DESIGN OF INTERACTIVE SYSTEMS

22 SEPTEMBER 2027

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Inria

WELCOME

DESIGN OF INTERACTIVE SYSTEMS + TER

Lectures
Tuesday 13:45 - 17:15
Room D101

TER
Friday 13:30 - 17:00
Room E212

NEXT WEEK

HCI EVENTS

PHD DEFENSE OF XIAOHAN PENG

TITLE: DESIGNER-LED INTERACTION WITH GENERATIVE AI

DATE: 28TH SEPTEMBER, 4 PM

Location: Digiteo (660), Auditorium

Jury:

Björn HARTMANN - University of California, Berkeley

Nick BRYAN-KINNS - University of the Arts London

Elena L. GLASSMAN - Harvard University

Steven DOW - University of California, San Diego

Nicolas SABOURET - Université Paris-Saclay

SIGCHI Paris Talk

Nick BRYAN-KINNS - University of the Arts London

Date: 29th September, 10 am

Location: Digiteo (660), Auditorium

LECTURES 5

OVERVIEW

Category	Activity	Duration (min)	Start	End
Homework	Review Brainstorming Concept	15	13:45	14:00
Lecture	Collecting and Interpreting Design Inputs	30	14:00	14:30
Exercise	Design Concept	30	14:30	15:00
Exercise	Design Alternatives	20	15:00	15:20
Exercise	Interaction Table	20	15:20	15:40
	BREAK	**15**	15:40	15:55
Lecture	Representing Design: Prototyping	35	15:55	16:30
Exercise	Future Scenario	30	16:30	17:00
Lecture	Storyboards & Video Prototypes	10	17:00	17:10
Homework	Finish Concept + Alternatives + Scenario	5	17:10	17:15

GENERATIVE DESIGN

Discovery

— Who is the user?

Inspiration

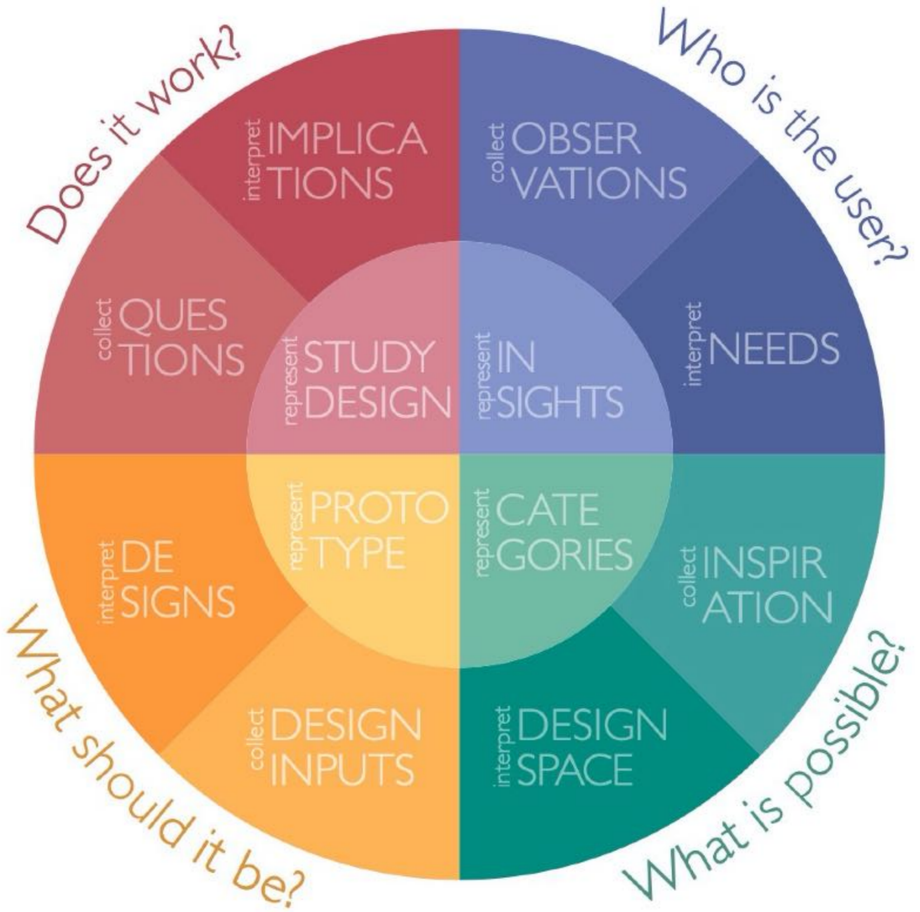
— What is possible?

Design

— What should it be?

Evaluation

— Does it work?



REVIEW HOMEWORK

Team — 50 min

EXERCISE

VIDEO BRAINSTORMING

Shoot at least 8 ideas (2-3 each)

Choose a team scribe to summarize all ideas
Each team member chooses 2+ ideas to direct

Roles:

Director	Choose idea, roles, presentation
Makers	Create paper prototypes
Talent	Manipulate prototype, act as user
Camera	Shoot 30”- 60” sequences

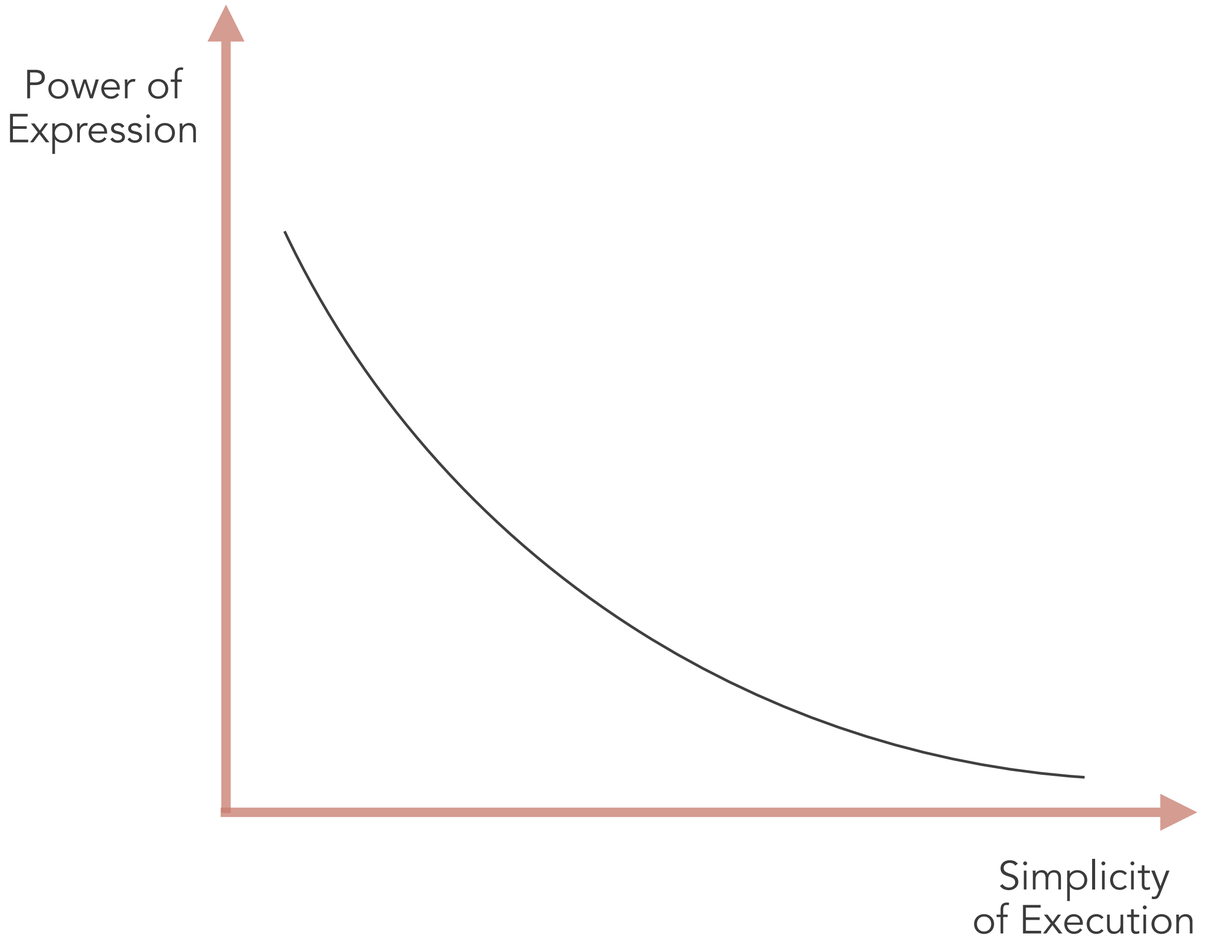
Now: Shut up and start shooting! :)

DESIGN

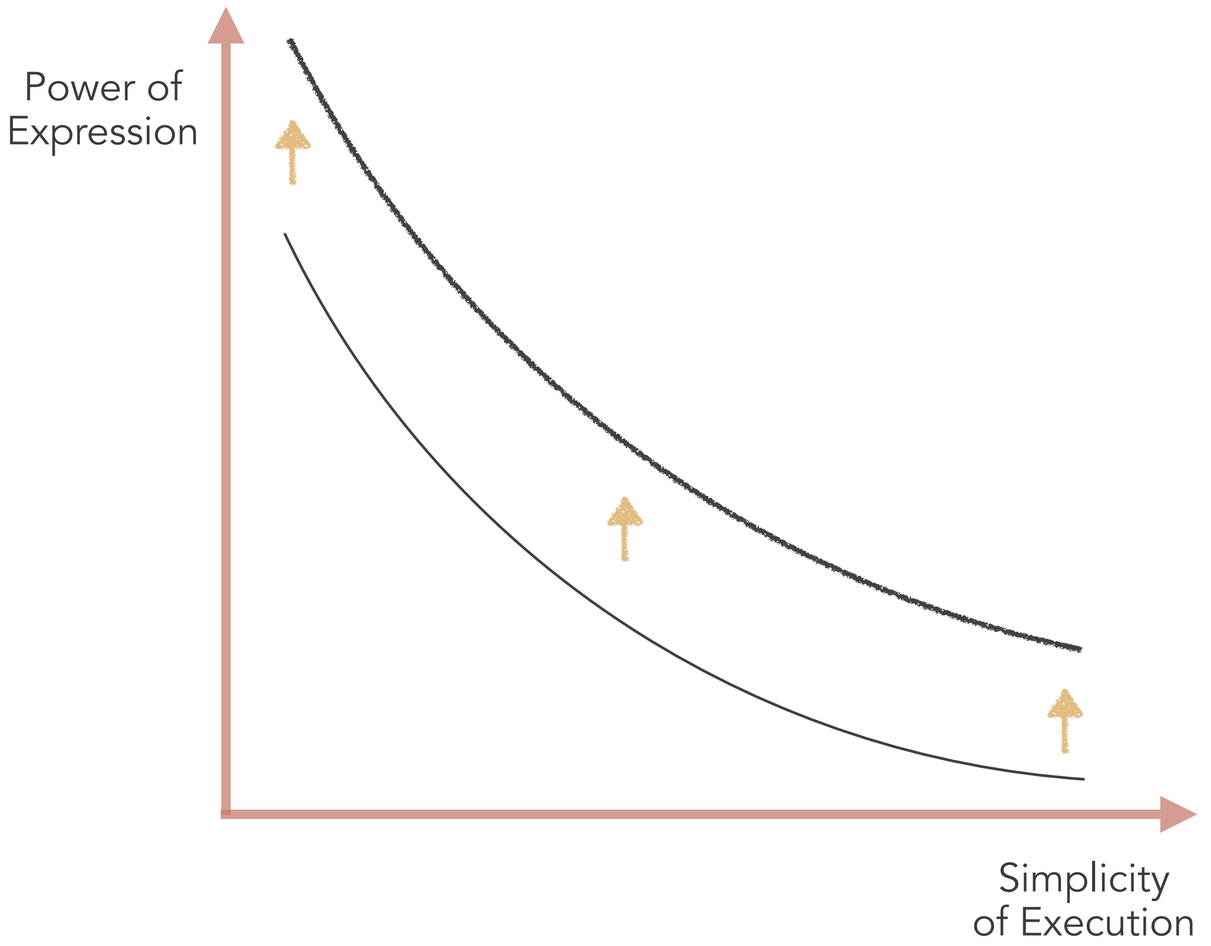


WHAT SHOULD I DESIGN?

