



UNIVERSITY OF
LEICESTER

SKETCHING AND LO-FI PROTOTYPING

CO1106 Requirements Engineering and **Professional Practice**

Dr Matthias Heintz , Prof. Shigang Yue
(mmh21@leicester.ac.uk) (sy237@Leicester.ac.uk)



Please join TopHat activities:
<https://app.tophat.com/login>
Join: **147651**

Reminder - Module Feedback Survey for (CO1106)

- You have just been invited to provide feedback for the module “(CO1106) Requirements Engineering and Professional Practice (2023/24-SEM2)”
- The survey will start now. It is scheduled as follows:
 - Survey start: 11.03.2024 12:00:00
 - Survey end: 29.03.2024 23:59:00
- Your feedback is important for the future improvement on this module

Hack Leicester Awards on March 25th

- The Leicester Computer Science Society -
- This event is for all students to
 - Witness the top five teams from the IBM Hackathon showcase their projects to a panel of industry professionals from IBM.
 - Network with IBM representatives and gain insights into industry innovation through informative talks.



AWARDS *Night*

We'd like to invite everyone to the final round of Hack Leicester 23/24.

Watch the five shortlisted teams present their big ideas and fight for the grand prize of IBM Insight Days and IBM merch!

Prizes
available!

Winning Team - £25
Amazon gift card each
Runner Up Team - £10
Amazon gift card each

**Monday 25th
March @ 6pm**

Lecture Theatre 2
Bennett Building



AWARDS *Night*

- Witness our top 5 hackathon teams pitch their projects
- Network with Senior IBMers, including the Head of CiC, Head of Ops @ CIC and more!
- Experience insightful talks by IBM on what it really means to innovate in the tech industry



25TH MARCH AT 6PM
BENNETT LECTURE THEATRE 2

Schedule

Week	Start Date	Monday / Wednesday - Lecture	Thursday / Friday - Surgery	Assessment
26	15/01/2024	Introduction & Why Requirements?	Icebreaker activity for groups & work on Project Description	
27	22/01/2024	Requirements gathering (Quan. & Qual. User Studies)	Work on requirements gathering for Assessment 1	
28	29/01/2024	Functional Requirements	Work on building list of funct. requirements for Assessment 1	
29	05/02/2024	Non-Functional Requirements	Work on building list of non-funct. requirements for Assessment 1	
30	12/02/2024	Overview of UML; Use Case diagrams and descriptions	Work on Use Case diagram and Use Case description for Assessment 1	
31	19/02/2024	Basics of git version control	Checkout and setup group git repository and set up Weekly Log .md file	Assessment 1 (50%)
32	26/02/2024	More advanced git topics	Work on reworked list of functional requirements	
33	04/03/2024	Class Diagrams	Work on Class diagram	
34	11/03/2024	Class Modelling	Rework Class diagram	
35	18/03/2024	Sketching and Lo-fi prototyping	Work on wireframes/lo-fi prototypes	
36	25/03/2024	Software Laws & Professionalism	none	Effective use of Git (10%)
37-40	01/04/2024	break	break	
41	29/04/2024	none	none	Blackboard Test (40%)

Matthias

Shigang

Session objectives

- At the end of the lecture you will:
 - Understand the ***role of sketching and prototyping in interface design***
 - Recognise the ***relationship between requirements specifications and prototyping***
 - Explain the ***benefits and drawbacks of prototyping***
 - Be familiar with some ***techniques with different levels of fidelity***

Group coursework in CO1106

■ Main group project

- ***Part 1*** (50% - due 23rd February)
 - Project description (10%)
 - Quantitative and qualitative studies (10%)
 - Written requirements (20%)
 - Use Case UML Diagram and Use Case Description (10%)
- *Part 2* (10% - due 27th March)
 - **Effective usage of git version control**
 - ***Upload your initial class diagrams***
 - **Individual Blackboard test (40%)**



Group Coursework Part 2 -

Effective use of git version control

- Your group will utilise a git repository in order to manage/submit any files produced as part of the second part of the group project for CO1106 (details of how to access the repository will be provided to you in the tutorial of Week 6).
- Groups should **make frequent usage** of their group repository - any shared files that you work on (for example, the .md files containing functional requirements and use case descriptions) should be added to the repository as soon as they are made, with regular changes being committed by group members until that particular file is finished. Each group will be responsible for coordinating their git usage.

Group Coursework Part 2 – Instructions

- A maximum of 3 marks are available, depending on **how effectively your group used git**. We will decide the number of marks you receive by inspecting the contents of your repository as well as the commit history of your repository:
 - For 1 mark, at least one member of your group needs to make a commit each week; no advanced features (i.e., branching/merging) have been used, and commit descriptions (included when you made the commit) may be non-descriptive and not give a good idea of the changes included in a particular commit.
 - For 2 marks, multiple commits should be made each week, and an initial (possibly incomplete) version of the artefact worked on during each tutorial session needs to be submitted in the week it was worked on. Commit messages must be descriptive (but succinct) and give a good idea of the changes that have been committed.
 - For 3 marks, you must satisfy all points from the previous two bullets, and it should be apparent from your commit log that all members of the group have

Group Coursework Part 2 – Weekly log

- Each group must also produce a '**Weekly Log**' (**.md format**) that is **updated** with the following contents in **each** of the **weeks** 6-10 (5 weeks in total):
 - A 'beginning of week' entry containing a summary of the work that the group plans to complete during that week, along with a breakdown of which members will complete which tasks. The beginning of week entry for each week should be produced by the group; for example, during your first groupwork meeting of that week.
 - An 'end of week' entry which lists the tasks that each member of the group has completed; any outstanding work; and any other additional information that your group feel is relevant to add .

Group Coursework Part 2 – Weekly log (continued)

- Each group will be responsible for **designing the Markdown structure** of their Weekly Log, ensuring that it is easy to read and maintained properly. The entries in the Weekly Log will be checked on a weekly basis (the entry for Week X will be checked by us during Week X+1). For the entries of Week X, there is a maximum of 0.75 marks available (up to a total of 3 marks for weekly updates):
 - 0.25 marks depending on whether both the 'beginning of week' and 'end of week' entries have actually been added to the log (if either one is missing, you receive 0 marks for that week)
 - 0.5 marks will be awarded depending on the quality of the entry (is it descriptive enough? does it contain all the information listed above?)
 - An additional mark out of 4 will be awarded based on the readability/quality of the Weekly Log document.

Marking rubrics

Markdown Usage, Marking Rubric					
Fail	Poor	Requires Improvements	Satisfactory	Good	Excellent
0	0.5	1	2	3	4
No serious attempt is made.	Required information is contained in the document but no Markdown syntax has been utilised in order to improve readability.	A limited amount of basic Markdown syntax has been used to produce a document that is readable but not aesthetically pleasing or easy to navigate. There may be some syntactical errors in the Markdown usage that cause the document to look untidy.	Basic Markdown syntax has been used to reasonable effect. The produced document is navigable and its contents is clearly displayed. Most audiences should have little to no problem with understanding the document, but it is not particularly aesthetically pleasing.	Same as Satisfactory, but with a number of more advanced Markdown features used in order to improve the readability of the document. Any member of the intended audience would be able to navigate the document easily.	Same as Good, but a clear effort to make the document aesthetically pleasing as well as easily navigable has been made.

PROTOTYPING



Prototyping defined

- “Prototyping is the process of quickly putting together a **working model** (a prototype) in order to **test various aspects of a design**, illustrate ideas or features and gather **early user feedback**.”
- IEEE defines prototyping as: “A type of development in which emphasis is placed on developing prototypes early in the development process to permit **early feedback and analysis** in support of the development process.”

