

**MAI4CAREU**

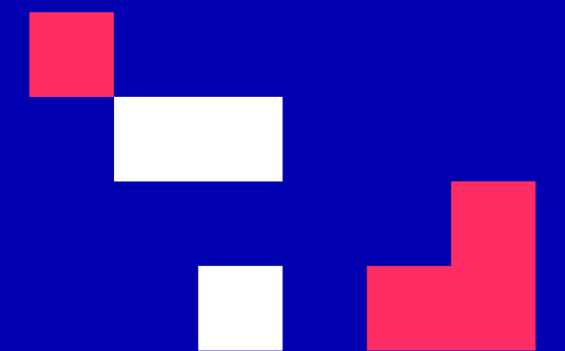
Master programmes in Artificial  
Intelligence 4 Careers in Europe

University of Cyprus

# HUMAN-CENTERED INTELLIGENT USER INTERFACES - MAI648

Marios Belk

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**CONTENT 3**

# Human-Centered Design

**CONTENTS**

- Design Principles
- Design Methodologies and Software Development Life Cycles
- User-Centered Design
- Needs Analysis and Requirements
- Personas
- Prototyping

**CONTENT 3**

# Learning Outcomes

- Understand the main principles of user-centered design
- Describe popular software development lifecycles
- Learn the main principles of prototyping

## CONTENT 3

# What is design?

**CONTENT 3**

## What is design?

- A design is a plan or specification for the construction of an object or system or for the implementation of an activity or process or the result of that plan or specification in the form of a prototype, product, or process - <https://en.wikipedia.org/wiki/Design>

**CONTENT 3**

# Achieving design objectives within constraints

- Objectives
  - What is the purpose of the design we want to produce?
  - Who is it for?
  - Why do they want it?
- Constraints
  - What materials should we use?
  - How much can it cost?
  - How much time do we have for development?
- Prioritizing objectives and constraints

**CONTENT 3**

# Golden Rules

- Understand the end-users
  - Psychological aspects
  - Social aspects
  - Human limitations
  - User preferences
- Understand the computers
  - Limitations
  - Capabilities
  - Platforms

**CONTENT 3**

## **Design methodologies / Software development life cycle models**

- Provide an overview of the processes of designing, developing and evaluating interactive software systems
- Demonstrate how the different phases of a system's development are related to each other
- Project management
- Simplified representations of reality



**CONTENT 3**

## Design methodologies / Software development life cycle models

- Design methodologies from the field of software engineering
  - Waterfall
  - Iterative
  - Agile
- Design methodologies from the field of HCI
  - User-Centered Design

**CONTENT 3**

# Waterfall model

- One of the oldest models
- The system's development process follows a number of phases
- Once a phase is completed you cannot go back to the previous phase
- Advantages: Clearly describes the phases of a product that one will encounter in systems design
- Disadvantages:
  - Inability to specify a product in detail prior to design
  - Does not work well when flexibility is required in the project

**CONTENT 3**

# Waterfall model

- Each phase is completed by a check
- Each phase is discrete
- Communication through official documents
- Minimal use of prototypes

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## Iterative design model

- Repetition at its core, the process does not start with full requirements
- Instead, initial requirements are defined and evaluated
  - Then more requirements are defined
- Each phase produces a software version and incrementally matures
- Advantages:
  - Implement a working version in early stages
  - Software updates are less expensive
- Disadvantages: Possibility to use too many resources with the repeating process

**CONTENT 3**

# Agile model

- Agile models aim to produce working products fast
- Practical and realistic approach
- Iterative approach
- New software releases are produced and evaluated with incremental updates
- Clients and the design/development team work closely together

**CONTENT 3**

# User-centered Design

- Iterative design process
- Designers focus on the users and their needs in each phase of the design process
- Users are involved throughout the design process via research and design techniques
- Main aim is to create usable interactive systems **for the user**

