

Prototyping

User Experience Design

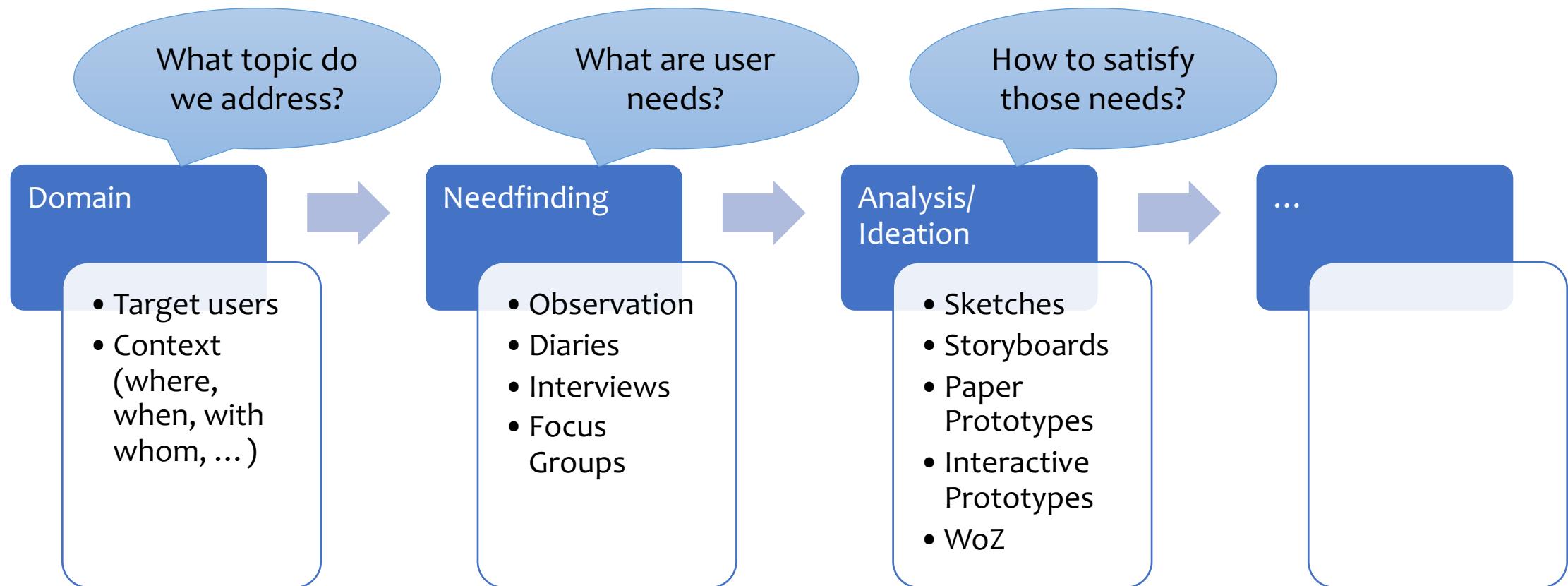
Alberto Monge Roffarello

Academic Year 2023/2024

Hall of Fame or Shame?



Process Recap



The Goal

- **Envisionment:** making ideas visible
 - Generating new ideas
 - Evaluating new ideas (within the design group)
 - Testing new ideas (with users)
- Different tools and techniques, according to
 - The stage of design (early, ..., advanced, final)
 - The intended audience (designers, test users, clients, management, ...)
- **Error to avoid:** focusing on the user interface before focusing on the task that the user has to accomplish

The Method

- Techniques to **explore** different design **alternatives**
- Explore
 - Flows of action
 - Devices and their roles
 - Interfaces
- Alternatives
 - More than one possible design
 - Impossible to get it right the first time
 - Find the best possible solution

Techniques

- Sketches
- Maps
- Low Fidelity (paper) prototypes
- Video Prototypes
- Medium Fidelity Prototypes
- High Fidelity Prototypes

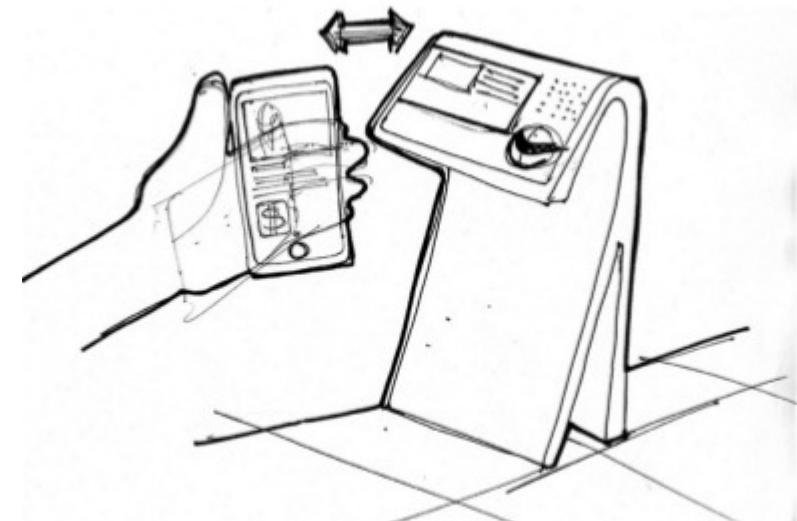
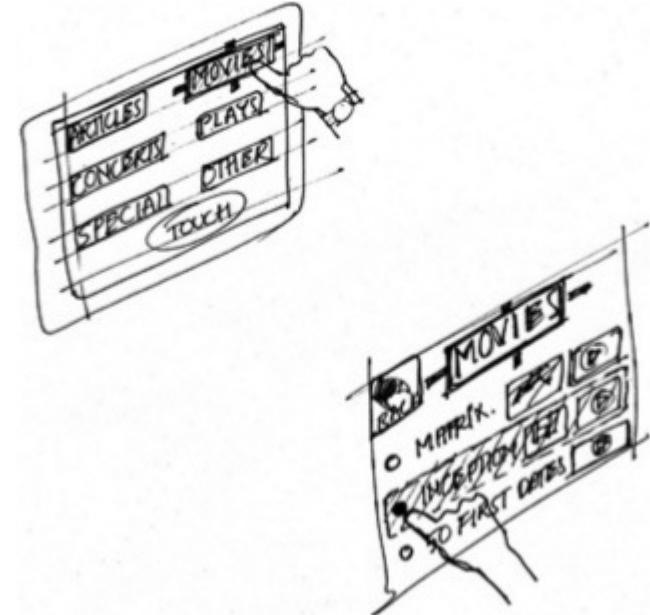
“If a picture is worth a thousand words, a prototype is worth a thousand meetings” — IDEO

Sketches and Snapshots

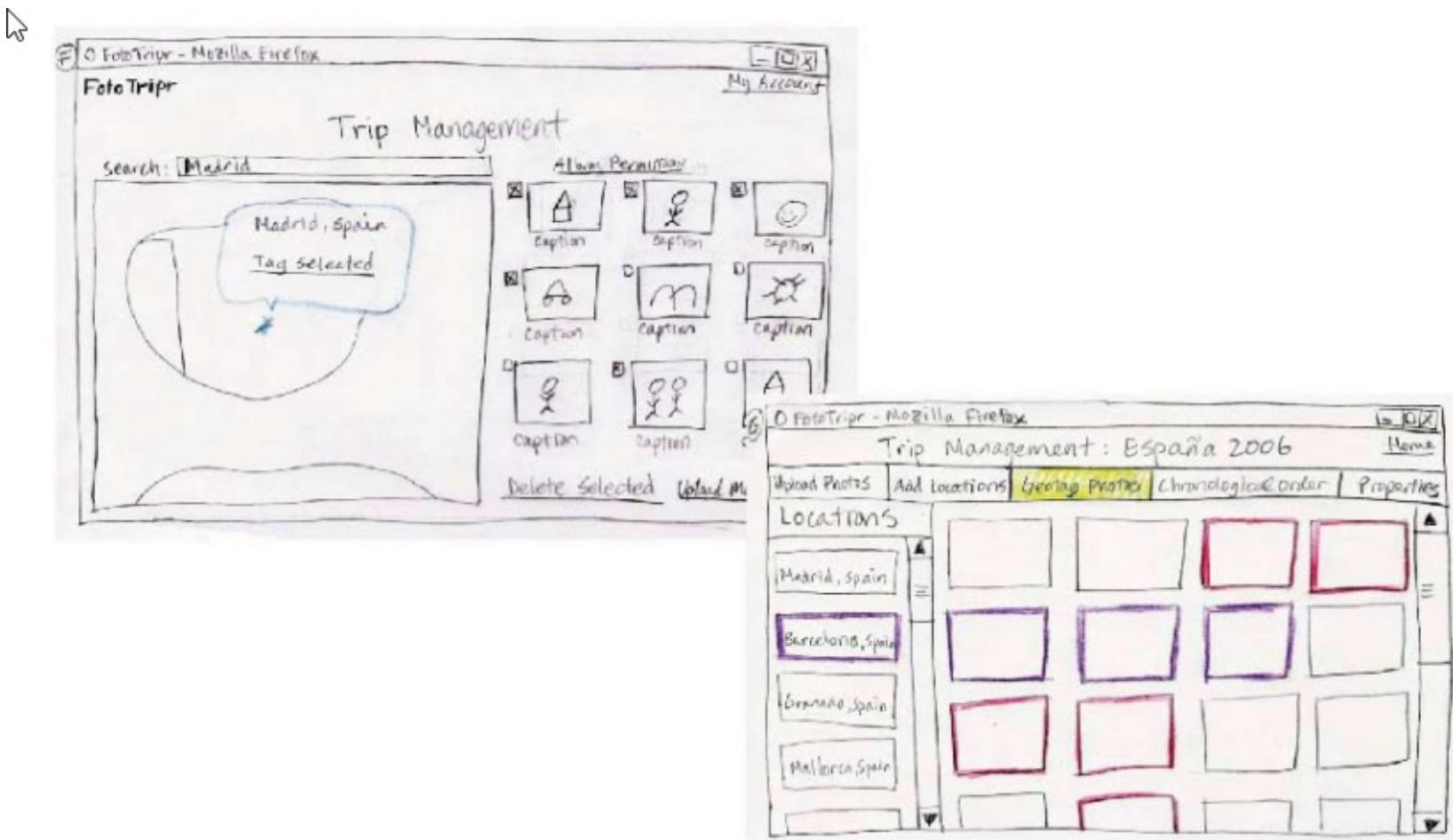
Quick drawings to convey a part of the interface, or a feeling about a device

Sketch

- An individual drawing showing
 - A single user interface screen
 - A drawing of an artifact part of the system
 - The shape of an interaction object
- Gives a static view of a possible interaction
- Helps setting the interaction context
- Often, part of a longer representation