DESIGN CHALLENGE



DESIGN CHALLENGE



HOMEWORK

DESIGN BRIEF

Clarify your design brief

- Who is the target audience?
- What is the context of use?
- Is the technology:
    worn by the user?
    embedded in an object?
    part of the environment?

- What is the key problem it will address?

GENERATIVE DESIGN

Discovery

— Who is the user?

Inspiration

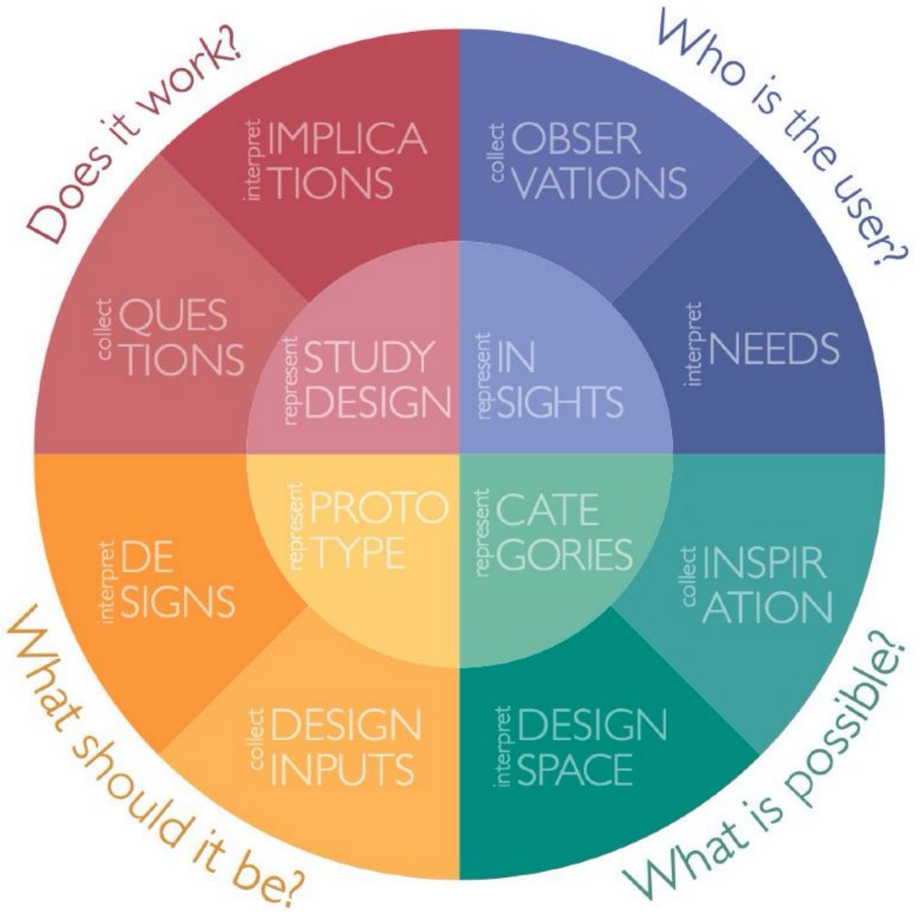
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— What should it be?

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— Does it work?



GENERATIVE DESIGN

Discovery

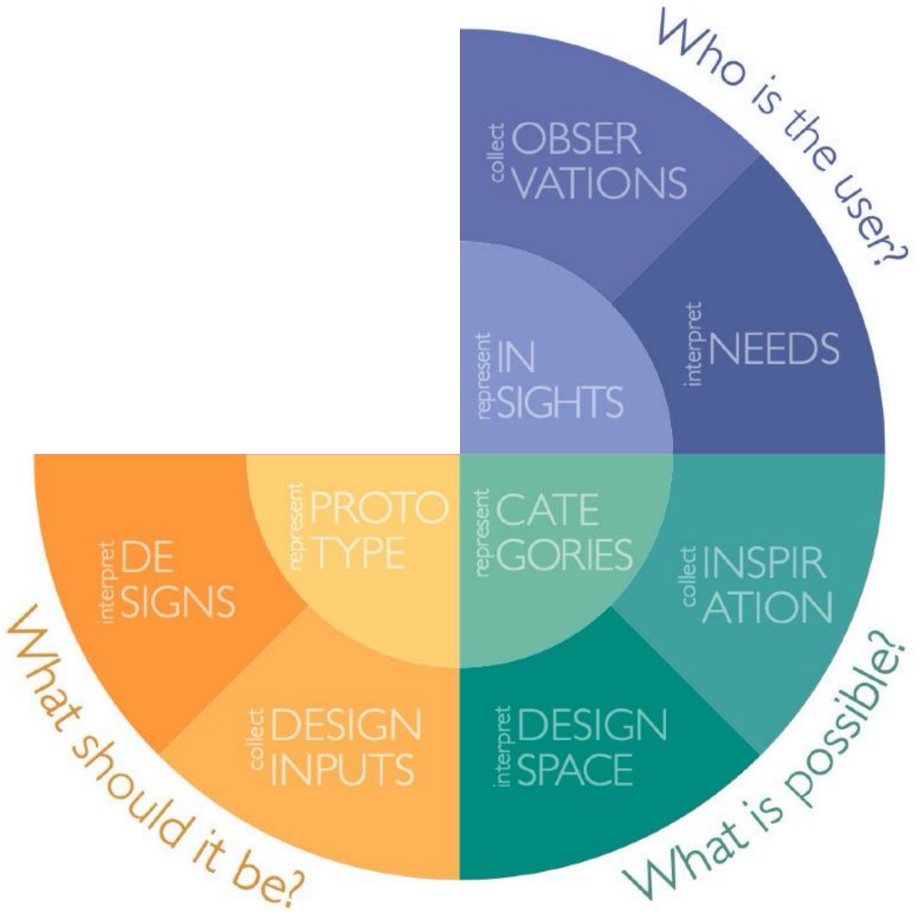
— Who is the user?

Inspiration

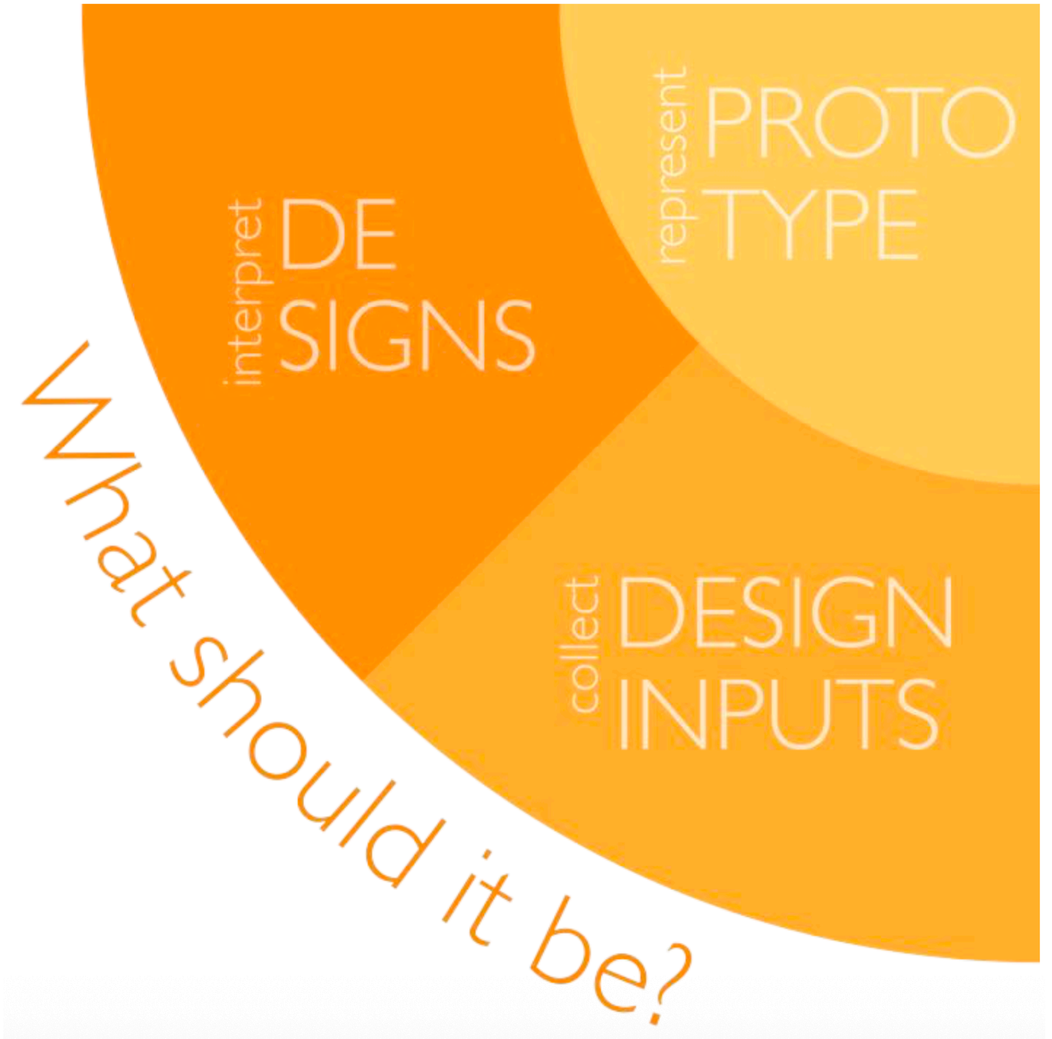
— What is possible?

Design

— What should it be?