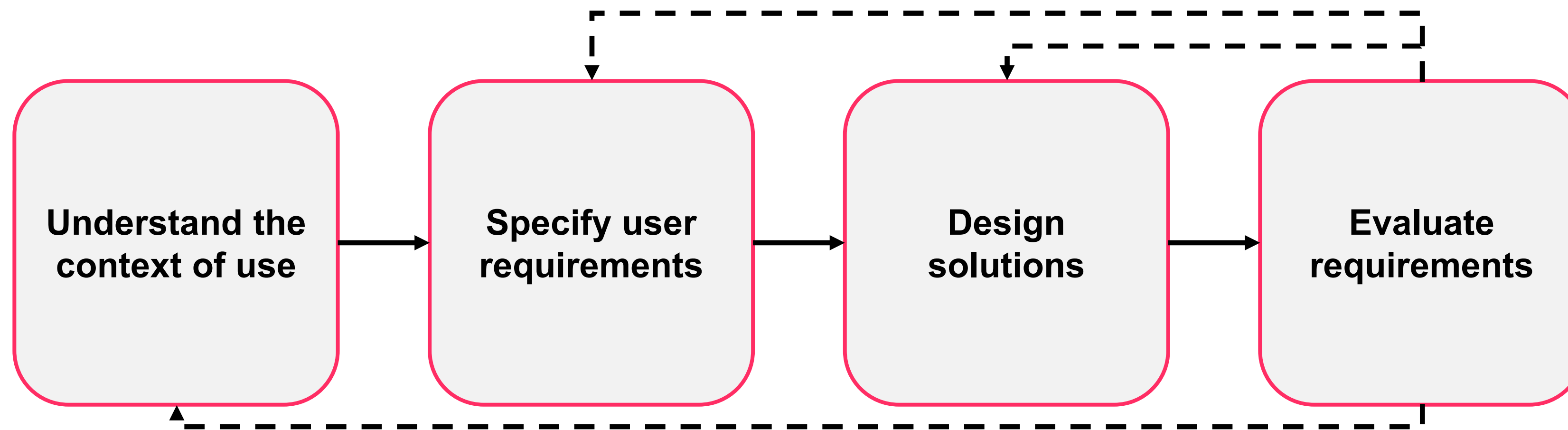
**CONTENT 3**

# Main Principles of UCD

1. Focus on the end-users of the system and the tasks they perform with it, from the initial design phases
2. In all design phases, we measure the end-users' reaction using prototype interfaces, manuals, simulators, etc.
3. We follow an iterative design process

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# User-centered Design



<https://www.interaction-design.org/literature/topics/user-centered-design>



**CONTENT 3**

# Think of an example intelligent interactive system

- Accordingly, we will go through all stages of a UCD method for designing the system

## CONTENT 3

# Needs and Requirements Analysis

**CONTENT 3**

## What do we want to achieve?

- Needs Analysis: Understand as much as we can about the users, their tasks, the environment they work in or operate in so that the system we create helps them achieve their goals
- Requirements Analysis: from the needs we have identified, extract the requirements we need to incorporate into the designs

**CONTENT 3**

## Why?

- The biggest failures of system software development projects are due to not sufficiently understanding and establishing needs and requirements
- One way to avoid this is to let the user get involved and be heard

**CONTENT 3**

# What do we mean by requirements?

- A requirement is a sentence that describes the behavior of a product
- Part of the process is to clarify the requirements and make them as clear and precise as possible
- We also need to be able to say when a requirement has been met

**CONTENT 3**

# Different types of requirements

- **Functional**
  - What the system should be able to do
  - What functions should be added
- **Non-Functional**
  - Limitations on the system, platform, environment
    - E.g., memory constraints, environmental constraints, platform constraints, etc.
  - What data should be stored in the system?
  - How/where will it be stored?

**CONTENT 3**

# Different types of requirements

- Environment
  - Sound, vibration, light, humidity
- Social
  - Shared screen,
- Organizational
  - Hierarchy, organization culture
- Users
  - Characteristics: prior knowledge, skills, experience

**CONTENT 3****What factors (environmental, user, usability) would affect the following systems?**

- Cognitive voice assistant
- Intelligent biometrics in outdoor ATM
- Intelligent GPS navigation system



**CONTENT 3**

# Collecting data

- How users perform their activities
- Study the users and their context of use
  - Office conditions

**CONTENT 3**

# Collecting data

- Focus on observable behaviors
- What are the practices, methods, procedures used?
- Record what, why, when and how users act and what tools they use.
- New technology is likely to change some of these
- Understanding how the new technology can lead to changes will help produce more knowledge on the activity

**CONTENT 3**

# Tasks and Activities

- Physical work - actions
- Cognitive tasks
- Communication tasks

**CONTENT 3**

# Tasks and Activities

- Conditions under which tasks are performed
- Outcomes of these tasks
- Conditions under which the tasks take place
- What task is mandatory, what is optional)
- Communication and cooperation with others
- Equipment

**CONTENT 3**

# Data Collection

- Interviews
- Open-ended questions
- Likert
- Think aloud protocol
- Focus groups
- Expert interviews
- Ethnography

**CONTENT 3**

# Personas

- Fictional characters of the interactive system
- Technique that helps UX researchers understand the characteristics of the end-users
- They are not real people but they represent real people and have real characteristics
- They should not be idealized
- Try to make them as real as possible by giving them a name, characteristics, goals, and personal history
- It is good to create at least one for each user category

**CONTENT 3**

# Archetype User

- Personas are archetype users that exist primarily to be design targets
- Personas help understand who to design for and how to make that user happy
- The generic “user” becomes the specific persona
- Every time a team member thinks of a feature and says: “Well, users might like it”, you can point to the persona and ask: “Would Anna like it?”

