able to adjust the height of the cookie cutter, length and width...but not the thickness of it. It doesn't even tell me what the thickness is currently if I had to guess it's probably defaulted at 1mm...and this is fine for the part of the cutter that actually cuts into the cookie dough. But 1 mm is flimsy and would be difficult to keep its shape. How do I do it. I'm amazed I've gotten this far just googling because I have NO IDEA what I'm doing!

I've been having difficulty with Tinkercad this week. They log in just fine, but the workplane will not load. We've tried Chrome and Explorer with no success. Anyone else experiencing this issue?

I'm trying to create a new project, so when I was in my old school last year we had to a project and pick a famous landmark and make a 3d sculpture out of it. We learned about architecture and geometry and I made an eiffel tower. It was fun. We made it out of plaster of paris, and printing. How can I get more fonts in Tinkercad or is there any better way to import into Tinkercad from a different software, Please help.

I would like to know if anyone knows what this website is... 410 - The requested page has expired. How can I view student work? I I have been gone from Tinker CAD for a very long time. I was hoping to find all of my old designs. Are they gone or am I not looking in the right place?

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Can Tinkercad be used to design simple 2D architecture style structures for a remodel of my home?

Hi, I have used the group option a lot to give shape to many of the objects of my design. I've noticed all these changes are stored, so every time I load the design or edit an object, it becomes slower and slower. Isn't there any way to make the program forget about all the objects used for cutting or adding shapes and expand the result as a definitive object? Thanx.

I used tinkercad quite some time ago for a school project and some other stuff and haven't logged in since. I think it must have been about 2 years (or more) since I last logged in. I had some projects that I worked on but now they're all gone?

Does anyone know why this could be and how to get them back (if possible)? Thanks in advance.

When we try to print our design on our 3D printer it keeps messsing up at the corners when it overlaps and then the nozzle pulls it from the bed. We have square corners not roundish corners. Its frustrating and we don't know if its the corners or the bed or something to do with the slicer.

Hi, I'm trying to create a lock for my tripod camera, I started the design but I'm sure not if it will work. I'm asking anyone to review my design please. the image show the lock, and the diameter of the tripod is 26mm so I have designed the lock as 27mm. I will appreciate your thanks

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I can't seem to find the button anywhere. Anyone know where the selector is, please let me know!

I keep running into the issue where I'll create an object, then change the workpane to one of its faces, and then come back to the original object to find that it's dimensions have changed themselves, or what was aligned now is not. For the dual mosfets and CPU. I added another designers 40mm fan covers to the box top. So my question is, when I share this design mod, what is the protocol for acknowledging the original designers? Would I need permission from them?

I am wondering if there is actually anyone looking after the support requests at all? More than 4 weeks ago, my child brought back the information for this thinkerad website and want to enroll to it. I have done the enrollment for her, but when I log in, I can't see any projects. Is there anything else I can do to make sure she can use the website. I would like to view her projects.

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I am trying to make a pillow for a project, this pillow in real life gets slimmer from bottom to top (Base is thick and half way up it starts getting slimmer). Is there anyway that I can replicate this in Tinkercad?

Can I import my own svg files into tinkercad like i can with AutoCad? it isn't a solid anymore.

Does tinkercad have any plans on upgrading cipher support to include stronger ciphers? The certificate is fine, but only weak or compromised ciphers are supported. I need to keep my browser at a high level of TLS+cipher security for printing. How can i get more fonts in Tinkercad or is there any better way to import into Tinkercad from a different software, Please help.
Categorical coding

• Create a coding frame of expected categories of interest
  • Bugs
  • Feature requests
  • Permission requests
  • Other
• Segment the text data
• Assign each segment to a category
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Can Tinkercad be used to design simple 2D architecture style drafting for a remodel of my home?
Inter-rater reliability

• Two or more people make the coding decisions independently to avoid systematic bias or misinterpretation
• Compare how many decisions agree, relative to chance
  • Calculate a statistical measure such as Cohen’s Kappa (for 2 people) or Fleiss’ Kappa (for more), comparing to typical levels (0.6-0.8 is considered ‘substantial agreement’)  
• May take account of how many decisions still disagreed after discussion  
  • Which may involve refining the coding frame to resolve decision criteria  
  • Can ‘prototype’ by discussing a sample before coding the main corpus
Grounded theory

- For research where you *don’t know in advance* what you are looking for, but wanting to learn something from qualitative data

- Read data closely, looking for interesting stuff (‘open coding’)
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Memo: Time for an educator’s forum?
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Open Coding

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Axial coding

Review the codes and memos, organising them according to themes that cut across the individual documents.

Community support ideas:
- Alumni
- Educators

Memo: Nice community spirit

Memo: Institutional Permissions

Parent assigning permissions to son

“Shard” as a feature name?