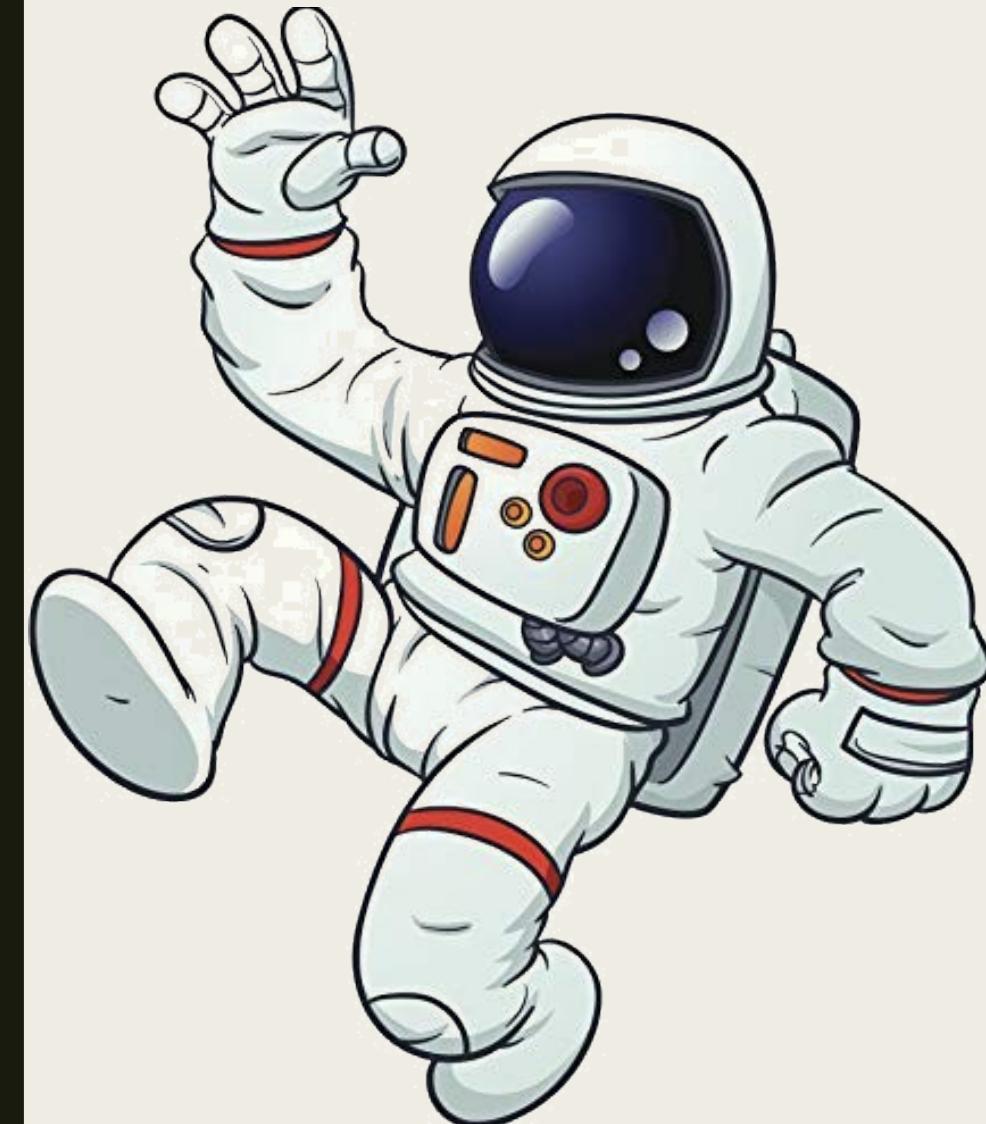
Need for prototyping

- Enables us to **explore the problem space** with the stakeholders.
- As a **requirements artifact** to initially envision the system.
- As a **design artifact** that enables us to explore the solution space of your system.
- A vehicle for you to **communicate the possible UI design(s)** of your system.
- A **potential foundation** from which to continue developing the system
 - *Beware of this though*

PHYSICAL PROTOTYPING

Prototyping

- During the Apollo missions NASA engineers built a full-size cardboard prototype of the lunar landing module to test the position and size of the windows in relation to the field of view of the astronauts.
- This experimentation led to the design decision that the astronauts would stand not sit inside the lander.
- This allowed the windows to be smaller, saving crucial weight.





Prototyping

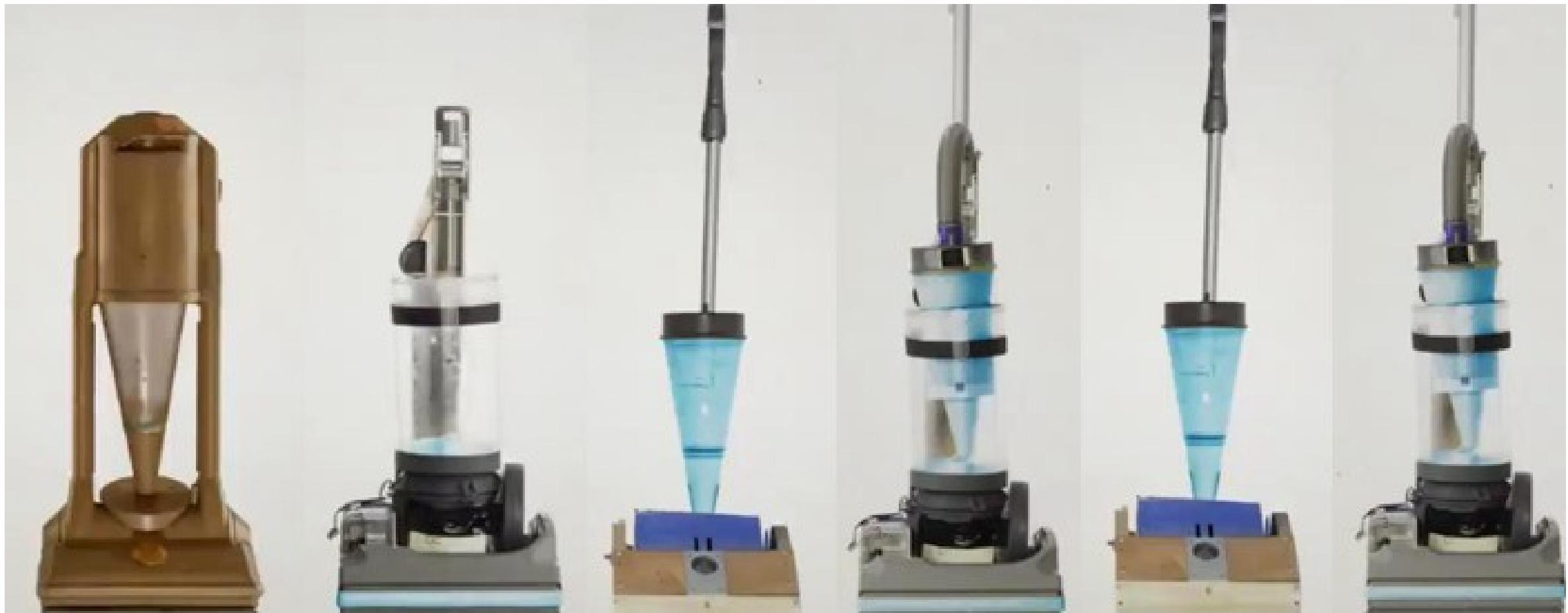
P



HOW MANY PROTOTYPES
DID JAMES DYSON
PRODUCE BEFORE
FINALISING HIS BAGLESS
VACUUM CLEANER DESIGN?