**CONTENT 3**

## How de we create Personas?

- Start with user research
- Get out and talk to people...
  - who use your product
  - who use your competitor's product
  - people who would like to use your product
- Find out what their goals are



**CONTENT 3**

# Different Perspectives on Personas

Four perspectives on personas by Lene Nielsen

- Goal-directed Personas
- Role-Based Personas
- Engaging Personas
- Fictional Personas

From: <https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them>

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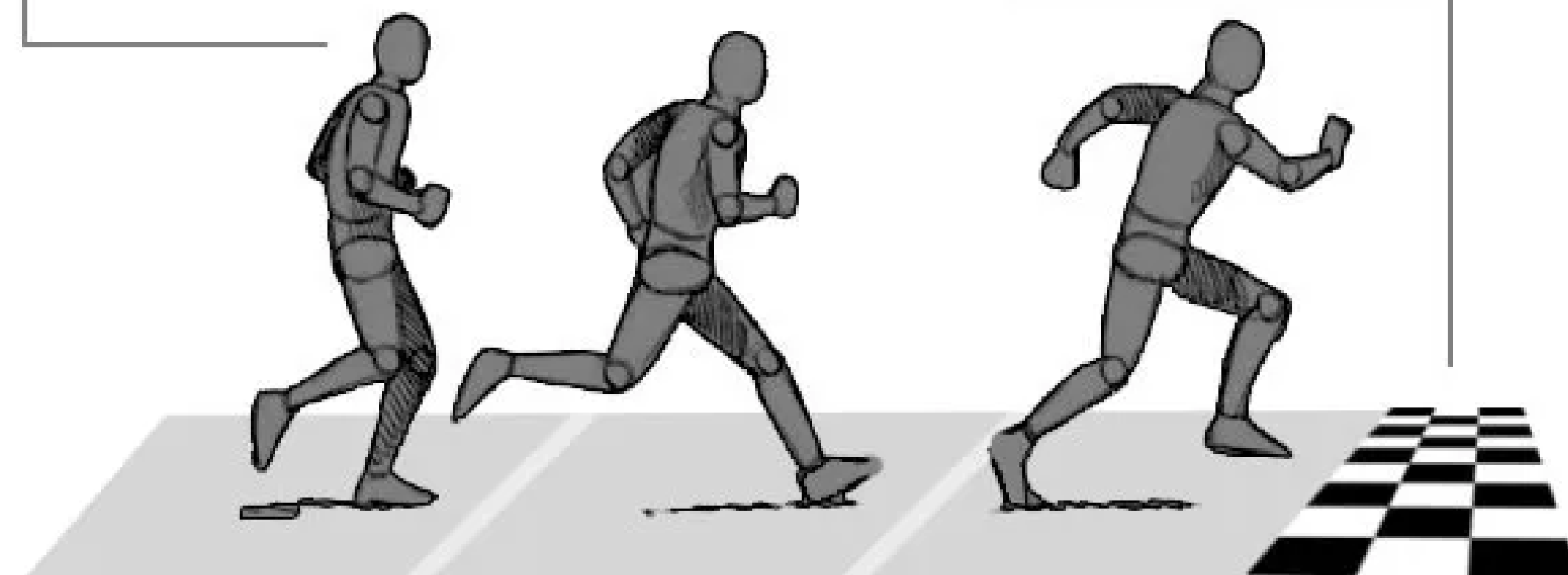
# Goal-directed Personas

### 1. Persona

Defines who the story is about. This main character has attitudes, motivations, goals, and pain points, etc.

### 3. Goal

Defines what the persona wants or needs to fulfill. The goal is the motivation of why the persona is taking action. When that goal is reached, the scenario ends.



### 2. Scenario

Defines when, where, and how the story of the persona takes place. The scenario is the narrative that describes how the persona behaves as a sequence of events.