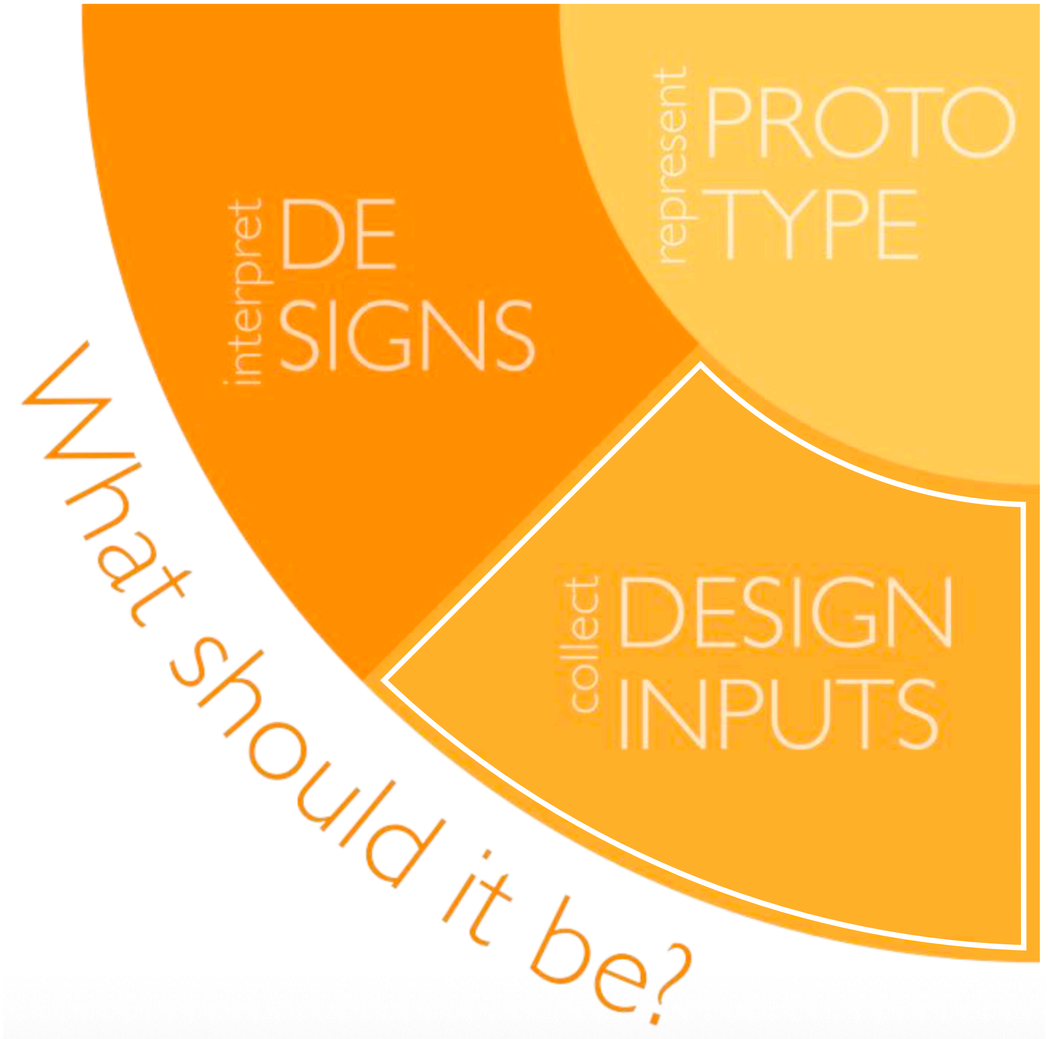
DESIGNING PROTOTYPES



DESIGNING ALTERNATIVES

Designing Prototypes	System	Action	Story
Collect	Design brief Design requirements	GATHER GENERATE	Persona Current scenario
Represent	Functional specification Paper prototype Tutorial video Wizard of Oz (tasks) Functional prototype	WRITE SKETCH SHOOT SIMULATE CODE	Future scenario Storyboard Video prototype (story) Wizard of Oz (scenario) Fixed-path prototype
Interpret	Interaction table Design diagram	DESCRIBE SKETCH	Concept description Flow diagram

COLLECTING DESIGN INPUTS



Methods

Design brief

Design specification

Interaction table

DEFINING REQUIREMENTS

DESIGN REQUIREMENTS

Design Brief

Communicate with clients

Project goals and objectives

Budget and schedule

Target audience

Project scope

Available resources

Overall style

Design Specification

Contract with clients

Functionality

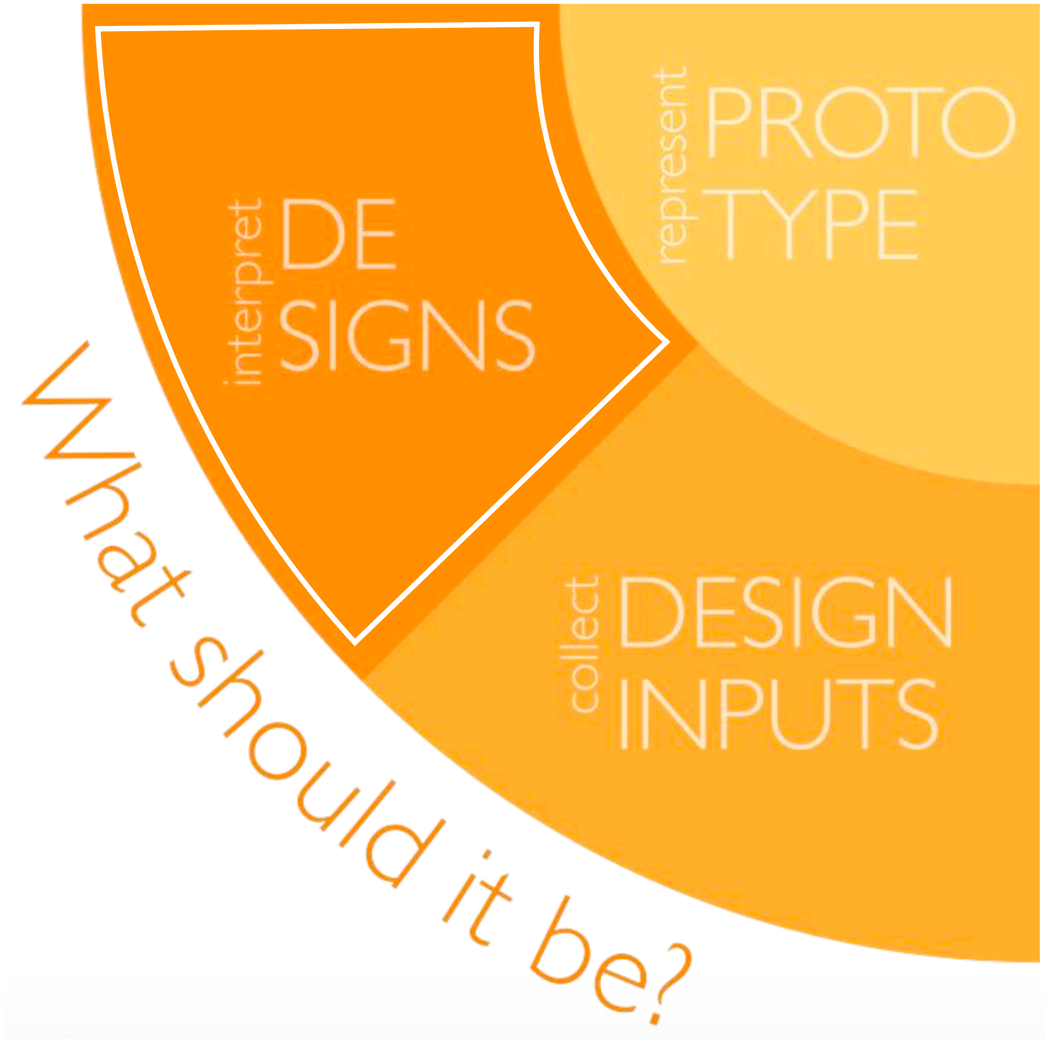
Performance requirements

Aesthetic factors

Maintenance

Project milestones

INTERPRETING DESIGN INPUT



DESIGNING ALTERNATIVES

Designing Prototypes	System	Action	Story
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Designer’s view of the system

How the designer wants
the user to see the system

Hides technical aspects

Includes what the user will use the system for

DESIGN CONCEPTS

Designer’s view of the system

A good conceptual model
corresponds with the user’s mental model

Take advantage of
metaphors
affordances

Follow design guidelines

DESIGN CONCEPTS

Don Norman’s guidelines

1. **Make things visible**
   User should understand the state of the system through the interface

2. **Mapping principle**
   Help users understand the link between:
   - Actions and results
   - Controls and their effects
   - System’s state and what is visible

3. **Feedback principle**
   Inform users about results of their actions

CONCEPTUAL MODEL

Ben Shneiderman’s design rules

1. Consistency
2. Short-cuts for expert users
3. Informative feedback
4. Design dialogues with closures
5. Prevent errors and help repair them
6. Provide reversible operations
7. Give control to the user
8. Reduce short-term cognitive load

But every rule has exceptions…

CONCEPTUAL MODEL

Create a conceptual model

Identify the **objects**:
What does the user want to manipulate?

Identify the **operations**:
What does the user want to do with these objects?

Identify the **commands**:
How can the user can activate these operations

CONCEPTUAL MODEL

DESIGN CONCEPT

Finding the design concept

Look at the results of your user studies
identify a need or problem to solve
specific to your audience.

Generate a variety of ideas
that offer potential solutions

Create a design space to
embody the set of alternatives

Choose a design concept to explore
focus on interaction, not just functionality

DESIGN CONCEPT

Finding the design concept

Identify a real, specific problem.
- Real problems are complex and messy
- Look for a small aspect of a real problem
- Avoid stereotypical ‘toy’ problems

Trade-off between power and simplicity:
- Less is More

Be curious, be creative, seek surprises and new opportunities

DESIGN CONCEPT

Finding the design concept

What will the user be able to do?
- What are the conceptual objects?
- How will users interact with them?
- What can the system do?
- How will the user learn it?

CHOOSE SOMETHING !!

First idea is **never** perfect ...
Reevaluate, redesign, & refine

CHOOSE SOMETHING !!

Avoid analysis paralysis!

Team — 20 min

EXERCISE

DESIGN CONCEPT___

One-sentence description:

What is the design concept?

What user problem(s) does it solve?

Is the interaction clear?

What technology does it use?

How does it help users?



Name | Team | Due

Concept

Design Prototypes **Worksheet**

ACTIVITY Summarize the key idea that underlies the design of the new system.

Who is it for?	
What should it do?	
One-line summary	
Full description	

Methods

Design brief

Design specification

Interaction table

DEFINING REQUIREMENTS

Reminder

Identify the conceptual objects from the **user's perspective**

Includes web pages and links, not buttons and menus

OBJECT TABLE

Object table				
	Conceptual object	Property	Representation	Operation
1	Web page	HTML text	Content window	Scroll
		Link to pages		Add to favorites
		Images		Copy
		Videos		
2	Link	Page destination	Underlined text	Jump
				Copy
				Bookmark

Ensure completeness & coherence

Top-down description of:
- conceptual objects in the system
- key operations (functionality)
- interaction with conceptual objects

Organized into two tables:
- Object table
- Operations table

INTERACTION TABLE

Ensure completeness & coherence

Interaction tables

consist of two inter-related tables

Object table

List conceptual objects (users' perspective)
plus: properties, representations, functions

Operations table

List key functionality and interactions

INTERACTION TABLE

Two inter-related tables

Object table				
	Conceptual object	Property	Representation	Operation
1	Web page	HTML text	Content window	Scroll
		Link to pages		Add to favorites
		Images		Copy
		Videos		
2	Link	Page destination	Underlined text	Jump
				Copy
				Bookmark

Operations table				
	Operation	User command	Feedback	System response
1	Scroll	Drag scrollbar's thumb	Content moves	Page has moved
2	Jump to a link	Click on link	Link highlights	Page appears

INTERACTION TABLE

Procedure

List conceptual objects
  How are they represented in the system?

List operations
  What does the system do?

List interaction techniques
  How will users manipulate conceptual objects to achieve each operation?

INTERACTION TABLE

Team — 15 min

EXERCISE

INTERACTION TABLE

Complete the two tables:

Object table

List conceptual objects (users' perspective)

plus: properties, representations, functions

Operations table

List key functionality and interactions

This is a working document:

Update it as your design changes



DESIGN EXPLORATION

Explore different interaction alternatives\

Ensure usability under diverse conditions

Let users & stakeholders imagine the interface

Focus on problematic parts of the interface

DESIGN ALTERNATIVES

Consider alternative types of interaction

Don’t stop with your first design concept
… but don’t explore 50 ideas either!

Carefully consider **3-5 alternatives**
Focus on alternative forms of interaction, not different functionality

Button presses and pull-down menus encourage procedural, annoying interfaces

You can do better!

