User-centred Design and Prototyping

Web Development and Security (ZEIT3119)

Week 3

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Outline

- Usability
- User Experience
- User-centred design
- Identifying User Needs
- Design Approaches
- Low-fidelity Prototypes
- High-fidelity Prototypes
- Mobile vs Desktop Websites
- Evaluation Techniques
- Web usability tools
- Figma

Bad Design

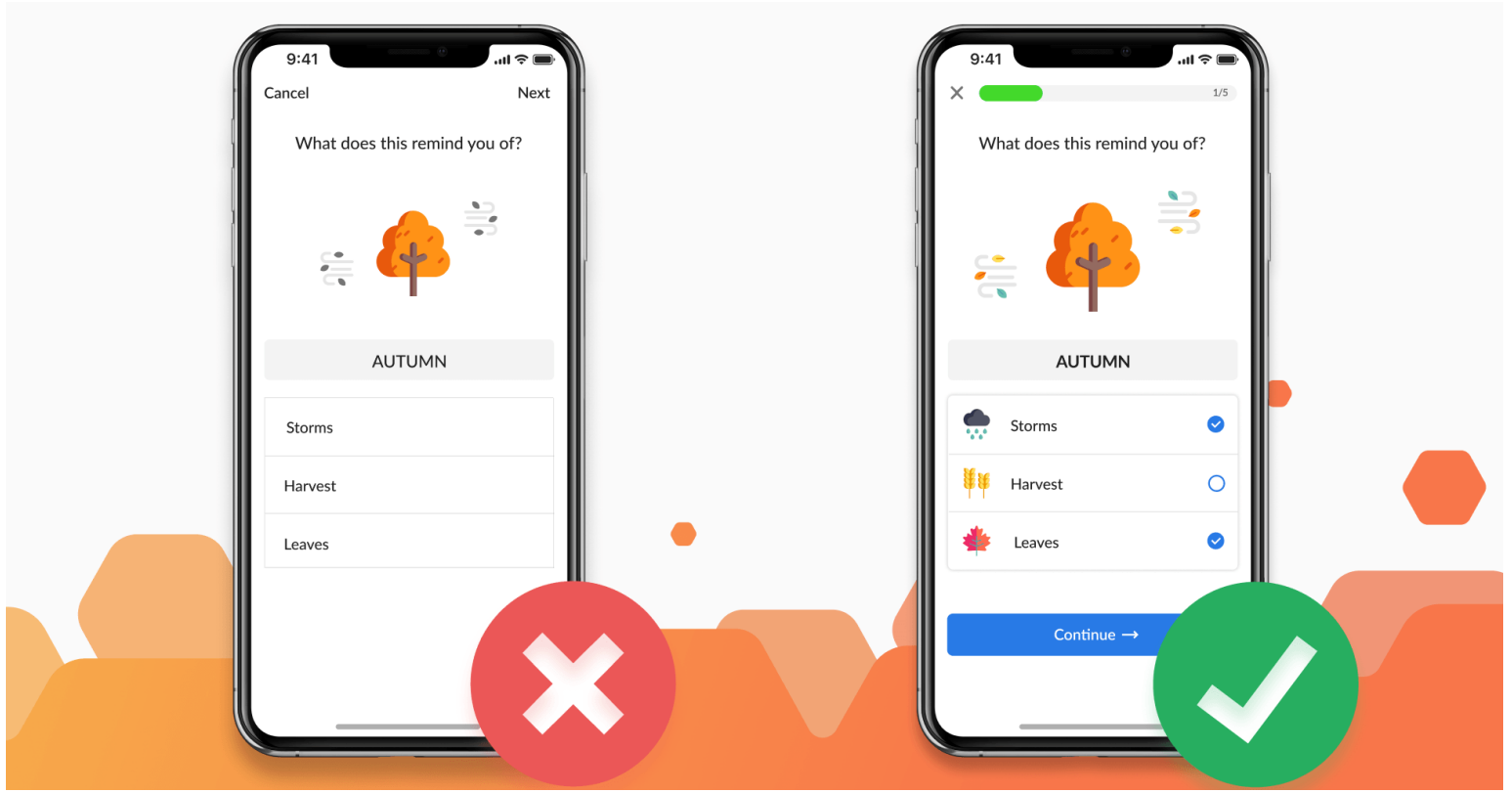
Good and Poor Design

- Good design aims to create products that are usable, which means:
  - Easy to learn
  - Effective to use
  - Enjoyable for users
- How do you define good or poor designs?

Which Design is Better?

Subjective

Which Design is Better?



Design Principles

Usability

- Learnability
- Efficiency
- Pleasantness

Usability

- Learnability
  - users can see and understand all operational instructions
  - navigation is clear and users know their current locations in the system
  - users don’t need to memorise lots of instructions
  - undoing mistakes and retrying operations is easy
  - help and assistance is easily accessible
  - for complex tasks, a step-by-step guide is provided to the user
  - terminology, behaviour, and visual layout is consistent
  - exceptions to the rules are minimised
  - clear feedback is provided to the user when performing an action
  - the status of the system is clearly presented to the user
  - the product conforms to generally-accepted standards
  - all parts are as simple as possible and make a coherent whole
- Efficiency
- Pleasantness

Usability

- Learnability
- Efficiency
  - expert users can quickly memorise how to complete tasks and don't need to refer to the instructions every time
  - users can complete tasks without much conscious thinking and deliberation
  - the error rate for a skilled user is low and any mistake can be easily detected and corrected
  - interruptions and delays are minimal
- Pleasantness

Usability

- Learnability
- Efficiency
- Pleasantness
  - the product is aesthetically pleasing
  - working with the product is enjoyable for the user
  - the product enables productive work to be done efficiently
  - the user feels rewarded after completing a task
  - the product is reliable and stable
  - the product performance is sufficient to avoid any delay or frustration
  - the product is ergonomically comfortable.

User Experience

The entire experience – including positive or negative emotional reactions and feelings of satisfaction and dissatisfaction – that a user or customer gets from using a software product or computing device is so important that we have a special name for it: user experience or UX' (Matz, 2013).

Example: User Experience for a Mobile Phone

- industrial design
- build quality of the device
- packaging
- downloading and installing required applications
- registering the device
- contacting technical support
- cost of the device
- feelings about enhancing their prestige or status

What to Design?

- Who will use the application?
- Where is this application to be used?
- What type of activities will people do when using the app?

Example: An Educational Web App

A university wants to develop an application for its online courses that enables students to study remotely, whether at home or on the bus using their phone or tablet (something similar to Moodle).

Educational App: Users

- Students
- Course creators
- Lecturers and tutors
- Administrative staff

Educational App: User Activities

- Students
  - accessing and engaging with the learning material
  - asking questions from lecturers and tutors
  - engaging in online discussions
  - performing assessment tasks
  - submitting assignments
  - receiving grades for their submissions
- Course creators
- Lecturers and tutors
- Administrative staff

Educational App: User Activities

- Students
- Course creators
  - creating new courses
  - uploading course material
  - creating quizzes and other assessment tasks
  - creating entries for assignment submission
- Lecturers and tutors
- Administrative staff

Educational App: User Activities

- Students
- Course creators
- Lecturers and tutors
  - answering students' queries
  - initiating and responding to online discussions
  - checking students' submissions
  - giving grades to students
  - checking students' progress
- Administrative staff

Educational App: User Activities

- Students
- Course creators
- Lecturers and tutors
- Administrative staff
  - enrolling students
  - assigning lecturers and tutors administrative access to courses
  - opening and closing courses
  - updating course material

Educational App: User Activities

- Students
- Course creators
- Lecturers and tutors
- Administrative staff
  - enrolling students
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  - updating course material

Educational App: Where and How?

- Home, university, library, park, bus
- Desktops, mobile phones, tablets

Collecting and Analyzing Requirements

- Functional - what must the product do?
- Data - what types of data must the product handle?
- Environmental - what requirements are related to the environment in which the product must be used?
- User - what are the characteristics of the target user group?
- Usability - what are the usability goals?