Examples



Maps

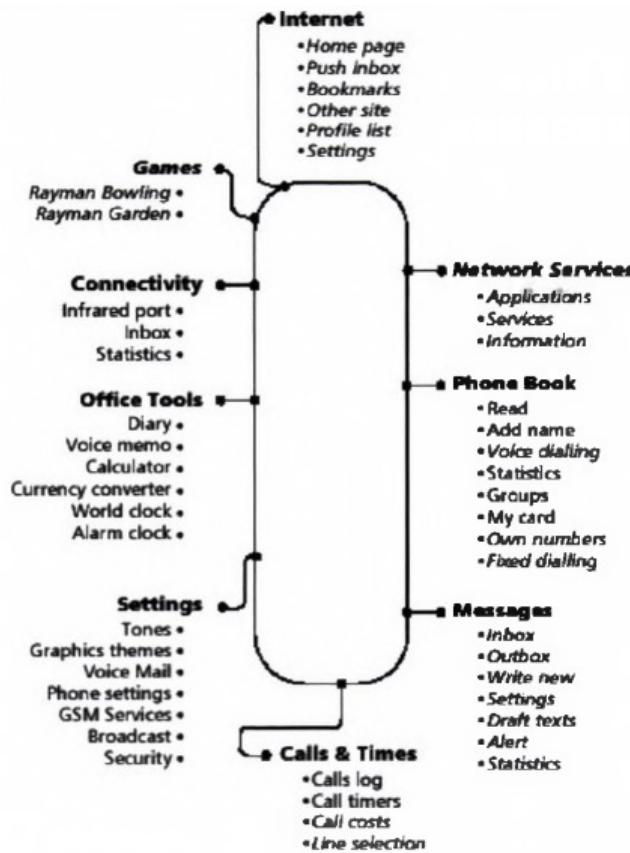
Visual overviews of navigation paths

Navigation Map

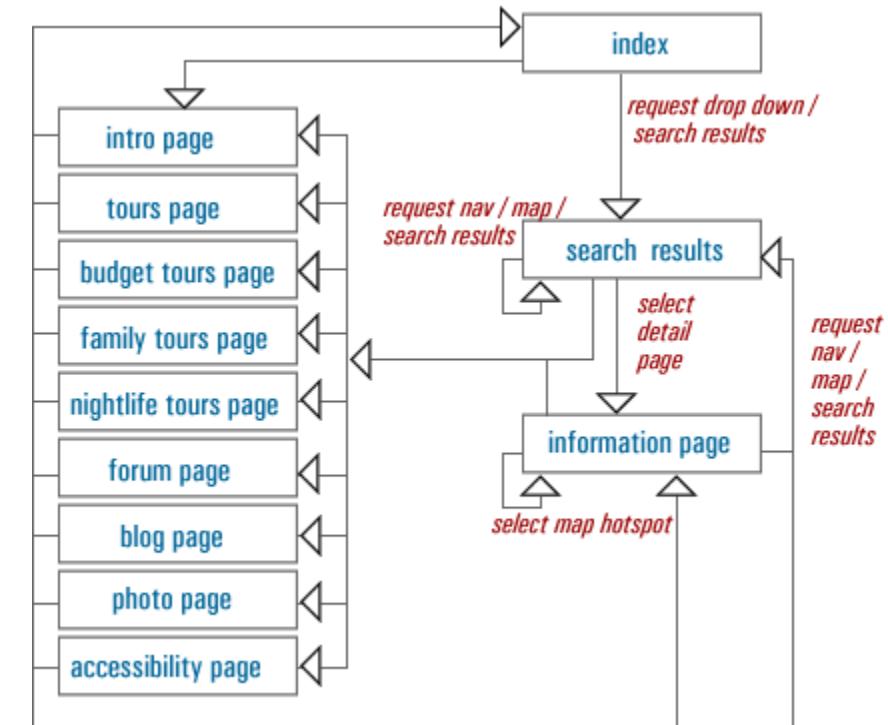
- A high-level view for the major structure of the interface
- Focus on how people move throughout the application
- Does not show the pages, only their organization and hierarchical relationship
- Related to the “information architecture” of the application

Map Examples

Old-style mobile phone menus



Website ‘sitemap’

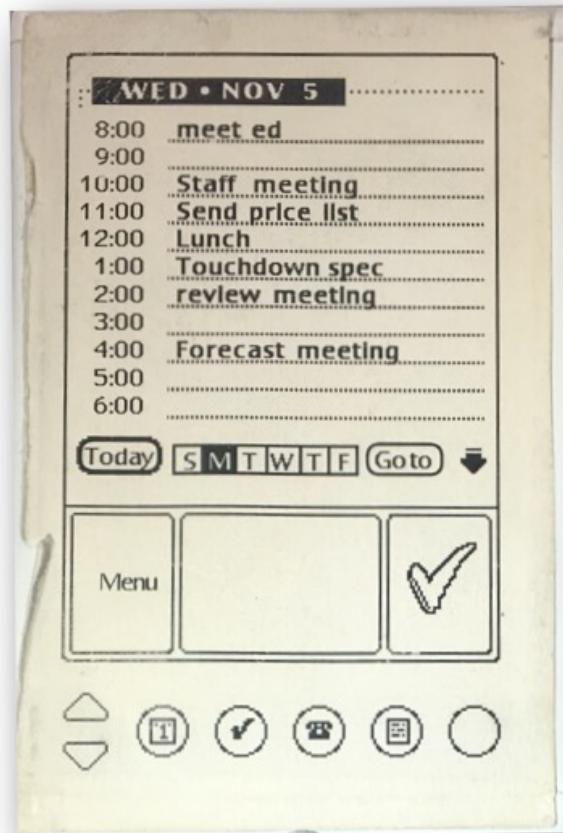


Prototypes

Tangible approximations, at various levels, of system behavior and appearance, to cheaply and quickly evaluate and explore design decisions

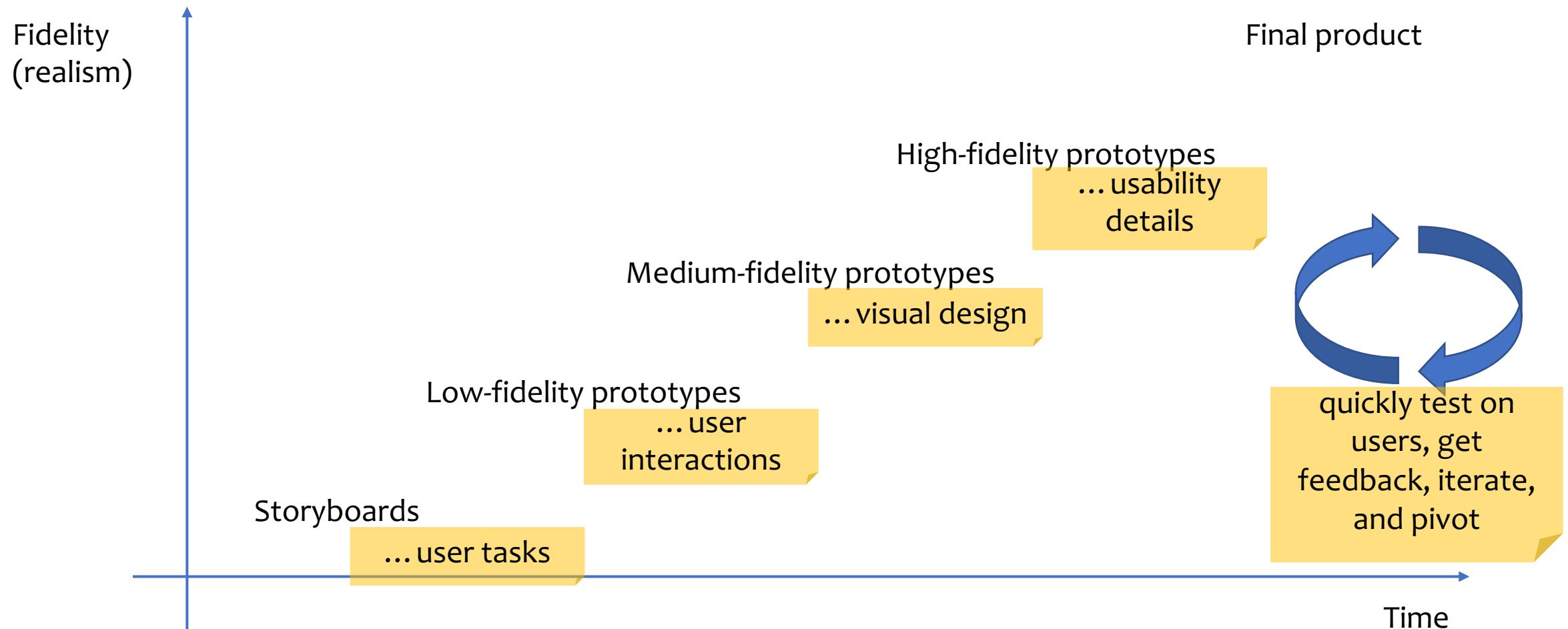
Prototypes

- «A prototype is a concrete but partial representation or implementation of a system design»
- «An easily modified and extensible model (representation, simulation or demonstration) of a planned software system, likely including its interface and input/output functionality»
- One of the most powerful tools for design exploration, visualization, and testing
- They let us ‘see’ and ‘feel’ interactivity (simulated or real)



source: <https://albertosavoia.medium.com/the-palm-pilot-story-1a3424d2ffe4>

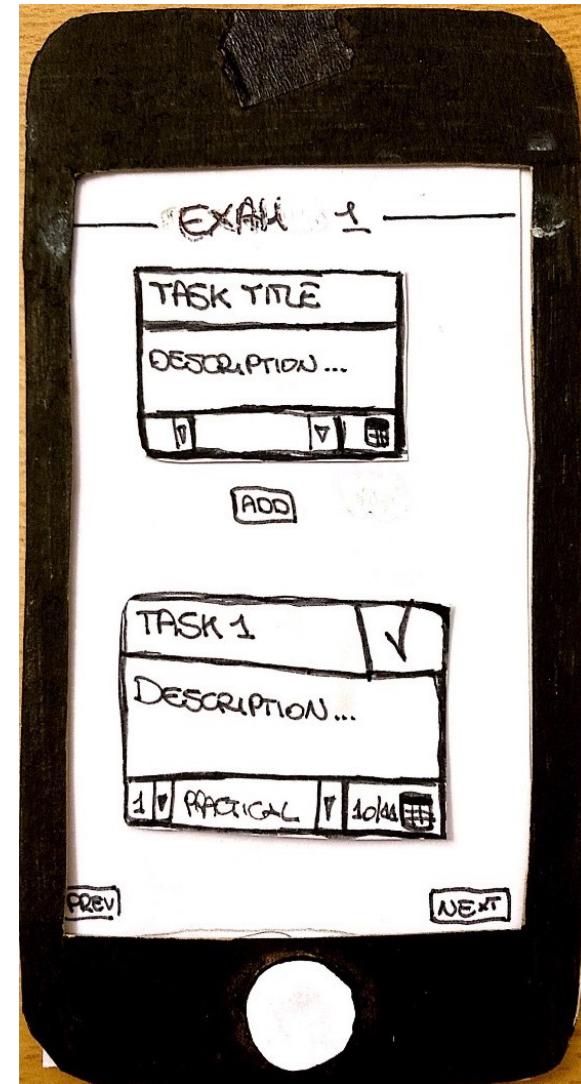
Prototypes Facilitate Conversations About...



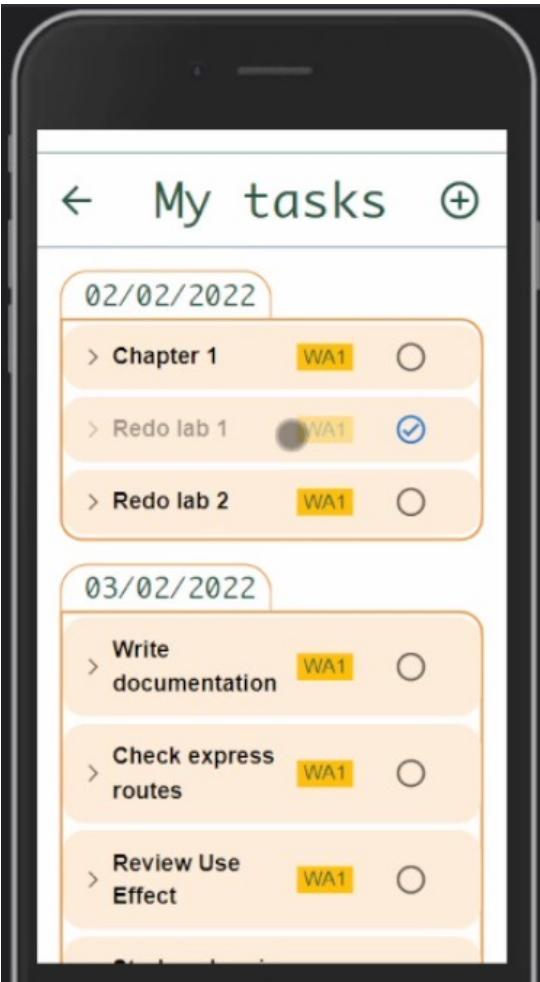
Low to High Fidelity Prototypes

Low-fi

- Lays out the *main* information, interactions, and design choices
- With many missing details



