Sketch and Prototype

Dr Charles Martin

Announcements

- **Assignment updates**:
  - template repo will be available this afternoon I promise
  - class reps: I'll get invites out this afternoon I promise!
  - questions on the forum welcome, look in the "assignments" category.

Apology: I completely changed what I planned to do in this lecture. This will be more fun / relevant to the assignment.

Plan for the class

- Sketch
- Prototype
- Make

Making

Last week I talked a bit about *identity* in HCI.
The *maker* identity is really relevant to me.
Making things to find out what, whether, how, and why.
Making as research methodology.
The framing this week around *sketches* and *prototypes* as different things with **rules** may not be something I agree with!

Figure 1: Make Magazine Issue 1, 2005. (Charles was 2nd year maths/music student at ANU)

Sketching Design Ideas

Sketching Design Ideas

- What is a sketch?
- What makes something a sketch?

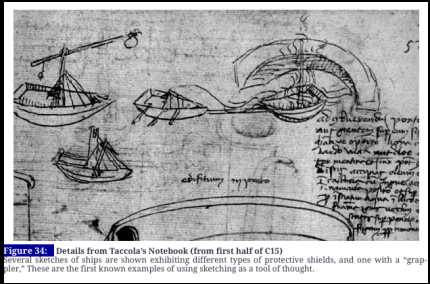


Figure 34: **Details from Taccola's Notebook (from first half of C15)**
Several sketches of ships are shown exhibiting different types of protective shields, and one with a "grappler," These are the first known examples of using sketching as a tool of thought.

Figure 2: (Buxton (2007) p.104)

What is a sketch?

- quick
- timely
- inexpensive
- disposable
- plentiful
- clear vocabulary
- distinct gesture
- minimal detail
- appropriate degree of refinement
- suggest and explore rather than confirm

(Buxton (2007), p.111-113)

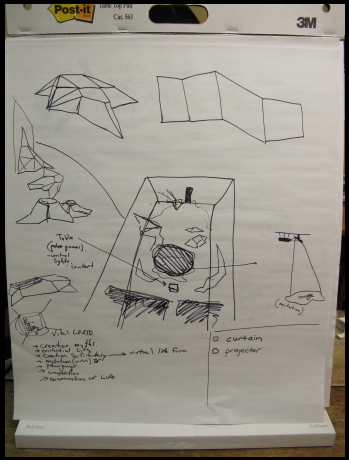


Figure 3: Sketching a stage in 2010

What should a sketch include?

This is up to you, but it could have

- title
- annotations
- short description
- a drawing

Design Idea: An AR app on a mobile phone that allows mosaic makers to preview tiles before gluing. This can help to choose colours and preview placement and positioning before being fixed.

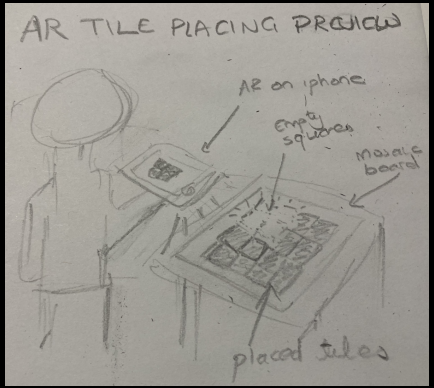


Figure 4: Sketch of the AR app idea.

Activity: Sketching toolkit?

What’s your sketching toolkit? How do you develop ideas?

- Discuss with someone for 2 minutes then we’ll hear some answers.

I give you permission to buy expensive notebooks and pens for this course.

Is a sketch a prototype?

No (apparently).

Sketch vs. **Prototype**

Sketch	Prototype
Provocative	Didactic
Suggest	Describe
Explore	Refine
Question	Answer
Propose	Test
Provoke	Resolve
Tentative	Specific
Noncommittal	Depiction