Non-Functional

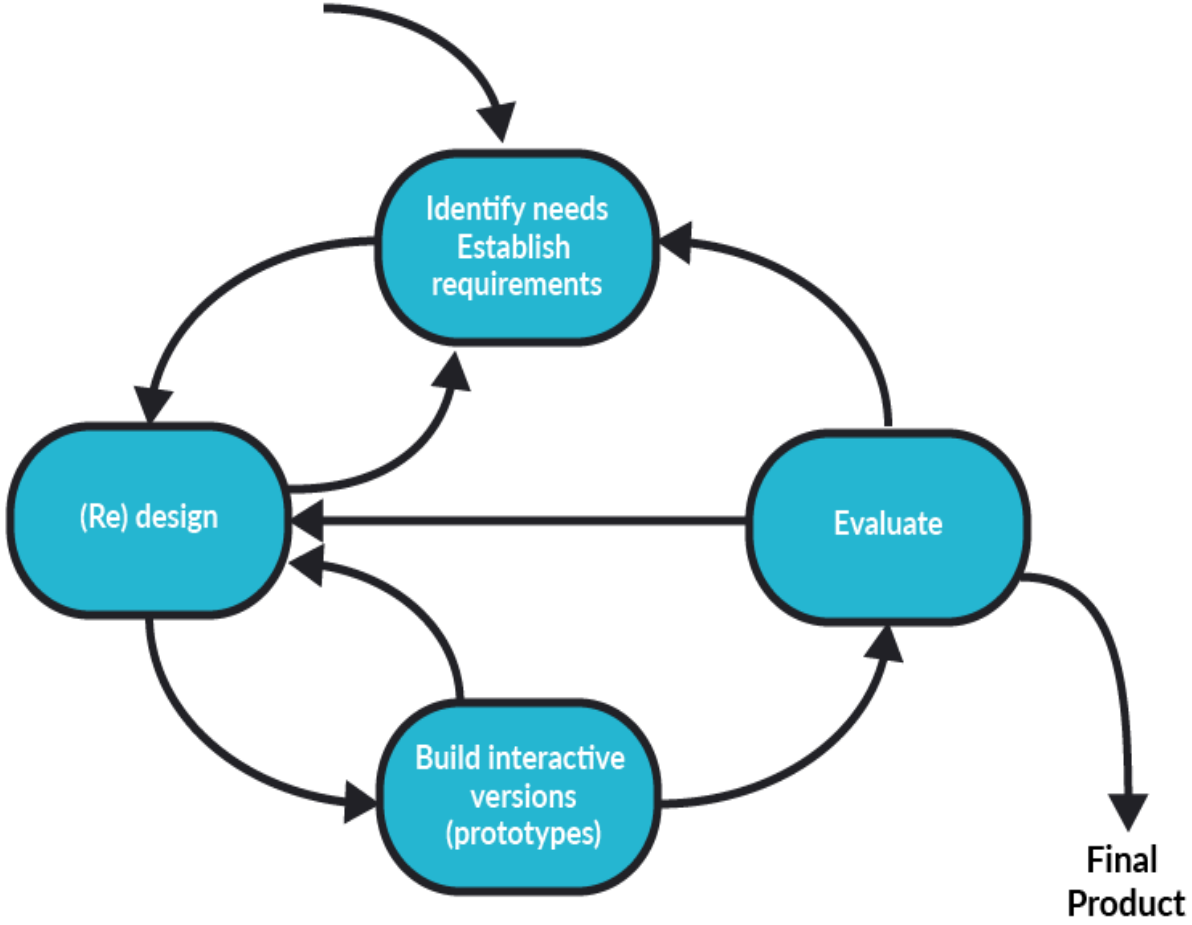
Identifying User Needs

- Questionnaires: Asking specific questions of a group of target users. Questionnaires are usually combined with other techniques such as data analysis.
- Interviews: Some advantages over questionnaires because the interviewer can clear up any confusion about questions or get more information if required. However, interviews are time-consuming.
- Focus groups: This technique is good for gaining a consensus view of an issue and/or highlighting areas of conflict or disagreement.
- Observations: Observing people while they are working with a system can provide more useful information than asking them to explain what they do.
- Studying documentation: Existing documentation about user activities can be a useful source of information.

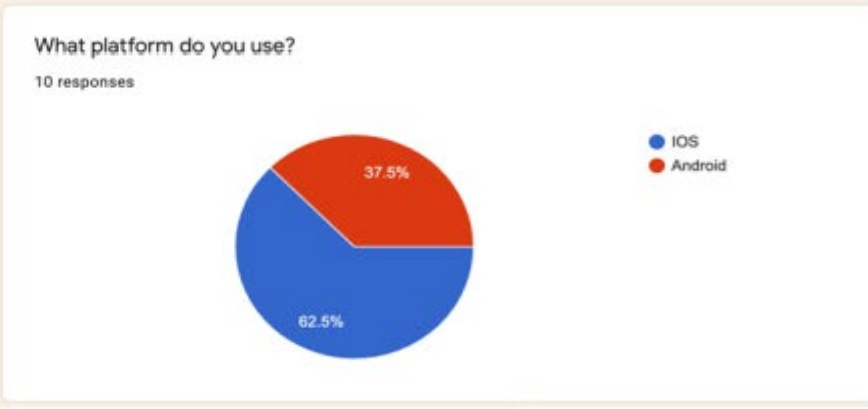
User-Centred Design (UCD)

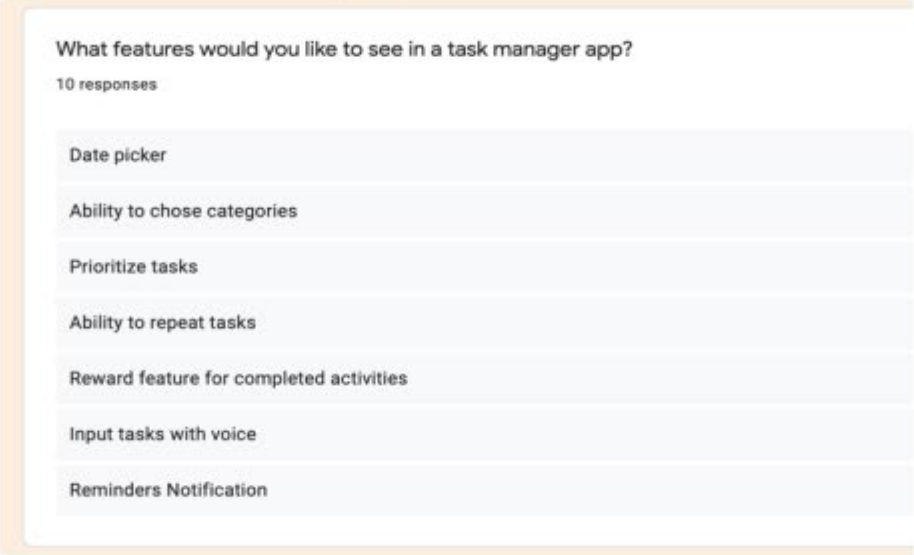
- User-centred design (UCD) focuses on the users and their experiences
- The main goal of developing a product is the users and their needs not the technology
- UCD approaches are mainly based on three principles (Preece, et al., 2015):
  - Early focus on users and tasks: which includes directly studying behavioural, anthropomorphic, cognitive & attitudinal characteristics.
  - Empirical measurement: which means that users' reactions and performance to scenarios, manuals, prototypes & and simulations are observed, recorded and analysed.
  - Iterative design: which included fixing any problem found in user testing and running more tests.

Design Process – Interactive Design Model



A Sample of User Studies





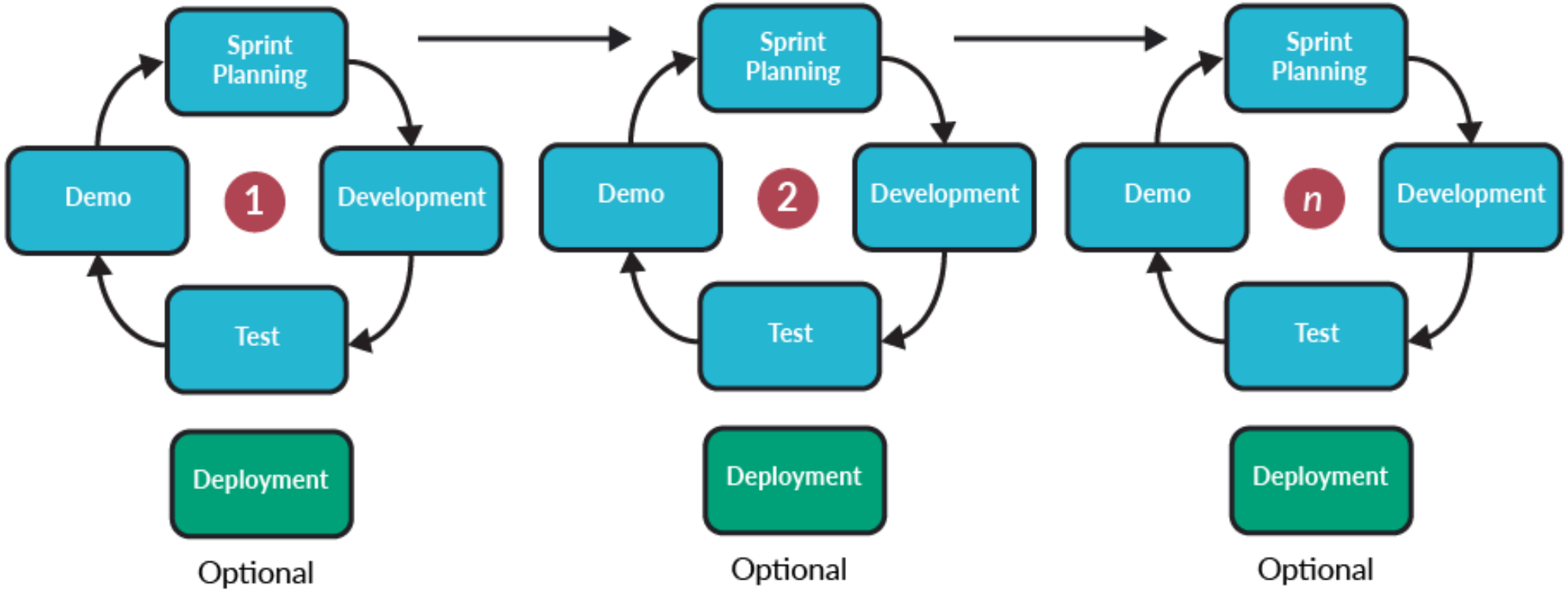
Functional Requirements

Functional requirements	Further comments
1. To-do / to-be style task management	Users should be able to add, edit, reorder, complete and delete ‘to-be’ tasks.
2. Subtasks management	Users should be able to add, edit, reorder, complete and delete ‘to-be’ subtasks.
3. Completion reward animations or audio	The app should reward users for marking tasks as completed in a visual and audible way.
4. Representation of life spheres	Similar to the Wheel of Life apps reviewed it should be possible for users to rate and see where they are with the current ‘to-be’ tasks. For example, if a ‘to-be’ a user enters is “energised”, they should be able to rate themselves on how energised they feel and what they have achieved (or not) to pursue that goal.
5. Satisfaction / fulfilment tracking	Users should be able to see a representation of their performance over time.
6. Notifications	Notifications should be able to be added to certain ‘tobe’ tasks or subtasks when the user chooses. These notifications should occur at a given time or location.
7. Calendar functionality	A calendar representation should be available to users so that they can schedule time-sensitive tasks to particular days or moments.