Image: <https://www.smashingmagazine.com>  
From: <https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them>

**CONTENT 3**

# Scenarios and Use-cases

- Scenarios: An informal narrative story, simple, “natural”, personal, non-generalizable
- Use cases: Assume interaction with a system and a detailed understanding of the interaction

**CONTENT 3**

# Writing Scenarios

- Scripting is a way of storytelling that we apply to the design of interactive systems  
How we use scripts  
As a design tool  
As an evaluation tool  
As a communication tool

**CONTENT 3****15-minute discussion – Create a persona, scenario and use-case**

- In your project groups, think of an intelligent interactive system and accordingly create a persona, scenario and use-case

## CONTENT 3

# Prototyping

**CONTENT 3**

# Prototyping - Question

- Wouldn't it be important to find out what your users want before you start writing code?
- Paper prototyping allows you to do just that
- While it may seem counterintuitive to someone to test a user interface without using a computer, paper prototyping is an appropriate method that allows you to get maximum feedback from your users with minimal development costs

**CONTENT 3**

# Prototyping

- Purpose: to model the final system, making it possible to examine its characteristics even when it is not yet complete
- When: at any stage of the development process
- It is possible to apply an iterative, evolutionary approach to prototyping to develop prototypes with increasing functionality and fidelity to the final system



**CONTENT 3**

# Prototyping

- It is functionally incomplete
- Does not cover the whole system
- Lags the final system in performance
- Prototypes are also known as "design mockups"
- In other fields a prototype is a small-scale model of the final system
- Prototypes are key components of iterative design that aim to engage users in the system design-development process

## CONTENT 3

# Why do we need prototypes?

**CONTENT 3**

## Why do we need prototypes?

- To get feedback on our design earlier
- Gain in time and money
- Users and other stakeholders can more easily see, keep and interact with a prototype than with a text or layout
- Gradual familiarization of users with the system

**CONTENT 3**

## Why do we need prototypes?

- Allow experimentation with alternative designs
- Evaluation of alternative designs through their prototypes allows many of them to be rejected at the initial design stages
- Errors are corrected before development at code or hardware level
- The use of prototypes keeps the design human-centered in which evaluation and feedback are of importance
- Allow design team members to talk on a common basis

**CONTENT 3**

# Types of Prototypes

- Based on how they are integrated into the final system
  - Throw-away
  - Incremental
  - Evolutionary

**CONTENT 3**

# Types of Prototypes

- Based on the supported functions
  - Horizontal
  - Vertical

**CONTENT 3**

# Types of Prototypes

- Based on fidelity
  - Low fidelity
  - Medium fidelity
  - High fidelity

**CONTENT 3**

# Integration in the final system

- Consumables (throw-away)
  - The prototype aims simply to elicit a reaction from users
  - The prototype must be created quickly and relatively inexpensively or the final cost of the system is increased



**CONTENT 3**

# Integration in the final system

- Incremental
  - The final system is developed as a set of independent modules
  - Each module is prototyped, tested and then added to the final system
  - It is a useful and efficient method when the various tasks supported by the interface are independent in nature

**CONTENT 3**

# Integration in the final system

- Evolutionary
  - The prototype is gradually improved until it reaches the final system
  - Design changes result from the analysis of user requirements and the various stages of evaluation

**CONTENT 3**

# Supported functionality

- Horizontal
  - The entire interface is prototyped having very limited or no functionality
  - Gives the overall picture of the interface and is very important in human-centered design
- Vertical
  - Includes almost full functionality for selected tasks/features
  - Features prototyped in this way are usually typical interface functions
  - Tasks and scripts related to the above features can be thoroughly tested

**CONTENT 3**

# Fidelity

- Fidelity refers to the degree of detail of the original system
- High fidelity
  - The prototypes resemble the final system
  - They are fully interactive

**CONTENT 3**

# Fidelity

- Intermediate fidelity
  - They are built through prototyping software such as Justinmind, Protoio or from design software packages (Photoshop, etc.)
  - They are interactive in terms of interface (navigation, dialogues, messages, help) but not in terms of functionality

**CONTENT 3**

# Fidelity

- Low fidelity
  - They are largely designed on paper with reduced or no interactivity
  - Aim to explore alternative designs from the initial design phases

