

Review of user-centered requirements engineering techniques

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User-centered RE techniques

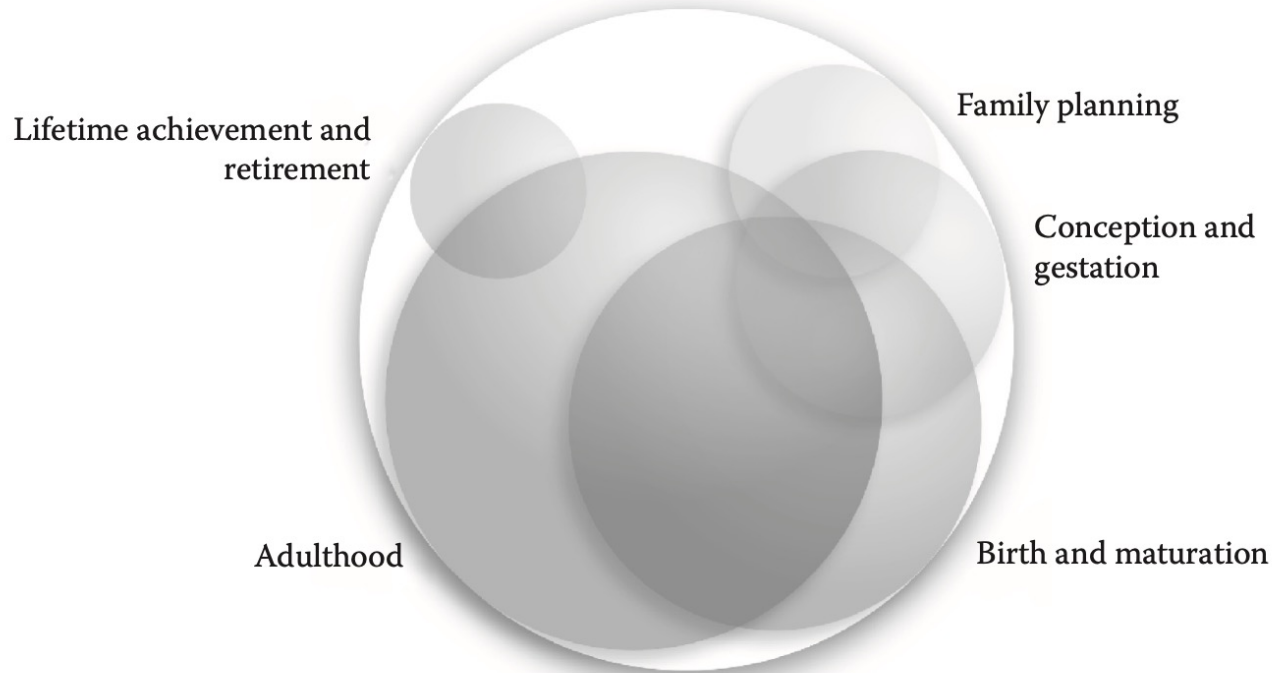
- Personas
- Scenarios and BDD Stories
- Conceptual Models
- GUI Prototyping

Personas

Personas (Pruitt and Adlin, 2012)

- The word “**user**” is part of the problem.
- Personas provide a way to keep everyone focused on **what** users really **wanted to do**, *rather than* on all the things they **might do**.
- “Personas” that are made up without data **are not** really personas.
 - ❖ They should be based on **ethnographic user data**.
- Assumptions vs Factoids.
- Requirements should be described from the **personas’ point of view**.

Persona lifecycle (Pruitt and Adlin, 2012)



Personas should include: (Pruitt and Adlin, 2012)

- Photo(s)
- Name
- Age
- Personal details/family life
- Income/spending habits
- Work/job details
- Use environment/artifacts
- Activities/use scenario
- Knowledge/skills/abilities
- Goals/motives/concerns
- Likes/dislikes
- Quotes
- Market size/influence

Personas



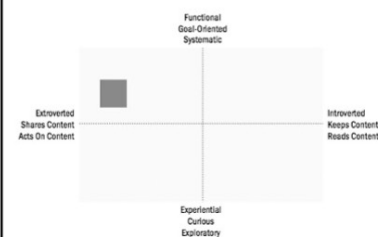
Verb-based persona posters (Pruitt and Adlin, 2012)

PLANNER

Planners have a task in their offline lives to complete, and they're looking for information, tools, and guidance to do it.