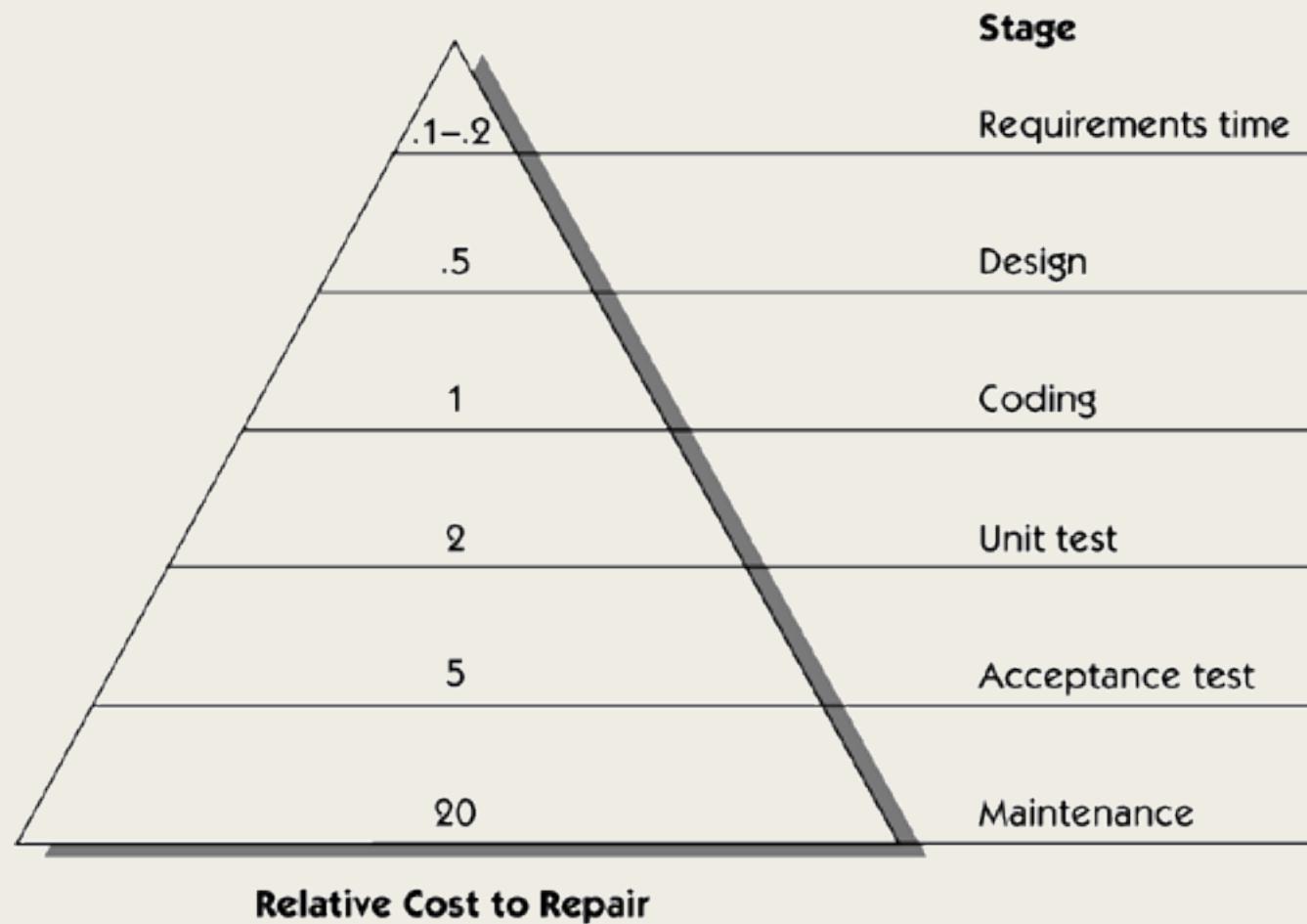




5126
ATTEMPT
S
LATER....

REQUIREMENTS SPECIFICATION AND PROTOTYPING

The requirements problem



Requirements specifications and prototyping

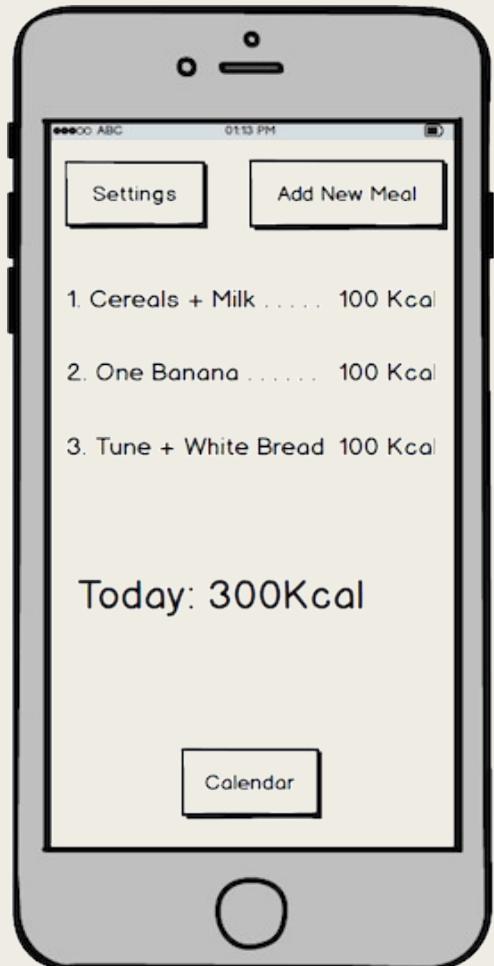
■ Specifications:

- *are good for a checklist of things to achieve*
- *are sometimes hard to understand the overall picture*
- *can contain conflicting specifications*
- *are bad for conveying the overall idea*

■ Prototypes:

- *are a way of envisioning how all your specifications work together*
- *are a way of testing the consistency of your specifications*
- *are easy to show people and talk about*

Requirements specifications and prototyping



- As a user, I want to open the app and instantly see today's meal log and calorie consumption.
- I want to quickly add new meals and calories that I've just consumed.
- I also want to quickly access the inapp calendar to view my meal log for other dates.

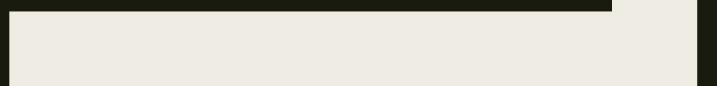
Prototyping

- Brings designs to life for:
 - *Designers*
 - *Users*
- Can be as sophisticated or as crude as you want
- Allows you to explore ideas
- Used properly, it is at the heart of human-centred design

Prototyping

- May (rarely) mimic the whole system.
 - *More usually looks at horizontal or vertical slice through the system*
- May evolve into final product, or be replaced by an idea that worked better.
- A prototype is about the presentation of ideas
- Different prototyping methods suit different situations.

LOW-FIDELITY AND HIGH-FIDELITY PROTOTYPING



Prototyping



Low fidelity prototypes explore initial concepts and broad ideas.



Higher fidelity prototypes help evaluate "look and feel" and functionality.

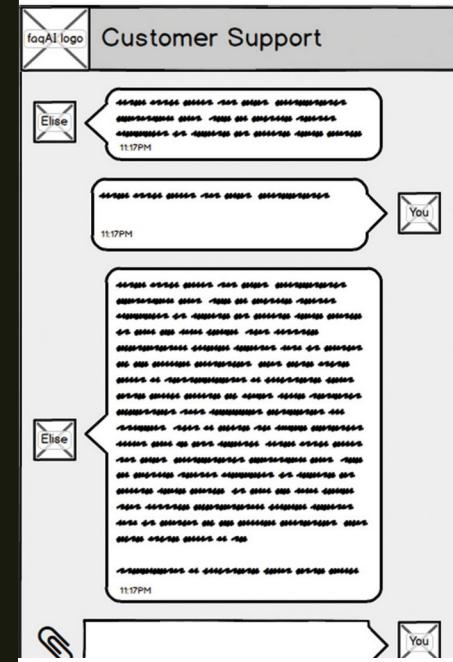


The main purpose of prototyping is to evaluate designs with users.

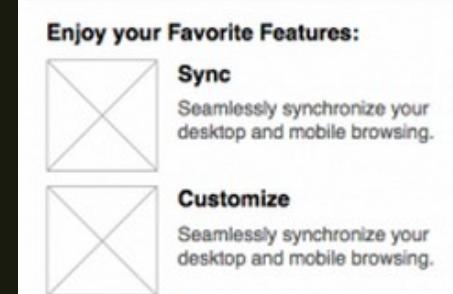
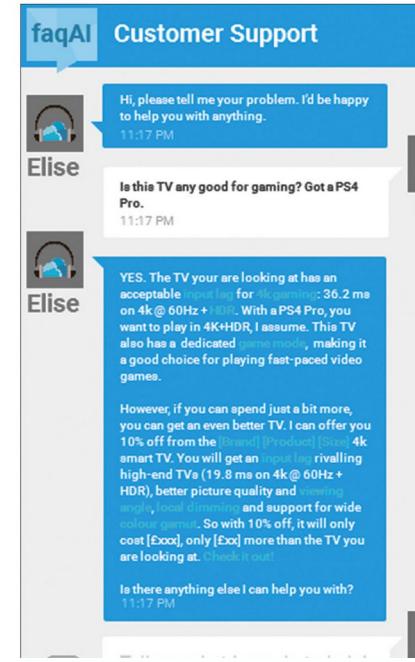
Low and high-fidelity

- **Low-fidelity** prototypes are often paper-based and do not allow user interactions (from hand-drawn mock-ups to printouts -> very quick).
- **Higher-fidelity** prototypes are computer-based, and usually involves more realistic user interactions (as close as possible to a representation of the user interface)