Interaction Design Foundation

Getting the Right Design vs Getting the Design Right

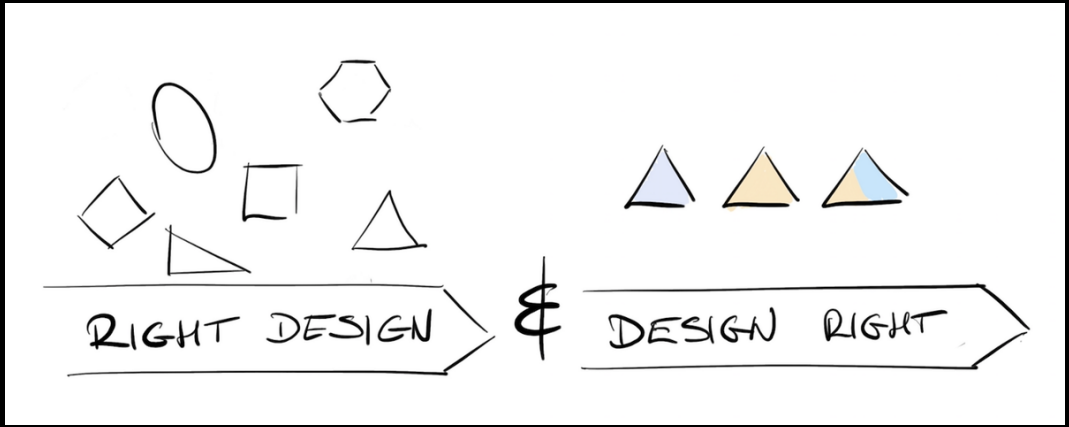


Figure 6: Image source: Getting the right design and the design right (uxdesign.cc)

Bill Buxton sez! So do it! (Buxton, 2007)

Activity: Sketch Demo

Let's sketch something:

How can tutors keep track of student questions, pain-points and successes during a tutorial?

1. Suggest a design idea on PollEverywhere: https://PollEv.com/charlesmarti205
2. Help me sketch it.

Figure 7: Poll Everywhere QR code

Prototyping

Prototyping

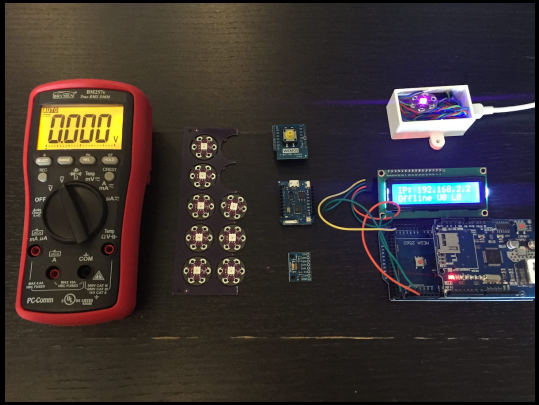


Figure 8: Bits and pieces for a hardware prototype.

What is a prototype

- *“primitive form”*
- the form that comes before… something.
- in this context:
  - a *testable* form
  - a form we can *experience*
- enables evaluation and iteration
- *primitive*: should be somehow rough or limited

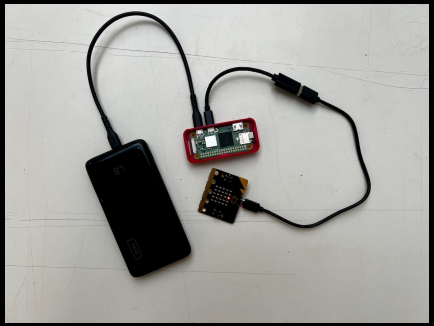


Figure 9: A prototype AI musical instrument.

More of what a prototype is

manifestation of an idea (Doorley et al., 2018), e.g.:

- a wall of post-its
- a role-playing game
- an activity
- an object
- a program
- a website
- an app

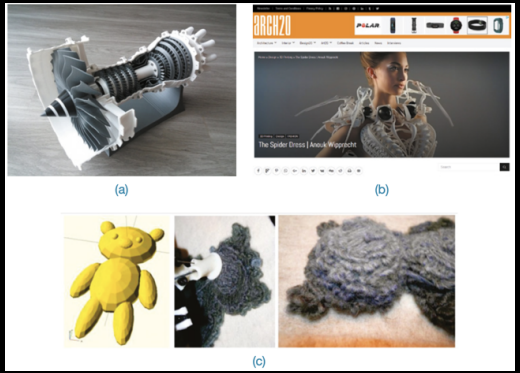


Figure 10: (Rogers et al., 2023) Figure 12.2: (a) model jet engine, (b) moving and sensing dress, (c) a teddy bear printed from a wireframe design

Why make prototypes

- empathy gaining
- exploration (build to think)
- testing
- inspiration
- learn
- solve disagreements
- start a conversation
- fail quickly and cheaply
- manage solution-building (Doorley et al., 2018)