DESCRIPTION

Planners come to NYTimes.com with specific goals in mind. They are often in the planning stages of a major event, such as purchasing a home or choosing a travel destination, or they may be planning something as simple as an evening out in New York City. They act on the information they got, and are very task-oriented and systematic in the ways they go about getting it. They are regular users of tools, and their loyalty may be swayed by competitors offering better or more comprehensive versions of what you offer.



Tina
42
New York, NY
Non-Profit Executive



Monica
33
Brooklyn, NY
Freelance Writer



Jonathan
29
Los Angeles, CA
Law Student



Nigel
54
London
Investment Banking Desk

Offline Behavior
Tina makes up to NYC. She enjoys the coverage of the city and the lifestyle forum. She spends a lot of time reading around the city, and likes to visit the New York Times where she has enough room on the subway to spend all the way.

Online Behavior
Tina does a lot online, but right now she's looking to both top and sell a house. That means searching for listings, planning open houses, searching for contractors, designers, and furniture sources, getting inspiration for decorating, and so on. She doesn't really have time for much other right now.

NYTimes.com Behavior
She goes to NYTimes.com and goes straight to the Real Estate section from the Home Page (she goes from there, she's looking for homes that fit within her price range within a group of neighborhoods she's considering. After browsing through a few listings, she checks the prices of similar homes to hers to compare and contrast them.

Offline Behavior
Monica is in and explorer of New York City, and she spends a lot of time visiting Times Square to see it. She is also a little addicted to Craigslist, things on her Time, and New York Magazine.

Online Behavior
She regularly goes large groups of people together, and that means finding a good location and sending out an invite. She searches for places she likes but doesn't know if she'll go for activities that might be fun. She finds Craigslist.com but ends up searching a lot of times then just searching through it.

NYTimes.com Behavior
Monica regularly visits NYTimes.com to fill out her plans, especially when she's on family or visiting. When she goes online on what she might be doing next. She goes to the Theater section to search for reviews she's doing next. She goes to the Theater and Dining sections to find places she wants to try. She's often search for places she wants to go to (she doesn't know if she prefers them mapping and ease of finding places for mapping restaurants.

Offline Behavior
Jonathan spends what little free time he has watching ESPN to take a break from studying about what he's going to do when he finishes school next spring.

NYTimes.com Behavior
He grew up in New Jersey, and he's a sports fan. He's a fan of the sports and local news, the sports the home page and occasionally clicks on articles, but now he mostly goes on every day on his own. If there are any new job listings, he likes the career tools and other resources that are right at the top of the site. He likes to read the coverage on industries, since he thinks he wants to work for a corporation rather than a law firm, and he's noticed the "Find a Resume" feature, which he intends to use when he is confident that he has something good to post.

Offline Behavior
Nigel takes the train from home every morning to go to his office in Central London. He regularly reads The Independent and The Economist on the way there on his iPod. He reads and Sky TV on his main TV destination.

Online Behavior
Nigel and his wife are planning a trip to New York, and possibly exploring New England by car when they are in the U.S. He wants to find out about the city, and he's looking for information on when he has time, and he's looking for information on when he has time, and he's looking for information on when he has time.