Low-fidelity

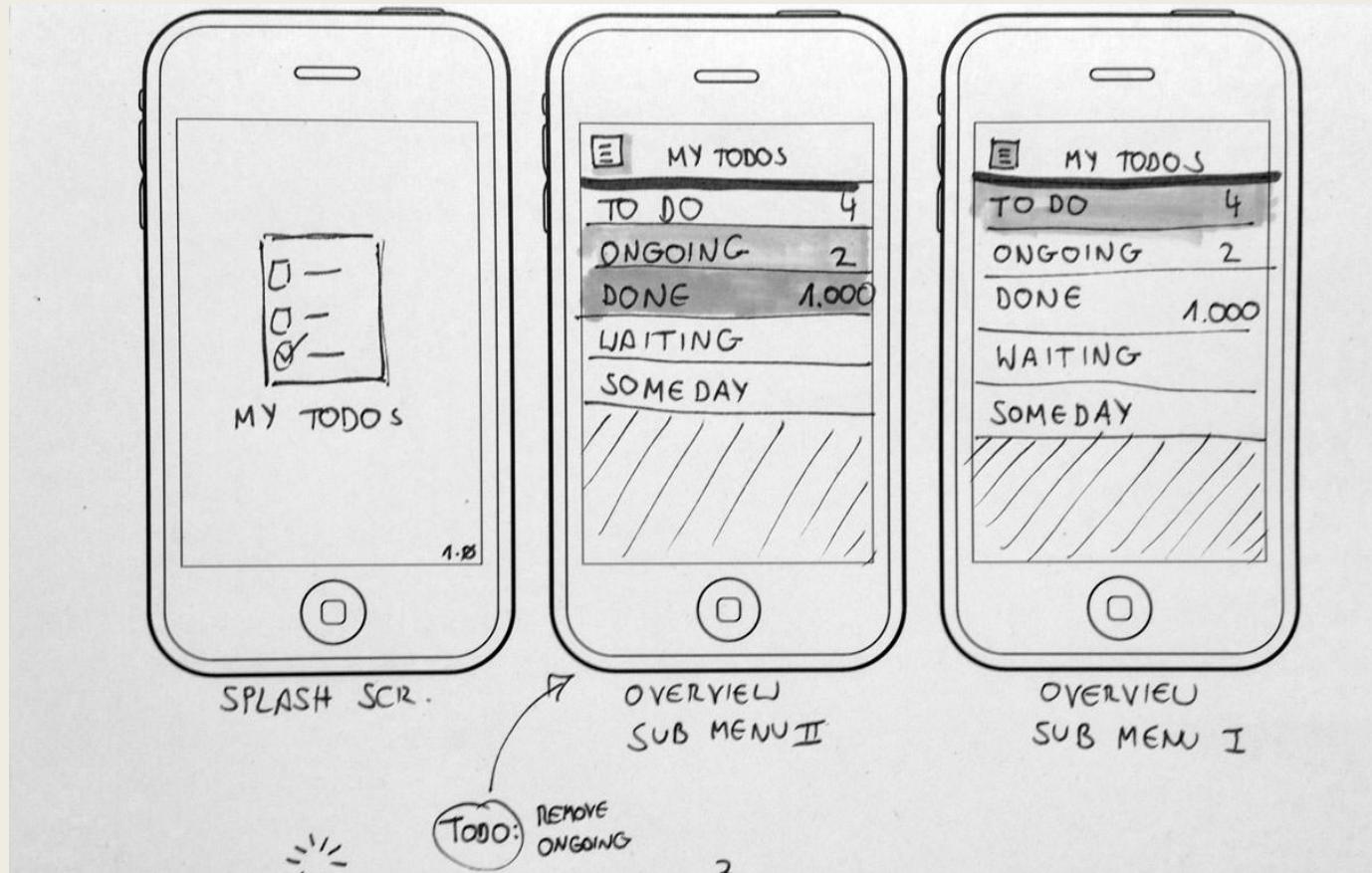


High-fidelity



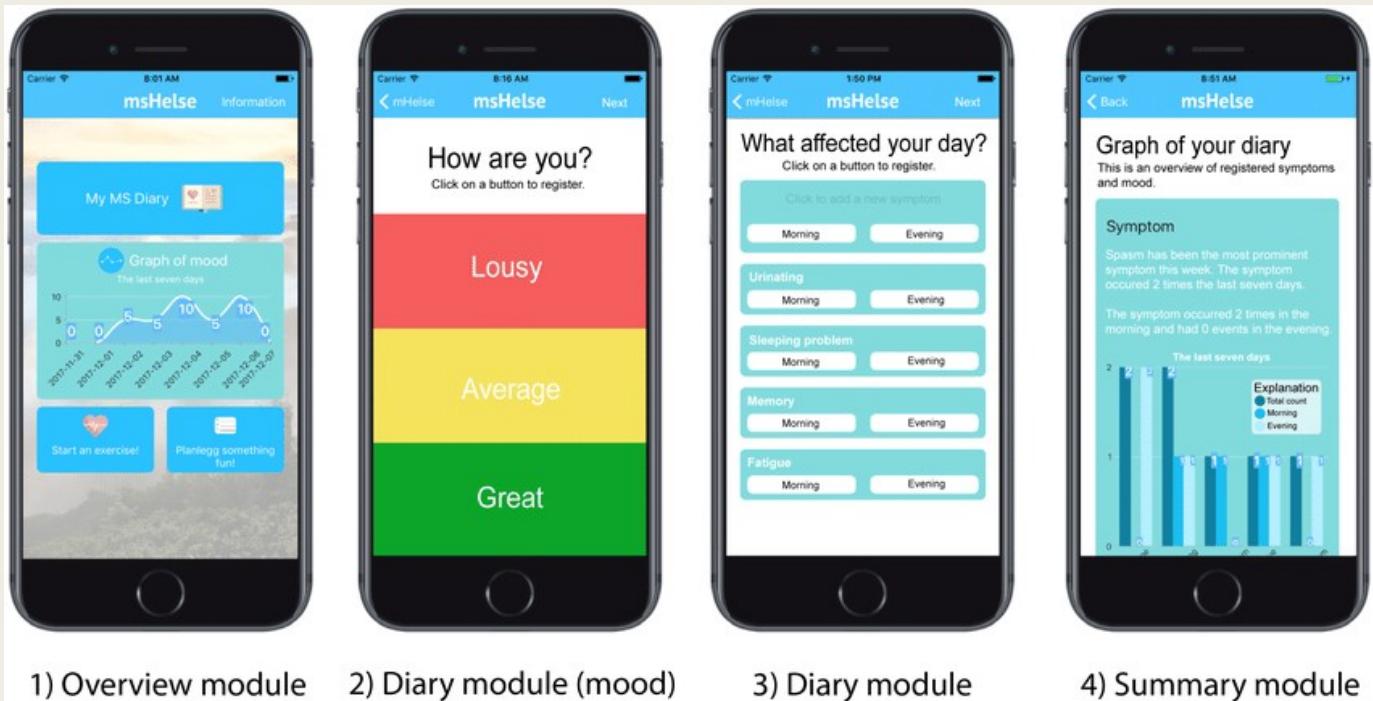
Lower fidelity

- Usually made from paper or cardboard
- Designed to be produced quickly and thrown away after use
- Focuses on underlying design ideas:
 - *Content*
 - *Form*
 - *Structure*
 - *Functionality*
 - *Navigation*



Higher fidelity

- Useful for an evaluation of the main design elements:
 - *Content*
 - *Visuals*
 - *Interactivity*
 - *Functionality*
 - *Media*
- Can be used to measure how fast a person can learn the system.

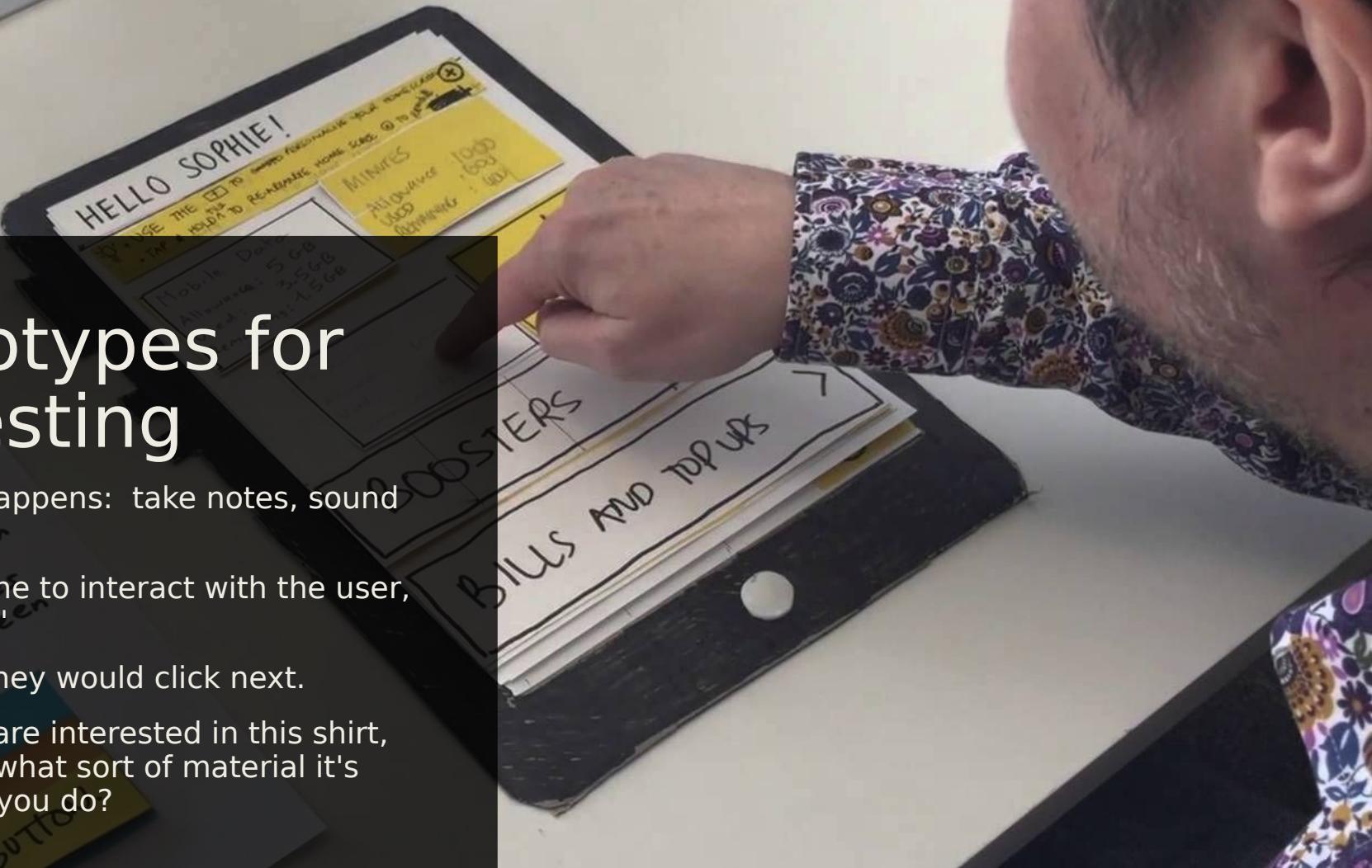


Prototyping

- Prototypes should always be interactive. They are made so that users can interact with part of the system.
- In the crudest example, a paper print-out of a web site can be made interactive: A user "presses" a button with his pen. The designer then changes the print-out to represent the system's response. (they might need to swap print-outs -
<https://www.youtube.com/watch?v=zOZkf70kUtc>)

Using prototypes for usability testing

- Need to record what happens: take notes, sound record or use video.
- Have two designers, one to interact with the user, one to "play computer"
- User points to where they would click next.
- Use a narrative: "You are interested in this shirt, but you want to know what sort of material it's made of. What would you do?"