Team — 10 min

EXERCISE

DESIGN ALTERNATIVES

Choose one or two design dimensions
- identify variations of your main concept

Generate three design alternatives

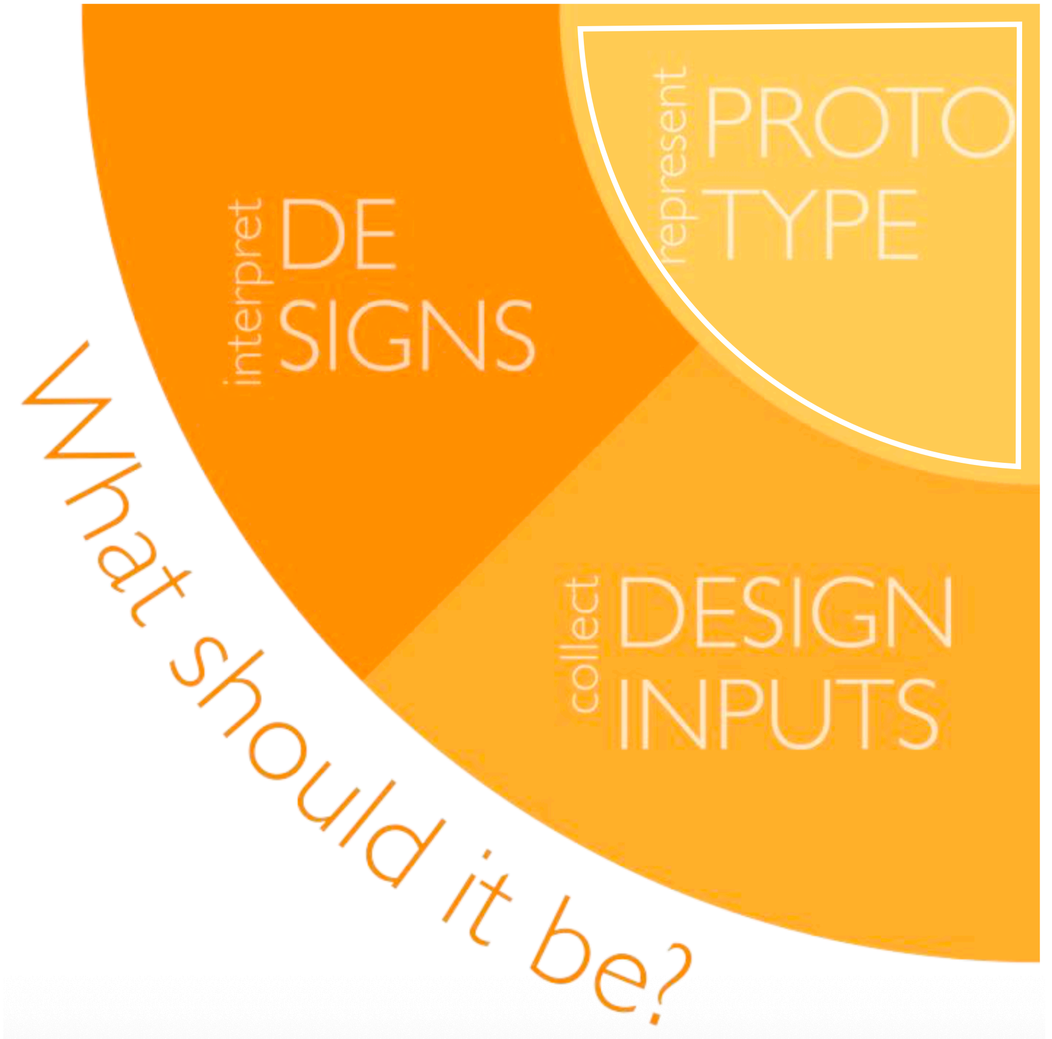
Consider the trade-offs between them
- What is better?
- What is worse?

Choose one or recombine features
- for a new concept



BREAK

REPRESENTING DESIGNS



DESIGNING ALTERNATIVES

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TAXONOMY OF PROTOTYPES

Participatory Design & Prototyping

Mackay & Beaudouin-Lafon (2022)

TYPES OF PROTOTYPES

Taxonomy

Mackay & Beaudouin-Lafon (2023)

Representation Physical form
from rough sketches to complete simulations

Precision Level of detail
from informal to highly polished

Interactivity Level of interaction
from non-interactive to fully interactive

Lifecycle Phase of project
from throw-away to components of final system

Scope Coverage
horizontal, vertical, matrix, path-based

PROTOTYPE

Representation

Physical form

Paper/Junk Create rough, quick sketches of the design

Example *Use paper and other materials to simulate interaction*

Online Create detailed, computer-based screen images

Example *Create Figma or Powerpoint wireframes*

Functional Develop working hardware and/or software

Example *Create interactive animations with Principle or working code*

PROTOTYPE

Precision

Level of detail

Lo-fidelity	Focus on overall design, omit most detail
Example	*Hand -drawn paper sketches and hand -crafted mockups*
Mixed-fidelity	Focus detail on current design issue, rest is rough
Example	*Dialog box layout includes key elements, sketches others*
High-fidelity	Include all key visual and interaction details
Example	Detailed version of final look & interaction characteristics

What about wireframes?

Graphic designers create wireframes

- Focus on screen layout, not interaction
- Static, not dynamic
- Encourages procedural interaction
- Assumes buttons, sliders and menus
  (least efficient forms of interaction)

Interaction designers

- should focus on interaction
- Create simple, but powerful interfaces

Detailed representations may not be precise

- Example: High-fidelity Figma-prototype may misrepresent or ignore key interaction

WIREFRAMES

Wrong focus

Highlights static screen layout but …

Ignores context

interaction over time

breakdowns

Advantages

Shows high-fidelity screen design

Permits realistic tests with user

Disadvantages

Suggests design is finished

which reduces feedback

Encourages surface design

rather than real-world interaction

WHAT'S WRONG WITH WIREFRAMES?

PROTOTYPE

Interactivity

Level of interaction

Non-interactive	Fixed path Show what interaction looks like
Example	*Video of user touching device*
Low interaction	Pre-determined path Test alternative interactions
Example	*Designer shows screen* *User performs action* *Designer shows system reaction*
High interaction	Open path Try any interaction
Example	*Wizard of Oz or limited functional prototype*

Simulate interaction with a new interface



WIZARD
OF OZ

Simulate interaction with a new interface

Designer (wizard)
- interprets user actions
- controls system responses

User experiences what the ‘real’ system might be like

Useful for creating video prototypes but also for creating live experiences that rapidly explore different design alternatives

WIZARD OF OZ

System may be:

- non-existent
- partially built
- completely functional

Best for certain types of interaction (based on wizard's reaction time)







WIZARD OF OZ

PROTOTYPE

Lifecycle

Phase of the project

Rapid Explore alternatives

Example *Create paper prototypes*

Iterative Refine modules over time

Example *Successively add detail and functionality over time*

Evolutionary Transform prototype modules into the final product

Example *Add new functions to software prototype (Agile approach)*

PROTOTYPE

Scope

Coverage

Horizontal Add layers of functionality

Example *Start with user interface, later add the underlying database*

Vertical Fully develop part of system

Example *Develop the spelling checker interface and algorithms together*

Scenario Develop the functionality relevant to a particular scenario

Example *Edit only three images*

TYPES OF PROTOTYPES

Consider design alternatives

Choice of prototype depends on
specific designer needs
phase of the design process

Dimension			
Representation	Physical	Non-functional	Functional
Precision	Low-fidelity	Mixed fidelity	High fidelity
Interactivity	Non-interactive	Fixed-path	Open
Lifecycle	Rapid	Iterative	Evolutionary
Scope	Horizontal	Vertical	Path-based

TYPES OF PROTOTYPES

Consider design alternatives

Choice of prototype depends on
- specific designer needs
- phase of the design process

Dimension			
Representation	Physical	Non-functional	Functional
Precision	Low-fidelity	Mixed fidelity	High fidelity
Interactivity	Non-interactive	Fixed-path	Open
Lifecycle	Rapid	Iterative	Evolutionary
Scope	Horizontal	Vertical	Path-based