Non-Functional Requirements

Non-functional requirements	Further comments
1. Cross platform (iOS and Android)	The app should be available on both Android and iOS. To really go beyond here the use of user accounts and syncing could allow a user to use the app on two or more different devices with different operating systems while sharing the same data. This extra work however is a stretch goal.
2. Fast	The app should be a pleasure to use with fast operations and minimal waiting time. If and when a longer running operation is in action, such as exchanging data with external services via the internet, the user should be made aware of this with a loading indicator and it should be run asynchronously in order to not tie up the UI thread.
3. Responsive	The app should scale well between different screen sizes such that elements fit responsively into the available space. The app should be as easy and pleasurable to use on a handheld mobile device as it is on a larger tablet.
4. Reliable	The app should function reliably with few if any bugs. Delete actions should be undoable or only actioned after a confirmation is received from the user. When exchanging data with the server or external services in unfavourable network conditions warning messages and local saving of data should prevent data loss until conditions improve.

Design Process – Agile Model



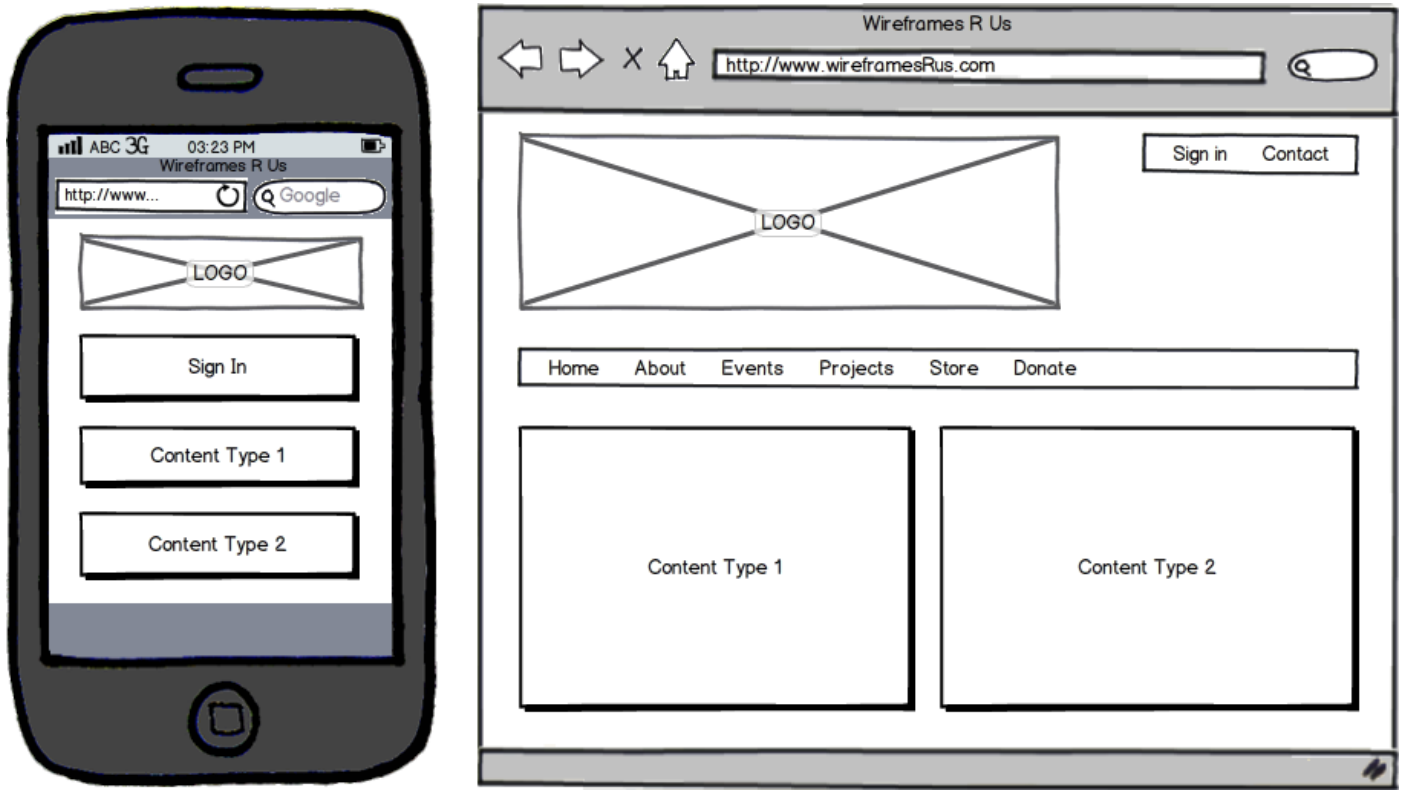
From Requirements to Design

Techniques for defining the appearance of the product

- Low-fidelity (wireframe) mockups and prototypes
- High-fidelity mockups and prototypes
- Style guides
- Navigation maps

Low-fidelity (wireframe) mockups and prototypes

A low-fidelity mockup can be drawn on paper or using some tools as Visual Paradigm, InVision, or Balsamiq



High-fidelity mockups and prototypes

High-fidelity mockup looks like the final application with a very similar appearance. Some tools like Figma can help designers to create high fidelity mockups.

BakeLove Mobile Application - Brooke Fry

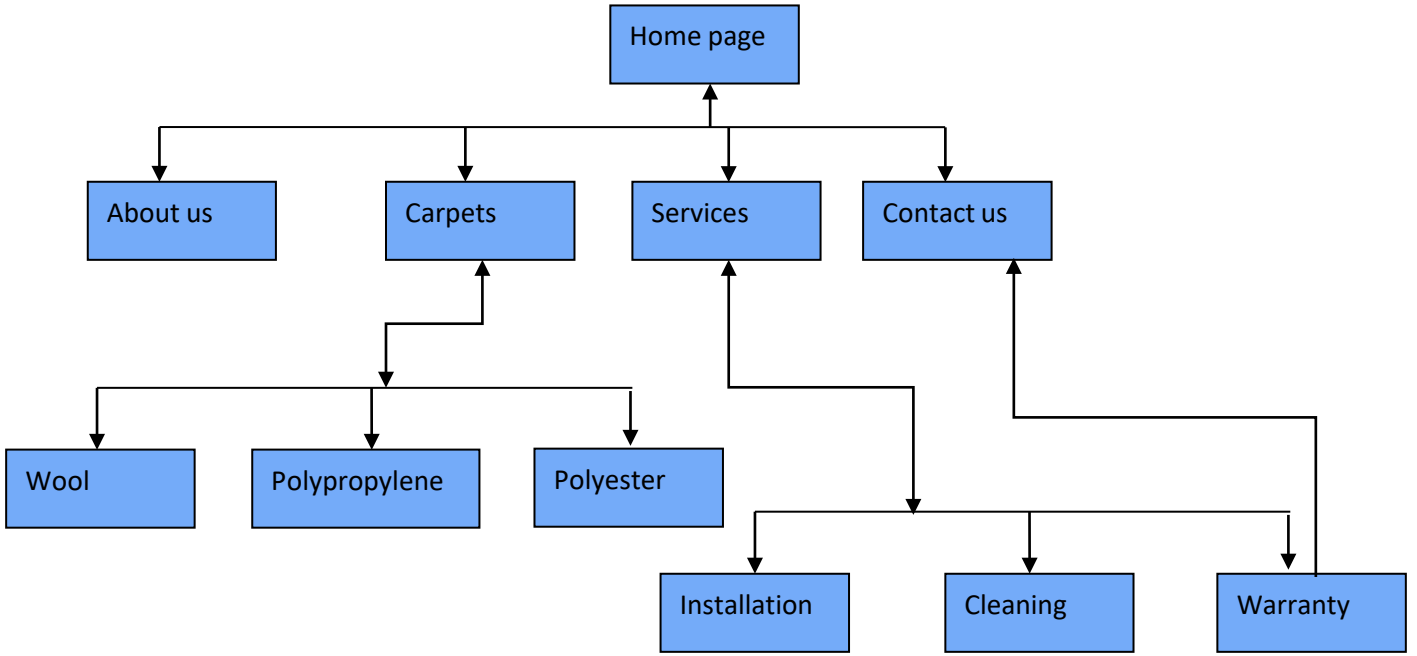
Style guides

A style guide is a document which consists of general rules for the graphic design of the interface.
It describes the page layout, color schemes, text, header, footer, and other graphical elements.
Developers can use style guides along with low-fidelity mockups to ensure that implementation match with the intended visual appearance.

https://www.youtube.com/watch?v=3YsyhUsIsLk

Navigation maps

Navigation maps are similar to site maps They show the possible navigation among places (pages, windows or screens)