## CONTENT 3

# High or Low Fidelity?

## CONTENT 3

# Paper Prototyping

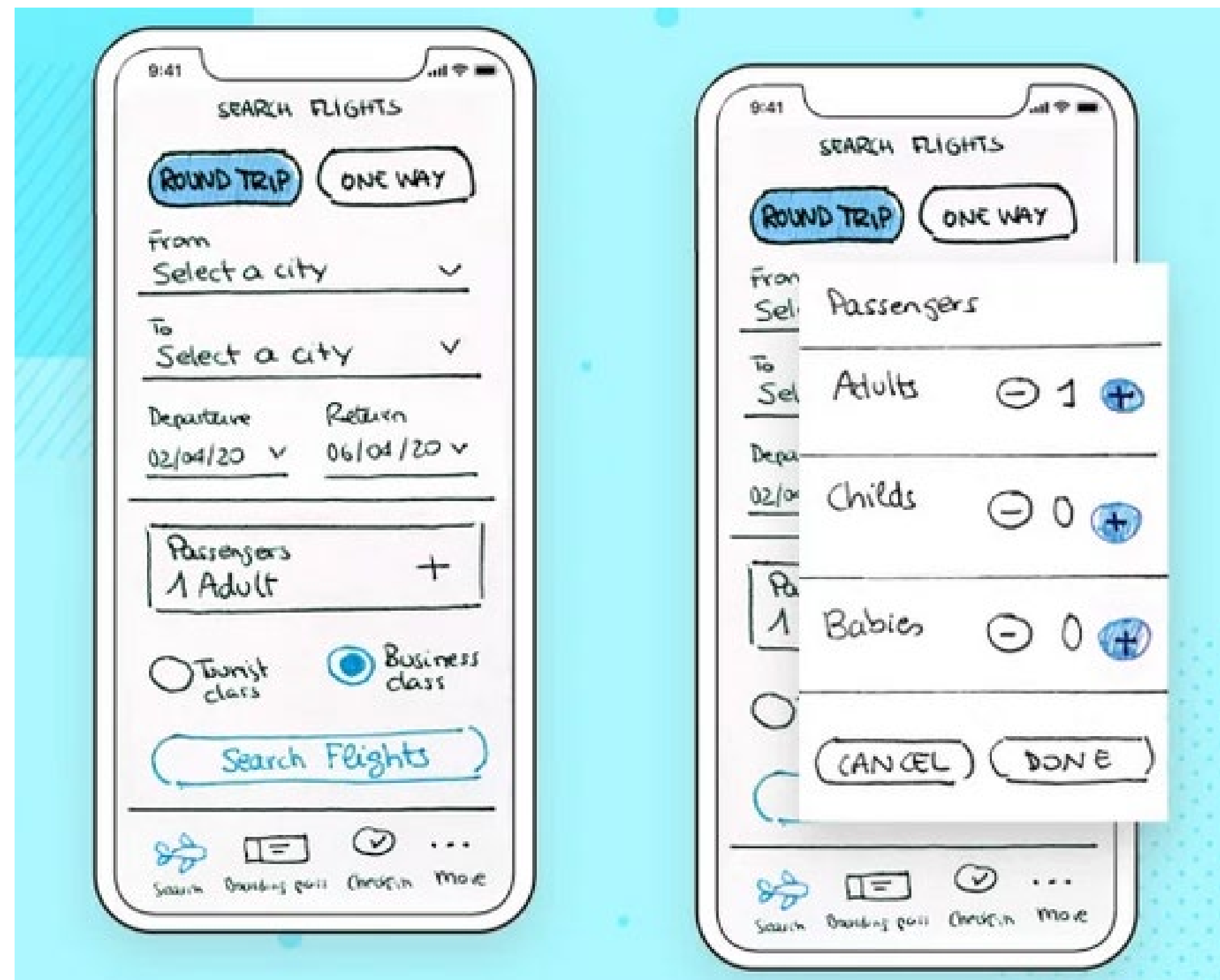


Image source:  
<https://www.justinmind.com/prototyping/paper-prototype>



**CONTENT 3**

# Paper Prototyping Procedure

- You must first have clearly documented the user requirements (usually represented by use case diagrams) that they want to accomplish through the system
- Then, screenshots are made outlining drawings related to all aspects of interaction such as menus, dialog boxes, pages, message popups, etc. that are required to complete each user objective

**CONTENT 3**

# Paper Prototyping Procedure

- We then test the usability of our designs in the context of an experimental setup in which one or two programmers play the role of “computer”, simulating the operation of the system, replacing parts of the designs according to the user's choices
- The users perform specific tasks by interacting directly with the prototype – “clicking” by touching buttons on the prototype or links and “typing” by writing their data in edit fields of the prototype’s edit fields

## CONTENT 3

# When and why is paper prototyping applied?

**CONTENT 3**

# When and why is paper prototyping applied?

- Terminology:
  - Do your users understand the terms and terminology you have chosen?
  - Are there key concepts that are misunderstood or not understood by your users?
- Navigation/interaction flow:
  - Is there a sequence or series of steps required to complete a task that is not understood by your users?

**CONTENT 3**

# When and why is paper prototyping applied?

- Content:
  - Does it provide users with the required information to enable them to complete their processes?
  - Is there any further information that the user does not need and is distracting?
- Functionality: Are there functionalities that are missing from your design, or are there functionalities that your users do not need?