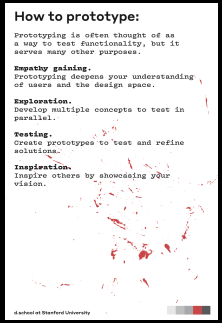


Figure 11: How t prototype from Doorley et al. (2018)

Figure 12: A prototype game from Anneysha Sarkar

EMPI (embodied musical predictive interface)

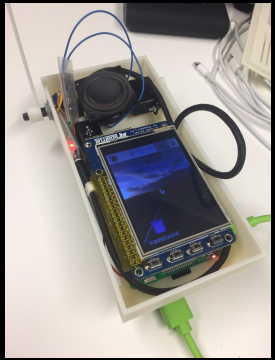


Figure 13: An early prototype (2018)

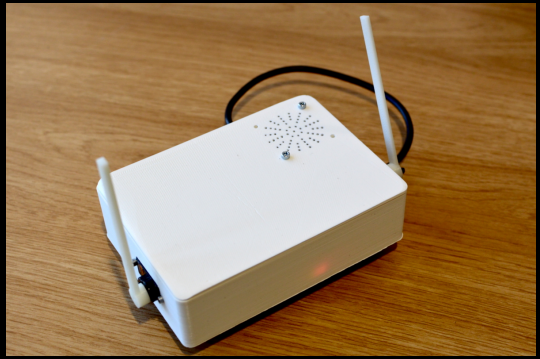
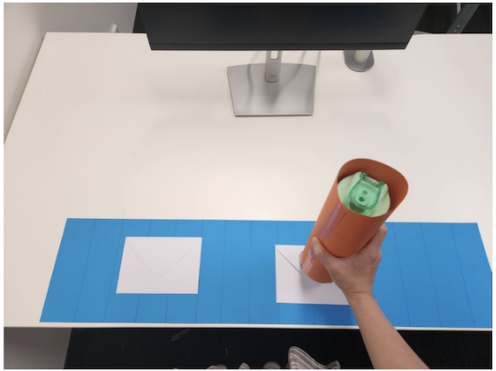
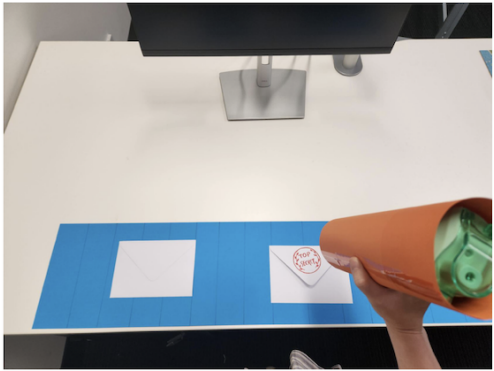


Figure 14: A later prototype (2019) (Martin et al., 2020)

Charades: Waterbottle Stamp (2025)



(a) Augmentation view: Hammer curl downward movement.

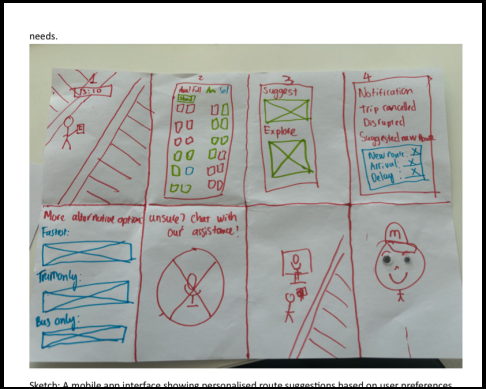


(b) Augmentation view: Hammer curl upward movement.

Figure 2: Our paper prototype for the weightlifting game. The water bottle is 'augmented' into an orange stamp. The player performs hammer curls to stamp incoming (virtual) letters on a (virtual) conveyor belt.