Methods

Paper and junk prototypes

Video prototypes

Software prototypes

Hardware prototypes

RAPID PROTOTYPING

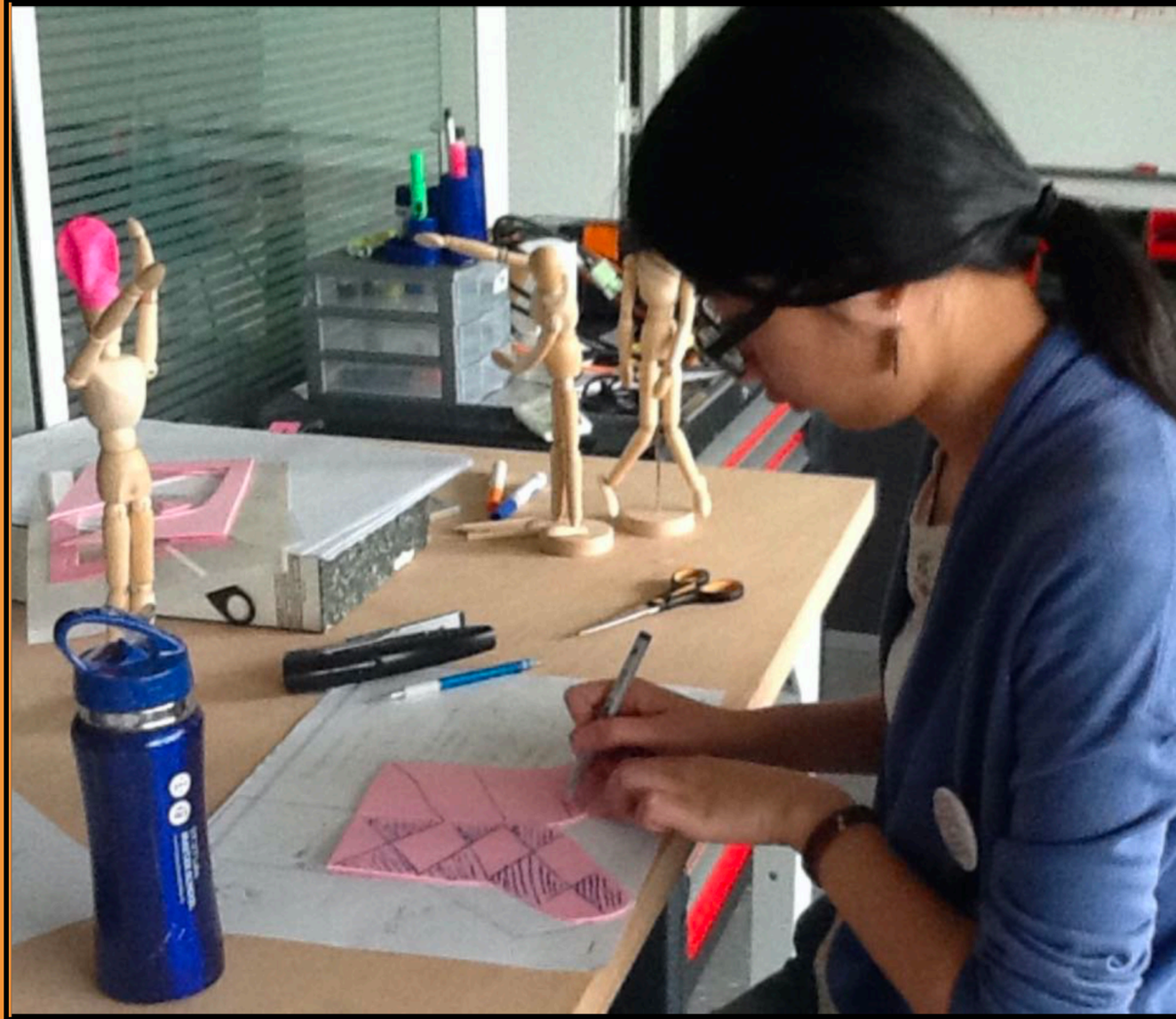
PAPER PROTOTYPE



PAPER PROTOTYPE



JUNK PROTOTYPE



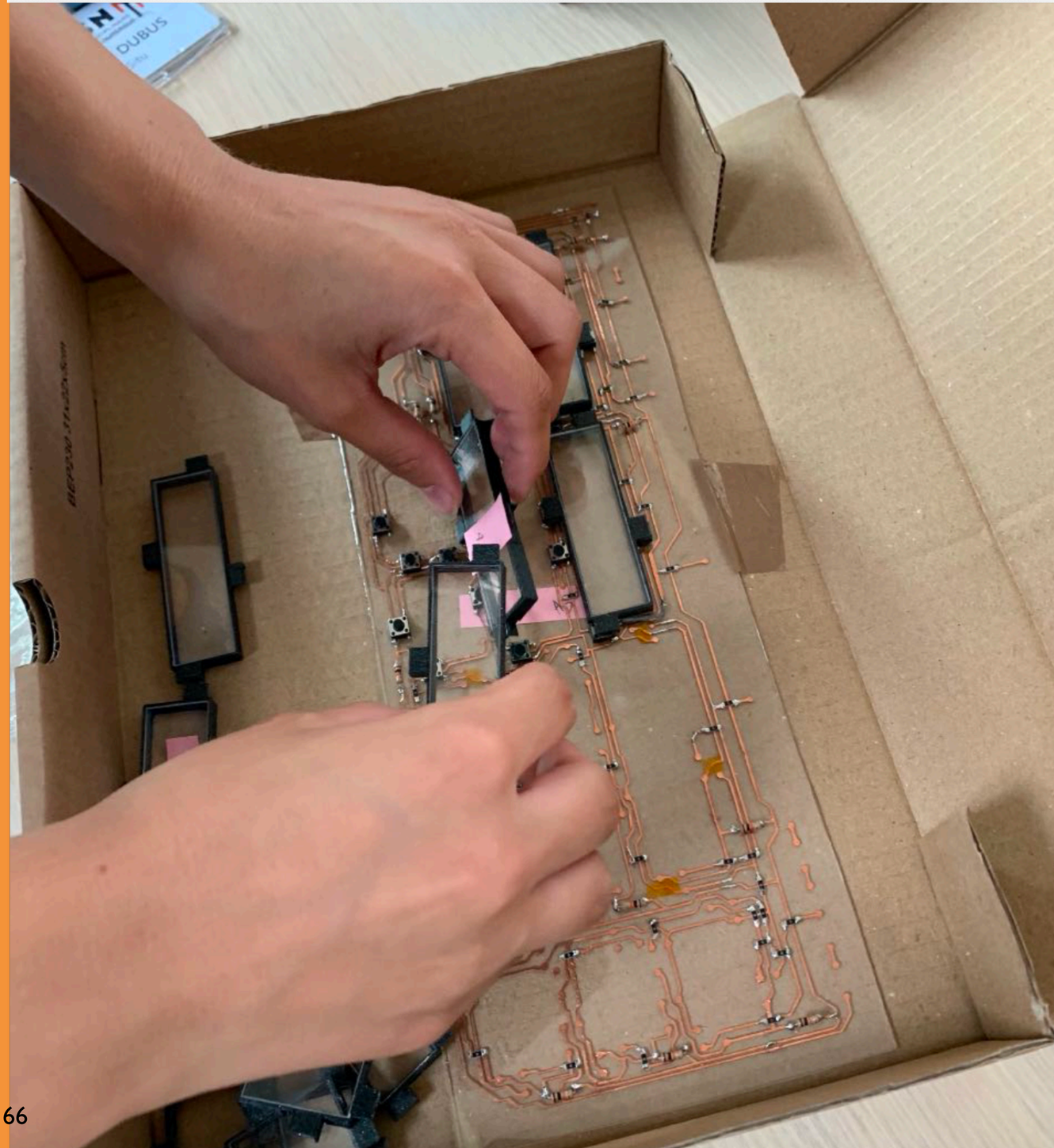
VIDEO PROTOTYPE



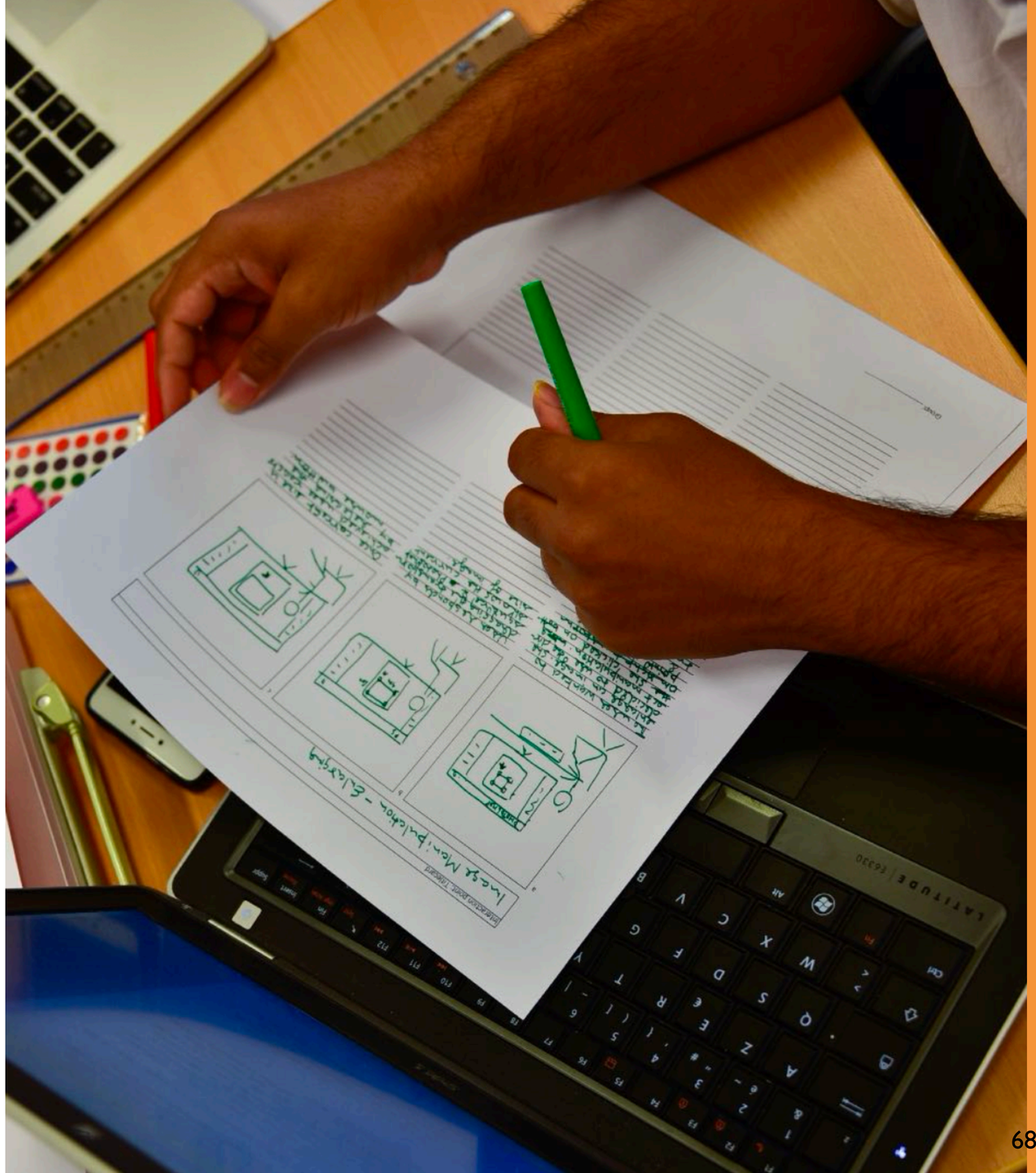
SOFTWARE PROTOTYPE



HARDWARE PROTOTYPE

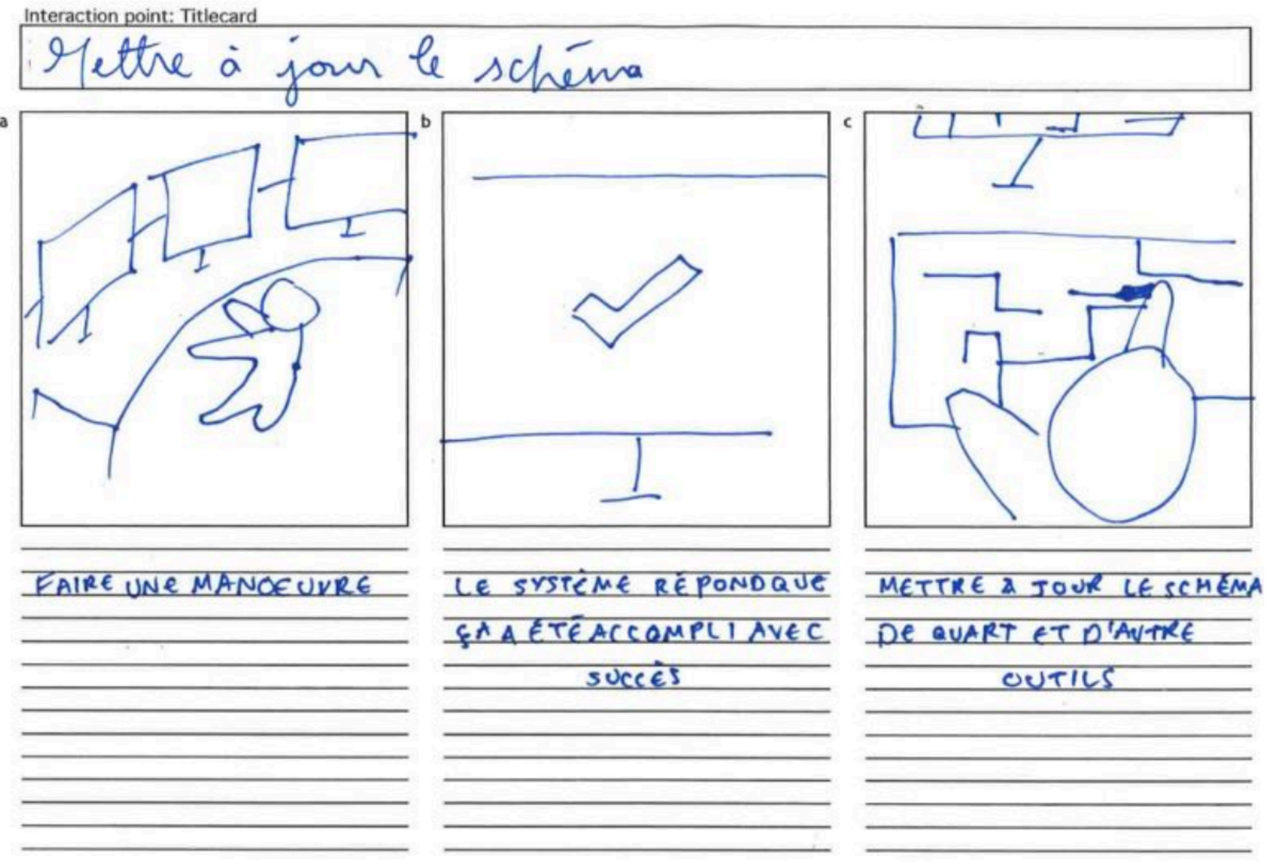


ABOUT: REPRESENTING TIME