**CONTENT 3**

## When it is not appropriate

- Paper prototyping is not suitable in the following cases:
  - Software response time
  - Use of scroll bars
  - Visual design and aesthetics

## CONTENT 3

# Examples of paper prototypes

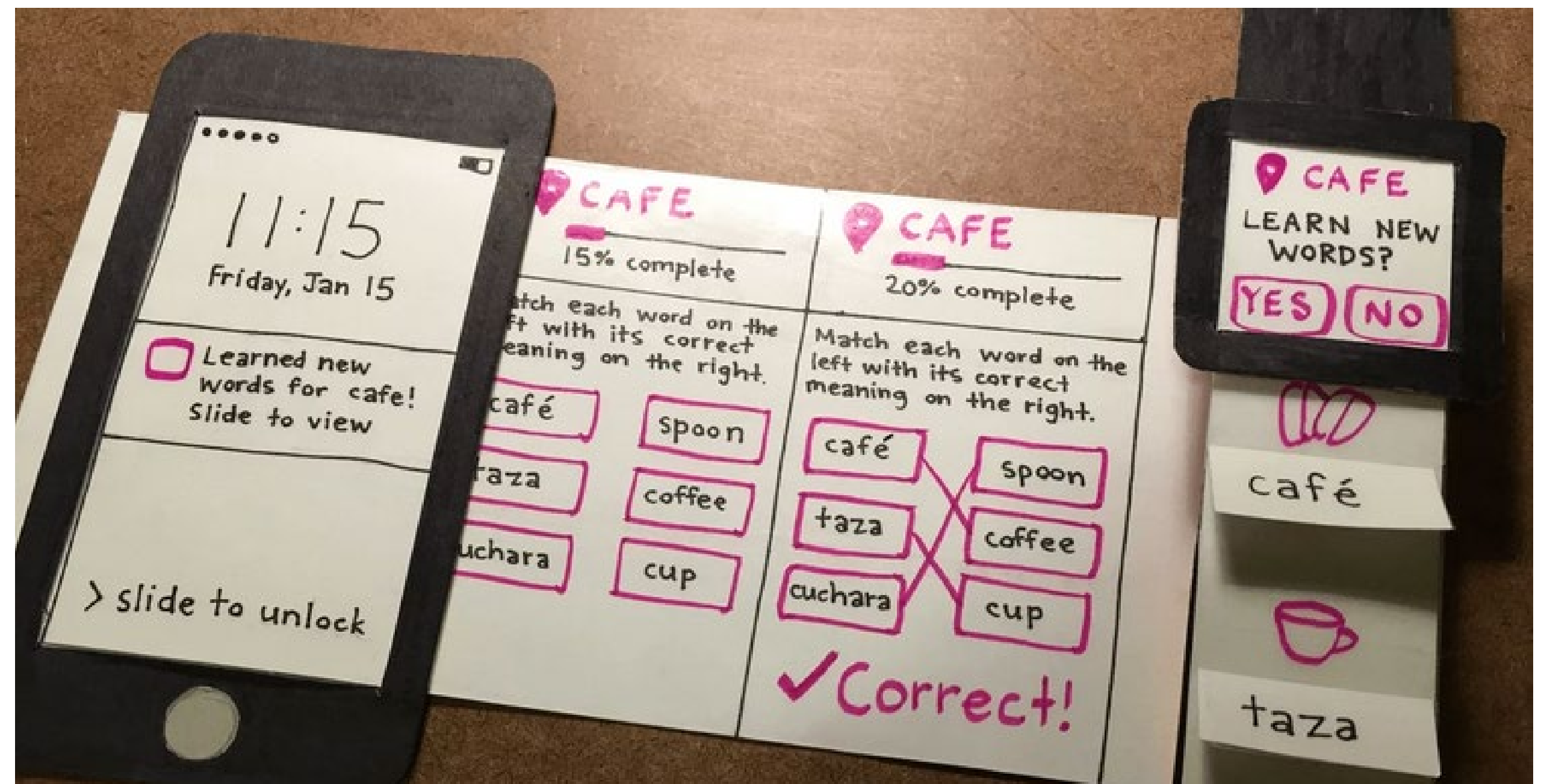


Image source: <https://ergomania-ux.medium.com/paper-prototype-fidelity-f021d7044bad>

From: <https://www.justinmind.com/prototyping/paper-prototype>

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# Examples of paper prototypes