Lo-fi prototypes

Main issues:

- **Robustness:** It needs to be strong enough for use
- **Scope:** Keep it simple so users can follow the story
- **Instructions:** Too little and they get lost. Too much and they obey without thinking
- **Flexibility:** Invite users to red

Sketch Pads



Stencils



p problems



<https://www.uistencils.com/>

Using higher fidelity prototypes

- Useful for getting client approval before developing all the functionality.
 - *"The site will look like this. Would you like changes before I go on?"*
- Usually appears well into the project.
- Beware: it looks so realistic that the client will regard it as real.
 - *Any typos etc. will be treated seriously and will distract from the main purpose.*
 - *Managing expectation*



Trade-offs

- Hi-fi prototypes can give you exciting prototypes...
 - Special-purpose prototypes can answer specific questions...
 - Realistic prototypes may increase validity of user test data...
 - Iterative refinement enables continual iteration and feedback.
- 
- ...but can lead to premature commitment to design decisions
 - ...but building all those prototypes is expensive, in time at least.
 - ...but may delay testing and require more prototype building
 - ...but may discourage radical transformations
- 

Presenting designs in meetings

Remember your audience!

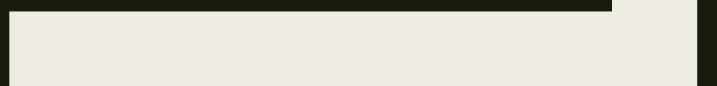
- If presenting to Senior Management:
 - *Vision, Concepts, Key features, Impact, Image*
- If presenting to client:
 - *Detail of design, Workings of system*
- If aimed at getting a contract:
 - *The main selling point, Differences between your product and others*

Presenting designs in meetings

Remember your audience!

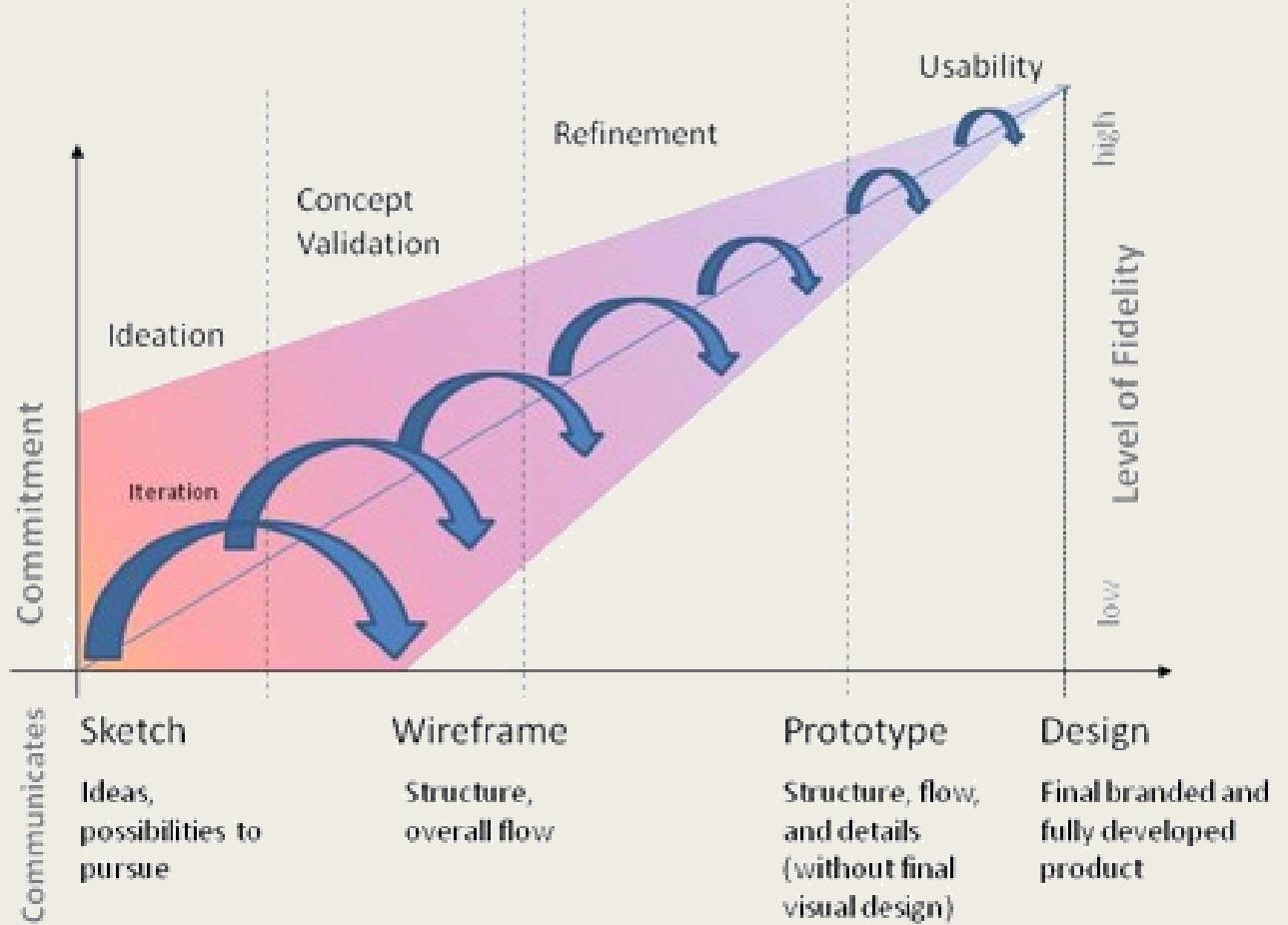
- If aim is to agree a concept:
 - *Restate client brief, Clarify requirements, Scope the project*
- If evaluating early designs:
 - *Design principles, How the parts fit together, Basic navigation*
- If evaluating detailed designs:
 - *Size, Shape, Colour, Text*

FROM SKETCHING TO FINAL DESIGN



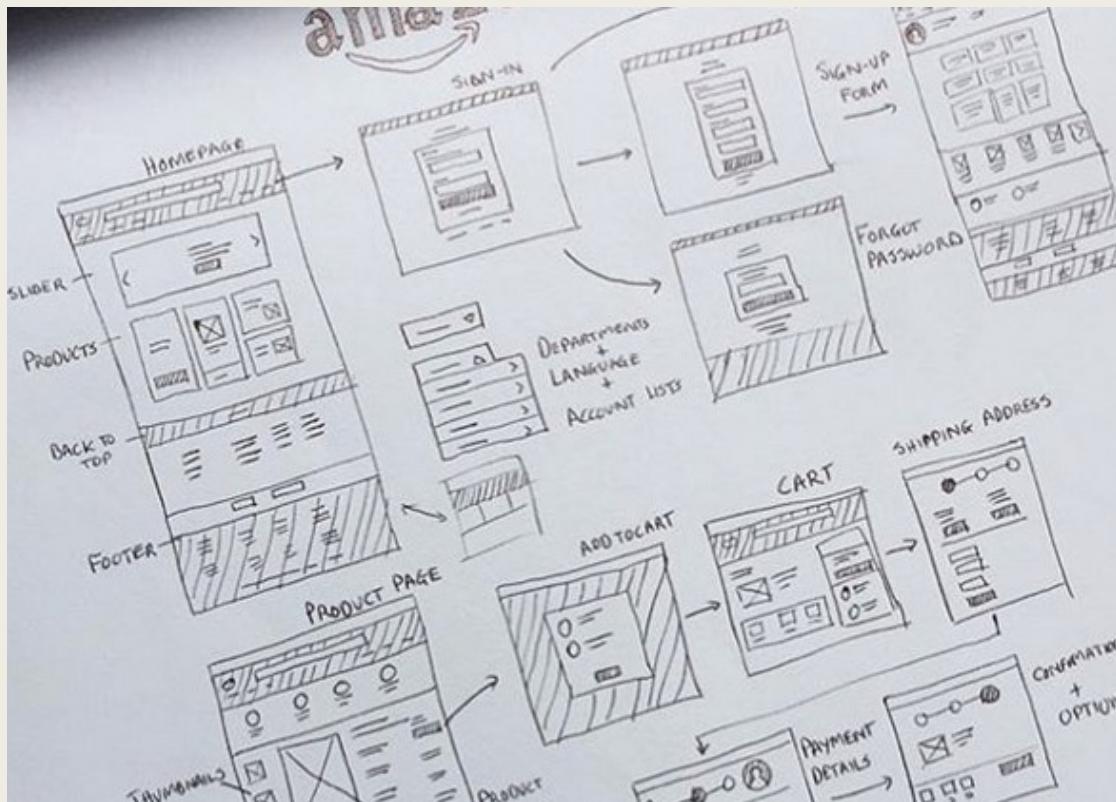
Techniques and tools at different levels of fidelity

