

Design Systems

CS 346 Application Development

<https://student.cs.uwaterloo.ca/~cs346>

Contents

Introduction	2
Motivation	3
Holistic Design	4
Phases	5
Phase 1. Understand	6
Phase 2. Explore	18
Phase 3. Materialize	25
Bibliography	27

Introduction

Motivation

Anything that we design should be useful. It should *also* be so carefully designed for users and their experiences that it becomes a *joy to use*.

The first requirement for an exemplary user experience is to meet the exact needs of the customer, without fuss or bother. Next comes simplicity and elegance that produce products that are a joy to own, a joy to use.

— Don Norman & Jacob Nielsen [1]

The field of [User Experience \(UX\)](#) aims to improve the user's experience with a product. It addresses interaction, ease-of-use, efficiency and overall usefulness. It's goal is to design the most engaging and useful solution for the user.



Figure 1: UX matters more than you might realize.

Holistic Design

[Design Thinking](#) is a UX-focused way to approach design. Its goal is to design software through the lens of user goals.

We can characterize design thinking this way:

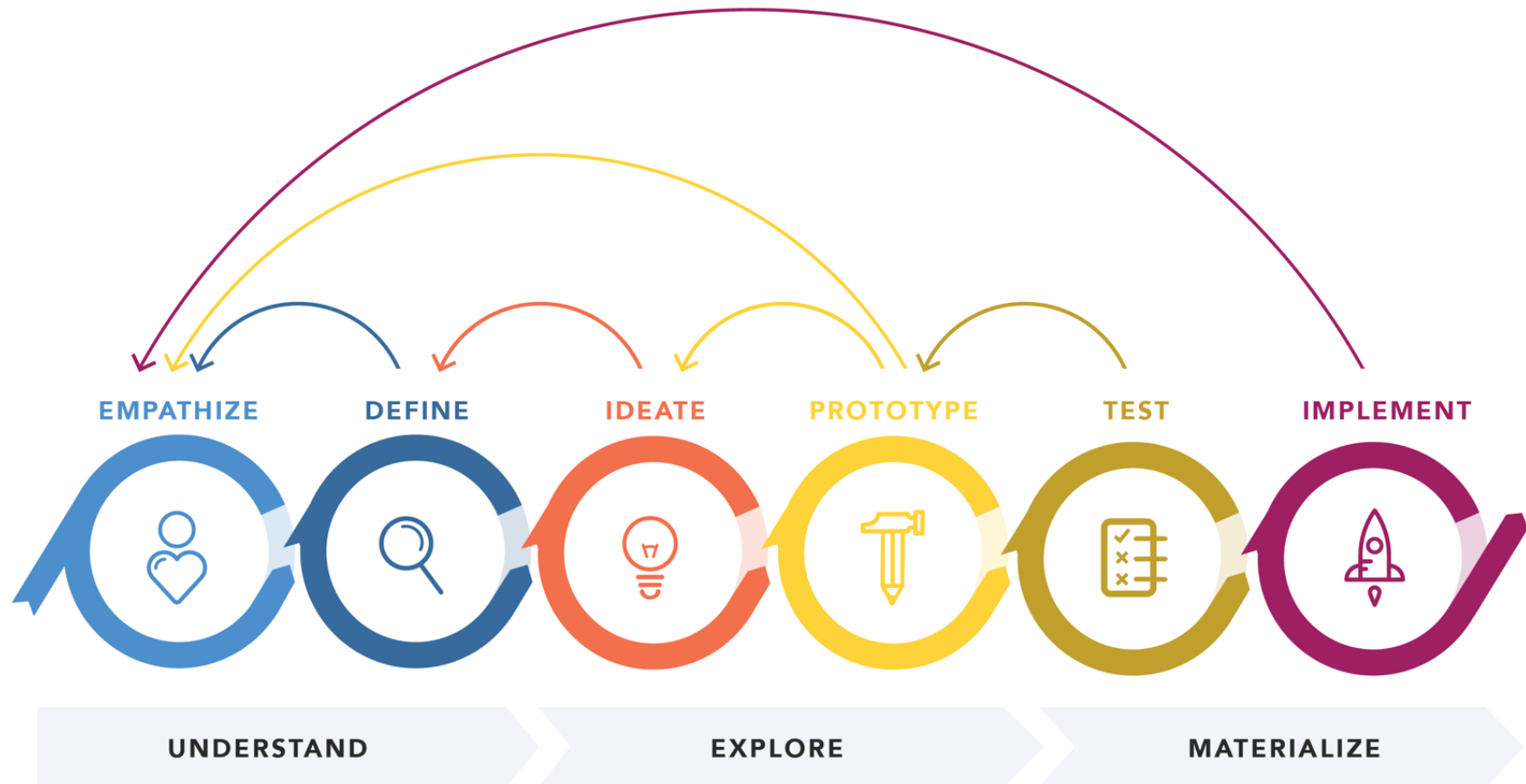
- It's fundamentally people-centred.
- The goal is always to solve the right problems and address the root cause.
- It considers everything as a system. You can't solve one little piece, because everything is interconnected. You really have to look at the nature of the system and how things “fit” together.
- It focuses on small and simple interventions. With complex systems, we probably won't get everything right, so build small and simple, check the results, change what we're doing and continually improve.