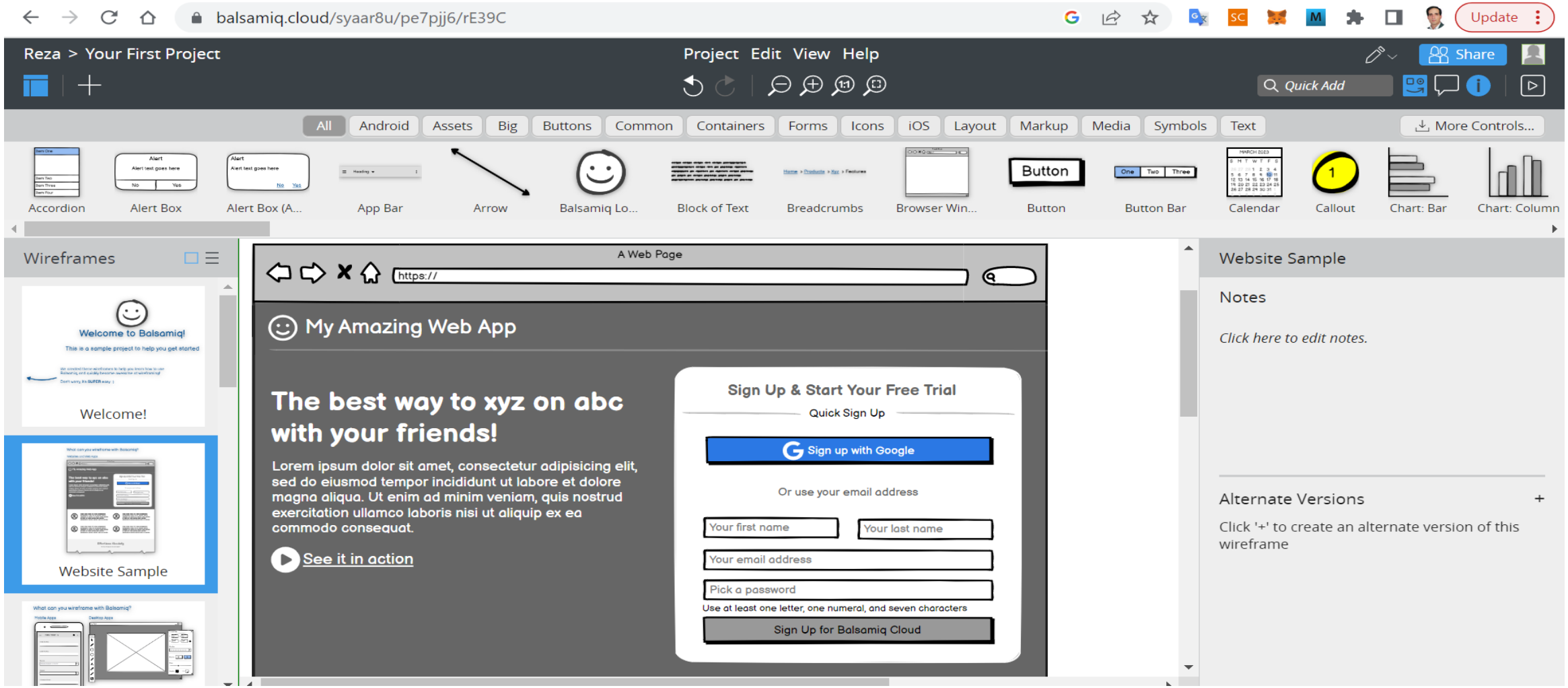


Low-fidelity vs High-fidelity Prototyping

Type	Advantages	Disadvantages
Low-fidelity prototyping	- Can be a proof of concept - Rapid production - Low development cost - Useful device for communication - Useful for identifying market requirements - Useful for evaluation of multiple design concepts	- Driven by the facilitator - Limited error checking - No enough details for coding - Limited usefulness for usability testing - Limited navigation and flow
High-fidelity prototyping	- Complete functionality - Driven by the user - Fully interactive - Navigational scheme is defined clearly - Good for marketing and sale - Looks like the final product - Efficient for exploration and test	- High development cost - Time consuming development - Ineffective for requirements gathering - Not very efficient for proof of concept

Balsamiq

https://balsamiq.com/



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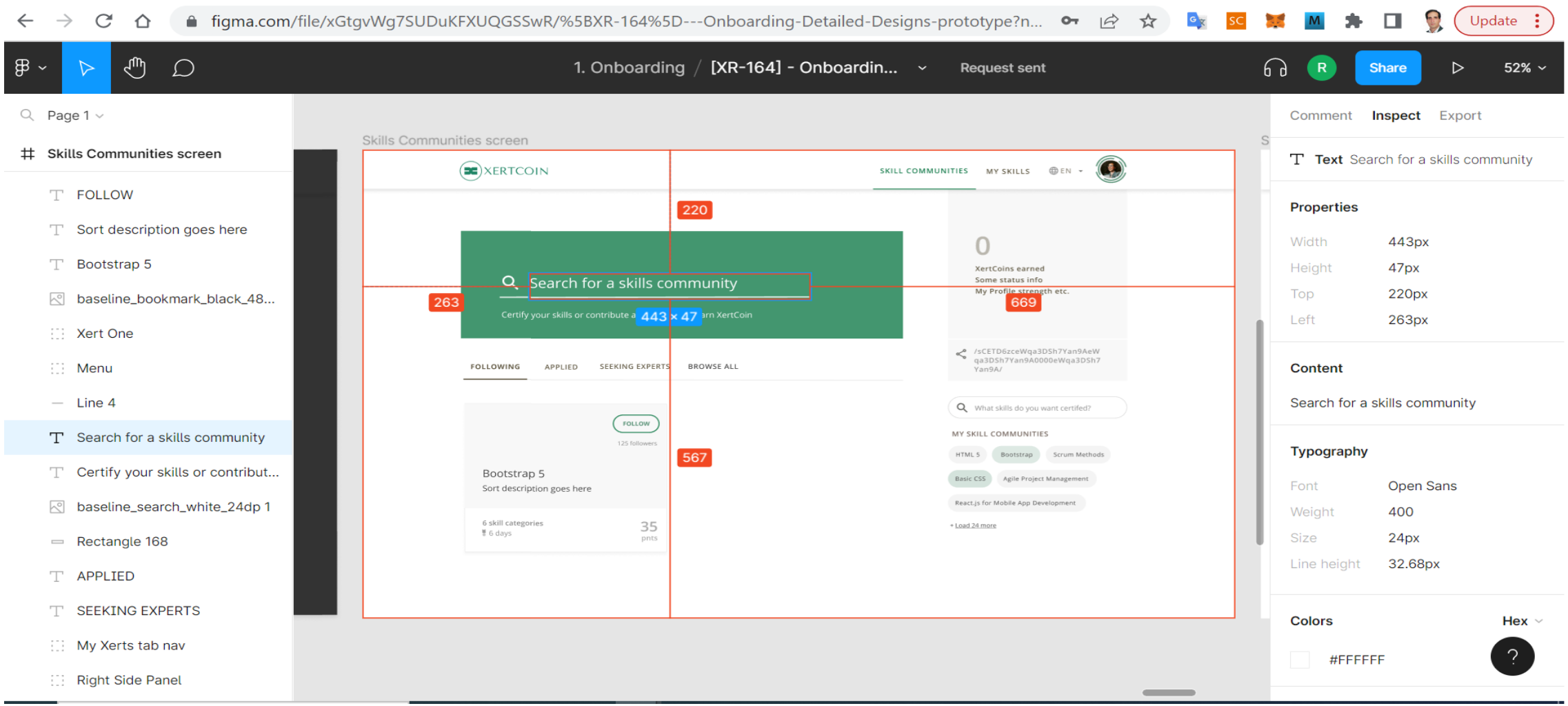
Figma

https://figma.com/



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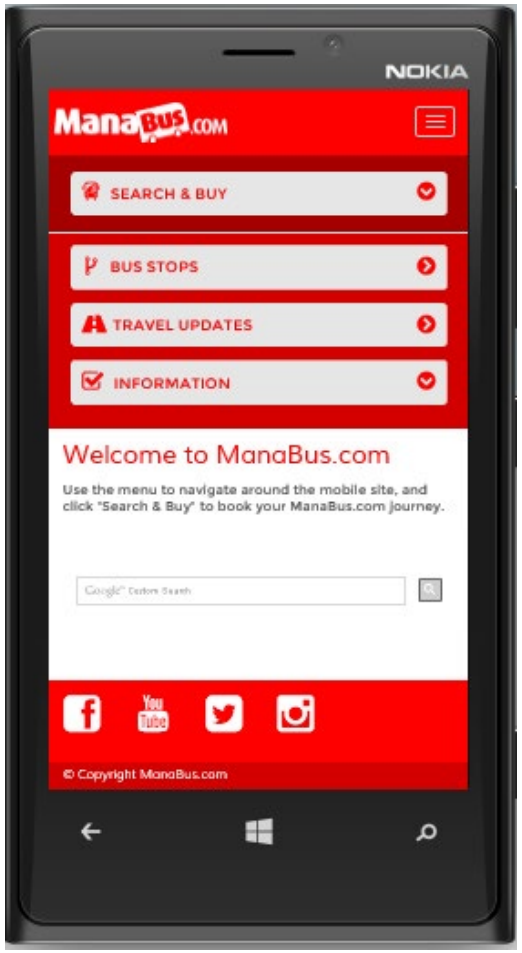
Mobile websites vs desktop websites



Adaptive vs responsive web design

- **Fluid websites** use percentages for widths allowing elements on the page to become narrower and the test to re-flow.
- **Adaptive websites** use media queries to target specific devices and change the layout displayed accordingly. Adaptive design uses static layout for different screen sizes (usually for six common screen widths: 320, 480, 760, 960, 1200, and 1600).
- **Responsive websites** use a fluid grid and media queries to control the way content is displayed across multiple devices and browser sizes. It uses CSS to change the style based on the target device.

Mobile-first Design

- **Mobile-first:** This approach designs for the mobile handset first and then enhances this experience for more capable devices (progressive enhancement)
- **Graceful degradation:** This is the opposite approach where the usually more complex desktop version is designed first and then designed to degrade gracefully for less capable devices, e.g. multimedia may be replaced with an image etc.