1. Sketching
2. Wireframes
3. (Working) prototypes
4. (Final design)



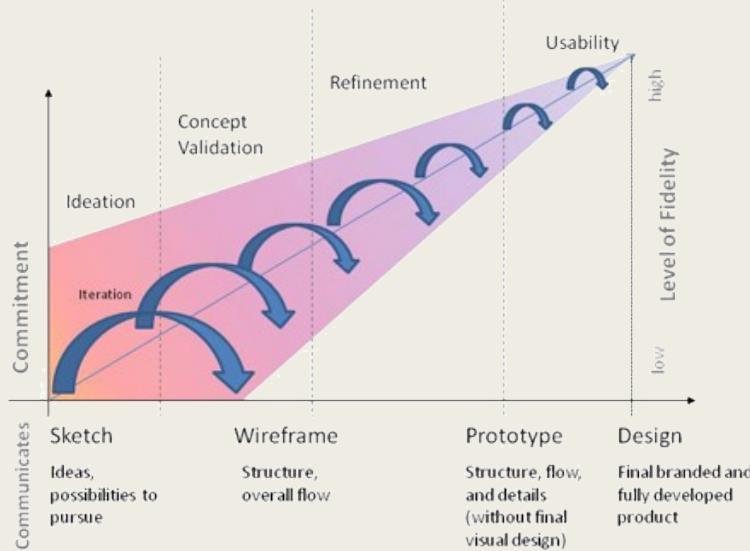
1. Sketching

- To visualise your ideas, work out logic problems, navigation, and more



Sketching and prototyping

- Sketches and prototypes are instantiations of a design concept, but sketches are not “complete” prototypes
- Sketches are used in the early ideation stages, whereas prototypes are more concentrated in later stages
- They differ in terms of cost, timeliness, quantity, and disposability

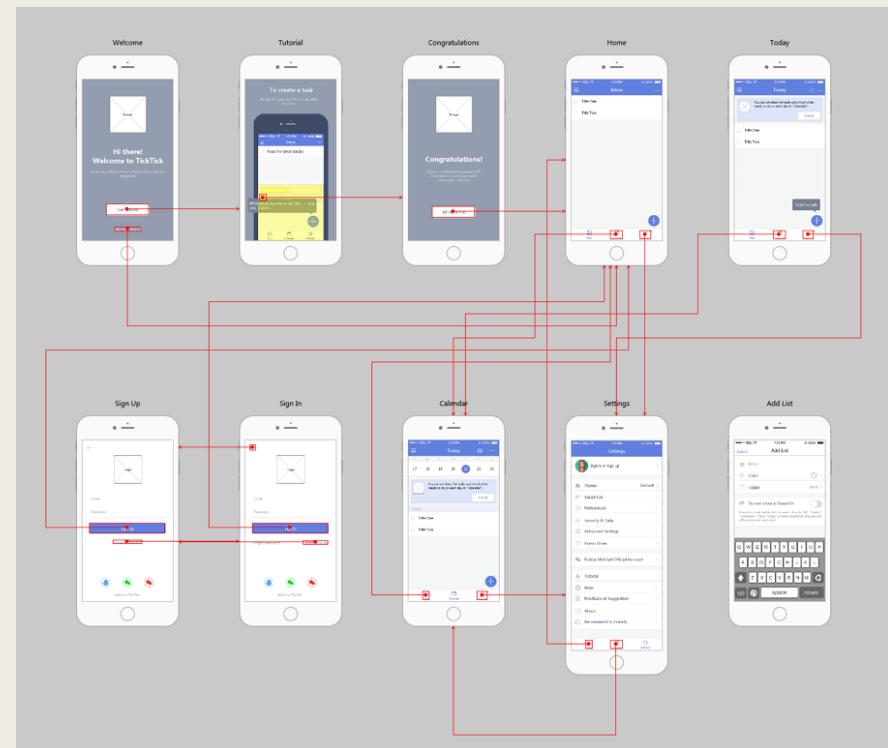


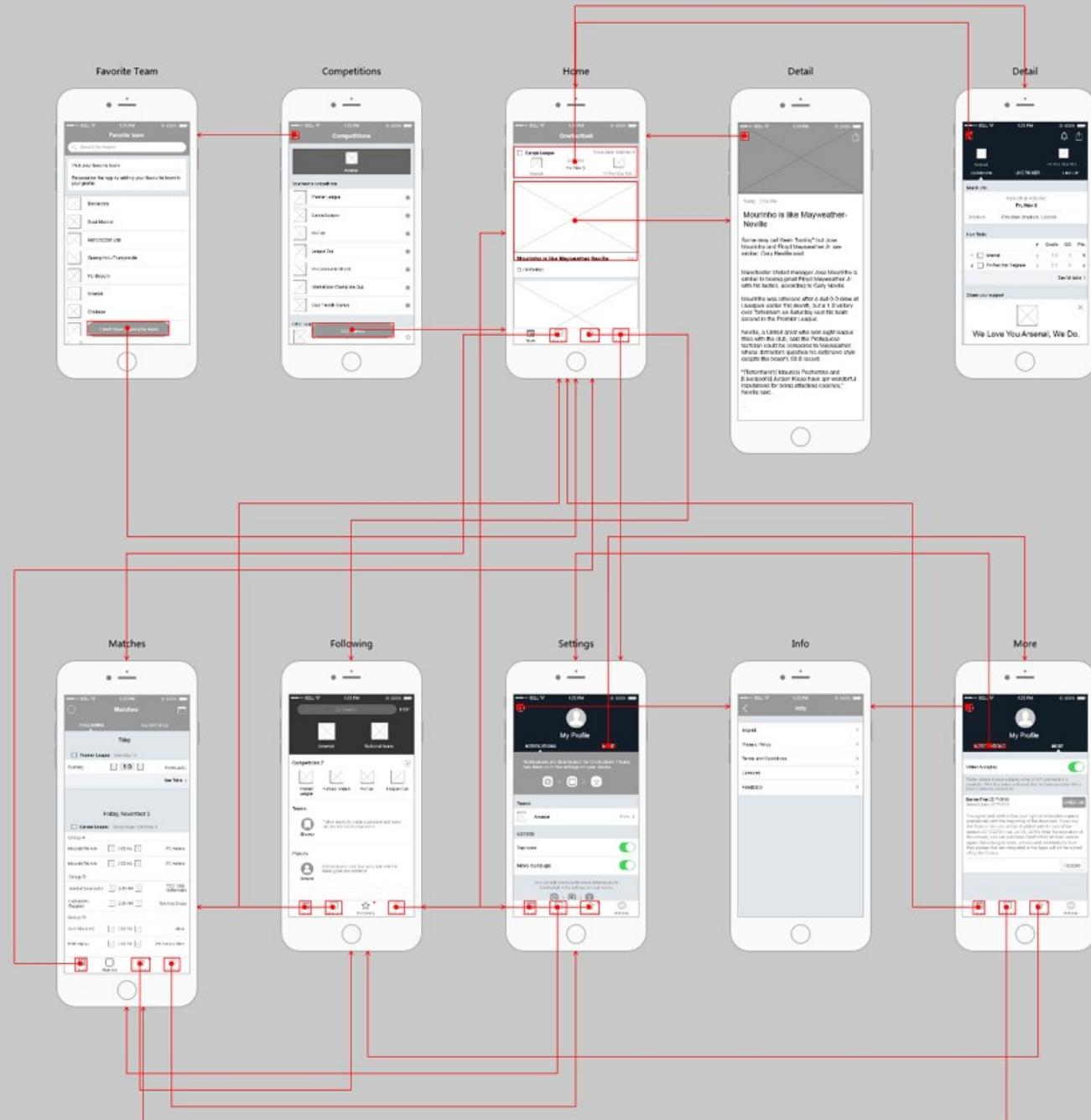
2. Wireframes (low to medium fidelity)

- Creates an outline representation of the key elements of the application
 - e.g., website or mobile app
- Interactivity is limited
- To provide an idea of the final prototype

www.creately.com

<https://uxplanet.org/5-free-quick-wireframe-tools-for-ui-ux-designers-in-2017-189e6a594fda>





Innovation Headline

Feature Headline

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer nec metus id nisl vestibulum volutpat. Nam semper commodo tellus, id lobortis magna tincidunt vel. In eget mi libero.

[SEE MORE](#)

Innovation Story #2
With a Really Long Name,
Which Spans Three Lines



3M Innovation Feed

[View All](#) | [Tweets](#) | [People](#) | [Stories](#) | [Events](#)

Tier 2 Story Headline

Tweet

Person

Event

Event

Tier 2 Story Headline

Tier 3 Story Headline

Tier 3 Story Headline



Innovation Headline

Feature Headline

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer nec metus id nisl vestibulum volutpat. Nam semper commodo tellus, id lobortis magna tincidunt vel. In eget mi libero.