Tip

Iteration is the cornerstone of interaction design. We iterate to “get it right”.

Phases



DESIGN THINKING 101 [NNGROUP.COM](https://nngroup.com)

Figure 2: Design thinking is inherently iterative, at every stage [2].

Phase 1. Understand

We take steps to understand the user, their context and potential problems that they might be experiencing.

1.1. Empathize

The first step to building a solution for someone is to understand who they are, what challenges and constraints they face.

You want to be able to state:

- “Who are my users?”“
 - e.g., “students who work out regularly”
 - e.g., “dentists working in KW”
- “What are they trying to accomplish?”
- “What tasks do they need to perform?”“
- “What works well for them?”“
- “What’s frustrating to them?”

Phase 1. Understand

Action: Conducting Interviews

The best way to understand a set of users is to talk to them! You need to interview people to understand them, their perspective (how they work, what they like, what they dislike and so on).

Interview guidelines

- Interview 5-6 users (Nielsen 2000)
- Ask open-ended questions i.e., what they do, how they work.
- Continue asking questions to identify other issues or challenges that they might have.
- Use follow-up questions to make sure that you understand their goals and motivations.

Phase 1. Understand

Good interview questions

- “What is something that you do in this role that takes a lot of time”.
- “Describe a problem that you frequently encounter”.
- “How would you accomplish X”?
- “What do you like about this existing solution? What do you dislike?”

Poor interview questions

- “I built this. Isn’t it cool?”
- “You want what? That’s a dumb idea.”

Phase 1. Understand

Action: Generating Personas

A persona is an archetypal description of a user of your product.

Personas are meant to be generalized descriptions that represent a category of people with similar characteristics. We use personas as stand-ins when discussing product goals and features.

- Think of personas as people with specific goals (i.e., someone who needs to accomplish something specific) or roles (i.e., someone with a series of responsibilities and expectations based on that).
- You will likely have multiple personas, where each persona represents a different type of user. It's not uncommon to have two or three personas, even for a small solution.

Phase 1. Understand

What to include in a Persona?

- **Name:** Make it up! Giving them a name gives them an identity.
- **Image:** A vivid image can help your team picture your users clearly and help establish a consistent understanding of the target.
- **Biography:** a short description of a typical user that fits this profile.
- **Goals & Motivations:** What are they trying to accomplish?
 - Lawyers bill clients (I'm sure they do more than this).
 - Software developers want to produce high-quality tested software on-time.
- **Likes/Dislikes:** identify pain-points (more on this in a moment).

You may have multiple personas, reflecting different users of your product.

Phase 1. Understand

Jessica Coder

BIO

Jessica is a professional software developer. She graduated from UW with a BCS and a minor in CO. She is the tech lead for her current project at Shopify.