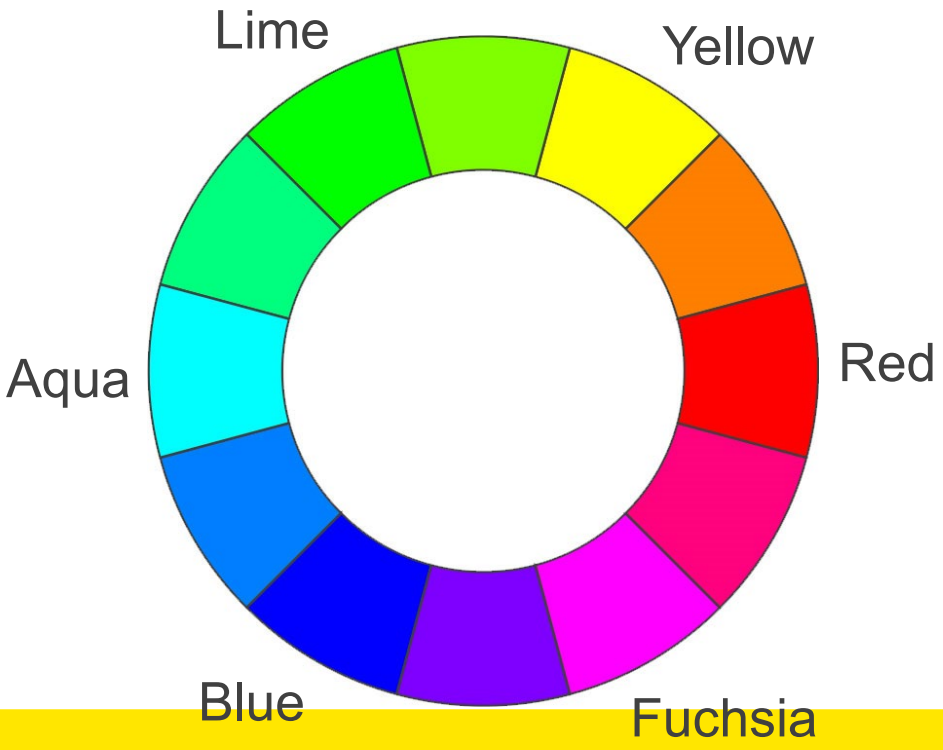
Designing a Website

When setting out to design a new website, we have plenty of decisions to make. Standard web design principles offer us some guidance on key aspects, such as:

- Choice of a site color scheme
- Choice of text font and size
- Placeholder text
- Use of white space
- Location of navigation menus
- Planning for different browsers and screen resolutions
- Testing

Choosing a Color Scheme

The background colors and graphics we use have a tremendous effect on the mood evoked for our visitors. We can use a color wheel to assist us with making selections:

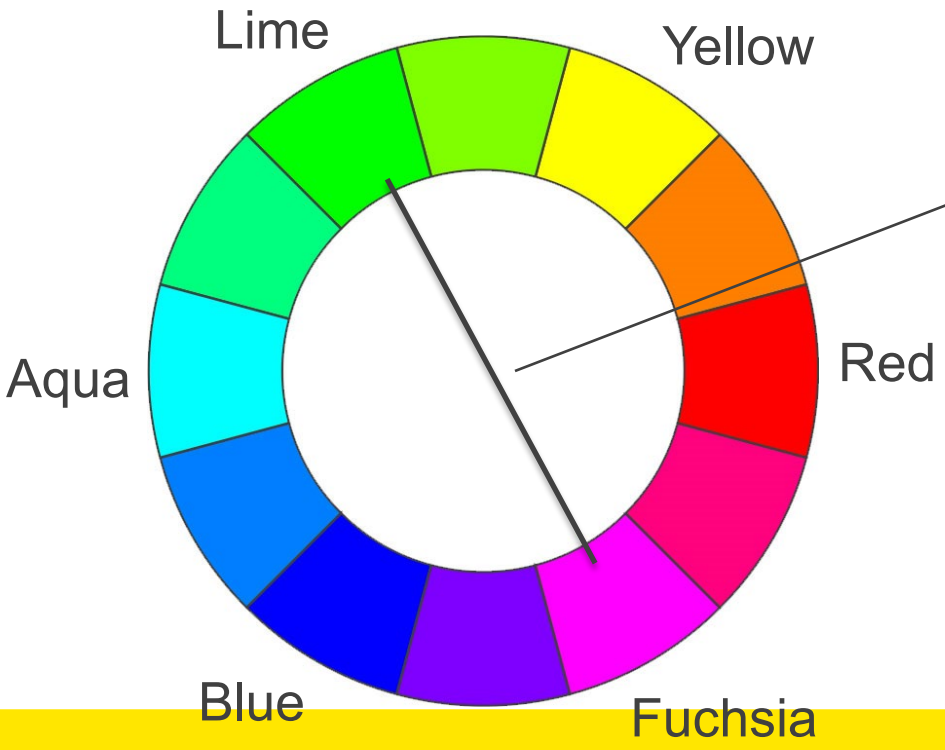


We should limit the number of main colors on our site to four (excluding black and white).

Color selection should always be made with our target audience in mind. A color scheme for a site aimed at teens would be very different than one targeted at business customers.

Complementary Color Scheme

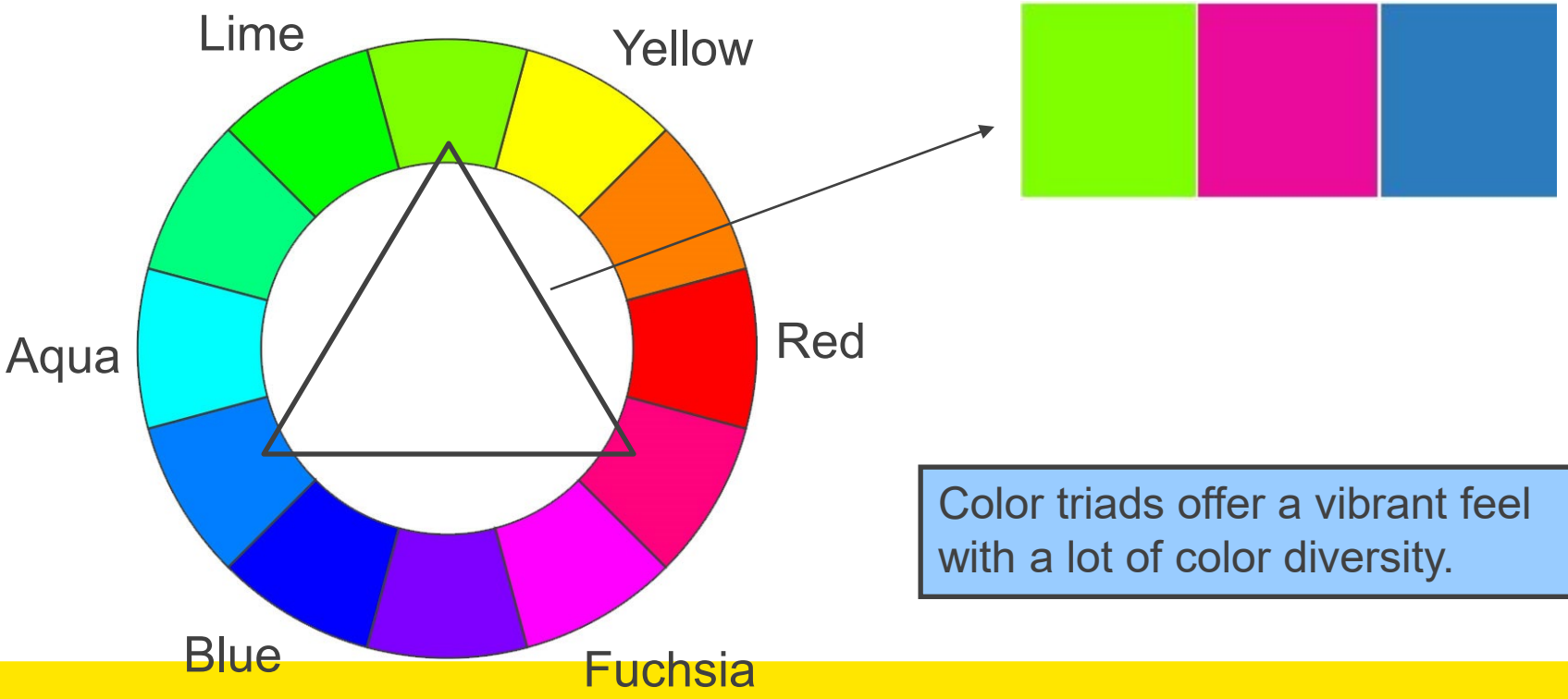
Complementary colors are directly across from each other on the color wheel:



This strong contrast lends a vibrant, energetic feeling to a site.

Triad Color Scheme

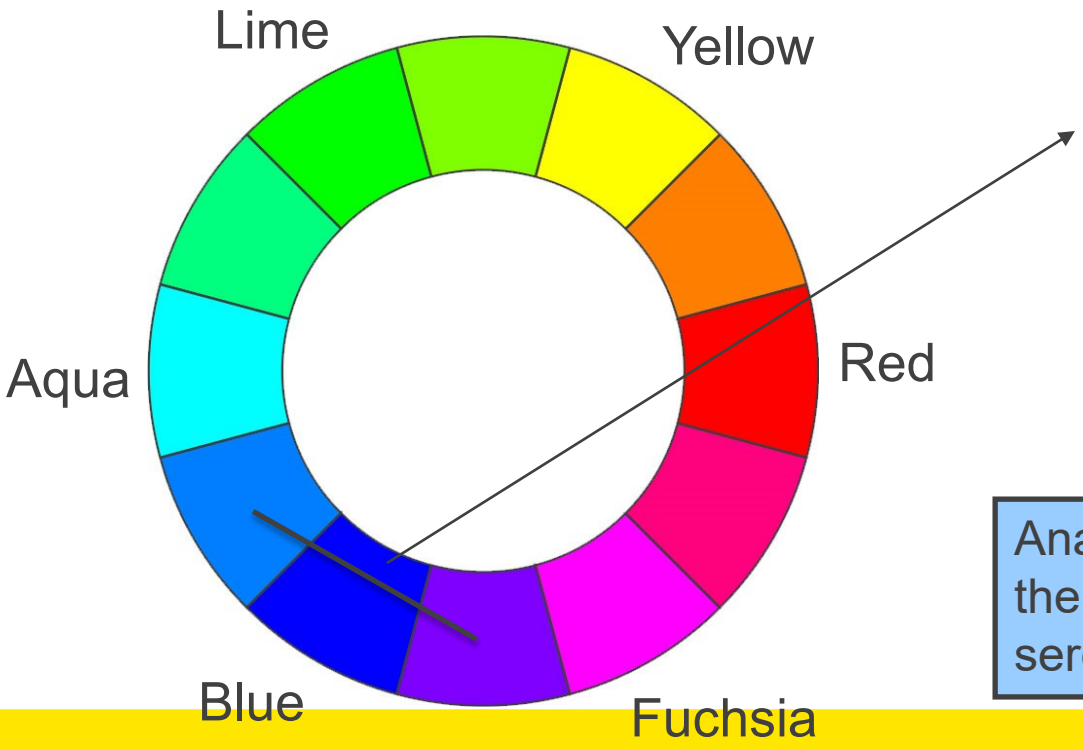
Triads are three different colors equidistant from one another on the color wheel:

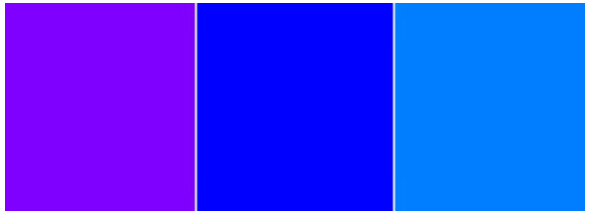


Color triads offer a vibrant feel with a lot of color diversity.