[SEE MORE](#)

3M Innovation Feed

All Technologies ▾ Clear

Tier 2 Story Headline

Tweet

Person

Event



Products

Enter English Keyword to search products



Get Quotations



All Categories



Trade Shows

Smart Living **NEW!**

Auto Parts & Accessories

Consumer Electronics

Drones & Robotics

Electronic Components

Fashion Accessories & Footwear

Fashion Apparel & Fabrics

Gifts & Premiums

Hardware

Home Products

LED & Solar Products

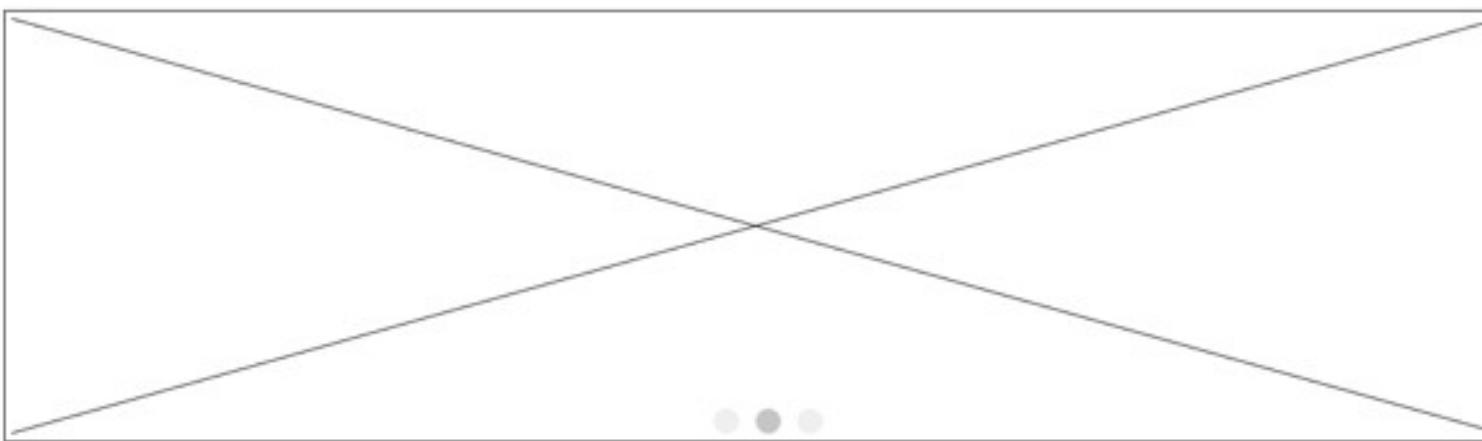
LEDs & Optoelectronics

Machinery & Parts

Mobile Electronics

Security Products

Underwear & Swimwear



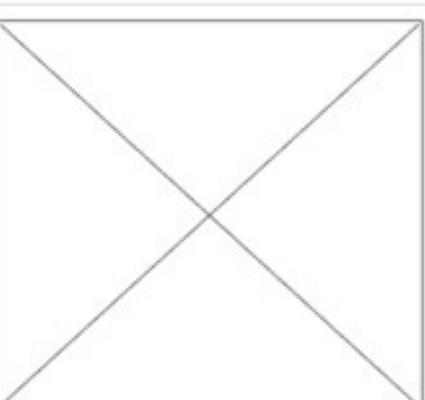
New Products



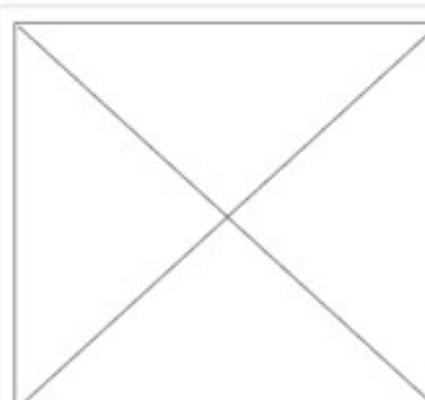
Free Alerts on newly added products!

Example: just@company.com

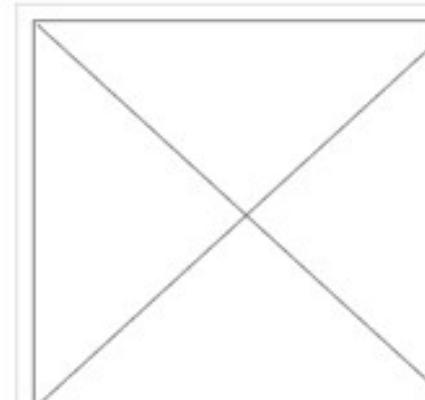
Subscribe



LED light shoes, fashion new design for women or ladies, factory BSCI checked



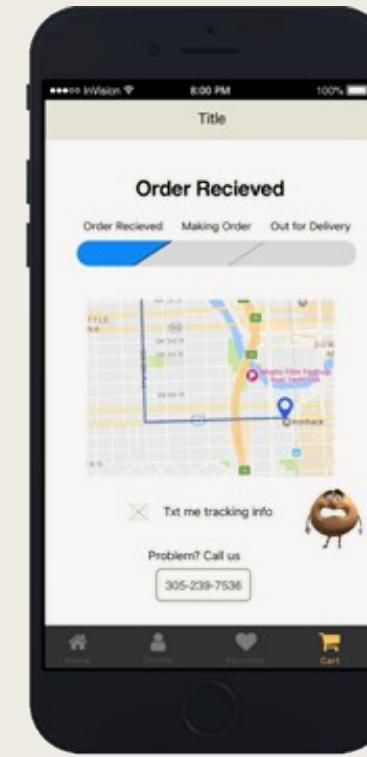
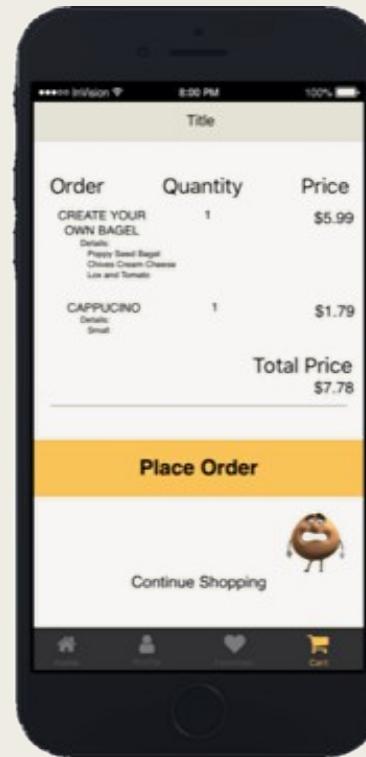
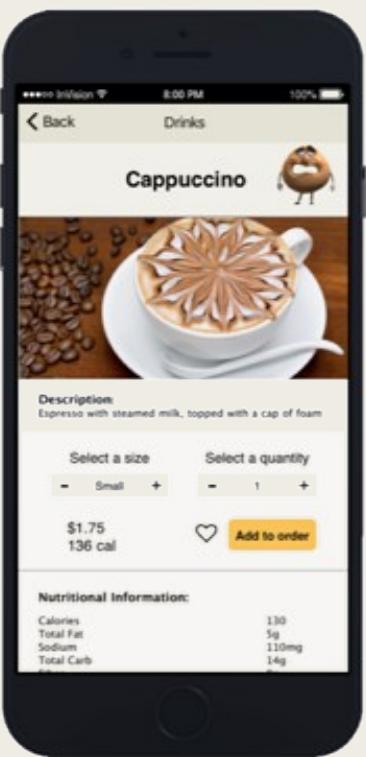
MTK 6261 smartwatch, LBS, Location, 1.44"