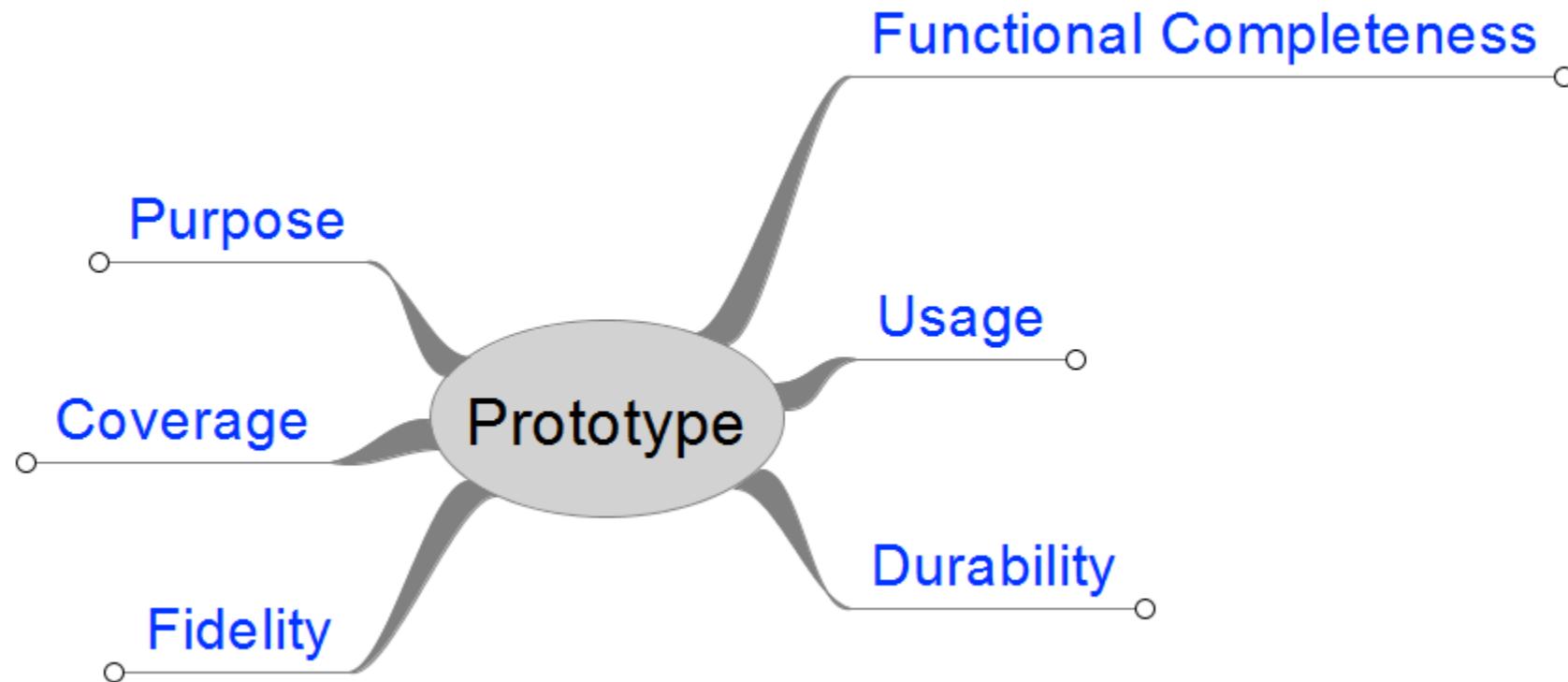
Low to High Fidelity Prototypes



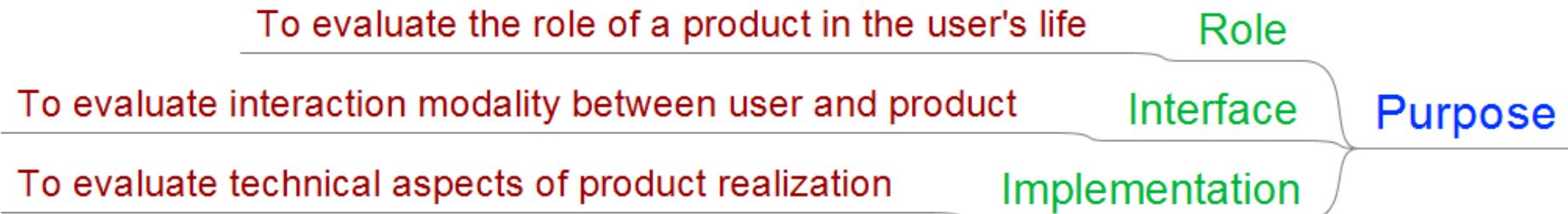
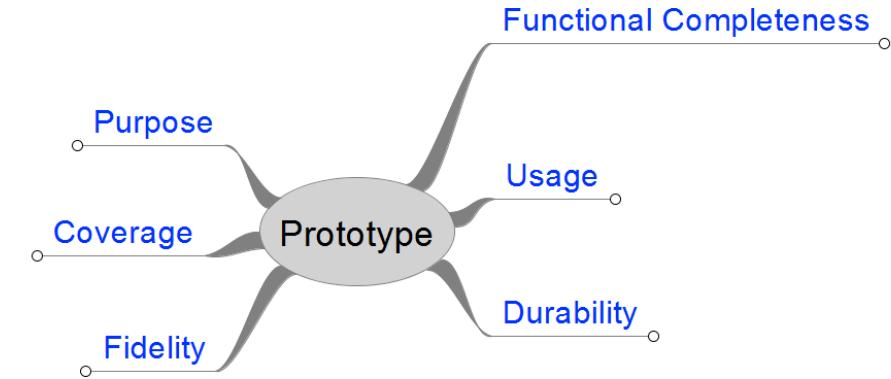
Hi-fi

- It looks like the final product

Characteristics of Prototypes



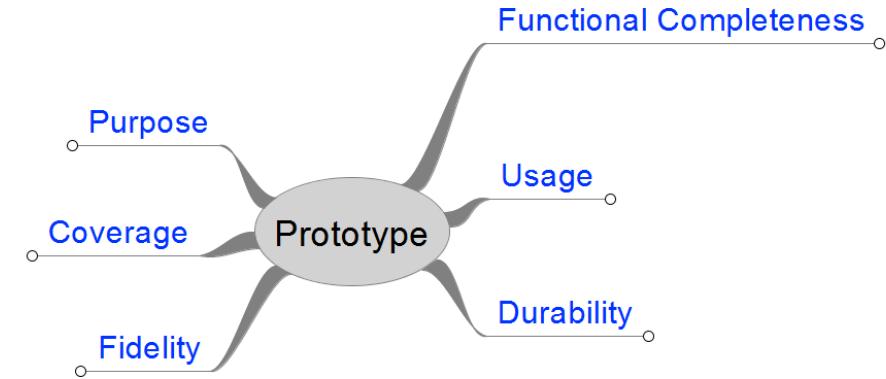
Characteristics of Prototypes



Possible Purposes For a Prototype

- Expert analysis
- Check with design rules and guidelines
- Involve users in a controlled experiment
- Involve users “in the wild”
- ...

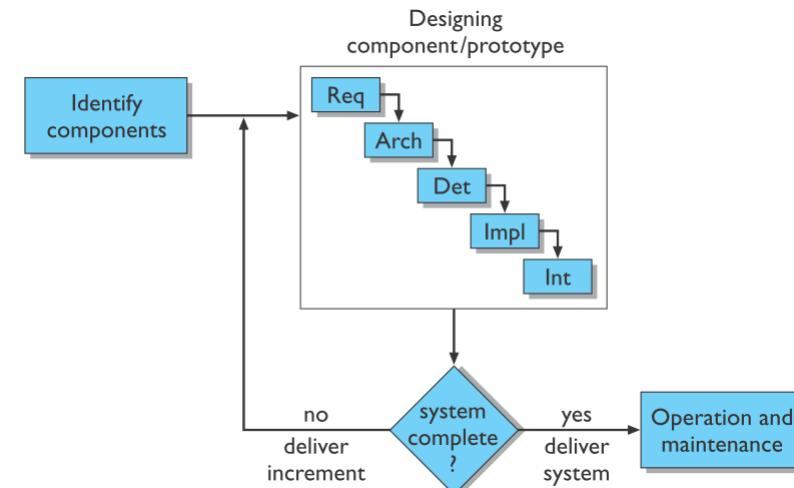
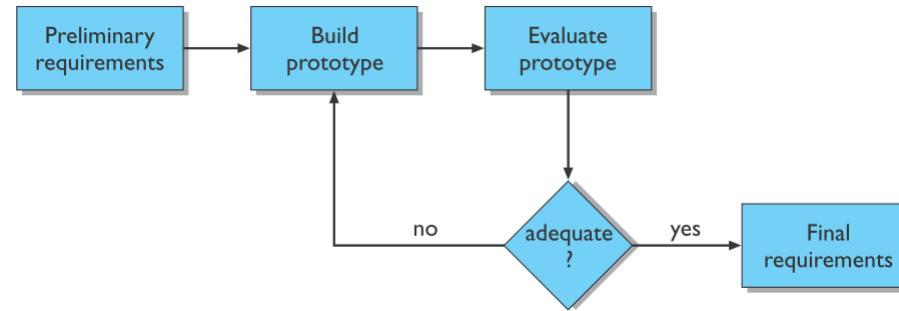
Characteristics of Prototypes



Durability	Exploratory	A throw-away prototype used to clarify project goals, to identify requirements, to examine alternative designs, or to investigate a large and complex system
	Experimental	A prototype used to validate system specifications
	Operational	An iterative prototype that is progressively refined until it becomes the final system

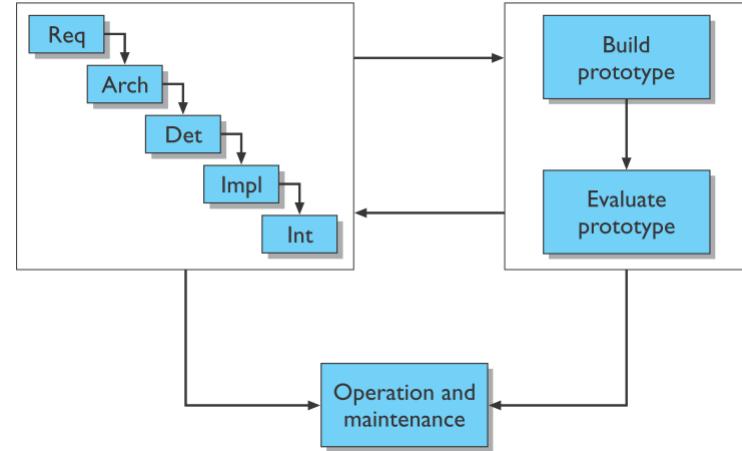
Durability (1)

- **Throw-away prototype:** used to assess some qualities of the system (gain knowledge), then discarded
- **Incremental prototype:** the system is developed as incremental modules, each of them released in a separate step



Durability (2)

- **Evolutionary prototype:** the prototype *becomes* the product; each product iteration builds upon the previous one



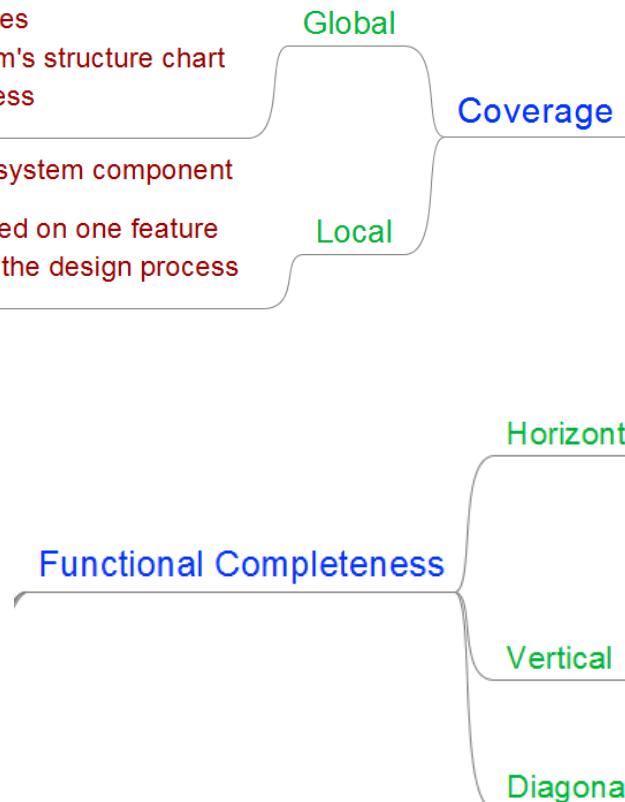
Characteristics of Prototypes

A prototype of the entire system

- an expanded horizontal prototype
- models a greater number of features
- covers multiple levels of the system's structure chart
- useful throughout the design process