Figure 15: (Adiwangsa et al., 2025)

Storyboard



Sketch: A mobile app interface showing personalised route suggestions based on user preferences

Figure 16: A storyboard as a prototype from Ethan Teber-Rossi

Wireframe

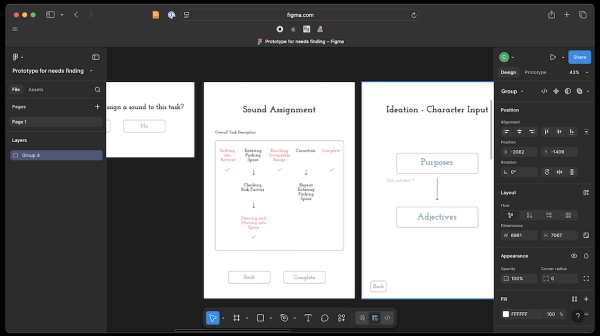


Figure 17: A wireframe prototype from Minsik Choi

FaderJam (2016)

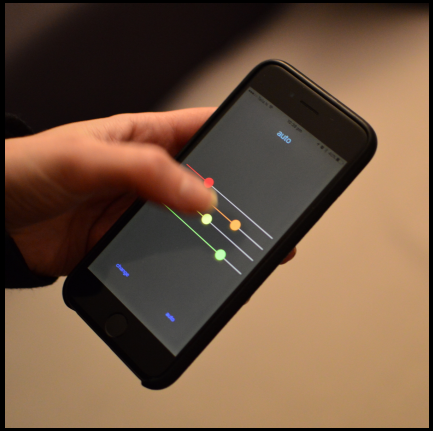
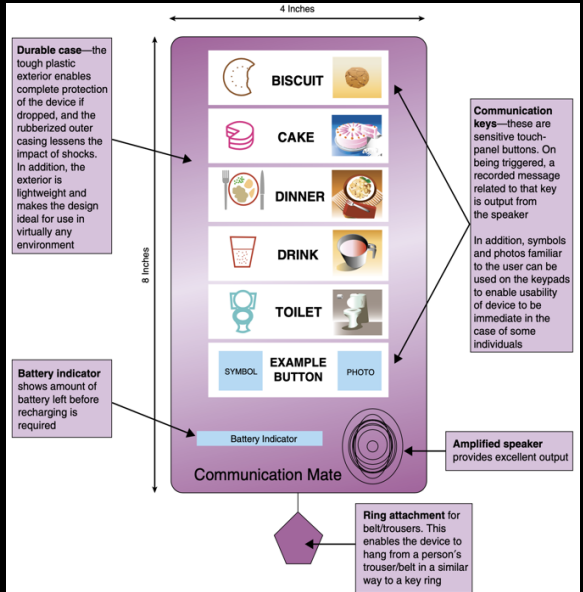


Figure 18: Prototype for a generative music app by Charles (turned out to be a bad idea)

Wireframe App

- Paper-based prototype to help a child with autism to communicate
- Functions and buttons
- Positioning and labels
- Shape of the device
- No actual functionality



Kinds of Prototypes

- all of the above were used to *test* ideas and drive evaluation
- some are more like a final product
- we use the word “fidelity” to mean how close a prototype is like a final product
- *low-fidelity:* (low-fi) rough, quick, not like a final product
- *high-fidelity:* (high-fi) more polished, slower to make, more like a final product

Prototype Definitions and Analysis

Filters and Manifestations

Filters: emphasise some aspects of a design, omit others. (Lim et al., 2008), (Rogers et al., 2023 Box 12.2)

- **Appearance:** size, colour, shape, form, texture, sound
- **Data:** size, type, use, privacy, organisation
- **Functionality:** needs, features
- **Interactivity:** input, output, feedback
- **Spatial Structure:** arrangement of interface, intangible, tangible, 2D, 3D

Manifestations: an external representation of the design (Lim et al., 2008), (Rogers et al., 2023 Box 12.2)

- **Material:** media used, physical, code, hardware etc
- **Resolution:** level of detail and sophistication (fidelity)
- **Scope:** range of functionality, needs addressed

The prototyping spectrum

- High Fidelity Prototype
- Low Fidelity Prototype
- https://collection.maas.museum/object/115505
- https://www.youtube.com/watch?v=k_9Q-KDSb9o

Prototyping - Low-Fidelity

- Don’t look/act like the final product
- Simple, cheap, quick to produce/modify
- Support exploration of alternative designs/ideas
- Important in early stages - exploration/modification
- Not meant to be kept and used for the final product
- Storyboarding, Sketching, Index Cards, Wizard of Oz

Figure 21: Rogers et al. (2023) Figure 12.1: PalmPilot wooden prototype

Low-Fi: Storyboards

- a scenario is one story
- a storyboard represents a sequence of events (can be sketches)
- generated from scenario
- break the story into steps
- thinking through process
- think about design issues