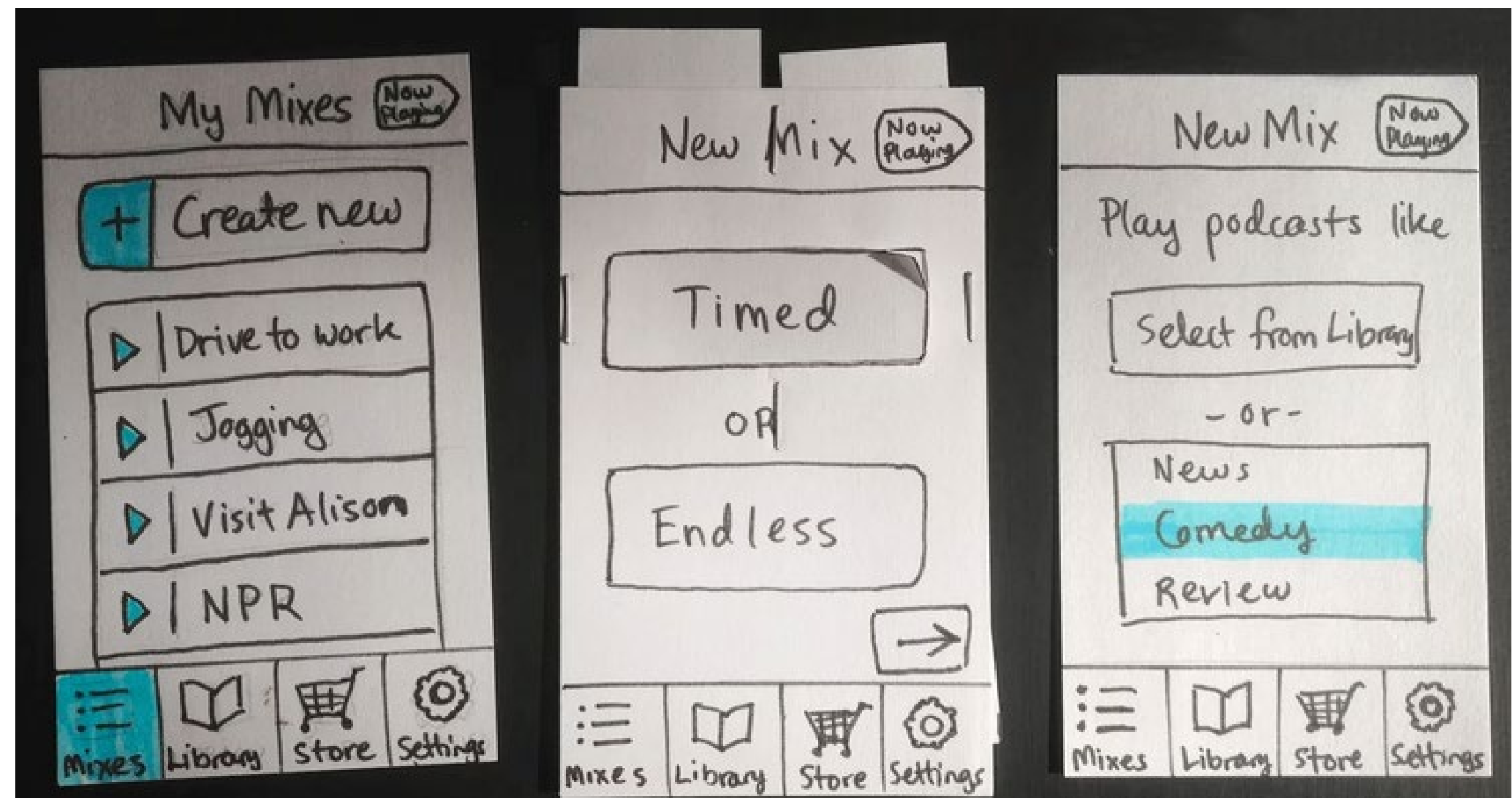


Image source: <https://www.uxpin.com/studio/blog/what-is-a-prototype-a-guide-to-functional-ux/>

From: <https://www.justinmind.com/prototyping/paper-prototype>



## CONTENT 3

# Examples of paper prototypes



Image source: <https://www.justinmind.com/prototyping/paper-prototype>

**CONTENT 3**

## Medium Fidelity

- Prototyping using a computer
- Use of prototyping software
- Use of prototyping software packages
- Use of simulation software
- They are interactive in terms of interface (navigation, dialogues, messages, help) but not in terms of functionality

**CONTENT 3**

## Medium Fidelity

- Create an interface that is closer to the final system
- Ability to build the final system on top of the prototype through incremental and/or evolutionary design
- Risks: User focus on unimportant details
- Creating the illusion of a real system