A prototype of a single usability-critical system component

- a vertical prototype that is focused on one feature
- useful at some specific stage of the design process



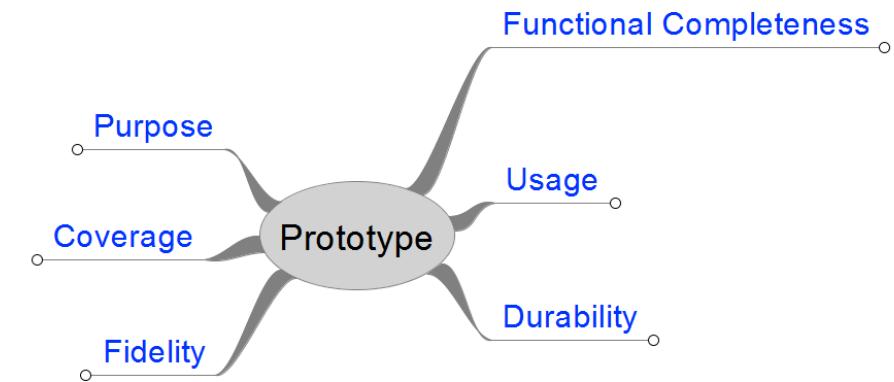
A prototype that models many features but with little detail

- a horizontal slice of a system's structure chart from the top down to a specific depth
- most useful in the early stages of design
- purpose is to test the overall interaction metaphor, so includes common functions that the user is expected to perform frequently

A prototype that models few features but with much detail

- a vertical slice of a system's structure chart from top to bottom
- most useful in the later stages of design
- purpose is to test details of the design

A prototype that is horizontal down to a particular level, then vertical below that point



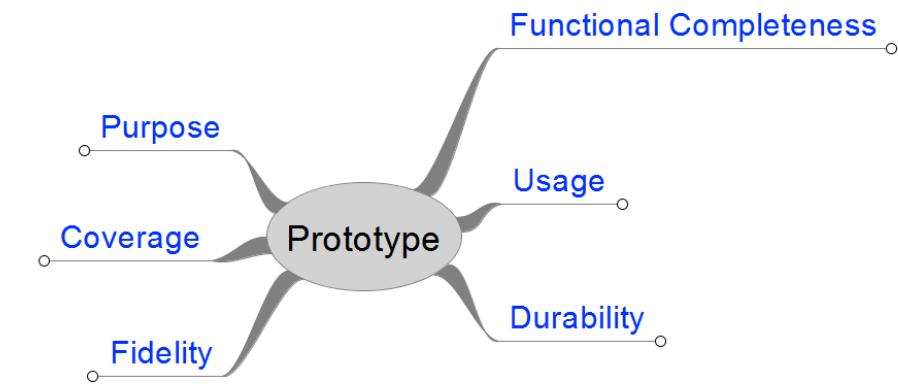
Characteristics of Prototypes

A set of drawings (e.g., storyboard) that provide a static, non-computerized, non-working mock-up of user interface for the planned system

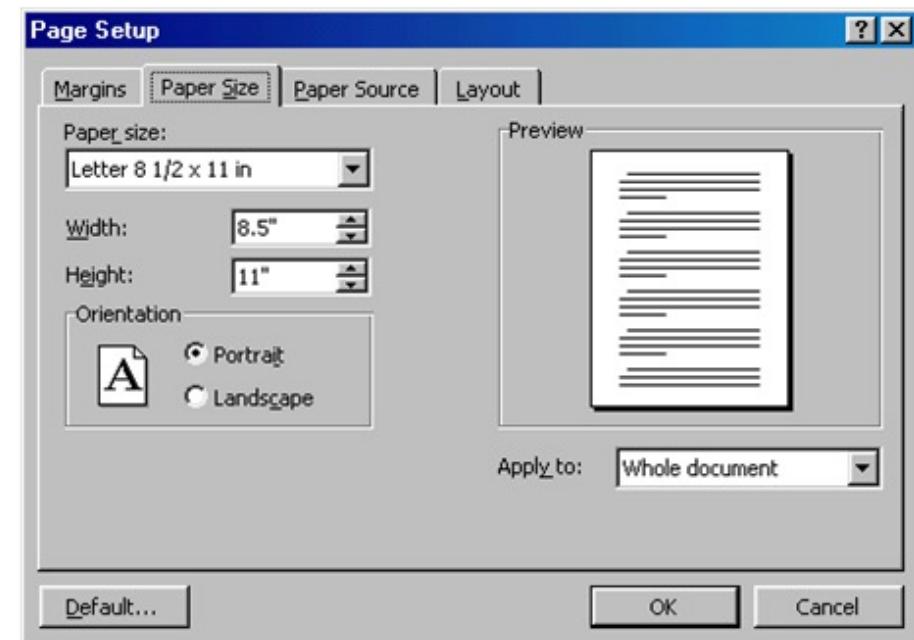
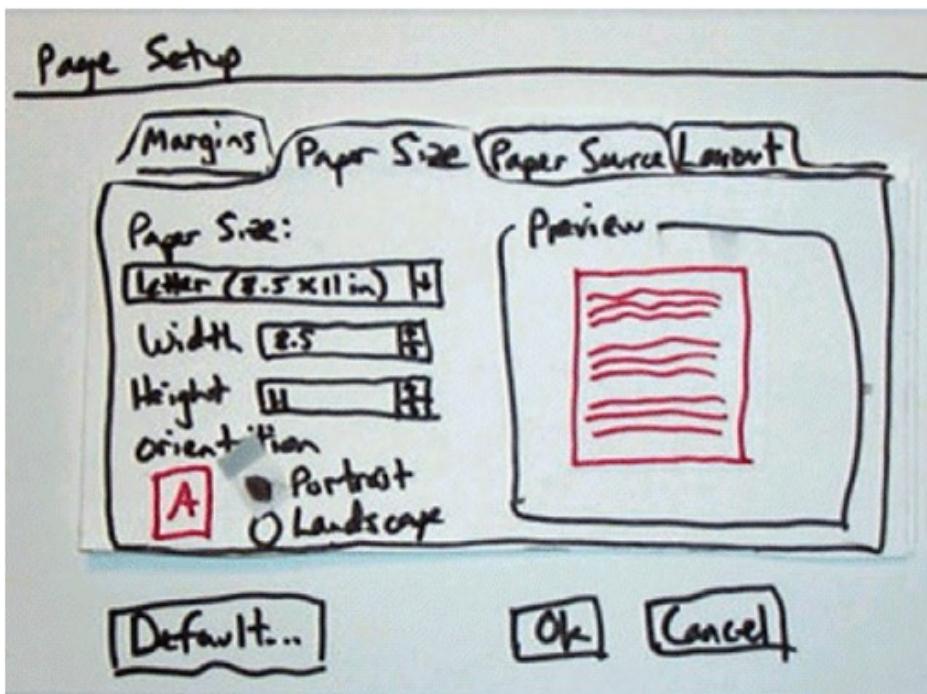
A set of screens that provide a dynamic, computerized, working model of the planned system

Low
High
Fidelity

Static	Static representation of the product (storyboards, diagrams, ...)
Dynamic	Dynamic (but not interactive) representation of the product (e.g., video)
Interactive	Allows users to test the usage of the system, even if in an approximate and simplified way



Fidelity: Different Information Is Conveyed

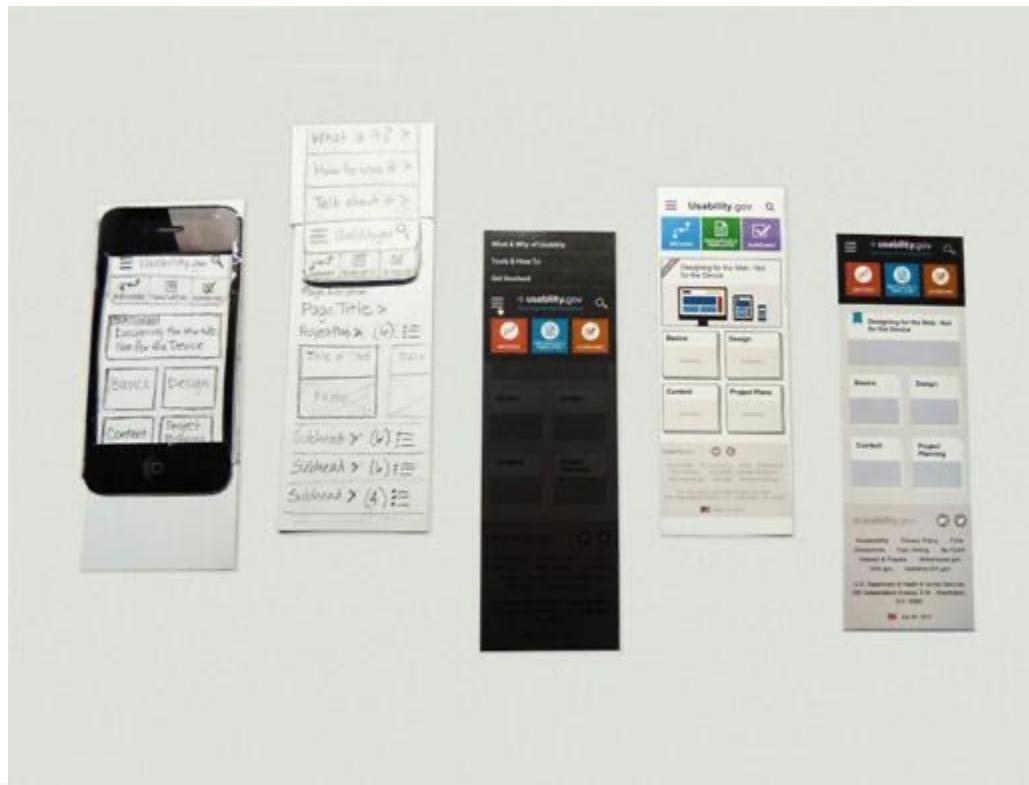


Low Fidelity Prototypes

How to start using an application, months before implementing it

Paper Prototypes

- A hand-drawn mock-up of the user interface (usually) on multiple sheets of paper of varying sizes



Key Features for Paper Prototypes

- Interactive paper mockup
 - Sketches of screen appearance
 - Paper pieces show windows, menus, dialog boxes
- Interaction is natural
 - Pointing with a finger = mouse click
 - Writing = typing
- A person simulates the computer's operation
 - Putting down & picking up pieces
 - Writing responses on the “screen”
 - Describing effects that are hard to show on paper
- Low fidelity in look & feel
- High fidelity in depth (person simulates the backend)

<http://web.mit.edu/6.813/www/sp18/classes/11-prototyping/>

Materials

- Paper, Transparent paper
- Pens, Markers
- Post-It notes
- Glues, scotch tape, scissors
- Photocopies
- UI Stencils
- Reusable UI components
- Printouts of screenshots

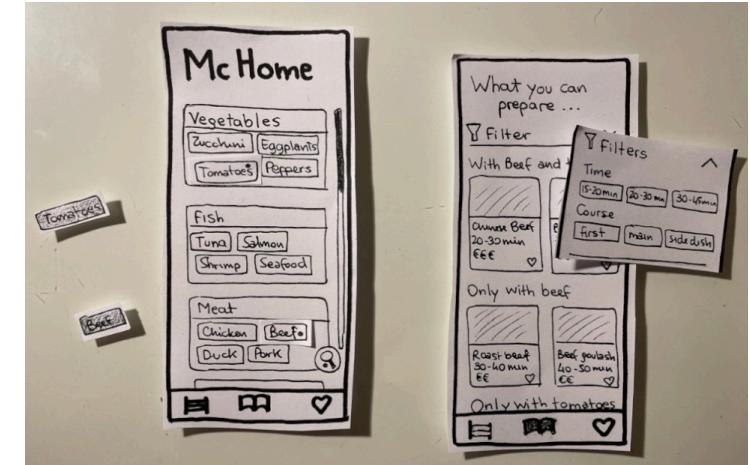
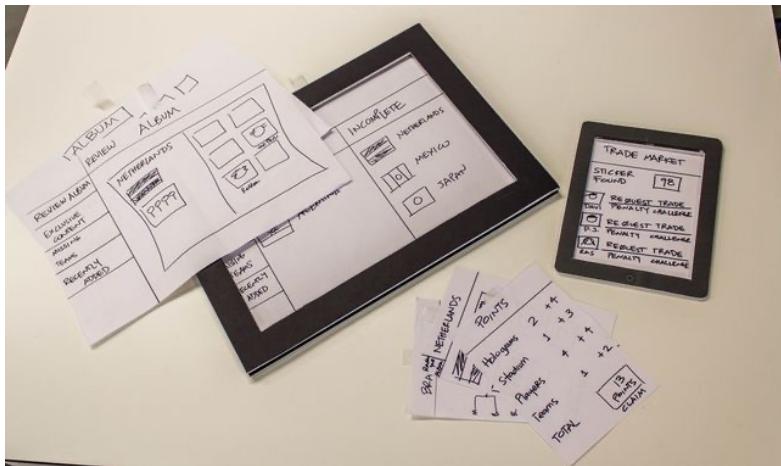


Why Paper Prototyping?