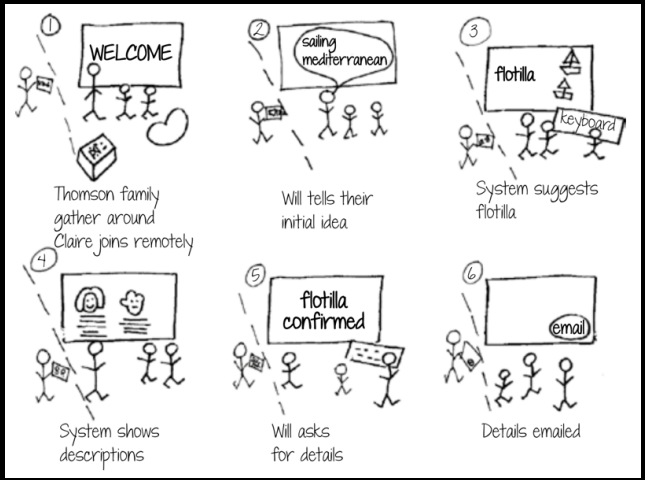


Figure 22: Rogers et al. (2023) Figure 12.12 travel organiser storyboard

Low-Fi: The Role of Sketching

- Sketching - a key part of low-fidelity prototyping
- “Sketching is not about drawing. Rather, it is about design” Saul Greenberg et al. (2012)
- Sketching vocabulary, required elements

So a sketch *is* a prototype?

Which is it?

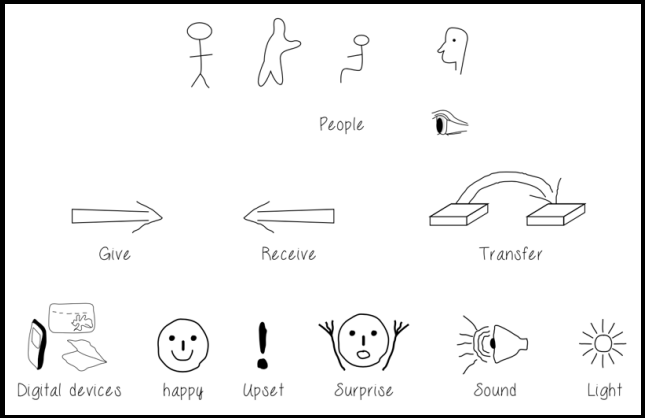


Figure 23: Rogers et al. (2023) Figure 12.5: simple sketches for low-fidelity prototyping

Low-Fi: Card-Based Prototypes

- Index cards (Small pieces of cardboard: 3x5 inches)
- Each card represents one element of the interaction
- A screen, icon, menu, dialog exchanges
- User can step through the cards
- Pretending to perform the task while interacting
- Explore user experience