GOALS

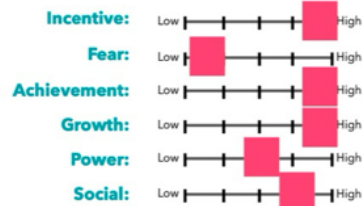
She is a packrat for saving technical information - code snippets, articles online.

FRUSTRATIONS

She finds it difficult to keep track of everything that she needs to work with in a day.

MOTIVATIONS

Anything to make her more efficient.



Age: 26

Occupation: Software Developer

Status: Single

Location: Toronto

Archetype: Developer

Personality: "Gadget person"; loves new tech; Android over iOS because she can tweak it.



QUOTES

"If I have to use a mouse, that just annoys me. I'm faster with a keyboard. VIM all the way".

"Information should be easy to access, and always accessible. Having everything searchable without breaking the flow would be amazing."

DOMAIN AWARENESS

Currently uses markdown notes and manually "greps" based on keyword.

TECH KNOWLEDGE

Expert in software, technology. Expects an advanced, polished solution.

Max Banker

BIO

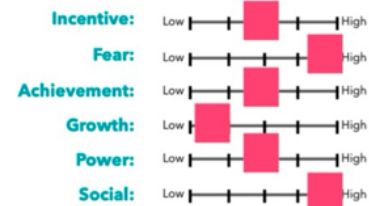
Max is a business student, with a political science minor. He has had multiple internships at banks and financial institutions. He's a capable technologist, but uses his computer for browsing the web and writing the occasional paper.

GOALS

Max has a lot of trouble keeping track of everything that he has to work on. Anything that would help him track course notes would be useful.

FRUSTRATIONS

Software is too complicated!



Age: 22

Occupation: Student

Status: Single

Location: Waterloo

Archetype: Student

Personality: Intense; serious; not particularly interested in tech.



QUOTES

"I'm too busy to learn some complex piece of software; it has to be easy to use."

"I hate my computer (Windows) so I'd rather use my phone."

DOMAIN AWARENESS

Not much. He scribbles everything in a paper notebook at the moment.

TECH KNOWLEDGE

Novice. He doesn't know much about computers.

Figure 3: Sample personas. Be creative with the format!

Phase 1. Understand

1.2. Define

This step involves identifying problems that your users may have disclosed in the interview.

- In reviewing your interview notes, you should be able to identify the needs that people are trying to meet.
- One way to do that is to underline verbs in the interview notes. These represent activities they are performing.
- Watch for actions that are unfulfilled or frustrating to them.

These actions or stories represent things the user needs to accomplish. You should focus on these ones specifically!

Phase 1. Understand

Action: Capturing User Stories

A [user story](#) is an informal, general explanation of a software feature written from the perspective of the end user.

- From your interviews, you should extract these user stories. They are the foundation for what you will build.
- You do NOT need to build everything you identify. Look for related actions or stories.
- User stories should be few sentences in simple language that outline the desired outcome. They don't go into detail.
- We will often pair user stories with personas to talk about “hypotheticals” when discussing potential solutions.

Phase 1. Understand

Examples

- “As a manager, I need to track my staff’s hours worked. To do that, I need to query their start and stop times for each shift and do the math; it’s time-consuming”.
- “I spend a lot of time in difficult taking detailed minutes. I mostly use MS Word, but it’s difficult to format notes during the meeting.”
- “As a software developer, I spend a lot of time collaborating with my team. This has become much more difficult since we work remotely a lot of the time. I wish I could share my sketches more easily online.”

Phase 1. Understand

Action: Define a Problem Statement

You should be able to capture an over-arching statement of the problem that you are trying to address:

- Look for the theme of your user stories.
- What is the common problem that you are addressing?

For example:

- “Lawyers need to track their time carefully. Existing solutions fail to capture the required data, or pose billing challenges. We propose a software solution to help them easily capture time worked by client, project and category on their phone or computer, and generate summary and billing reports.”

Phase 1. Understand

Terminology

In large projects, we will often group user stories by functionality.