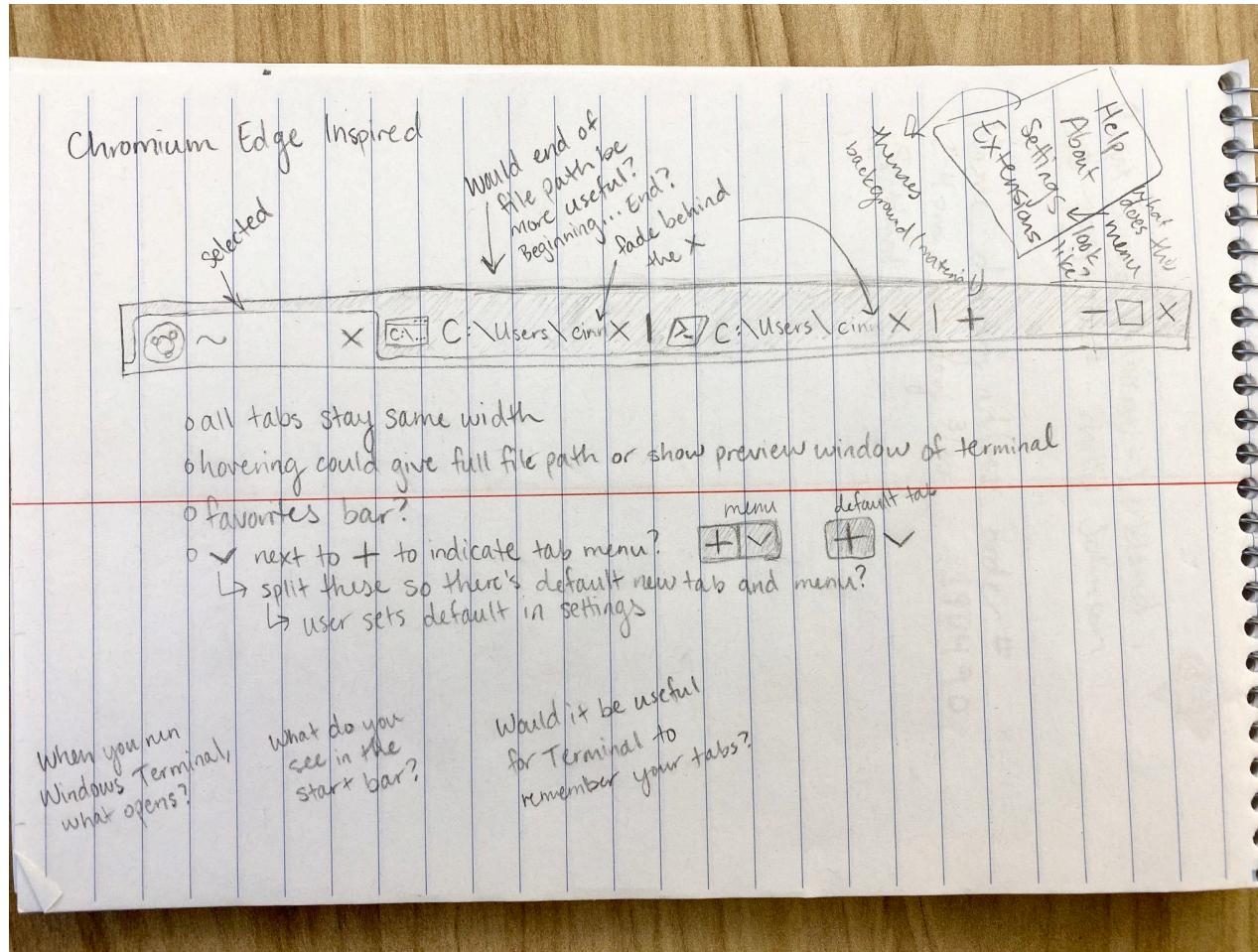
- Faster to build
 - Sketching is faster than programming
- Easier to change
 - Easy to make changes between user tests, or even **during** a user test
 - No code investment - everything will be thrown away (except the design)
- Focuses attention on big picture
 - Designer doesn't waste time on details
 - Customer makes more creative suggestions, not nitpicking
- Non-programmers can help
 - Only kindergarten skills are required

<http://web.mit.edu/6.813/www/sp18/classes/11-prototyping/>

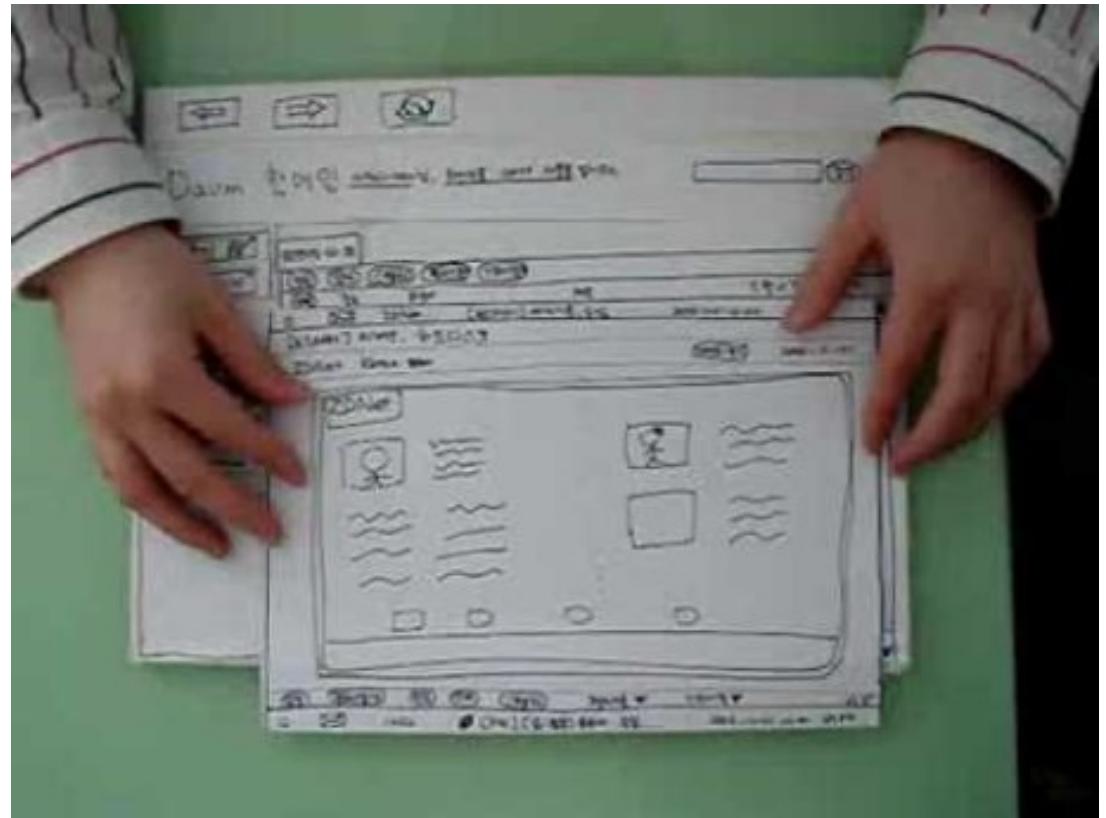
Paper Prototypes: Examples



First Ever Mockup of the Windows Terminal Tab Bar

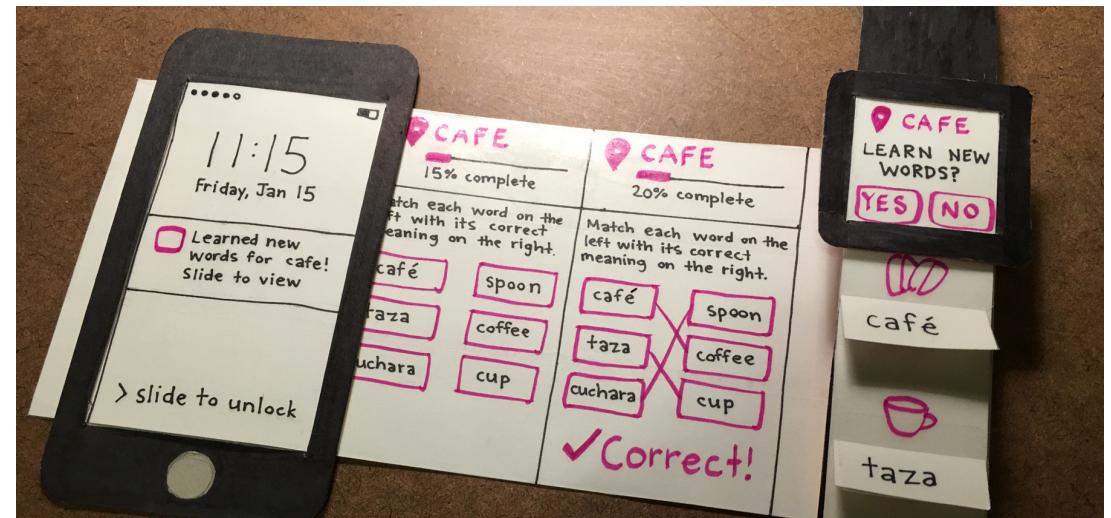


Creating Flows With Paper Prototypes



<https://youtu.be/GrV2SZuRPvo>

“Dynamic” Screens



How to Test a Paper Prototype

- The Design Team should cover these roles
 - ‘Computer’ actor
 - Simulates prototype
 - Does not give any feedback that the computer would not
 - Facilitator
 - Presents interface and tasks to the user
 - Encourages user to “**think aloud**” by asking questions
 - Keeps user test from getting off track
 - Observer
 - Keeps mouth shut
 - Takes copious notes

Learnable Lessons From Paper Prototypes

Can Learn

- Conceptual model
 - Do users understand it?
- Functionality
 - Does it do what's needed? Missing features?
- Navigation & task flow
 - Can users find their way around?
 - Are information preconditions met?
- Terminology
 - Do users understand labels?
- Screen contents
 - What needs to go on the screen?