Analogous Color Scheme

Analogous colors are those that are next to each other on the color wheel:





Analogous colors are pleasing to the eye and make for a peaceful, serene design.

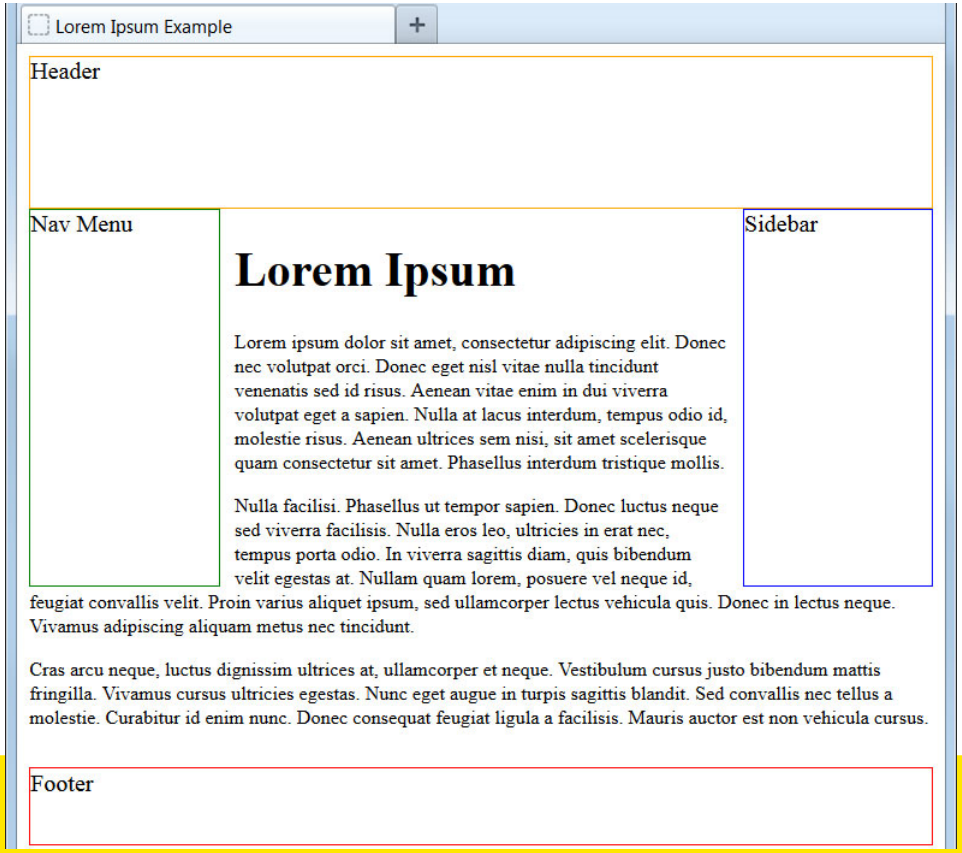
Choosing Fonts and Sizes

When choosing fonts, font sizes, and text colors for our site, we should keep the following tips in mind:

- Many designers use two different fonts for their sites: one for headings and one for regular body text.
- Font size must be large enough to read easily. Consider 12px to be the minimum acceptable size.
- Black text on a white background is the most common. However, any light color text with a dark background or dark color text with a light background can be acceptable, provided there is strong contrast.
- Avoid using bright colors for text.
- Avoid underlining text or making text blue for emphasis, as this can easily be mistaken for link text. Use bold or italics for emphasis instead.

Placeholder Text

Often when designing a web page, we don't have our text content written yet, but we want to see a mock-up of how text will look on the page. In these cases, we can use the "Lorem Ipsum" text temporarily:



"Lorem Ipsum" is text in Latin that we copy and paste into our pages for testing. A copy is available free at lipsum.com and many other sites.

White Space

White space is the space between the elements of your web page. It does not literally have to be white; it can be the color of your background:

Too many elements crammed onto a page can be overwhelming to the visitor.

Plenty of white space makes for an uncluttered and easy-to-read page.

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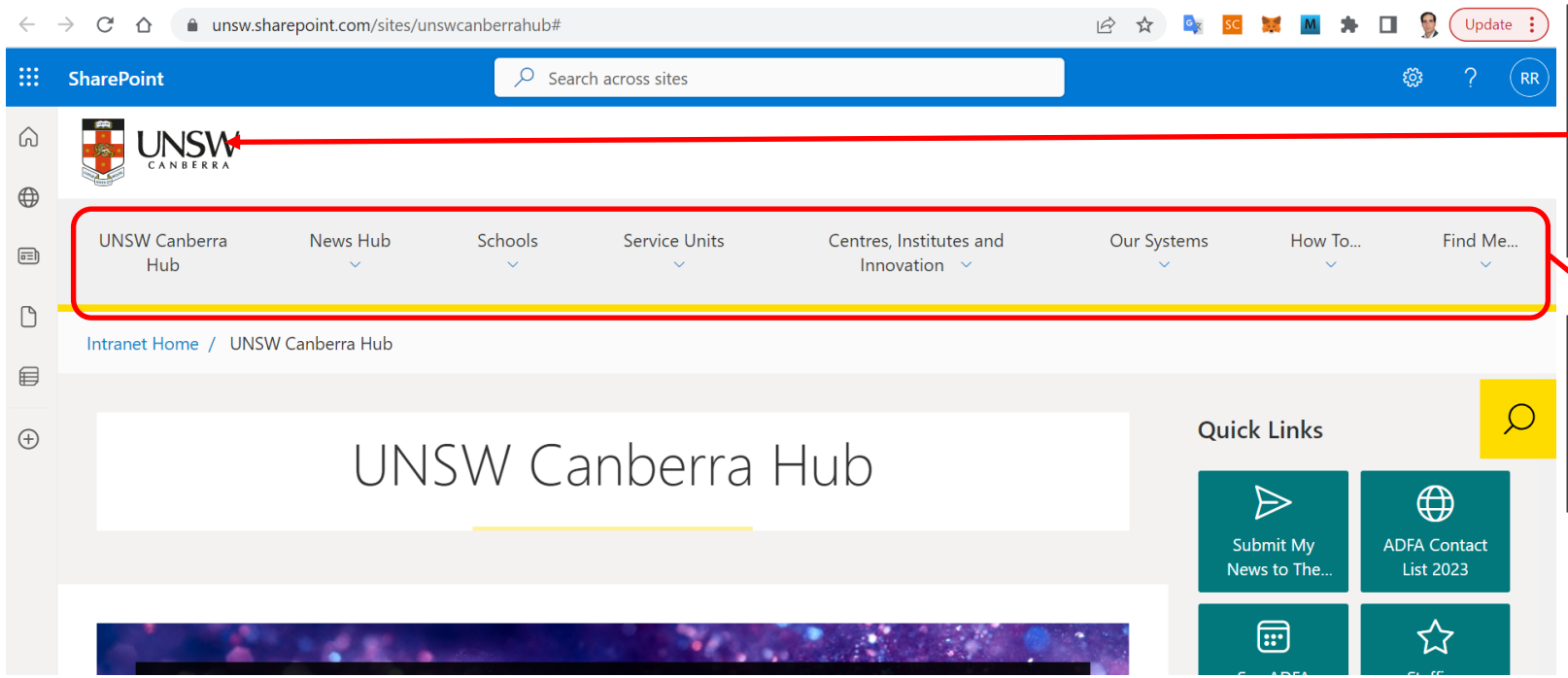
Navigation Menus

Most websites have their navigation links across the top or down the left side of the screen:



The logo or name of the site in the header is traditionally a link back to the home page.

Navigation menus should be consistent on all pages of a site.

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More Design Tips

Here are a few more design tips to bear in mind when setting out to build a website:

- Aim for consistency in the look and feel of the site. Logos, headers, footers, and navigations bars should reside in the same spot from page to page, and site colors and text should remain consistent site-wide.
- Align groups of elements horizontally or vertically on the page. Alignment makes a site both easier to use and more visually appealing.
- Always proofread your site content. There's no excuse to have misspelled words or grammatical errors. Such errors reflect poorly on you as a designer.

Types of Software Testing

- Functional Testing
- Usability Testing
- Interface Testing
- Database Testing
- Performance Testing
- Compatibility Testing
- Security Testing

Evaluating the Design

In (Preece, et al., 2015), evaluation is defined as:

"The process of systematically collecting data that informs us about what it is like for a particular user or group of users to use a product for a particular task in a certain type of environment."

Evaluation Techniques and Paradigms

- **User studies:** “user studies essentially involve looking at how people behave either in their natural [environments], or in the laboratory, both with old technologies and with new ones.“(Preece, et al., 2015)
- **Evaluation paradigm:** Evaluation is usually based on some beliefs backed up by theories. These beliefs and the associated techniques are called an evaluation paradigm (Preece, et al., 2015). Each paradigm has its own techniques and methods.
- **Formative evaluation:** It refers to testing at early stages of the design. Formative evaluation is to know about user requirements and check whether they have been reflected in the design.
- **Summative evaluation:** It refers to testing after implementation. Summative evaluation is usually to check with a sponsoring agency such as National Institute of Standards and Technology (NIST) in the USA, to see a standard has been fulfilled in the design.