Sometimes people don’t want help

Bug: Firefox load
Reliability through constant comparison

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Can someone tell me how to add a design to "Favorites"?
How to evaluate your Part II project
When HCI methods will be relevant

• Systems that a user will interact with
  • e.g. games, programming systems, VR
• Systems with perceptual goals
  • e.g. graphics, audio, affective computing
• Systems that you plan to deploy
  • e.g. apps, mobile sensing, software tools
• Systems that analyse social data
• In all these cases, you will be doing research with human participants - guidance is available & permission is necessary
  • https://www.tech.cam.ac.uk/Ethics_guidance
Thinking about evaluation (even if not HCl)

• Approach ‘testing’ as a scientific exercise, with intellectual outcomes
  – Define goals and hypotheses
  – Understand boundaries and performance limits by exploring them - failure is necessary!
• Should your evaluation be analytic (reasoning/argument) …
  – How consistent / well-structured is your analytic framework?
• … or empirical (measurement/observation)?
  – What are you measuring & why? Are the measurements compatible with your claims (validity)?
• Should your evaluation be formative or summative in nature?
  – If formative – couldn’t you finish your project?
  – If summative – are the criteria internal (from some theory) or external (from some problem)?
• Is your data quantitative or qualitative?
  – Descriptive aspects of the system, or engineering performance data?
  – If qualitative, how will you establish objectivity (i.e. that this is not simply your own opinion)?
Summary of analytic options (analysing your design)

• Cognitive Walkthrough
  – Normally used in formative contexts – if you do have a working system, then why aren’t you observing a real user (far more informative than simulating/imagining one)?
  – But Cognitive Walkthrough can be a valuable time-saving precaution before user studies start, to fix blatant usability bugs

• GOMS
  – unlikely you’ll have alternative detailed UI designs in advance
  – If you have a working system, a controlled observation is superior

• Cognitive Dimensions (lecture 8)
  – better suited to less structured tasks than CW & GOMS, which rely on predefined user goal & task structure
Summary of empirical options (collecting data)

• Interviews/ethnography
  – could be useful in formative/preparation phase

• Think-aloud / Wizard of Oz
  – valuable for both paper prototypes and working systems
  – can uncover usability bugs if analysed rigorously using qualitative methods
    • It would be wise to make this clear in your dissertation, to avoid reasonable suspicion of bad techniques

• Controlled experiments
  – numbers sometimes appear more ‘scientific’, but only:
    • If you can measure the important attributes in a meaningful way
    • If you test significance and report confidence interval of observed means

• Questionnaires
  – be clear what you are measuring – is self-report accurate?

• Field Testing
  – controlled release (and data collection?) may be possible

• See human participants guidance for empirical methods
Surveys and questionnaires

• Standardised *psychometric instruments* can be used
  – To evaluate mental states such as fatigue, stress, confusion
  – To assess individual differences (IQ, introversion …)

• Alternatively, questionnaires can be used to collect *subjective* or *self-report* evaluation from users
  – as in market research / opinion polls
  – ‘I like this system’ (and my friend who made it)
  – ‘I found it intuitive’ (and I like my friend)

• This kind of data can be of limited value
  – Can be biased, and self-report is often inaccurate anyway
  – It’s hard to design questionnaires to avoid these problems
Questionnaire design

• *Open* questions …
  – Capture richer qualitative information
  – But require a coding frame to structure & compare data (if hypotheses)
  – Or grounded theory methods (if you have broader questions)

• *Closed* questions …
  – Yes/No or Likert scale (opinion from 1 to 5)
  – Quantitative data is easier to compare, but limited insight

• Collecting survey data via interviews gives more insight but questionnaires are faster
  – Can collect data from a larger sample
  – Remember to test questionnaires with a pilot study, as it’s easier to get them wrong than with interviews
Product field testing

- Brings advantages of task analysis/ethnography to assessment and testing phases of product cycle.

- Case study: Intuit Inc.’s Quicken product
  - originally based on interviews and observation
  - follow-me-home programme after product release:
    - random selection of shrink-wrap buyers;
    - observation while reading manuals, installing, using.
  - Quicken success was attributed to the programme:
    - survived predatory competition from Microsoft Money
    - later valued at $15 billion.
Bad evaluation techniques - don’t use these!

• Purely affective reports: 20 subjects answered the question “Do you like this nice new user interface more than that ugly old one?”
  – Might apparently be empirical or quantitative (do you like it on a scale of 1 to 10)
  – But probably biased – if these are your friends, or trying to please (experimental demand)
• No testing at all: “It was deemed that more colours should be used in order to increase usability.”
  – Apparently formative/analytic
  – But subjective – since the author is the subject
• Introspective reports made by a single subject (often the programmer, project manager or your project supervisor): “I find it far more intuitive to do it this way, and the users will too.”
  – Might be apparently analytic or qualitative, for example drawing on folk wisdom
  – But is often both biased and subjective
  – Unfortunately common in industry - the HiPPO evaluation method (Highest-Paid Person’s Opinion)
Research problem:
“How do you know if your evaluation is inline with user goals?”