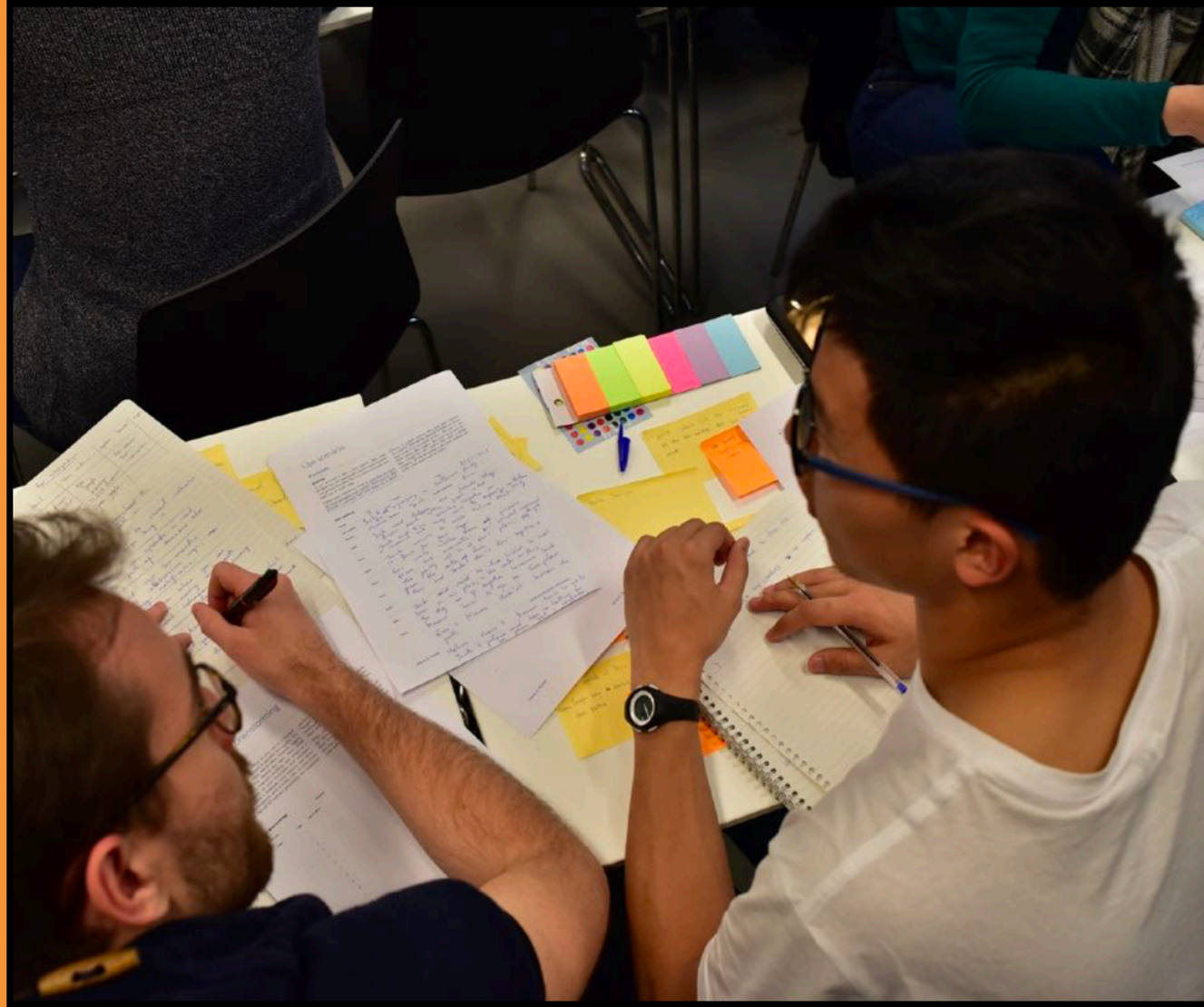
INTERACTION SNIPPET

Immediate interaction



INTERACTION SNIPPET

SCENARIO



SCENARIO

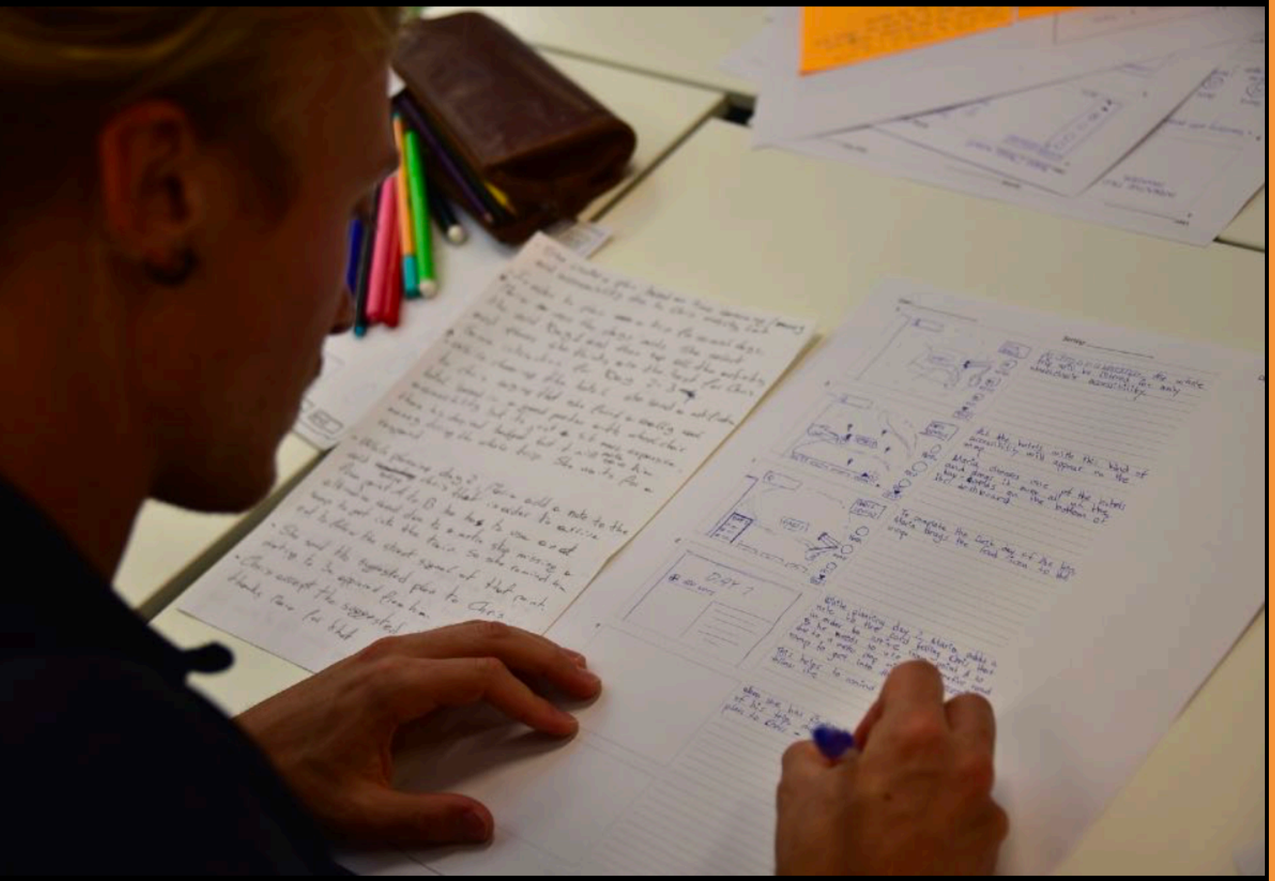
Name	Annika, Lars, Lena, Sonny	Team	7	Due	16.11

Future scenario

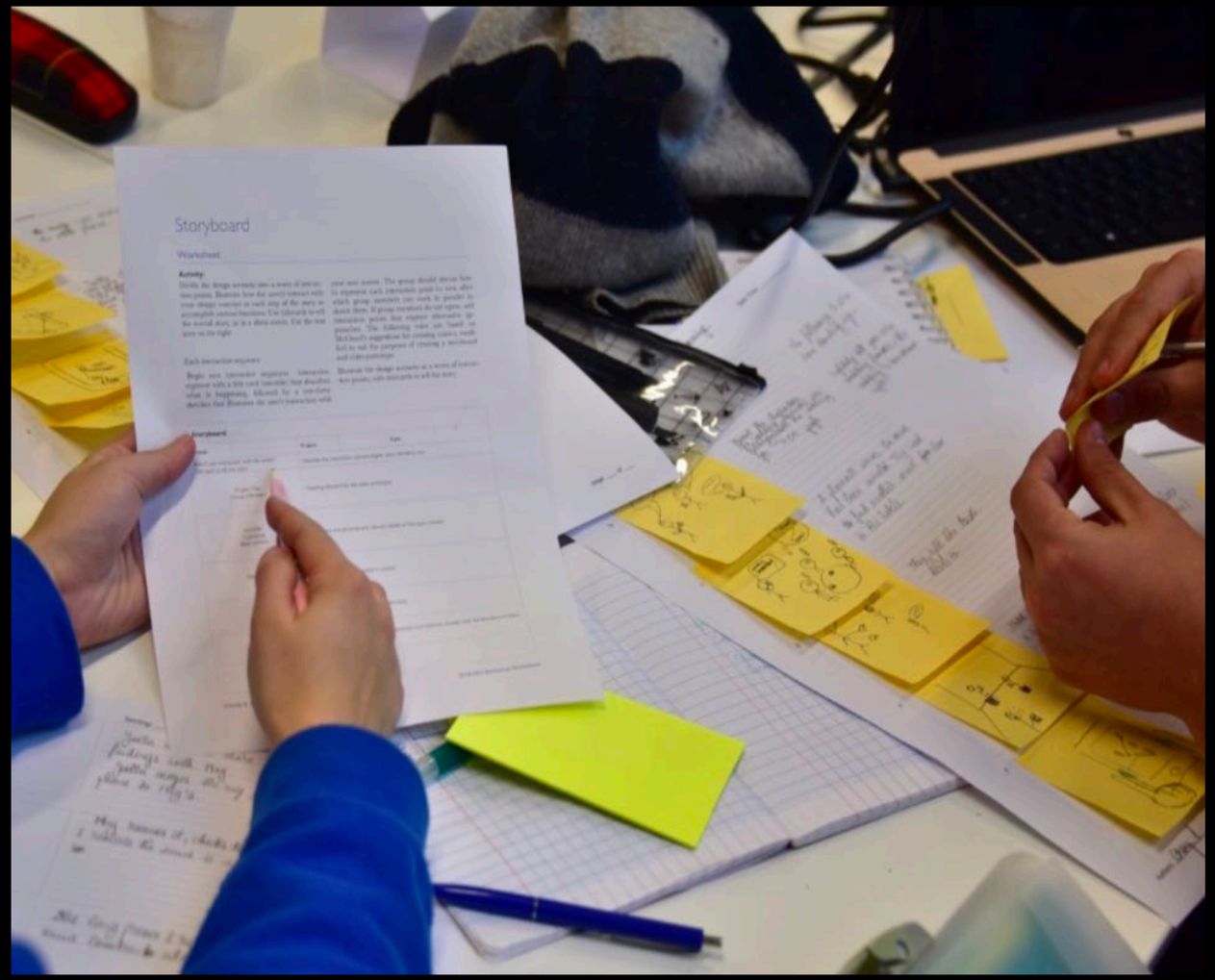
Design Prototypes Worksheet

ACTIVITY Describe a story of how one or more users would interact with the new design in a realistic setting.