- **Stories**, also called “user stories,” are short requirements.
- **Epics** are large bodies of work that can be broken down into a stories. They represent higher-level objectives. e.g., “Implement a new login system”.
- **Initiatives** are collections of epics that drive toward a common goal. e.g., “Redesign the user interface”.



Figure 4: A more complex structure for multi-part goals.

Phase 1. Understand

Outcome

You should “finish” this section with

- a list of personas and their details,
- a problem statement,
- a number of user stories,
- tasks corresponding to your user stories.

Phase 2. Explore

We brainstorm ways to solve their problems, and explore the options that are open to us. We consider alternative solutions.

2.1. Ideate

You have a problem statement, and a bunch of user stories. This step is all about brainstorming solutions to these problems!

Bring your team together and brainstorm ideas you have that could contribute towards a solution.

- No idea is too far-fetched! Share ideas with one another, mixing and remixing, building on others' ideas.
- Reduce the set of solutions to a single “best solution” i.e., a set of user stories and features to address them.
- You will want to document every idea that you have, not just the “winning ideas”.

Phase 2. Explore

Action: Affinity Diagram

One way to collect ideas is to build a large affinity diagram.

1. Write down each idea on a sticky note.
2. Put them on a whiteboard or large wall.
3. Organize them into clusters of related ideas. This can help you create hierarchies, or figure out dependencies.

You can use this to cluster use cases or features/solutions.

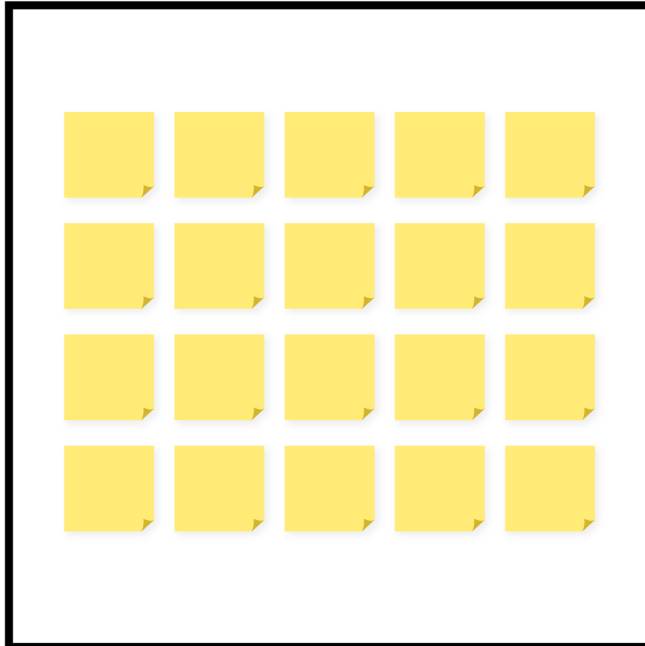
Your goal is to identify broad features that solve related problems (remember: think broadly).

Phase 2. Explore

3 Steps to Affinity Diagramming

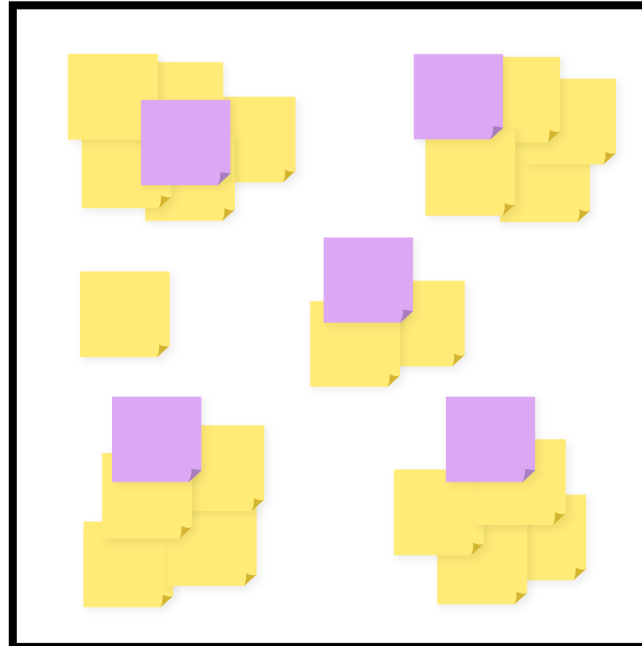
STEP 1

Generate ideas as sticky notes.