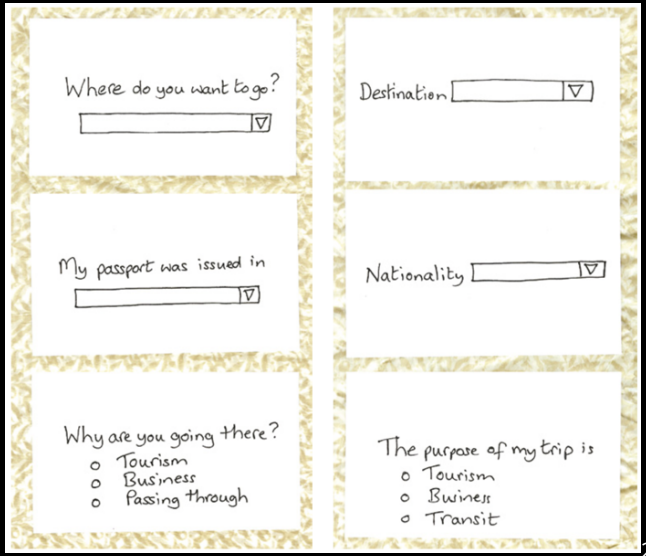


Figure 24: Rogers et al. (2023) Figure 12.12 travel

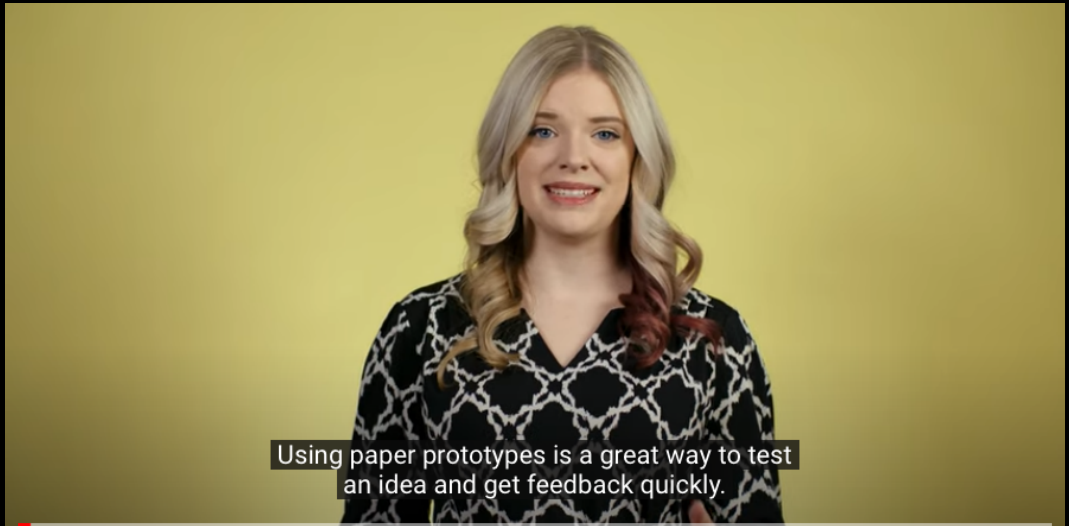
Low-Fi: Paper and Cardboard Prototypes

Figure 25: Interactive Paper Prototypes

Figure 26: Cardboard Prototypes

Paper Prototyping

It’s not just the prototypes, but how you use them!



Low-Fi: Wireframes

Wireframing is the Art of Efficiency

The aim is to communicate the structure of a possible solution so your team can identify solid user experience (UX) design foundations to build on and stakeholders can offer feedback on a visual item.

So, you should show what elements your users would expect to find and how these work in flow. To begin, you should:

Focus on functionality, accessibility, layout and navigation to make a design easier to use, produce and sell – Leave nice-to-have features out.

Structure a hierarchy with a list of prioritized elements for each page – Determine the information architecture early so you can categorize information clearly.

Divide the screen into large blocks for content.

Fine-tune these blocks with details – links, placeholders for images, etc.

Maintain a clean grid-oriented view of all content – Apply best practice design principles to maximize ease of use.

Use annotations to help others understand your wireframes faster.

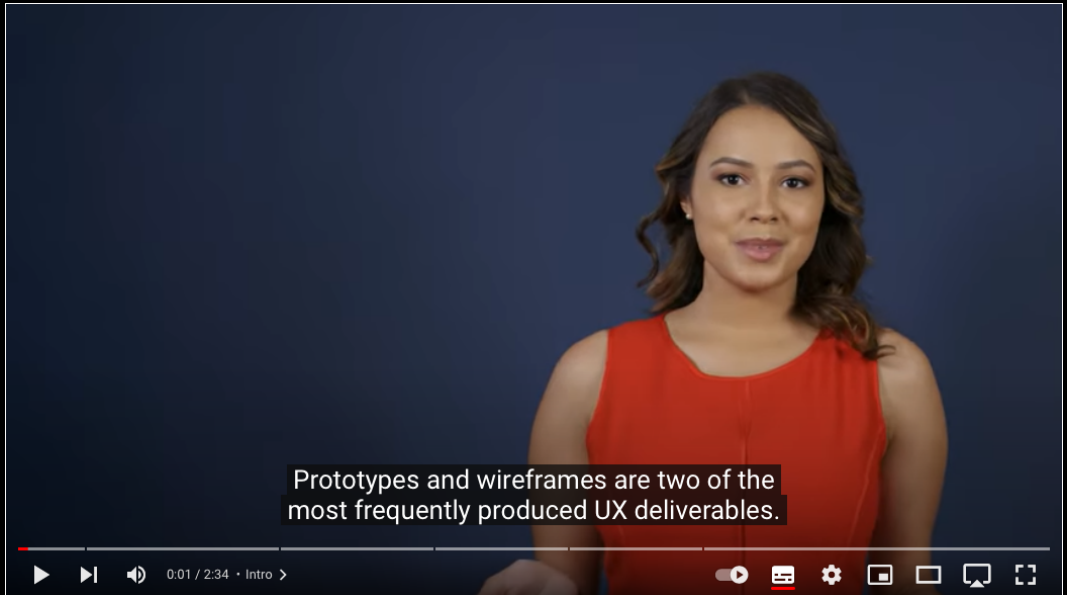
Put mobile first – When you start wireframing for the smallest screens, you can achieve better consistency across devices.