NYTimes.com Behavior
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GOALS

- To very easily be able to plan an activity
- To make decisions about something they'll do in their "offline life"
- To get assistance in their planning when they need it
- To search for something in particular
- To get trustworthy guidance and assistance in planning when needed

SUPPORT EXISTING BEHAVIORS

- Planning tools must be easy to find off the homepage, and visually differentiated from top-level news categories
- Maintain usability and value-added UI design of sections (e.g. real estate)
- Highlight unique "New York" features that only you can provide

ENHANCE THE EXPERIENCE

- Create a page that highlights all the "things you can do" on NYTimes.com - find a way to differentiate tools from content
- Invest in the user interface layer for sections like travel or movies where content is commoditized, but users might be enticed to search more often based on the quality of the search experience
- Provide users tools to allow them to easily share, save and organize content
- Give users guidance in the form of editorial recommendations and highlights based on popularity
- Give users a wider range of sources in classifieds to give them more comprehensive data set
- Allow users to receive more "push" content related to their planning activities (e.g. email new articles on specific destinations or new restaurant reviews)
- Provide more guidance in relevant pages by showing them what's hot (and what's not)
- Connect users to the community of NYTimes.com readers who have like interests
- Create relationships with third parties, to enable users to complete their transactions within NYTimes.com

TYPICAL TASKS

- Choosing a destination for an upcoming trip and learning more about what to do once one has been selected
- Browsing new information for inspiration to plan something around (e.g. new restaurants, hot destinations)
- Searching for reviews for specific movies, restaurants or Broadway shows they heard about
- Finding the right activities for an upcoming weekend trip to New York
- Planning a night out with friends and picking the perfect restaurant and bar
- Browsing apartment listings in specific areas to determine affordability and to discover what the neighborhood is like
- Going directly to the job section to look for new job listings in a certain field and particular area
- Looking for recipe and menu ideas for this weekend's summer barbecue

ENCOURAGE MODE SWITCHING

- Cross-link content or tools from related planner categories (such as linking local restaurant information within real estate, or recipe information within travel)
- Find ways to encourage visits to relevant sections - promote reading archived articles

NAVIGATION STYLE

USAGE MODES

USAGE DRIVERS

Headline Surfer

Knowledge Exploring/ Surfer

SECTION SURFER

SEARCHER

Daily Headlines / Click and Chase

Other Editors / Click and Chase

Feed Reader

Exploring

SEARCHING

Browsing

PLANNING

Sharing

NEW YORK CONNECTING

Ramping Up

A Break in the Day

Daily News

TASK MASTERING

Design Map (Pruitt and Adlin, 2012)



Design Map: Megan delivers the presentation

Ivan has already set up the streaming media and 'enabled' the broadcast for Megan.

Megan logs on to the presentation system.

Megan sees the presenter page.

Megan sees that her slides are ready and she does a last-minute flip through.

Megan sees that her slides are ready and she does a last-minute flip through.

Megan sees that audience members are starting to arrive.

Megan communicates with the early arrivals.

Megan decides it's time to start the presentation.

Megan starts her presentation.

...

Scenarios: BDD Steps

Should we let Megan log on if Ivan hasn't set everything up yet?

Megan has already uploaded all of her slides.

The presenter page should reassure her that the streams are started and the preso is good to go.

The presenter page should let her see that Ivan is there already.

What if an audience member tries to connect before Megan, or even before Ivan?

Let's create a way for her to flip through her slides (and change them?) without any audience members seeing this process.

See Design Map: Sam arrives for the presentation.

Can we do this? how do we let Megan communicate with Ivan about any technical issues *and* with early audience members?

Let Megan decide if she simply wants to turn on the Q&A tools early...leave it up to her.

How do we make sure that Ivan 'hands over' control to Megan in time? should Megan be able to do this herself?

Is there some signal we should send to the audience members, like a countdown?

Key:

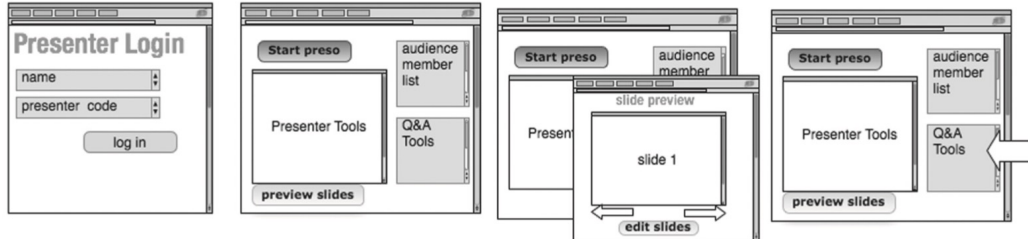
Step

Comment

Question

Idea

See a related Design Map



Persona Stories (Hudson, 2013)