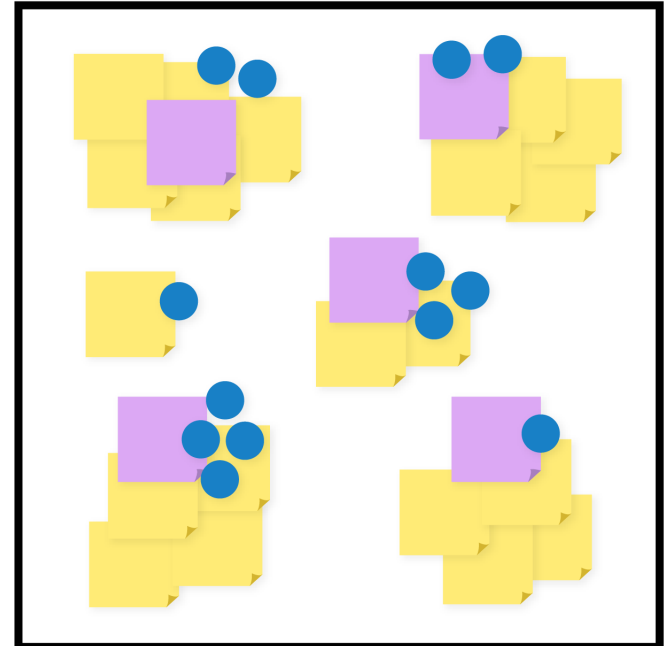
STEP 2

Organize notes into clusters.



STEP 3

Prioritize clusters and next steps.



NNGROUP.COM **NN/g**

Figure 5: Steps to take to extract features from chaos. Courtesy of [NN/G](https://nngroup.com) [3]

Phase 2. Explore

2.2 Prototype

Next, you will build a prototype of your solution. A prototype is essentially a mock-up of your solution, that is built to demonstrate functionality and elicit feedback from your users.

The goal of this phase is to understand what components of your ideas work, and which do not! In an ideal world, everything would work perfectly, but you probably will need to iterate a few times.

You want to show this prototype to your user and walk through all of the features to get initial “buy in”.



Warning

You will not get everything right the first time! The goal is to get early feedback and iterate.

Phase 2. Explore

Low-fidelity prototypes are deliberately simple, low-tech, and represent a minimal investment.

- sketch on paper.
- simple wireframe in Figma

Medium/high are progressively closer to “real” functionality.

- can model user interaction
- show “real” data

Focus on low-fidelity prototypes!

- Highest value for the effort
- Avoids users thinking you’re “almost done” when you show them a working prototype.

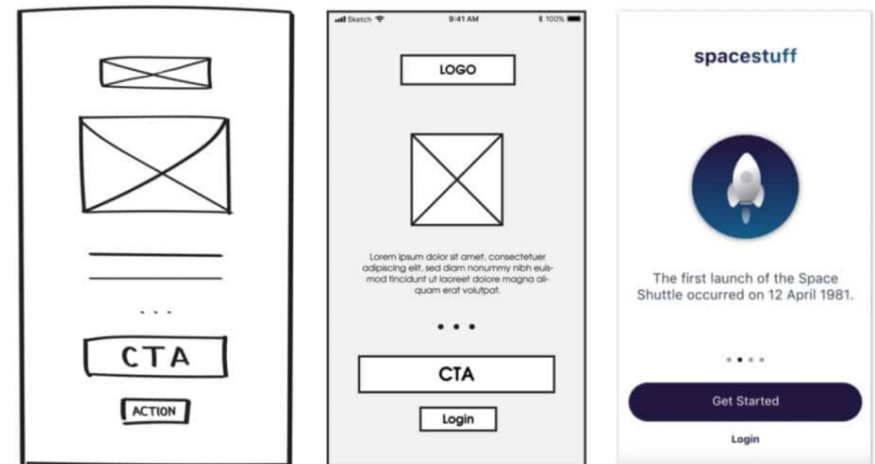


Figure 6: Low, Medium and High fidelity prototypes.