Cannot Learn

- Look: color, font, whitespace, etc
- Feel: efficiency issues
- Response time
- Are small changes noticed?
 - Even the tiniest change to a paper prototype is clearly visible to user
- Exploration vs. deliberation
 - Users are more deliberate with a paper prototype; they don't explore or thrash as much

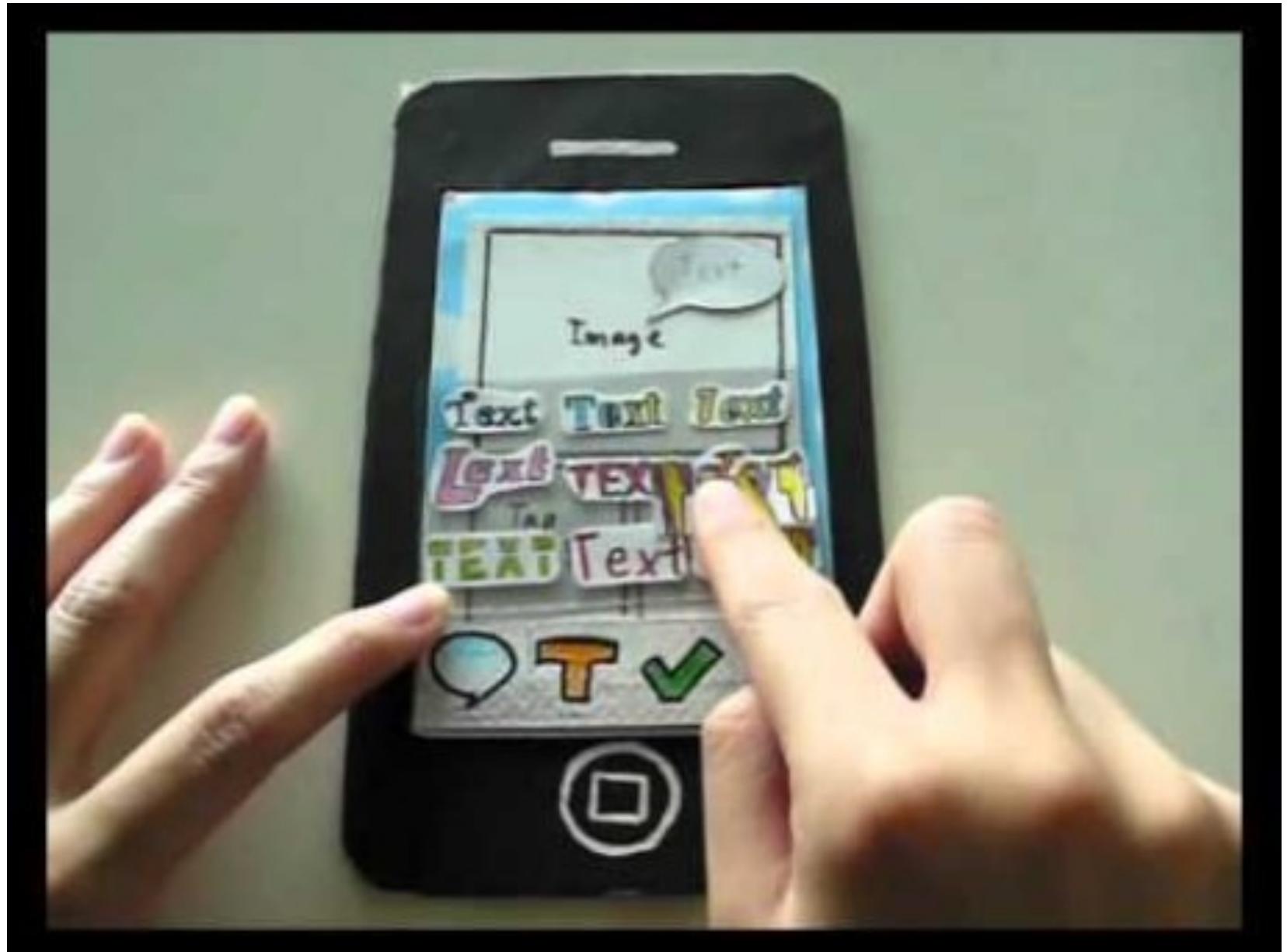
Video Prototypes

Sharing a rich experience of your prototype

Video Prototype

- A video that conveys your storyboard and/or paper prototype concepts

Example



<https://youtu.be/wbiYAqbZryA>

Example



<https://youtu.be/kWsBvUnvCmg>

Video Prototype Fidelity

- Informal, still low fidelity
 - Just for brainstorming
 - A few minutes to create
- Medium fidelity
 - Starting with paper prototype
 - One-two hours to create
- High fidelity
 - Need to get support from organization or client
 - Expensive

Required Content

- Show the whole task (like a storyboard), including motivation and success
- Choose important tasks, that show cases when your system is performing really well
 - Tasks that you have observed
 - Key tasks in the application
- Defines the scope for an MVP: the shown tasks are the features of the first launch
- Defines the topics for the design team to argue discuss

Creating a Video Prototype

- Define an outline
 - Or pick one of the storyboards
- Use minimum technology
 - High-quality equipment may become distraction
 - Reduce post-production and editing to a minimum
- Establish context
 - Choose representative users
 - Choose a meaningful location
- Focus on the message, not on the production quality

Tips For Production

- Bad audio is annoying and distracting
 - May also be a silent movie with “title cards” to explain what’s happening
- Choose the amount of interface you want to show in the video
 - Real-looking interactive prototype
 - Paper prototype
 - No interface at all (just users)
- Show both success and failure

Benefits

- Cheap and fast
- Can more vividly inspire people's imagination – Great communication tool
- Clean & self-explanatory – just share a YouTube link
 - More portable than a paper prototype!
 - Good for “pitching” or “selling” to management
- Shows context of use: helps achieve common ground
- Can serve as a ‘spec’ for developers
- Ties interface design to user tasks
 - Ensure you develop all that is needed, nothing extra

Medium Fidelity Prototypes

Wireframes, PowerPoints, Sketching tools

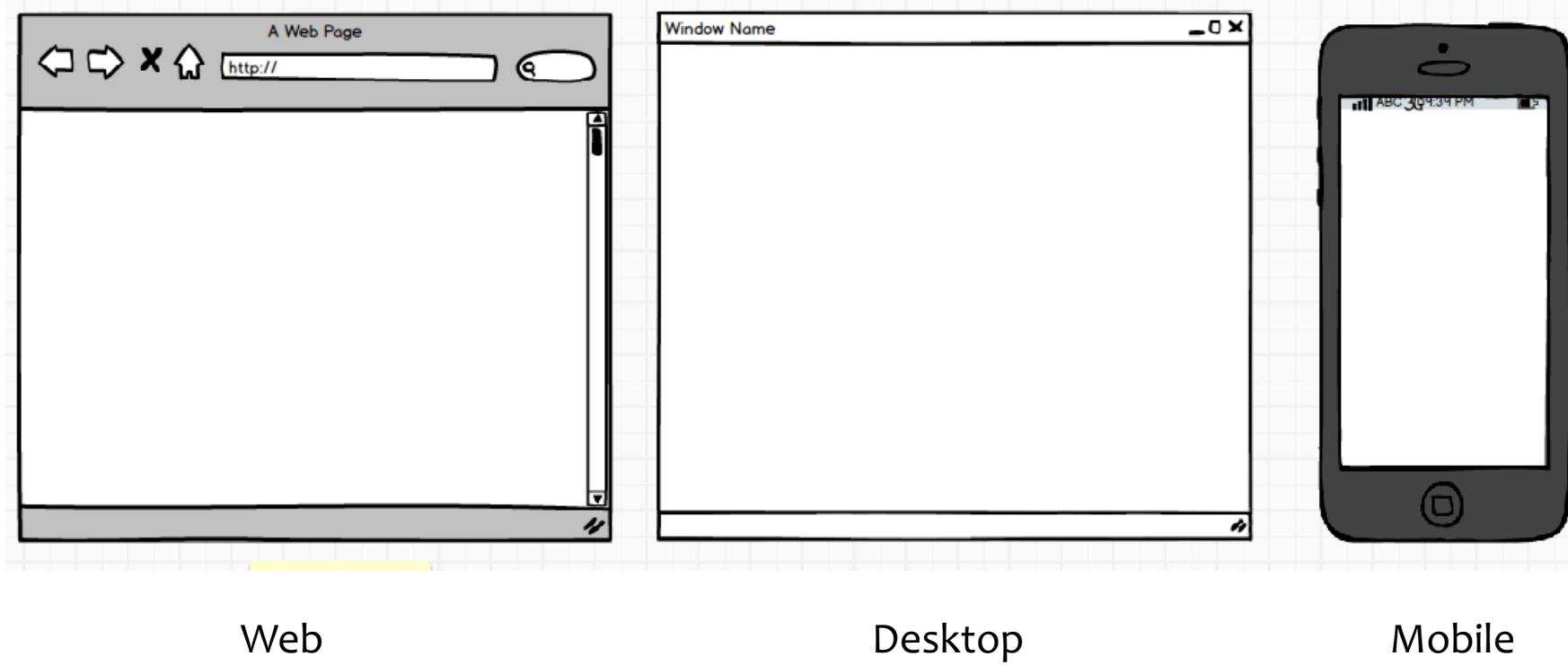
Computer Prototypes

- Interactive software simulation
 - Renders user interface
 - Accepts some user input
 - Responds by switching pages
- Medium-fidelity or High-fidelity in look & feel
- Low-fidelity in depth
 - The human operator in paper prototyping is aware of the algorithms

Medium-fidelity

- Also known as “Mockups” or “Wireframe interface”
- Design of a single screen or a set of connected screens (following a task)
- “Wavy” or “imprecise” drawing (inspired by hand drawing)
 - Want to convey the impression that the design is still preliminary
 - Mostly gray scale (or black and white)
- Usually static information (predefined pages, only)
- May suggest user device

Wireframes For The Three Interfaces



Web

Desktop

Mobile

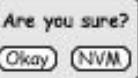
moqups ▾  ⌂ ▾

Search stencils

Stencils Images

Horizontal Line Vertical Line

iPhone iPad

Are you sure? 

iOS Alert iOS Picker

Settings Enabled Selected item Some items 

iOS Menu iOS Button

Quick Introduction to Moqups / Playground  Tweet 3,718

Mozilla 

Our Online store 

Home Products About Contact

Some areas of the design may be “active” (link to a new page)

Add to cart

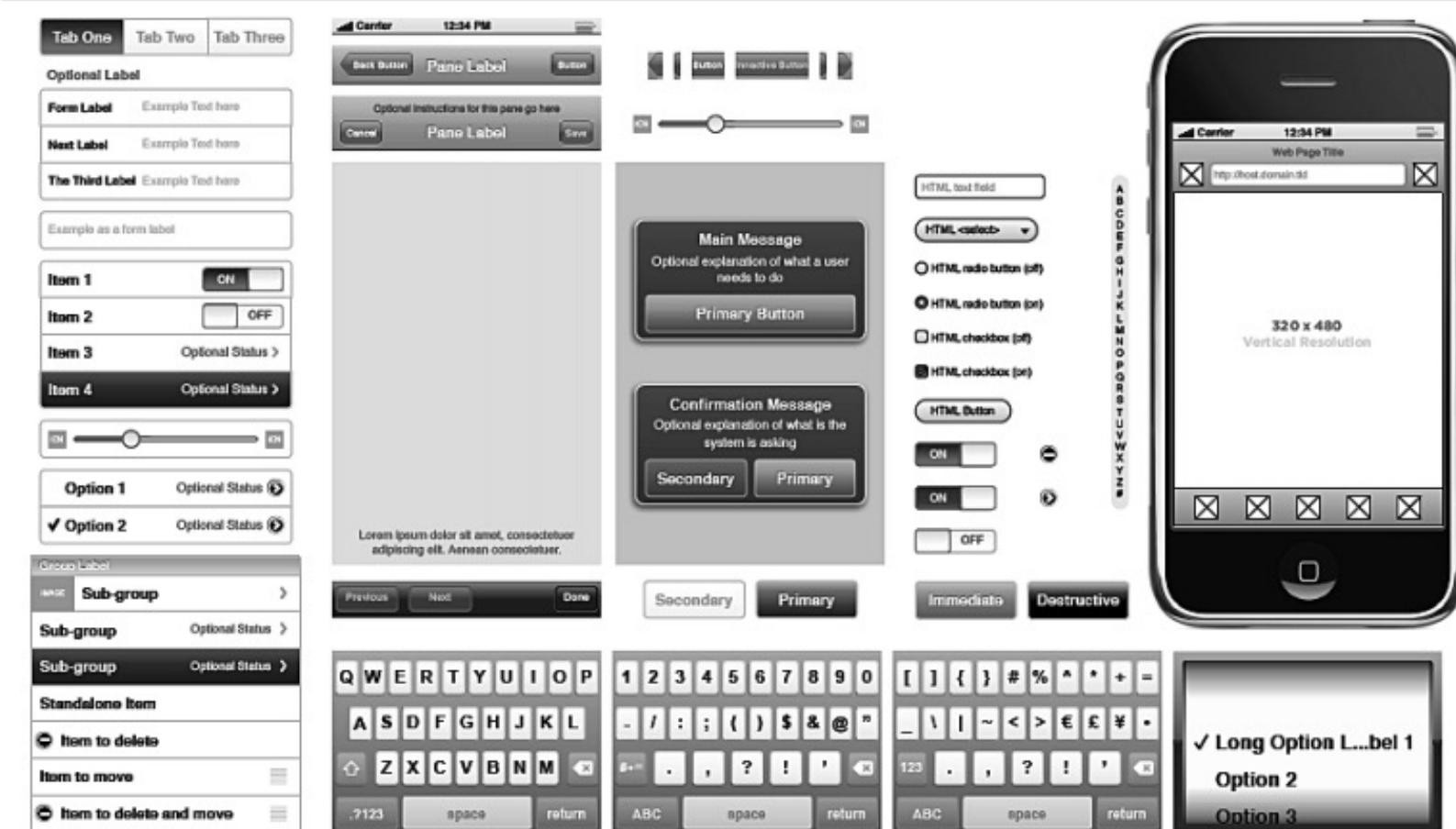


UI Design Libraries

The image displays a variety of UI design components and wireframes:

- Top Left (Web Page):** A screenshot of a web browser showing a "A Big Title" page. It includes a search bar, a link icon, a text area, a button group, a date picker, a radio button section, and a dropdown menu.
- Top Middle (Mobile Phone):** A smartphone screen showing a "Heading" section with a list of items (Item One, Item Two, Item Three) and a "Multiline Button" section with an alert message.
- Top Right (Mobile Phone):** Another smartphone screen showing a "Simple Label" section with various UI elements like checkboxes, buttons, and alerts.
- Middle Row:**
 - A set of four charts: a horizontal bar chart, a vertical bar chart, a line graph, and a pie chart.
 - A hierarchical site map diagram starting from "Home" and branching into "Products", "About Us Company", "Support", and "Blog". "Products" further branches into "Product 1" and "Product 2".
 - A media player interface with tabs (First Tab, Second Tab, Third Tab, Fourth Tab), a video thumbnail, and a control bar.
 - A map with a green highlighted area and a yellow line, labeled "A comment".
- Bottom Row:**
 - A data grid table with columns for Name, Age, Nickname, and Employee status. It lists several rows of data.
 - A horizontal scrollable text area with a progress bar and a dropdown menu.
 - A list of keyboard shortcuts and their descriptions.

Stencils For UI Elements



Some Tools For Med-Fidelity Prototyping



<https://www.figma.com>

<https://www.figma.com/education/>



balsamiq®

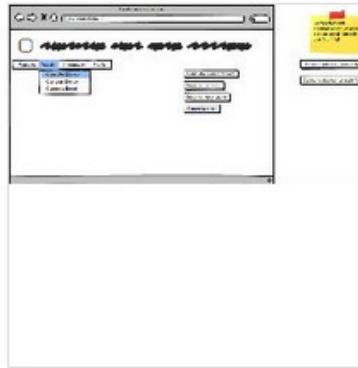
<https://balsamiq.com/wireframes/>

<https://balsamiq.cloud/>



<https://moqups.com/>

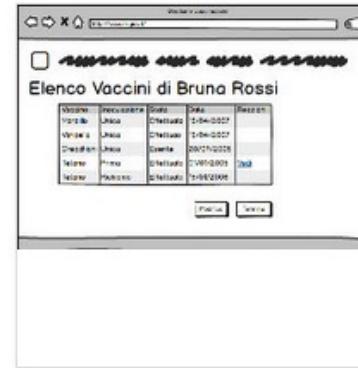
Example



Step 1 e B-Step 1



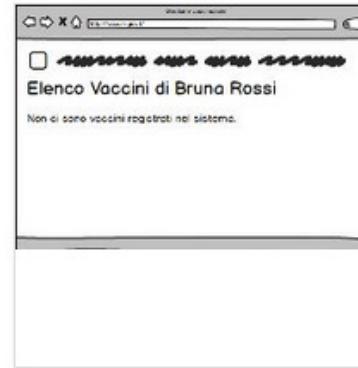
Step 2 3



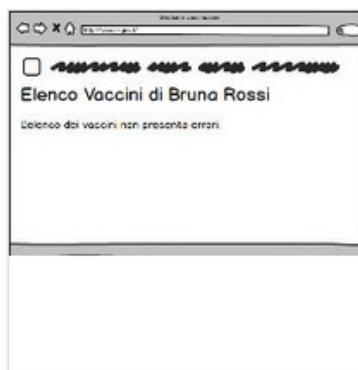
Step 4.5a



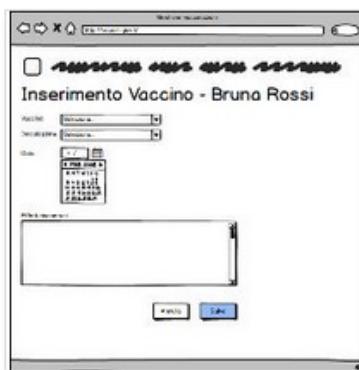
Step 2a



Step 4b



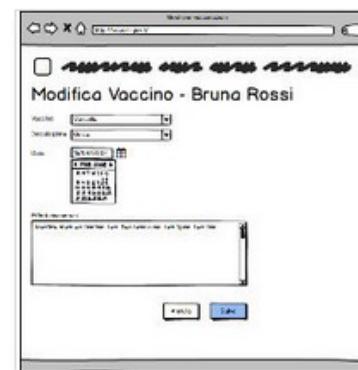
R_Step 6



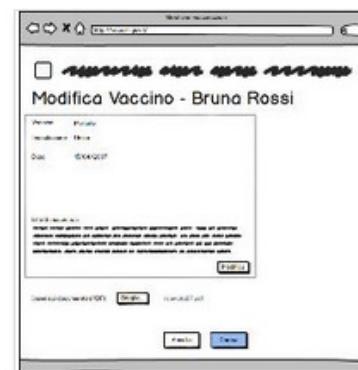
R_Step 5a1 5a2



R_Step 5a3 5a4



R_Step 5c1 5c2



R_Step 5c3 5c4

PowerPoint-based Interactive Mockups



Tools' Drawbacks

- Click, not interact
 - No text entry, no data entry, no real selection of listed data
 - Widgets aren't active
- Paths are static
- The tester is engaged in a “hunt for the hotspot”, to find the (few) only widgets that really clickable
 - Good for testing understanding of the UI and the workflow
 - Not good for testing the UI behavior

High Fidelity Prototypes

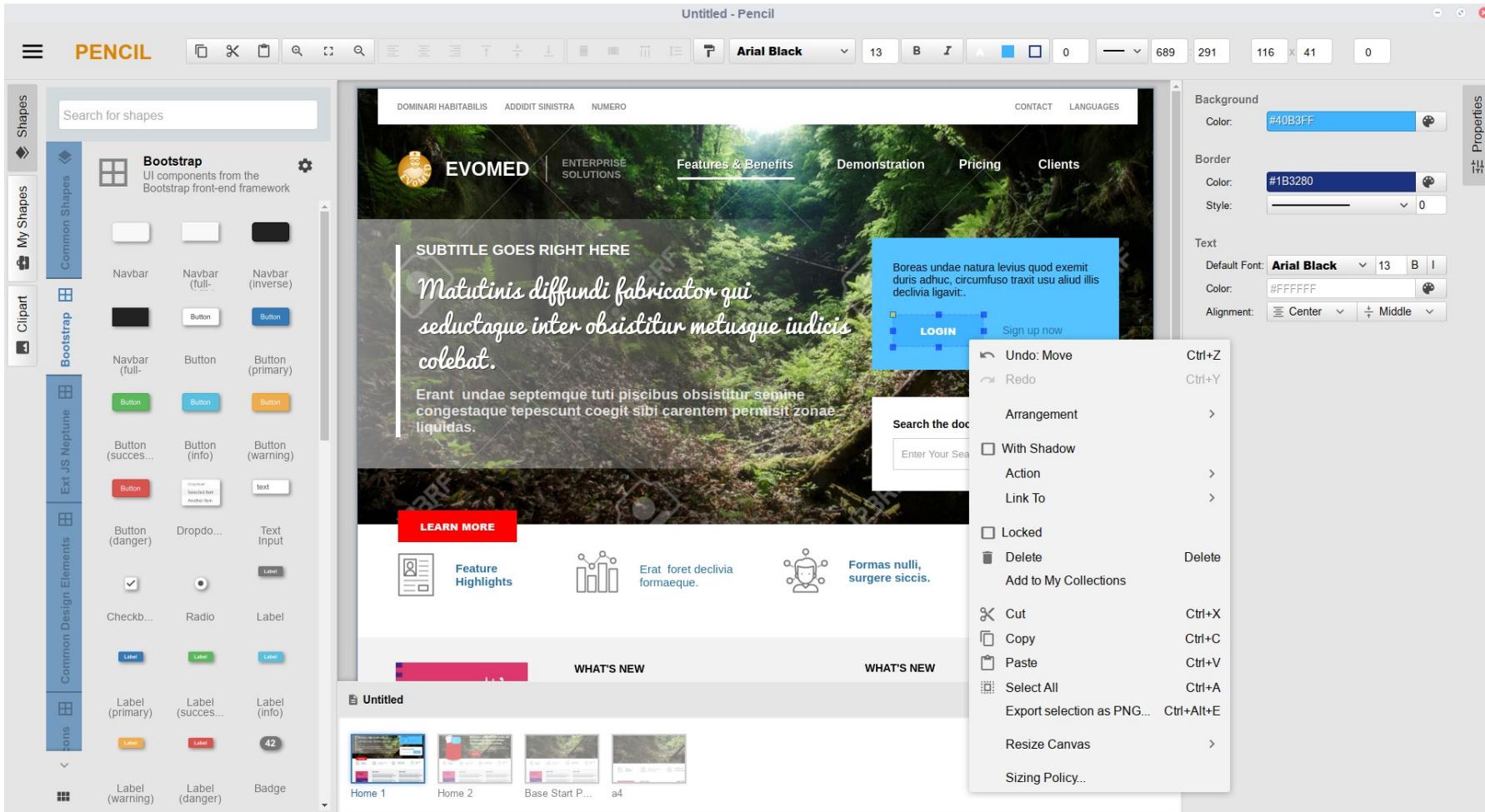
They look like the real thing. Widget behave realistically. But it's still an illusion.

Hi-Fi Prototypes

- Actual computer application, with final-looking layout, colors, and graphics
 - May use design prototyping tools
 - May use real application code
- Much more expensive to build
- More time is spent with graphic design than interaction design
- When tested, people will mostly comment about colors, fonts, ...
 - representation communicates “finished”

High-fidelity Computer Prototypes

Semi-interactive



What Can We Learn From Hi-Fi Interactive Prototypes?

- Screen layout
 - Is it clear, overwhelming, distracting, complicated?
 - Can users find important elements?
- Colors, fonts, icons, other elements
 - Well-chosen?
- Interactive feedback
 - Do users notice & respond to status bar messages, cursor changes, other feedback
- Efficiency issues
 - Controls big enough? Too close together? Scrolling list is too long?