Evaluation Paradigms

- **“Quick and dirty” evaluation:** It emphasizes on a quick input from the user rather than documenting the findings elegantly. The feedback from the user can be scheduled at different stages of the design.
- **Usability testing:** It aims at measuring user performance when performing tasks. Performance may refer to the error rate or the time is taken for the user to complete a task. Users are observed when accomplishing the tasks and their performance is calculated to explain why their performance is as such and how it could be improved. Questionnaire and interviews can be also useful for collecting such information about users.
- **Field studies:** This kind of evaluation is conducted when the participant accomplishes the tasks naturally. To fully observe the participant, you need to setup some equipment, such as cameras, microphone, eye tracking devices, etc in the field.
- **Predictive evaluation:** Experts apply their knowledge about the users to predict usability problems.

Evaluation Techniques

- Observing users
- Asking users
- Asking experts
- User testing
- Modelling users' task performance

Comparing Evaluation Paradigms

Technique	Usability testing	Field studies	Predictive evaluation
Observing	X	x	
Asking users	X	x	
Asking experts		x	X
Testing	X		
Modeling			x

Main Questions about Evaluation

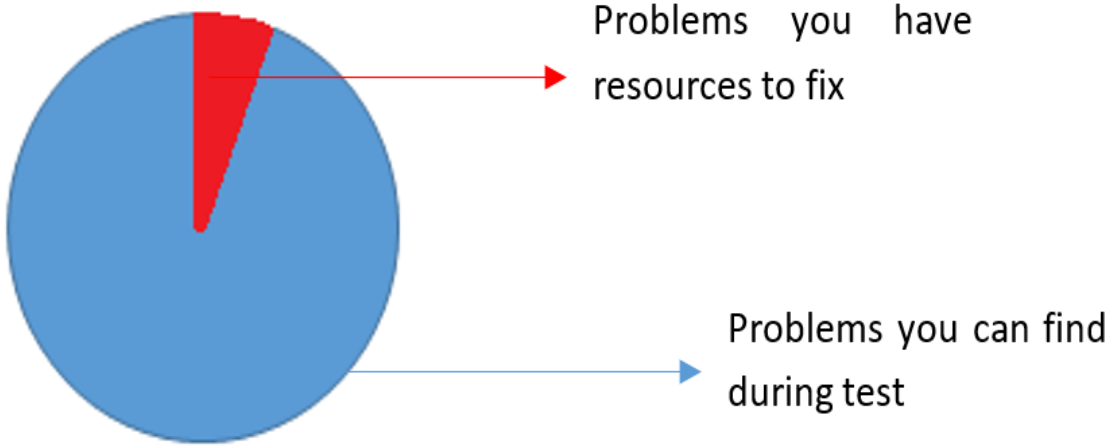
- Why evaluation is needed?
- What to evaluate?
- When to evaluate?
- How many users do you need for evaluation?
- Who are the participants?
- Where is a suitable place for test?
- Who should test and who should observe?

Main Questions about Evaluation

- Why evaluation is needed?
- What to evaluate?
- When to evaluate?
- How many users do you need for evaluation?

Krug believes three users should be enough (Krug, 2014)

- Who are the participants?
- Where is a suitable place for test?
- Who should test and who should observe?



Test Plan

- Scope
- Purpose
- Schedule and location
- Sessions
- Equipment
- Scenarios
- Roles
- Subjective metrics
- Quantitative metrics

Quantitative Metrics

- Successful task completion
- Critical errors
- Non-critical errors
- Error-free rate
- Subjective measures
- Likes, dislikes and recommendations

Running a Test

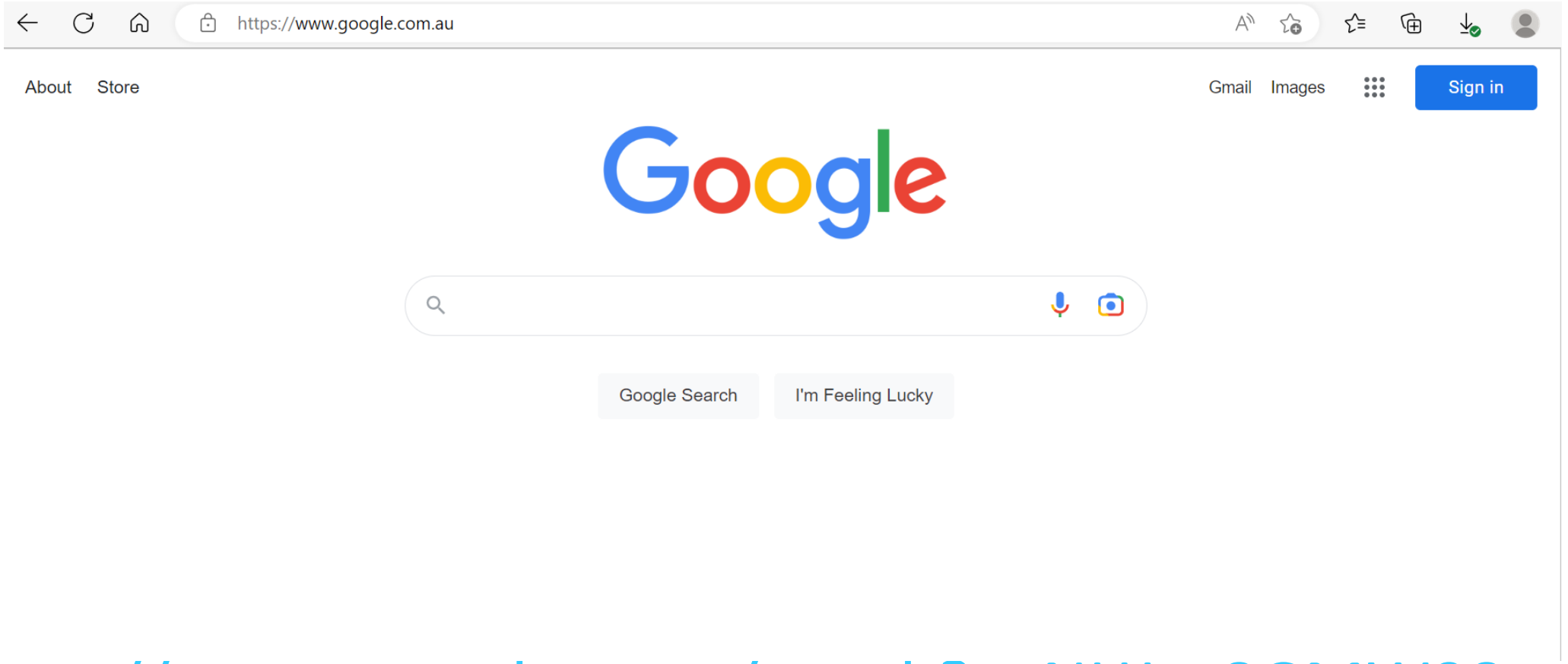
- Welcome (4 minutes): You just introduce yourself and say welcome to the participant and briefly explain what is this about.
- The questions (2 minutes): You ask the participant some questions to estimate his/her background knowledge.
- The product tour (3 minutes): You briefly introduce.
- The tasks (35 minutes): This is the main part of the test. You provide a list of tasks and ask the participant to perform them using the product.
- Probing (5 minutes): After the tasks, you must check with both participant and the observation team for any question they would like to ask.
- Wrapping up (5 minutes): You thank the participant, pay and show him/her the door to exit the room.

(Krug, 2014)

Heuristic evaluation (Nielsen)

- Visibility of system status: System status must be always visible to users though providing informative feedback within reasonable time
- Match between system and real world: System must communicate with users in terms of the concepts familiar to them, rather than technical terms which are difficult to understand for users.
- User control and freedom: Users must be able to exit from any situation they unexpectedly find themselves, by using clearly marked exit or back signs.
- Consistency and standards: All parts of the system must be consistent in all aspects of user interface.
- Error prevention: As far as possible all errors must be prevented.
- Good error messages and recovery from errors: A meaningful error message must be shown to the user and a way must be suggested to solve it.
- Recognition rather than recall: System must make objects, actions, and options visible, so the user doesn't need to recall them.
- Flexibility and efficiency of use: System must provide accelerators for more experienced users to carry out tasks more quickly while these accelerators may be invisible to novice users. Keyboard shortcuts is an example of such accelerators.
- Aesthetic and minimalist design: Design must be aesthetic and minimal which means that irrelevant information must be avoided.
- Documentation and Help: Users must be able to search information and receive help when they need it.

Nielsen's Usability Heuristics and Google Search



https://www.youtube.com/watch?v=NHJrn8GMW98

Nielsen's Usability Heuristics

A good sample can be found here:

https://www.diva-portal.org/smash/get/diva2:1680527/FULLTEXT02

Web usability tools

- **W3C validator:** It checks the markup validity of web documents in the following formats: HTML, XHTML, MathML, SMIL, etc. You can access W3C validator via the following link: https://validator.w3.org/ This checks if the syntax is valid, is this related to usability?

It checks several things of which one is syntax.

- **Achecker:** AChecker is used to evaluate HTML content for broken links and accessibility problems. You can either enter the location of a web page, or upload an html file through the system for checking its accessibility. You can access Achecker through the following link: http://achecker.ca/.
- **Pingdom:** This is a website speed test which tests the load time of a webpage and helps you to make it faster. You can access this tool through the following link: https://tools.pingdom.com/

Pingdom

tools.pingdom.com/#61b2dd2883400000

Update

solarwinds pingdom

Product Pricing Resources Support **Tools**

Pingdom Website Speed Test

Enter a URL to test the page load time, analyze it, and find bottlenecks.

URL: https://www.unsw.adfa.edu.au/

Test from: North America - USA - San Francisco

START TEST

The internet is fragile. Be the first to know when your site is in danger.