UserX Story (Choma et al., 2016)

UserX Story (template)
As a < Persona >, I need < Feature > for this <interaction>, through < Feedback > / <context>]. I evaluate that my goal is achieved when <feedback>
Acceptance criteria: Checks <action> that <set of conditions> to satisfy <Nielsen's heuristic(s)> of <Feedback> and < Nielsen's heuristic(s)> of feedback.

As <Persona>, **I want** <Feature>, **so that** <Goal>

Meet Alice & Bob

- Alice, 32yo, croupier;
- Does not like poker, do prefer blackjack and roulette;
- Fears to make careless mistake when animating a poker game and to lose her job for such a mistake.



goal: secure her job



- Bob, 28yo, poker player (average plus);
- Plays poker at home with friends, and love to visit Las Vegas;
- Trains a lot on the Internet to prepare for a BIG tournament.

goal: improve his skills

Associated User Stories

- *As **Bob**, I want to enter my hand on the command line so that the game knows the contents of my hand.*
- *As **Alice**, I want to identify cheaters who trick the card deck with extra cards so that I can report cheating attempts to management.*

Scenarios and BDD Stories

Scenarios (Rosson & Carroll, 2012)

- Narrative descriptions of envisioned **usage episodes** (user interaction scenarios): *sketch of use*.
 - ❖ Used in various ways to **guide** the development of the system that will enable these use experiences → *Behaviour-Driven Development* (BDD).
- Consists of:
 - ❖ A setting or situation stage (**context**).
 - ❖ One or more actors (**personas**).
 - ❖ Various tools and objects that the actors encounter and manipulate (**interaction**) to achieve a **goal**.

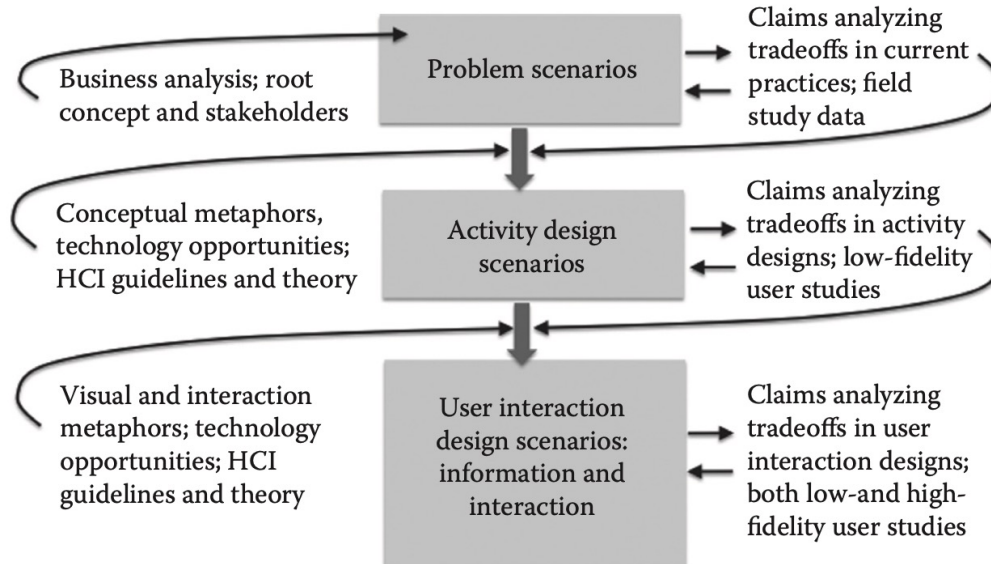
Scenarios (Rosson & Carroll, 2012)

- It describes a sequence of **actions** and **events** that lead to an **outcome**.
- Scenarios help to explore:
 - ❖ Multiple design solutions (avoid “representational bias” in human cognition).
 - ❖ The multiple **interaction paths** that lead to expected system outcomes (i.e., the work that users will try to do when using the system).
- ❖ Scenarios are based on **concrete examples of use** → *Specification by example* (Adzic, 2011) → BDD.
 - ❖ People remember (and understand) concrete examples **far better** than the abstract category to which they belong.