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# Prototyping Software

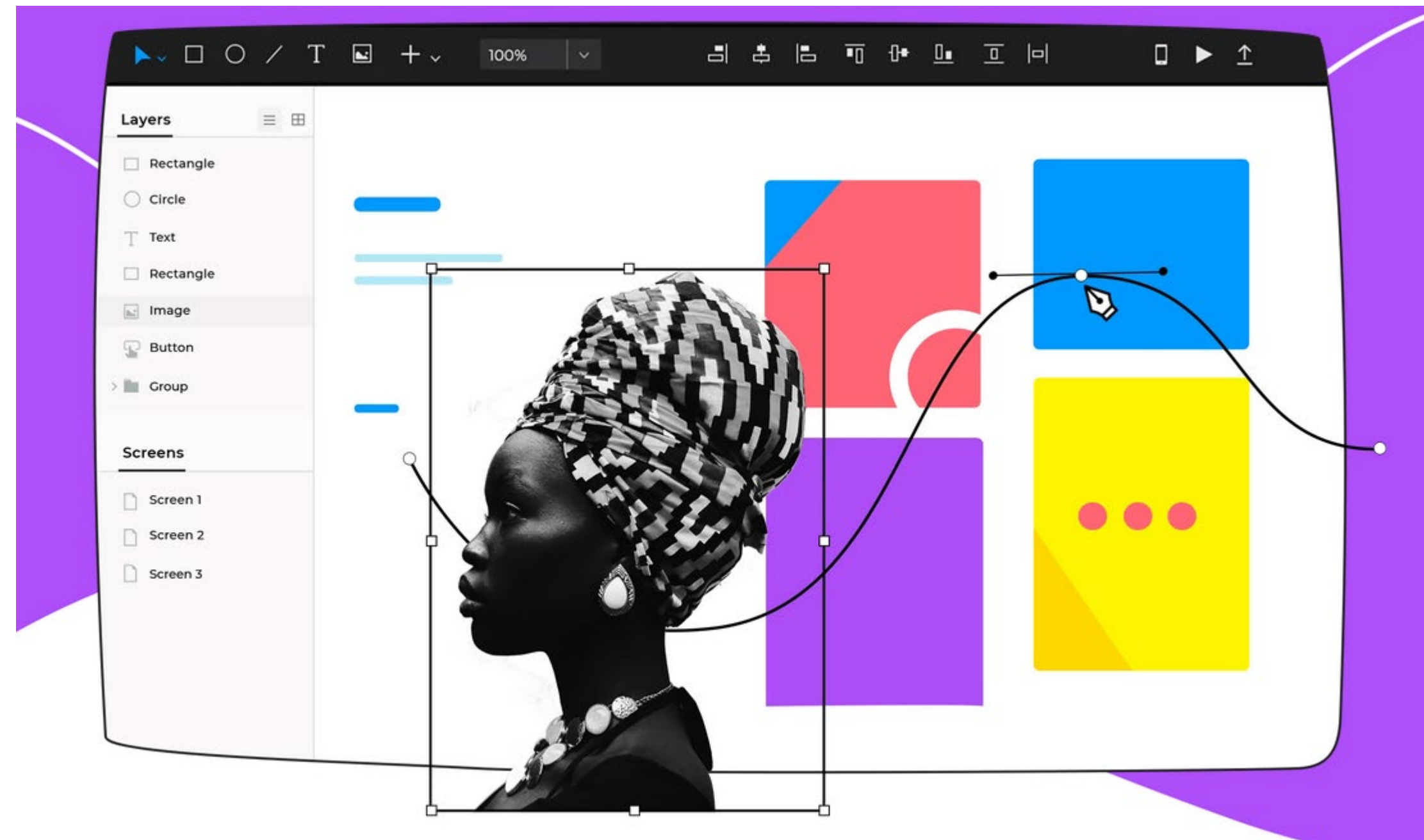
- Screens are designed with graphic design tools to give a clearer picture of the interface
- Practically applied in cases of horizontal prototyping which covers the whole interface but supports practically no functionality
- They give a reduced sense of interactivity

## CONTENT 3

# Prototyping Software - Justinmind



- <https://www.justinmind.com>



**CONTENT 3**

# Scripted simulations

- Implementation of storyboards in a computer environment
- The selection of a button by the user activates a new screen (or a change to an existing screen)
- They are very good for testing scenarios and use cases and are widely used in vertical simulations
- Alternative system behavior is simulated using different scripts (small pieces of code)
- The user views the simulated system behaving as the real one would behave
- Very important for testing dialogs, error messages, and online help

**CONTENT 3**

## Sources and further readings

- <https://www.interaction-design.org/literature/topics/human-computer-interaction>
- <https://www.interaction-design.org/literature/topics/user-centered-design>
- <https://www.justinmind.com>
- HCI course, Department of Computer Science, University of Cyprus

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**Thank you.**