With higher-fidelity wireframing, be more specific – Although you shouldn't overdo content, still show what *needs to* appear and *accurate* sizes of fonts, icons, links, etc.

Keep your wireframes concise – Don't worry about finer details such as aesthetic appeal.

Figure 29: Wireframes in a sketchbook

Prototypes vs Wireframes



Wizard of Oz Experiments

Can we test a product that doesn't exist?

- user interacts with the software
- a human simulates the software's response
- assumes a software product or app

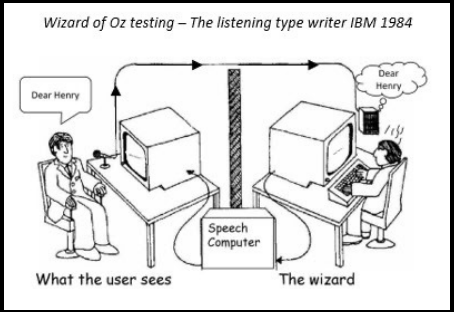


Figure 31: Testing a system that doesn't exist.

Making Hardware Prototypes

- Build *working* prototype systems in hardware
- micro:bit - cheap, small, with IO on the board (hello comp2300!)
- arduino, big ecosystem, not-as-good boards.
- raspberry pi, cheap way to get Linux into a prototype
- Bela (charles' friends!), pricey but hard realtime OS is good for audio interactions.

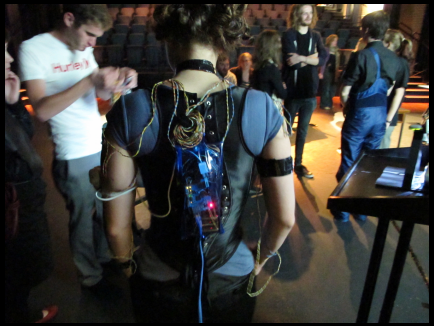


Figure 32: Actor arduino interface (2010)

Makey Makey

- alligator clip to connect switches / sensors
- works as a keyboard
- e.g., banana spacebar
- programmable arduino-like microcontroller

Figure 33: The Makey Makey

High-Fidelity

- looks and acts more like the final product
- answer design questions, learn about constraints
- evolve through stages of fidelity
- can be used in a real application setting
- design-evaluate-redesign cycles
- modify/integrate existing components / tools / kits

Figure 34: What could this be?

low- versus high-fidelity

Type	Advantages	Disadvantages
low-fi	- quick revision- multiple ideas- good for communication- good proof of concept	- limited error checking- poor specification for dev- facilitator driven- usability not clear- flow limitations
high-fi	- more functionality- more interactive- user driven- exploration and test- look and feel- marketing/convincing	- hard work- time consuming to fix- inefficient for proof of concepts- could be mistaken for a product- could set poor expectations

Compromises

- compromise is inherent to prototyping
- make something quickly to test a particular aspect
- prototype must be built with the key issues in mind
- robustness vs flexibility

Prototyping Starter Kit

Figure 35: Prototyping workshop for AI musical instruments at NIME 2024.

Post-its, notebooks, arts and craft materials

- take one step up from sketching
- paper version of your work *testable*
- low tech, low-fi, low risk, low cost
- from storyboards to cardboard mockups with moving parts

You'll do this in the tutorial next week!

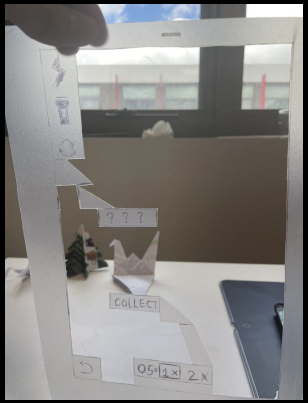


Figure 36: Paper AR app by Kevin Zhu, 2024.

Digital Wireframe

wireframes are visual plans for a user interface focussed on structure.

- Figma
- wireframe.cc

Established part of UX design process. Can walk through details of an interactive system with stakeholders.