Scenarios (Rosson & Carroll, 2012)

- Scenarios also describe the “**conversation**” (→ *semiotic engineering*) that happens between users and systems.
 - ❖ The designer makes moves (by allowing **user actions**) and then “listens” to the design situation (**system outcome**) to understand their consequences.
- Each scenario serves as a **test case** → BDD.
- Scenario-based processes can produce an unwelcome documentation burden.
 - ❖ What if we make the documentation **executable** (“living documentation”)? → BDD.

Scenario-based design process (Rosson & Carroll, 2012)



Example

A. Online Science Fair in a Web Forum

Sharon's friends Alicia and Delia have submitted projects to the online science fair, and they are counting on her to visit and talk to them while they "host" their exhibits tonight. At 7:30 P.M., she clicks on the URL in the e-mailed announcement to open a web browser on the science fair's home page. She sees a welcome notice and a categorical listing of projects at the fair (biology, forestry, astronomy, etc.). She knows that Alicia's project is on black holes, so she quickly scans the astronomy list to find her project and follows the link. She goes to another web page and admires Alicia's overview poster. She sees a number of links leading to the normal parts of a science project (problem, significance, methods, etc.). She also sees a link named "Talk to Me" and follows this, hoping to get in touch with Alicia. She sees a list of comments about the exhibits, from visitors as well as responses from Alicia. Alicia's most recent response was at 7:29 P.M., so Sharon thinks she may still be online. She posts a message ("Very flashy poster!") and is happy to get an immediate response from Alicia asking what else she has seen at the fair.

Source: Rosson, M. B., & Carroll, J. M. (2009). Scenario based design. In: Human-Computer Interaction: Development Process.

Piece of a User Interaction Scenario for Jerry's Use of the Microblogging Tool

User Interaction Scenario: Jerry Visits a Remote Company Site to Carry Out a Training Session

<Background on Jerry and his upcoming visit, goals and decision to review the posts...>

Jerry starts up the company microblog tool, which by default opens to his own workgroup. He calls up an org chart, pans the map to locate the Seattle lab, then finds Susan's group (her name and group title appear when he hovers over her node with his mouse). When he double-clicks to open her group, all posts from her staff appear, with most recent posts at the top of the list. In the header, he can see summary information, including the number of blogs in the past week, the number of staff who have contributed, and the top five tags that have been active over that time.

Jerry knows he can access subsets of tags by selecting any of the top five but instead decides to first get an overview by asking for a tag cloud.

This causes a secondary display to pop up, showing all tags used by this group. The size of the tag shows its overall use and its shading (more or less saturated) shows how recently it has been used. He can quickly see that several tags related to graphics transformations and data consistency are a recent popular topic, so he decides to begin with these feeds. He can open each subset by double-clicking its tag in the cloud. This helps him to grasp the key issues they have been wrestling with, with plenty of evidence for the frustration they are feeling; he even finds links to code examples he can incorporate into his training talk. Before closing the group, he takes a bit of time to find and browse a few more personal blog sets, including the "fun stuff" and "family news" tags.

<Ending that conveys the benefits of the microblog browsing Jerry has done, including helpfulness of the personal information>

"If a user interaction scenario is evocative, but it is not based on what is known about human cognition, social behavior, and motivation, it may well be inspiring and building the wrong system"

(Carroll et al. 1998)

BDD Story (North, 2006)

Title: (one line describing the story)

Narrative:

User Story {
 As a [persona]
 I want [feature]
 So that [goal]

Acceptance Criteria: (presented as Scenarios)

Scenario [n]: Title

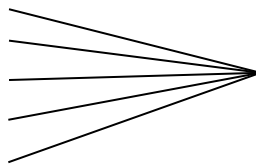
Given [context]

And [some more context]...