Two way Radio Battery for Ericsson MPA MPD PLS TRX P404

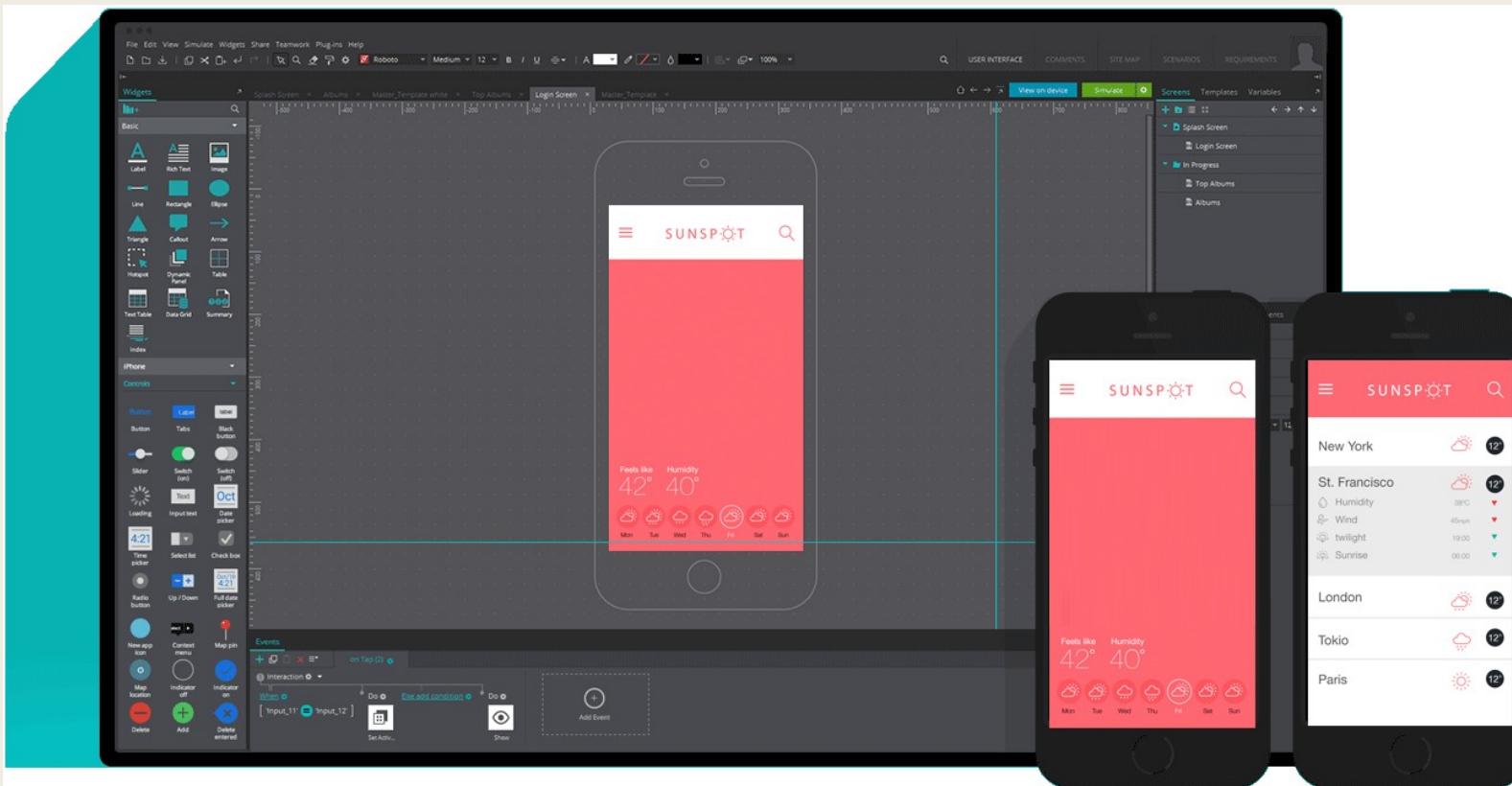
3. Prototypes (higher fidelity)

- Simulation of interaction through presentation, still limited or no functionality

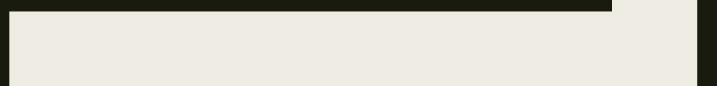


Tools for prototyping

■ E.g. JustInMind - justinmind.com



FROM REQUIREMENTS TO SKETCHING AND PROTOTYPING



From requiremen ts to sketching and prototyping

- Validate assumptions and requirements
- Discover problems early
- Brainstorm ideas
- Design more iterations
- Conduct early usability testing
- Cheaper & faster to implement
- Shorten the feedback loop
- Disposable
- Explore alternatives
- Helps communication between the team
- Ensure the right thing is being designed

After you have gathered requirements...

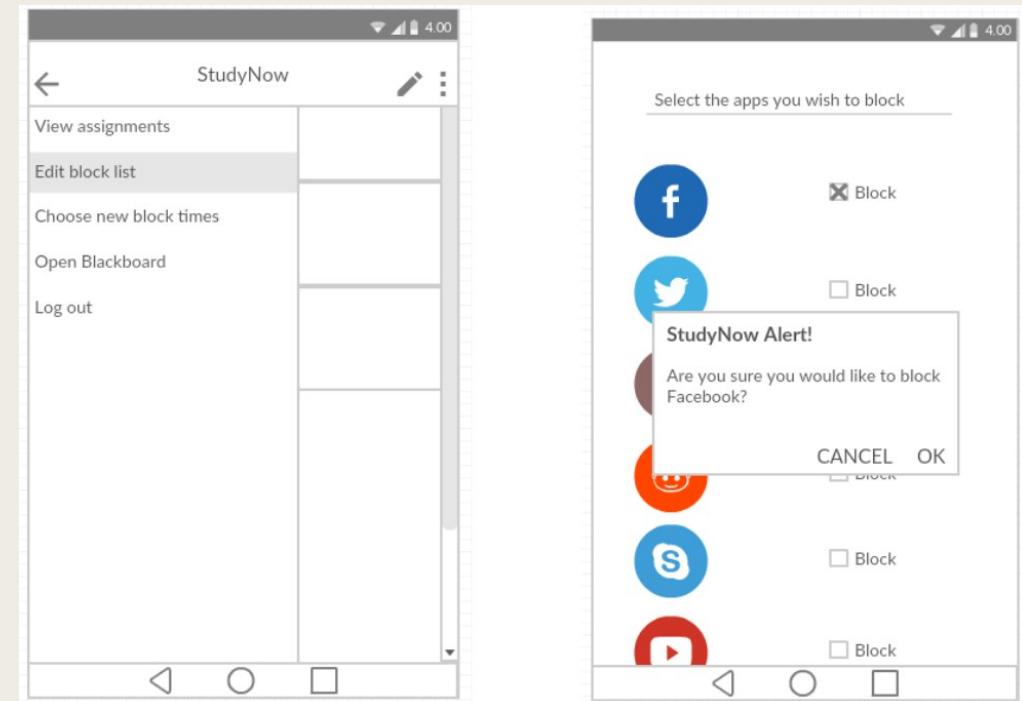
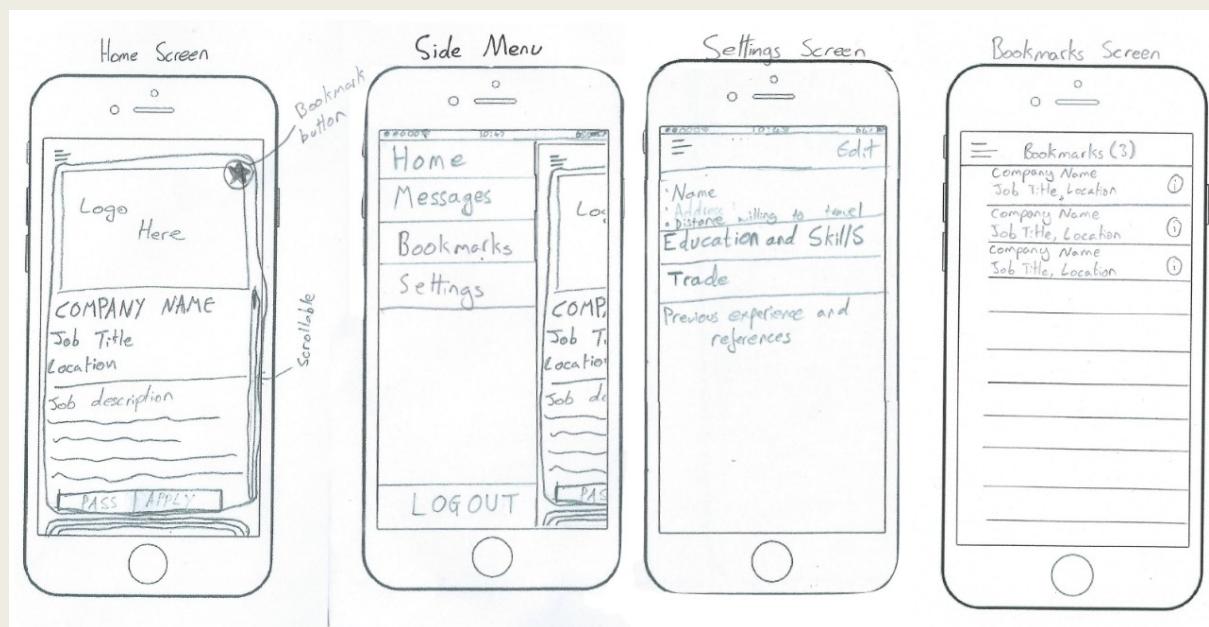
- Now you can think about technological possibilities
- Brainstorm and get ideas about how to tackle the problems
- Being well prepared here will really help



Taking brainstorming seriously

1. Defer judgment
 2. Encourage wild ideas
 3. Build on the ideas of others
 4. Stay focused on the topic
 5. One (brief) conversation at a time
 6. Be visual
 7. Go for quantity
- Tips:
- *Look at inspiring or existing technologies and / or services*
 - *Best solutions not always the simplest, or the most obvious*
(
https://www.youtube.com/watch?v=5TL80_8ACPc
)

Examples



What's next?

- Work on your sketches and prototypes
 - *Receive feedback during the next surgery*
- Lecture next week:
Software Laws & Professionalism



Instructions

■ Sketches and Prototypes

- *Create sketches, wireframes and / or high-fidelity prototypes representing at least three requirements of the proposed system, with a clear description of how the requirements and functionalities are represented in these prototypes.*

■ Based on your functional and non-functional requirements:

- *Think about screens that can visualise several requirements*
- *Create sketches and / or prototypes that show at least 3 different requirements*
- *Point out and describe where and how the requirements are reflected in the sketch / prototype*

Questions?

- Dr. Matthias Heintz or Prof. Shigang Yue
 - *mmh21@leicester.ac.uk*
or *sy237@leicester.ac.uk*
 - *Microsoft Teams*
 - *Office 613 or 608*
in Ken Edwards Building



UNIVERSITY OF
LEICESTER