Persona 1	Ann (sporty student)	Persona 2	Bob (businessman)	Extreme character	Christian (elder man)
Date:	Wednesday	Time:	morning hours	Setting:	bus station in Antony
Specific Context	Sunny day (not raining). Ann, Bob and Christian are in the stop waiting the bus. Bus has extroordinaly delay. Speaker announced that bus is delied. And red lights blinks and the floor display alerts. Ann, foreign student, doesn't understand the announcment. Christian doesn't here because he is old. Bob realizes that he has a huge problem because he will be late for the meeting.				
1.	Bob goes for the info point, and checks alternative routes option for his destination. There are three provided options: take a bike, wait a 30 mins for another bus or call for a shared taxi. He doesn't want to take a bike, (he doesn't want to be sweaty before the meeting), he can't wait so long for another bus, so he chooses to take a shared cab and pays directly on the info center.				
2.	Ann doesn't rely on her French and goes to info point to see what is the problem (checking info on her own language). She reads that the bus is delied. She selects where she wants to go on the interactive map and checks the alternatives. And she decides to take a bike, provided on the bus station. Ann unlocks the bus with her bus ticket (she could also pay by card).				
3.	Christian realized that something is wrong by seeing the red lights flashing on the floor and all over the station. He also goes to check the interactive map. He interacts with the info system by speech. He also choses to share the ride, and pays directly on the info center.				
4.	Ann leaves the bus stop with a bike. And Bob and Christian leave on the shared taxi.				



SCENARIO TO STORYBOARD



SCENARIO TO STORYBOARD

Scenario title

Workshop, date, time

Intertitle:
Users and basic situation

List personas in greater detail
Describe relevant details of the situation

Establishing shot

Sketch of people talking in a meeting
Long shot

Intertitle:
Describe the situation

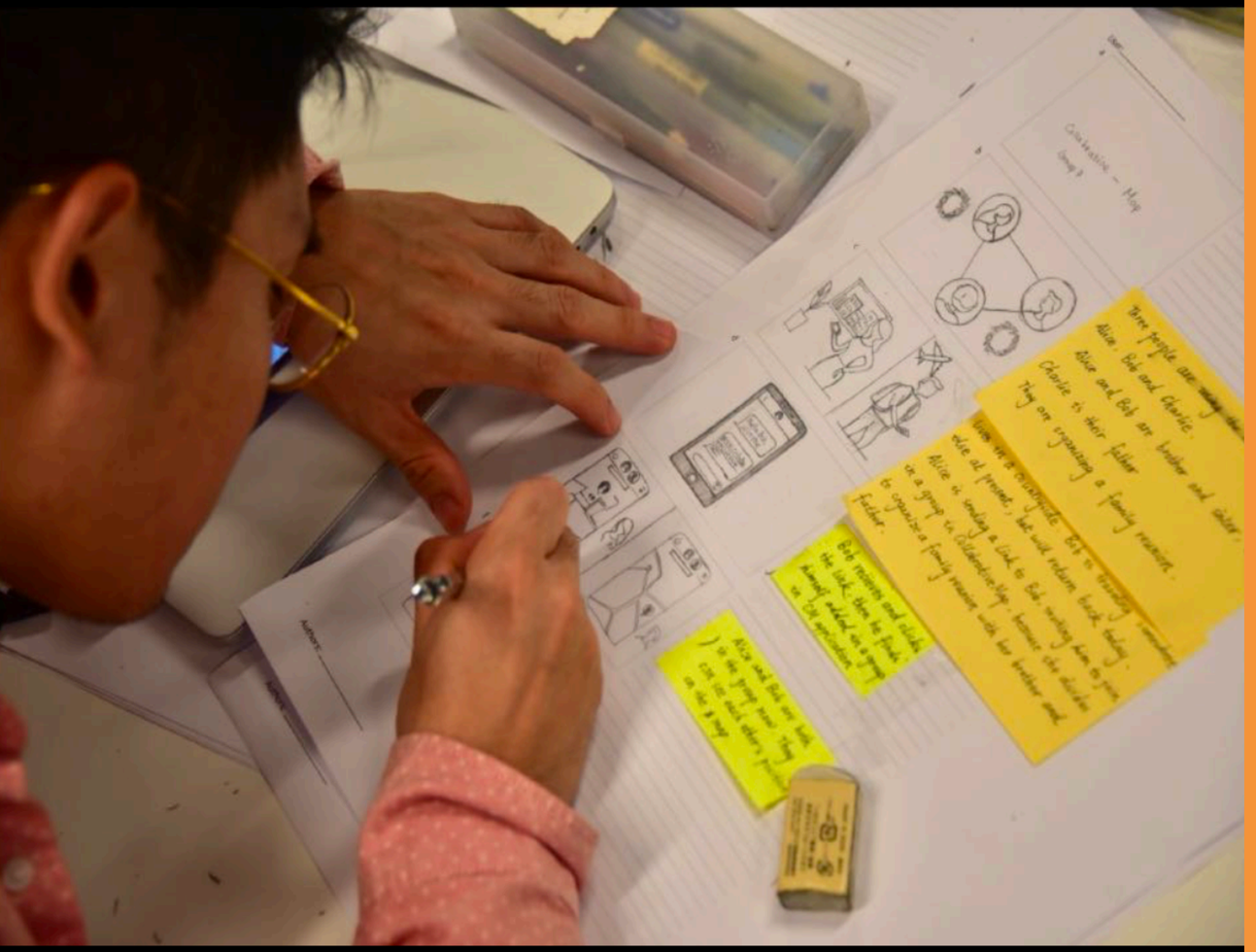
Add voice-over here or instructions about how to shoot the scene

Mid-shot :
Sketch of two people talking

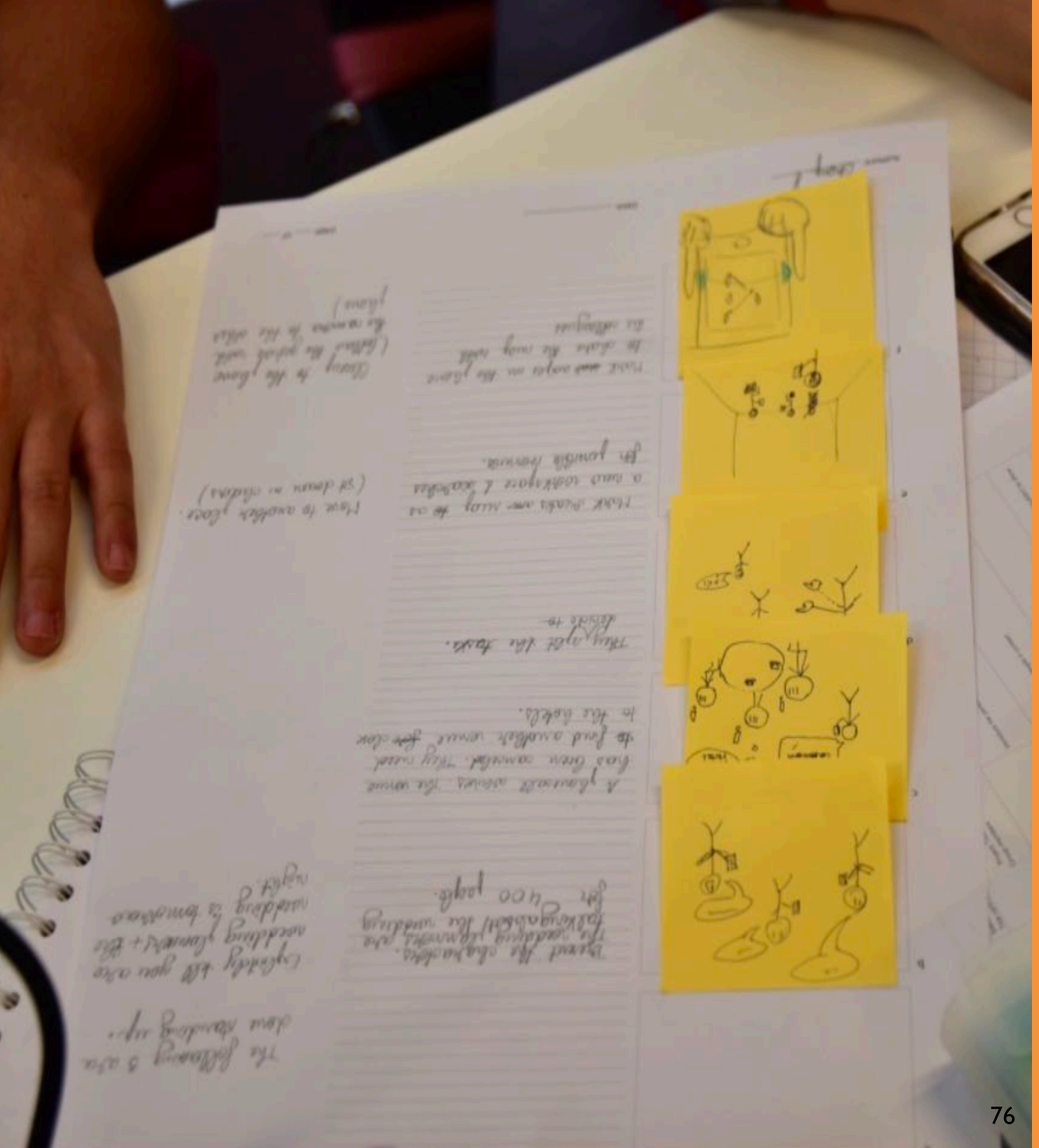
Close-up
Sketch of a smart phone in hand

(page ___ of n)

STORYBOARD

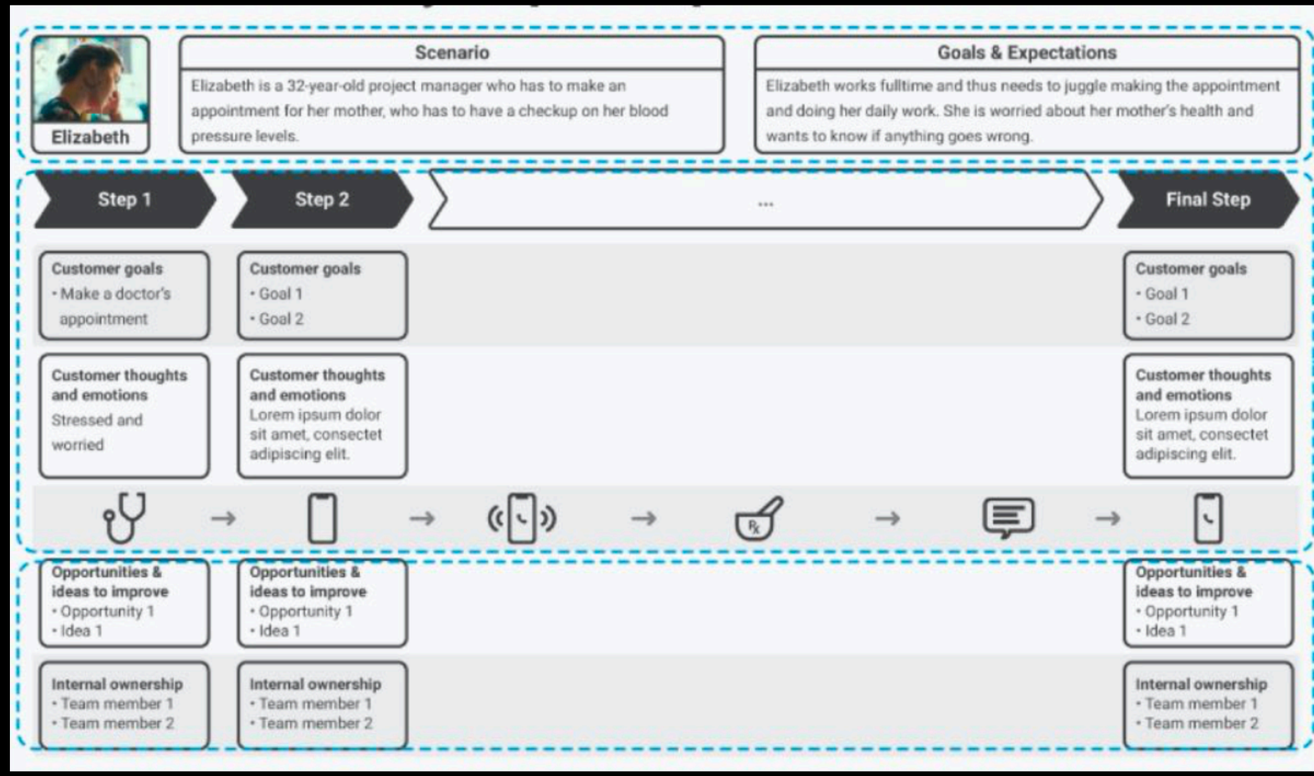

Three people are
Alice, Bob and Charlie.
Alice and Bob are brother and sister.
Charlie is their father
They are organising a family reunion.