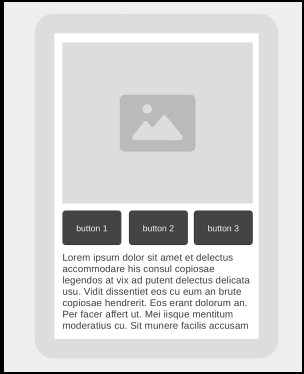


Figure 37: A wireframe of my awesome product.

p5.js or Processing

Make interactive systems quickly with a “sketching in code” mindset.

- Processing is the original (Java-based)
- includes a simple IDE and library system
- p5.js is a javascript port
- includes an online editor

Fast, interactive, not good for “normal” web design.

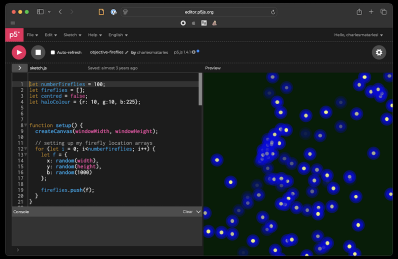


Figure 38: Interactive “Fireflies” in p5.js

Hardware Prototyping

Sketch in hardware.

- Arduino, Microbit, Bela
- soldering and circuit design
- 3D printing
- fun, frustrating
- can be expensive

Convincing to test with a “real” product, can be used in real-world experiences.

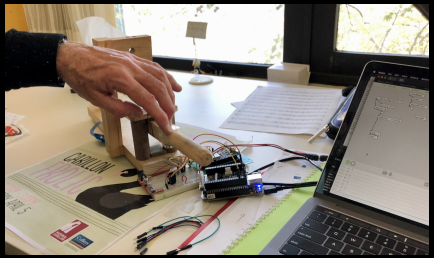


Figure 39: Alistair Riddell testing an electronic carillon key.

Web or Application Stack (of your choice)

Everybody has different skills and areas of interest.

- where are you comfortable to experiment?
- where do you want to build experience?
- for Charles it's usually:
  - Python/Flask/Bootstrap
  - or iOS/iPadOS, libpd (for sound)

Need to be careful to focus on *prototyping*.
What does a prototype *not need*?

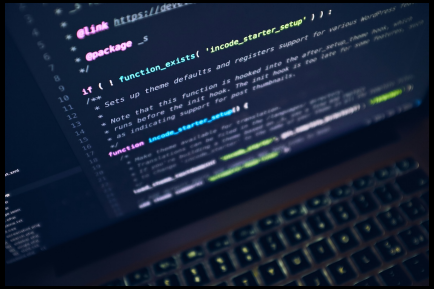


Figure 40: Go code. (Image: Photo by Luca Bravo on Unsplash)

Vibe Coding

GenAI is pretty good at making interactive websites!

- just ask chattie to build a prototype of your idea.
- fast, cheap
- possibly a bit broken (bad if you don't know how to fix)
- risks?
- problems?
- affordances?

Not necessarily bad in HCI: can we vibe code *way more* prototypes than we could afford to build?

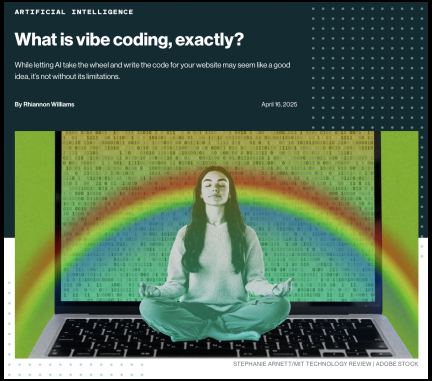


Figure 41: Vibe coding. Source: MIT Technology Review, April 2025.

Activity: prototyping by request

Can we live-code a prototype before the end of this lecture?

1. Choose a prototype idea on PollEverywhere: <PollEv.com /charlesmarti205>
2. Help me figure out how to prototype it.
3. ???
4. 💸💸💰💲

Figure 42: Poll Everywhere QR code

Sketching and Prototyping in your Assessment

- in your assessments, sketches and prototypes are differentiated by role in a design process.
  - **sketches:** part of ideation process, quickly find lots of ideas, explore the needs and solutions
  - **prototypes:** lead to something *testable*, should articulate an interaction

Highest-fidelity is not necessarily better!

- best prototypes demonstrate a design process
- allow the important aspects of interaction to be evaluated
- I want to see evidence (through your prototypes) of a considered design process
- different prototypes may be appropriate for different designs

Questions

Who has a question?

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