Suggested Video

- **Prototyping: fake it till you make it**
- By Apple Design Team
- <https://youtu.be/3lqh-A5Jy4Q>



Some Tools For Interactive Hi-Fi Prototypes

No-Code



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



<https://www.figma.com>

FROONT

<https://froont.com/>

webflow

<https://webflow.com/>



Principle

<https://principleformac.com/>

Wizard-of-Oz Techniques

Faking a technology, or filling-in for missing functionality

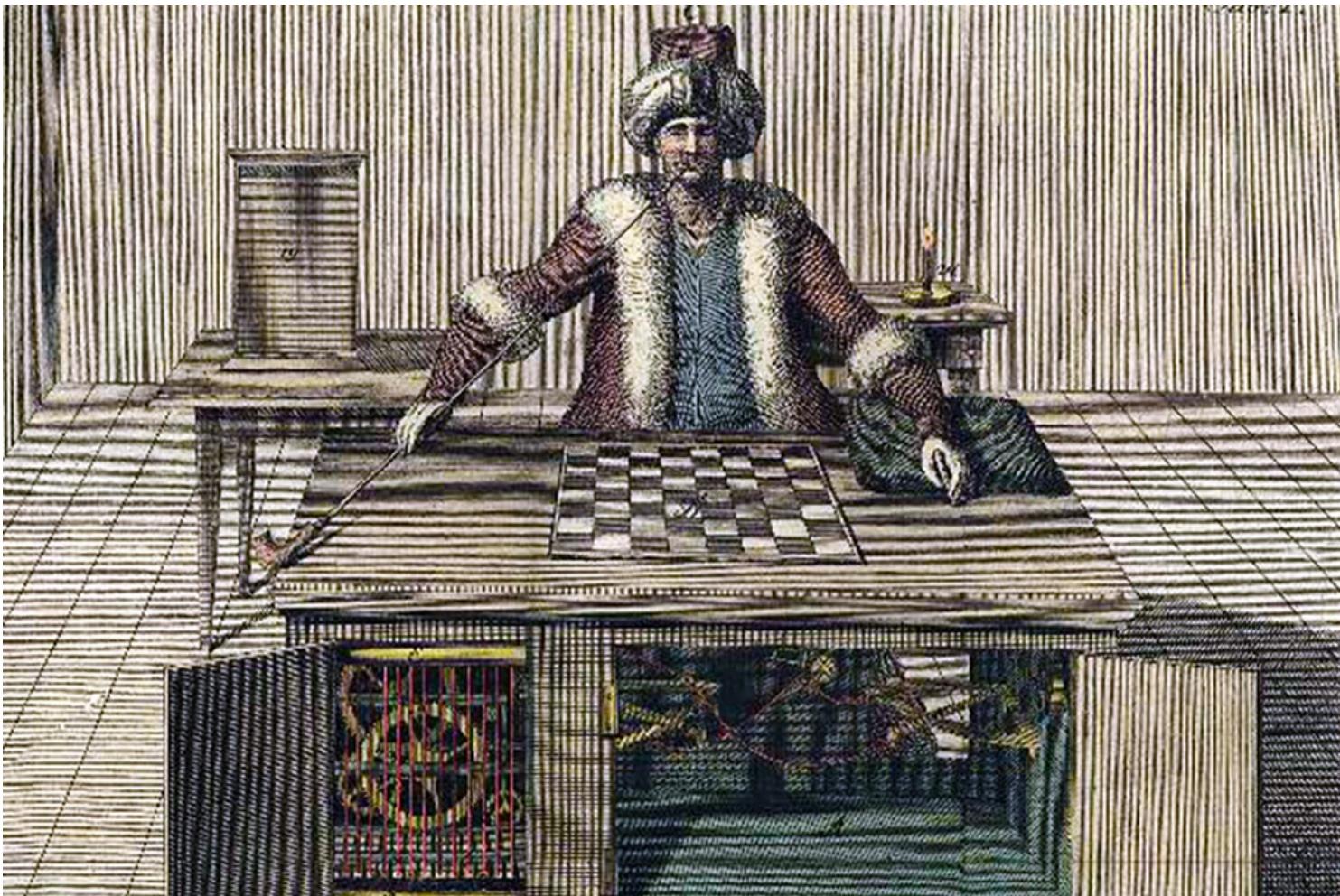
Goal

- How to test an application that is really complete...
 - With finalized user interface
 - With finalized algorithms
 - Also including stuff that we still are not able to implement
- ...but without actually writing the code
 - Except for a semi-interactive ‘dumb’ prototype

Remember The Man Behind The Curtain?



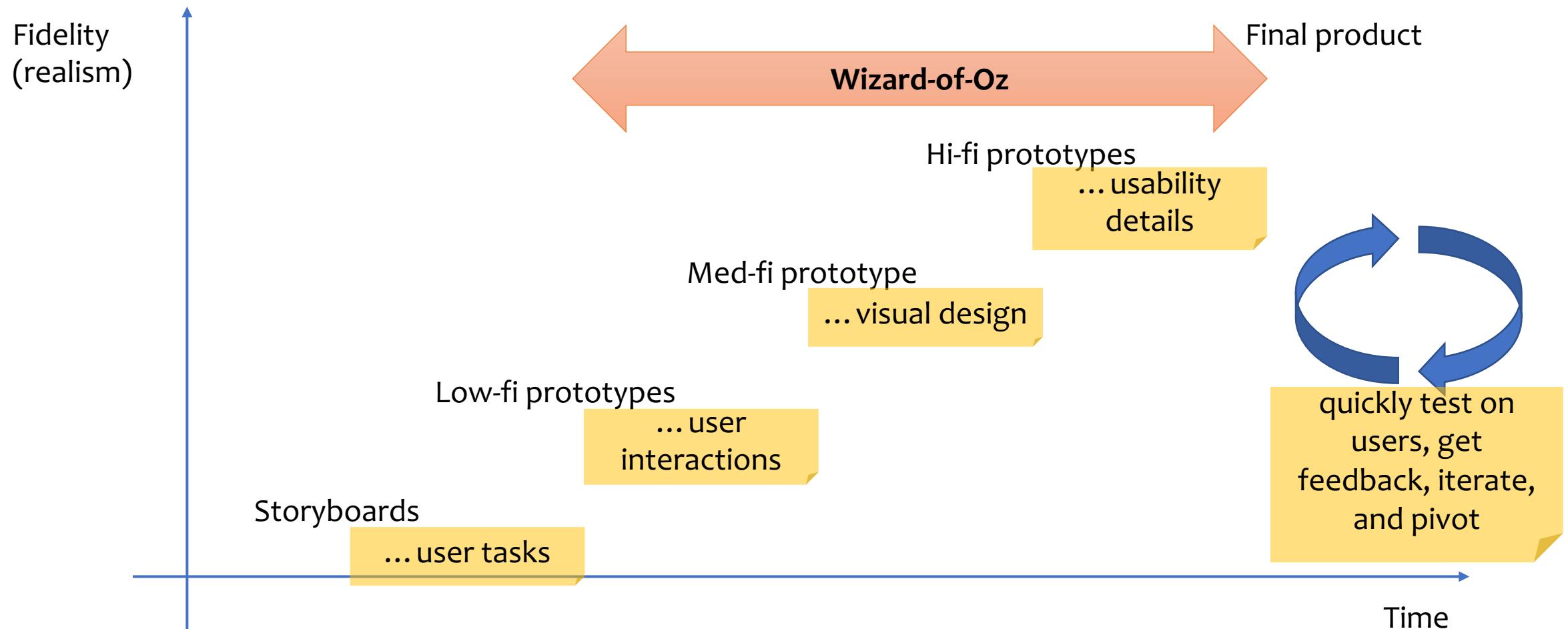
Remember the Mechanical Turk?



Wizard-of-Oz

- Software simulation with a human in the loop to help
- “Wizard of Oz” = “man behind the curtain”
 - Simulates the machine behavior with a human operator
 - Wizard is usually but not always hidden
- Often used to simulate future technology
 - Speech recognition
 - Learning
- Wizard may be hidden or visible
 - Must always be revealed, at least at the end

Prototypes Facilitate Conversations About...



Implementing a Wizard-of-Oz Prototype

- Choose supported tasks and scenarios
- Create User Interface mock-ups
 - Implement a part of the system
 - Leave “hooks” for the Wizard’s actions
- Implement a back-office interface for the Wizard
- Define “rules of behavior” for the Wizard
 - When he should respond
 - How it should respond (the “algorithm”)

Benefits

- Faster and cheaper than most interactive prototypes
- More “real” than paper prototyping
- Creating multiple variations is easy
- Identifies bugs and issues with current design
- Can envision applications that are difficult to build
- Playing wizard allows a better understanding of algorithmic requirements

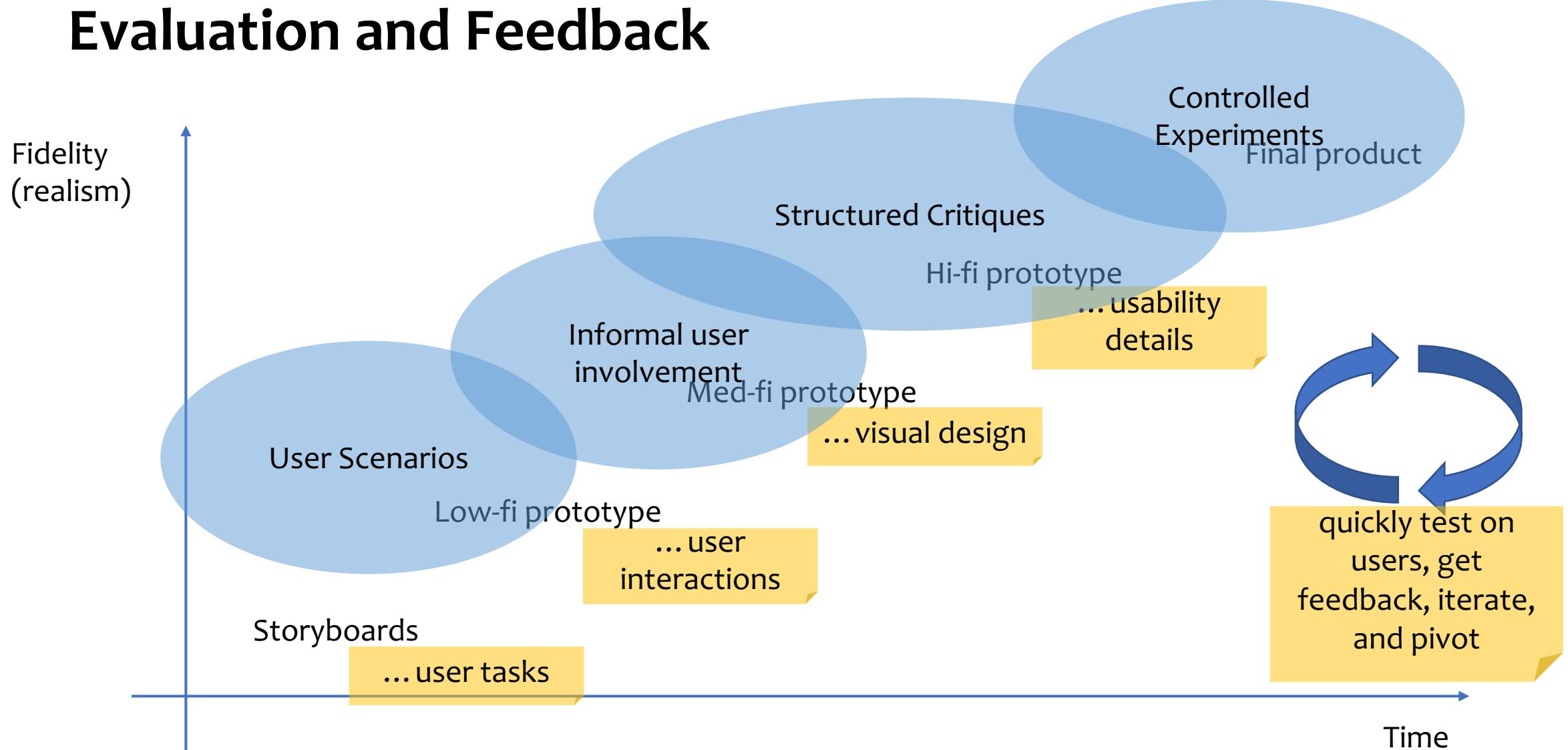
Risks

- May be over-optimistic
 - Speech recognition that always works (instead of having an error rate)
 - Super-intelligence (that will never exist)
- Wizard behavior is difficult
 - Take into account system limitations
 - Emulate expected system response
 - Within acceptable timing
- Needs at least two researchers

Wrap-up

Many different techniques, applicable to different goals and contexts

Evaluation and Feedback



References and Acknowledgments

- Google, Begin Today With Rapid prototyping,
https://www.youtube.com/playlist?list=PL9KVldeJ2K8NDpsiYpcbB_qifd3y5CYZ
- MIT, http://web.mit.edu/6.813/www/sp18/classes/11-prototyping/#reading_11_prototyping
- Scott Klemmer, Storyboards, Paper Prototypes, and Mockups,
<https://youtu.be/z4glsttyxw8>
- Most of the slides are adapted from those used in the "Human Computer Interaction" course of Politecnico di Torino
 - <http://bit.ly/polito-hci>



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