Phase 2. Explore

Prototyping Tools

[Figma](#) is a very popular prototyping tool (desktop, mobile, web).

- Mock screens & interactions.
- Can build specific UI designs (e.g., iPhone, iPad, desktop).
- Iteration is much easier compared to paper prototyping.

Other options

- [Balsamiq](#) (win, mac, web)
- [Omnigraffle](#) (mac)
- Hand-drawn diagrams

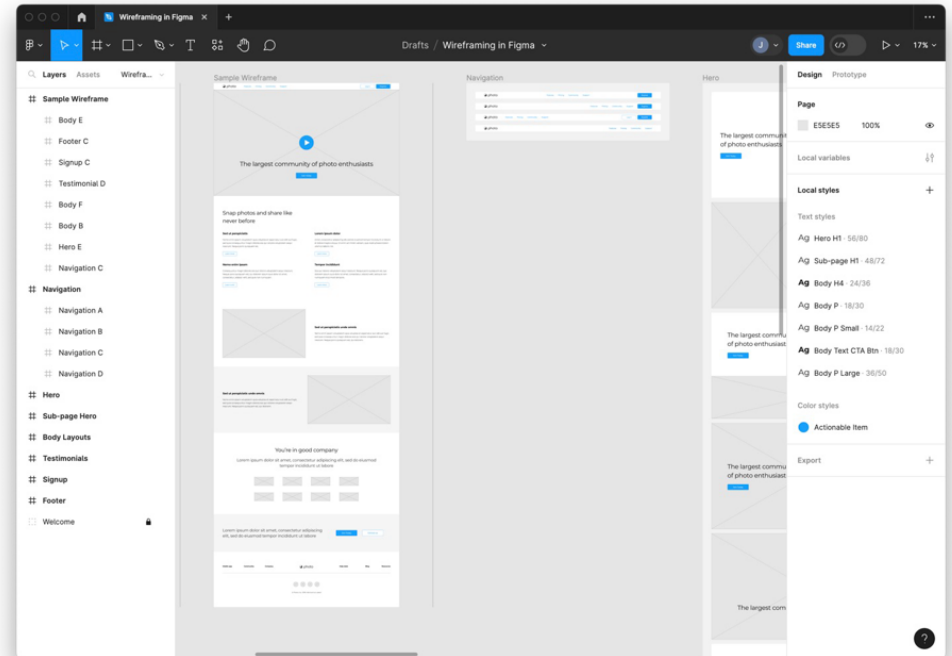


Figure 7: [Figma](#) can build prototypes for many targets

Phase 2. Explore

Outcome

You should “finish” this section with

- a list of ideas,
- an affinity diagram from brainstorming,
- prototypes of UI features.

Phase 3. Materialize

We iterate over potential solutions with our users and collect their feedback.

3.1. Test

This step involves taking your prototype back to your users and collecting their feedback. You want to address questions like:

- Does this solve your problem it is intended to solve?
- Is it easy to understand? Easy to use?
- Does this functionality make sense to you (as a user)?
- What would you change?



User feedback is invaluable, but you are not obliged to act on it! You're the designer, it's your goal to pore over feedback and make decisions.

3.2. Implement

At some point, you will have enough feedback to be able to proceed with the actual implementation. You should still demo occasionally to users, but you have enough information to proceed.



Keep your prototypes in-sync with your code as you are developing it. If you need to change anything, it's easiest to be able to put a prototype in front of your user (again) to get more feedback.

Bibliography

- [1] D. Norman and J. Nielsen, “The Definition of User Experience.” [Online]. Available: <https://www.nngroup.com/articles/definition-user-experience/>
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