STORYBOARD

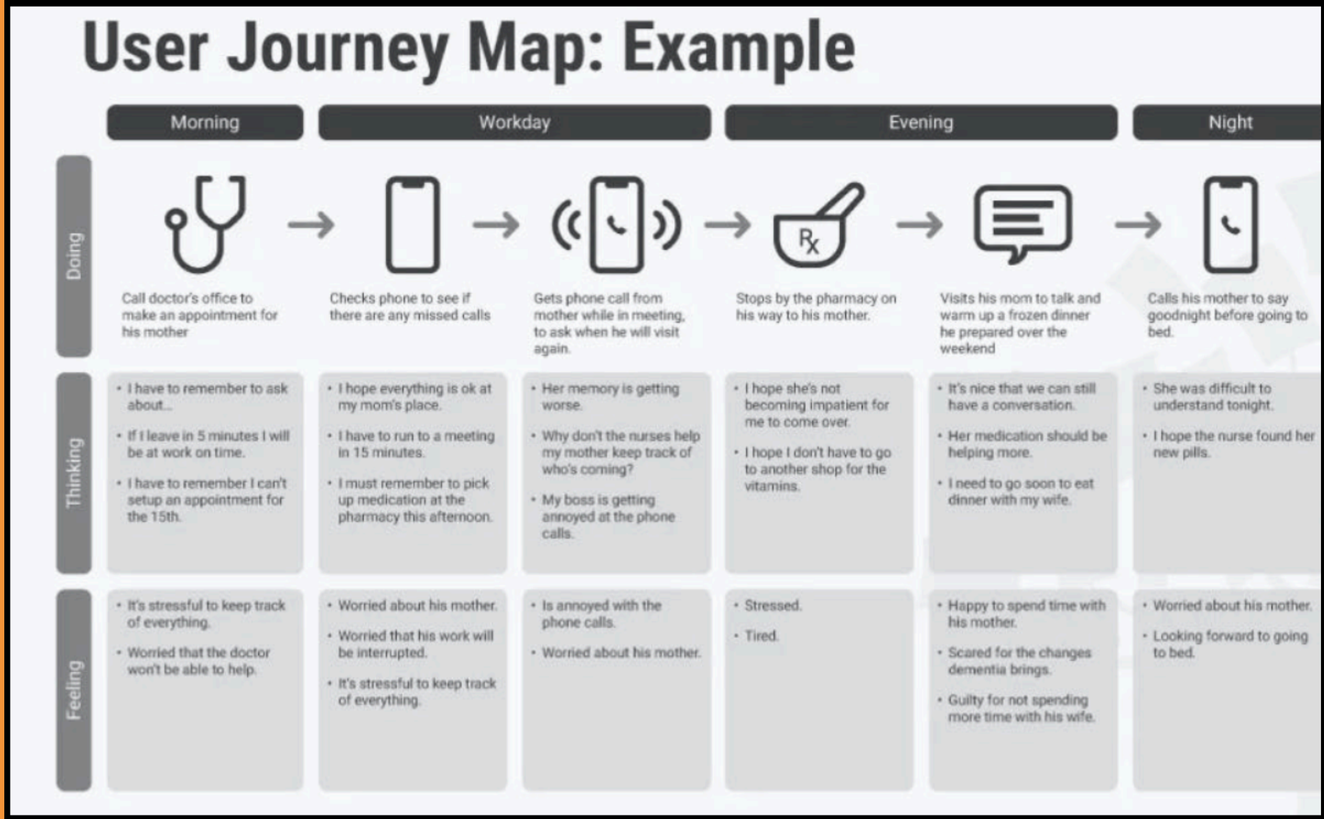


STORYBOARD

JOURNEY MAP


Elizabeth
Scenario
Elizabeth is a 32-year-old project manager who has to make an appointment for her mother, who has to have a checkup on her blood pressure levels.
Goals & Expectations
Elizabeth works fulltime and thus needs to juggle making the appointment and doing her daily work. She is worried about her mother's health and wants to know if anything goes wrong.
Step 1
Step 2
...
Final Step
Customer goals
• Make a doctor's appointment
Customer goals
• Goal 1
• Goal 2
Customer goals
• Goal 1
• Goal 2
Customer thoughts and emotions
Stressed and worried
Customer thoughts and emotions
Lorem ipsum dolor sit amet, consectet adipiscing elit.
Customer thoughts and emotions
Lorem ipsum dolor sit amet, consectet adipiscing elit.
Opportunities & ideas to improve
• Opportunity 1
• Idea 1
Opportunities & ideas to improve
• Opportunity 1
• Idea 1
Opportunities & ideas to improve
• Opportunity 1
• Idea 1
Internal ownership
• Team member 1
• Team member 2
Internal ownership
• Team member 1
• Team member 2
Internal ownership
• Team member 1
• Team member 2

JOURNEY MAP


User Journey Map: Example
Morning
Workday
Evening
Night
Doing
Thinking
Feeling
Call doctor's office to make an appointment for his mother
Checks phone to see if there are any missed calls
Gets phone call from mother while in meeting, to ask when he will visit again.
Stops by the pharmacy on his way to his mother.
Visits his mom to talk and warm up a frozen dinner he prepared over the weekend
Calls his mother to say goodnight before going to bed.
I have to remember to ask about...
If I leave in 5 minutes I will be at work on time.
I have to remember I can't setup an appointment for the 15th.
I hope everything is ok at my mom's place.
I have to run to a meeting in 15 minutes.
I must remember to pick up medication at the pharmacy this afternoon.
Her memory is getting worse.
Why don't the nurses help my mother keep track of who's coming?
My boss is getting annoyed at the phone calls.
I hope she's not becoming impatient for me to come over.
I hope I don't have to go to another shop for the vitamins.
It's nice that we can still have a conversation.
Her medication should be helping more.
I need to go soon to eat dinner with my wife.
She was difficult to understand tonight.
I hope the nurse found her new pills.
It's stressful to keep track of everything.
Worried that the doctor won't be able to help.
Worried about his mother.
Worried that his work will be interrupted.
It's stressful to keep track of everything.
Is annoyed with the phone calls.
Worried about his mother.
Stressed.
Tired.
Happy to spend time with his mother.
Scared for the changes dementia brings.
Guilty for not spending more time with his wife.
Worried about his mother.
Looking forward to going to bed.

ABOUT: TELLING STORIES

Methods

Current scenario

Future scenario

Storyboard

Video prototype

TELLING STORIES

Future Scenario → **Storyboard** → **Video Prototype**

1. Create your **design concept**
   influenced by findings from users
   and favorite brainstormed ideas
2. Create a **future scenario** with key events
   Fit your ideas into the scenario...
   or change the scenario to fit your ideas
3. Draw a **storyboard** with titlecards,
   sketches and descriptions
   Animate personas to illustrate the
   interaction
4. Shoot a **video prototype**
   Tell the story as a series of titlecards
   and interaction snippets,
   using the storyboard as a shooting guide

TELLING STORIES

Future Scenario → **Storyboard** → **Video Prototype**

Scenario *describes the interaction*

Each paragraph explores one design issue with one or more interaction snippets

Storyboard *sketches the interaction*

Break up the story into a series of titlecards followed by 1-3 interaction snippets

Video prototype *shows the interaction*

Use the storyboard to guide shooting.
Intersperse titlecards to tell the story with video clips that show the interaction between realistic users in realistic situations

TELLING STORIES

CURRENT SCENARIO

Reminder

Short one-act play about today's experiences
sub-divided into one-paragraph scenes
each describing an interaction snippet

Create one or more personas with
name, age, gender, motivation
usually with a profession, expertise
usually with a goal or motivation

Create one or more realistic setting(s):
date, time, place, context

Assemble interaction snippets into a coherent
story, a series of events over a period of times

Transform current into future scenario

Draw from real, grounded observations,
interviews and introspection

Capture the details of how users
currently interact with the technology

Do Highlight problems & opportunities
Do not “Sell” the idea!

FUTURE SCENARIO

SCENARIO

CONTRAST ___

Current scenario

Draws from **current** real-world observations of how people **use technology today** to identify issues the new technology will address

Future scenario

Builds upon current scenarios to imagine how **future** users will interact with the new technology in this setting and context

Yes! You may u**pdate the scenario** if it helps you **explore alternatives** as long as it remains true to real users

Revise current scenario

Revisit your personas

- Can you target the users better?

"Animate" the personas in the current scenario

- How does applying the concept help?
- Push the limits to create something new

Transform scenario into a future scenario

- Revisit every interaction snippet
- Apply video brainstormed or new ideas

Create a storyboard and a video prototype

- to illustrate the concept in context

FUTURE SCENARIO

Collect **Story interviews**

Represent **Interaction snippets**

Interpret **Personas & Extreme characters**

Current scenario

Personas in a realistic setting
perform a series of activities
drawn from collected user data
to highlight opportunities for design

FUTURE SCENARIO

Reminder

Create a theme … and variations

Balance ‘normal’ and unusual situations
include breakdowns and errors

Consider external events that affect interaction

Include patterns of interaction over time
including repetitions and wasted effort

Highlight surprises

FUTURE SCENARIO

TIPS

Choosing informative persona names

Choose **short names**:

Easy-to-pronounce, one syllable

Alphabetize names:

Ann, Bob, Chuck, Dave, Eli

Link names to **functions**:

Pat is a patient

Sue is a surgeon

Bob the boss

AVOID...

What NOT to do

‘over-selling’ the technology

Explore options rather than one solution

irrelevant detail

Focus on interaction, not users’ personal lives

superfluous description

Stick to the facts

humor, at least for now

Difficult to do well

Often distracting

Paper prototypes are amusing anyway

Basic structure

Title	Event or technology to design
Who?	Name, sex, age, job ...
What?	Event that sparks the story
Where?	Location
When?	Date, time
Motivation	Why is this happening?
Situation	Relevant detail to aid understanding
Story	Paragraph-by-paragraph description of who does what and why

FUTURE SCENARIO

Team — 30 min

EXERCISE

FUTURE SCENARIO

Decide how the personas will interact with
your new concept

Tell the story, step by step,
using interaction snippets
to highlight the interaction

Update the personas, setting, story as needed
but stay grounded in the original story
interviews and user data



IN GENERAL

EXERCISES AND HOMEWORK

Every **Exercise** is due in class
  if you don't finish in class do it after class

Every **Homework** is due to the next class
  Homework from Tuesday is due on Friday (TER) at 1:30pm
  Homework from Friday is due on Tuesday (Lecture) at 1:30pm

All **Exercises** and **Homework** should be uploaded to the webpage
  This is your digital design journal and helps you to see your progress
  This is a living journal and should be updated by you if necessary
  Exercises and Homework help you to progress and are not all graded

HOMEWORK

OVERVIEW

Design Concept

One-sentence description of the design concept:

- What user problem(s) does it solve?
- What is the interaction?
- Which technology?
- How does it help users?

Interaction Table

Object table:

- Identify user's key objects of interest
- Identify their properties, representation & operations

Operations table:

- Identify key operations, user command, feedback & system response

Future Scenario**

Transform your **current scenario** into a **future scenario**

Modify the scenario to highlight key interactions your system solves … and challenges that remain

**** Critical for Friday!**