START YOUR FREE 14-DAY TRIAL

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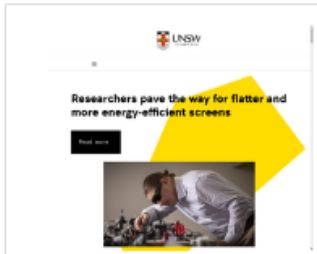
Pingdom

Your Results:

DOWNLOAD HAR | SHARE RESULT



Performance grade	Page size
D 61	6.8 MB

Load time	Requests
3.56 s	141

Improve page performance

GRADE	SUGGESTION
F 0	Avoid URL redirects
F 0	Reduce DNS lookups
F 0	Make fewer HTTP requests
F 0	Compress components with gzip
F 0	Use cookie-free domains
F 0	Add Expires headers
A 100	Avoid empty src or href

Response codes

RESPONSE CODE	RESPONSES
200 OK	130
204 No Content	1
302 Found	10

Content size by content type

CONTENT TYPE	PERCENT	SIZE
Image	61.00%	4.2 MB
Script	24.31%	1.7 MB
Font	8.03%	547.5 KB
HTML	5.21%	355.1 KB

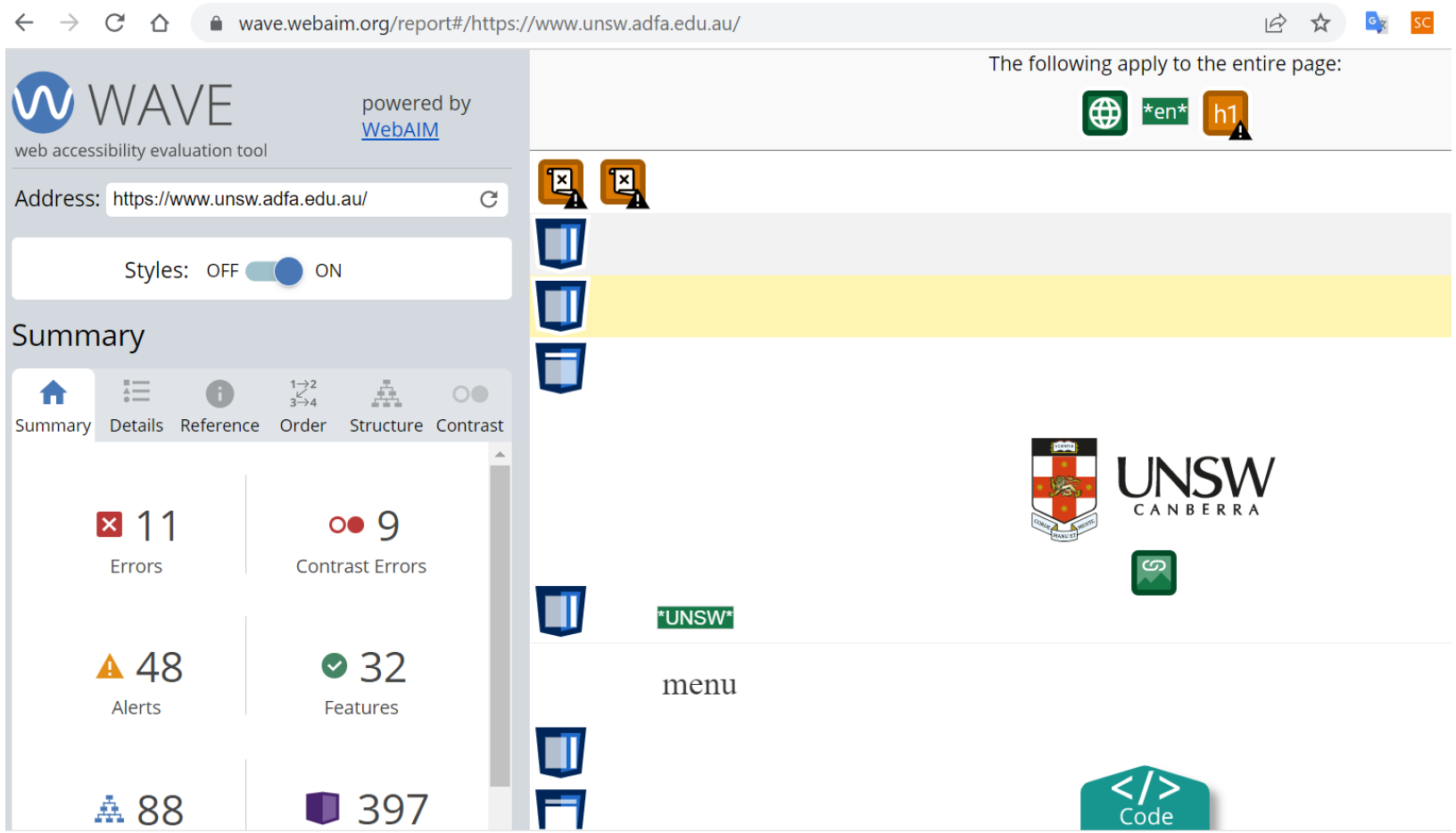
Requests by content type

CONTENT TYPE	PERCENT	REQUESTS
Image	43.97%	62
Script	29.79%	42
Redirect	7.09%	10
XHR	5.67%	8

WAVE

- This tool provides visual feedback of a webpage accessibility.

https://wave.webaim.org/



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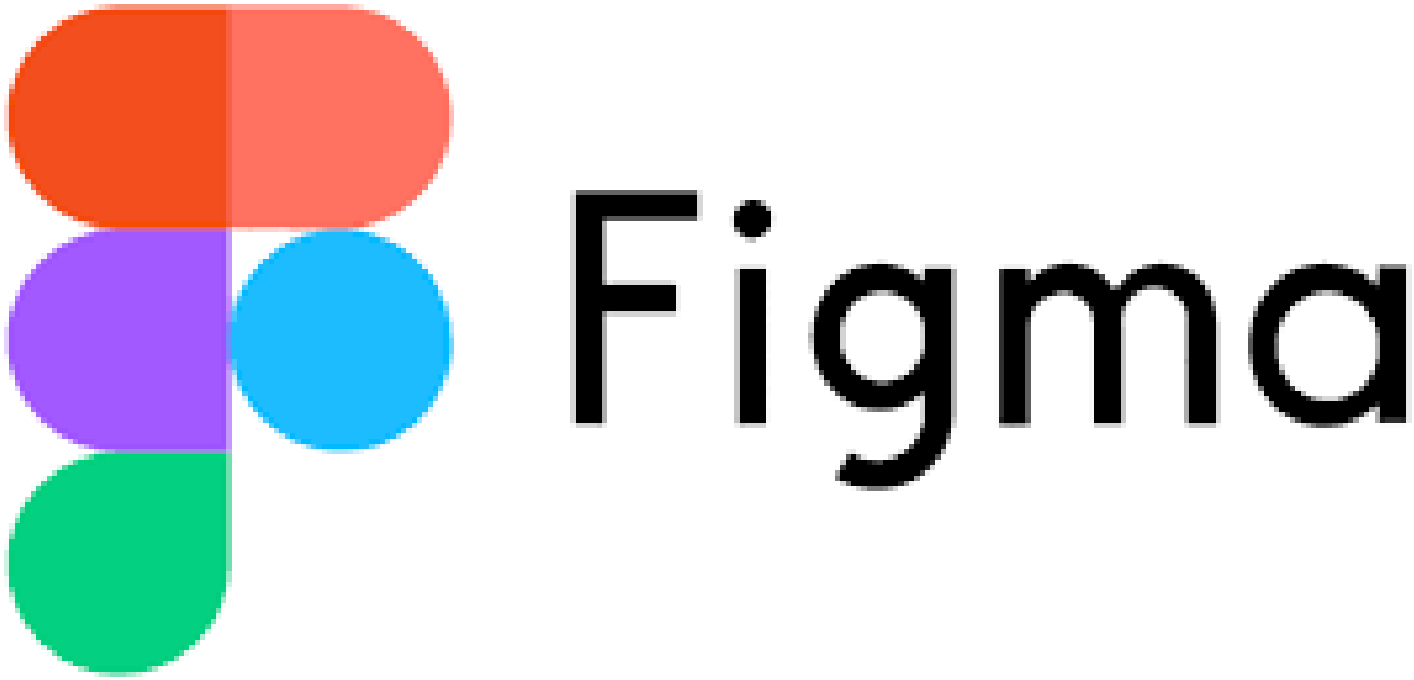
A Sample of User Evaluation

#	Heuristic	Notes	
1	Visibility of System Status	•	The progress of a plan box looks very clean and fancy, it seems it will be very useful.
7	Flexibility and efficiency of use	•	Although the add task button is very visible, it may work better at the top right instead of notification icon so the user can find the add button faster.
		•	It is difficult to understand the meaning of the icons in the main bottom navigation.
		•	In the add task view, the date, priority and repeat options are far away from the form, also, there is not a view how those options will look in that form and how the user can edit them
		•	Setting the date and time don't look intuitive because displaying the selected values are missing
8	Aesthetic and Minimalist design	•	The design of the app is clean and minimalistic overall, good combinations of spaces and colors. The components are easily to find thanks to the clean and fancy layout.
2	Match Between System and Real World	•	Although the home view does not look exactly to a calendar, it gives an easy way to navigate between dates and see their tasks. Also, the home view has a lot of blank space, maybe a way of showing more components would be useful
3	User Control and freedom	•	Users can close the app any time
		•	User can close the add task view any time with the back button
		•	User does not have the ability to save a draft when closing the add task view
		•	Instead of a back button, a close button would be better

Figma Demo



Final Notes

- Continue working on Project 1 this week.
- Task 2 (group-based):
  - Each group needs to create a high-fidelity prototype using Figma or a similar tool and share it with other students for evaluation
  - Each group needs to reply to their initial message on Project 1 Forum and share the link with others. Also, provide a list of tasks you would like other students accomplish using your prototype and give you feedback on it. The deadline is **19th March 23h59:**
  - In week 4 labs, teams can also get some classmates to accomplish these tasks in front of them to better understand their interactions with the designed prototype.
- Task 3.1 (Individual): Each student must check the forum and participate in evaluation of two other projects individually. The deadline is **22nd March 23h59**. You need to document the process and in reply to the designers' message in the forum, share the feedback with them to help them with improving their design.