When [event]

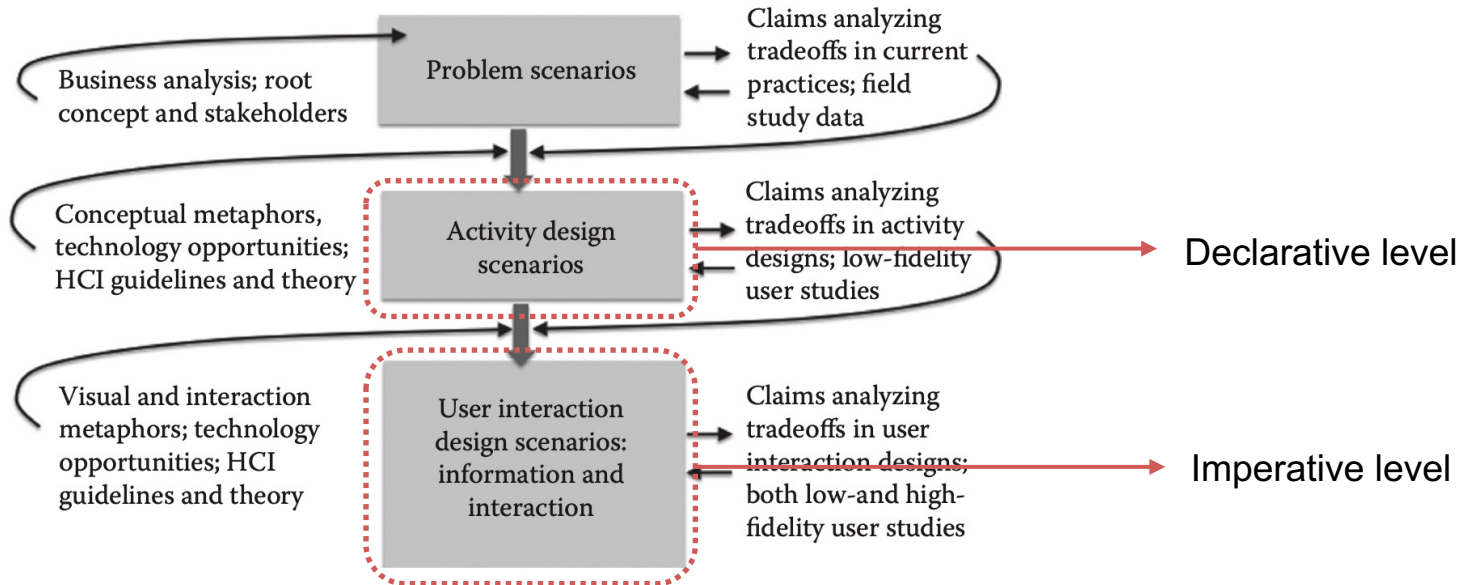
Then [outcome]

And [another outcome]...



Steps

BDD Stories: Abstraction Levels



BDD Stories: Declarative Scenarios

Title: Subscribers see different articles based on their subscription level

Narrative:

As (a subscriber), **I want** to get access to my articles, **so that** I can catch up on the latest news

Scenario: Free subscribers see only the free articles

Given Frieda has a free subscription

When Frieda logs in with her valid credentials

Then she should see a free article

Scenario: Subscriber with a paid subscription can access both free and paid articles

Given Patty has a basic-level paid subscription

When Patty logs in with her valid credentials

Then she should see a free article and a paid article

BDD Stories: Imperative Scenarios

Title: Subscribers see different articles based on their subscription level

Narrative:

As (a subscriber), **I want** to get access to my articles, **so that** I can catch up on the latest news

Scenario: Free subscribers see only the free articles

Given users with a free subscription can access "FreeArticle1" but not "PaidArticle1"

When I type "freeFrieda@example.com" in the email field

And I type "validPassword123" in the password field

And I press the "Submit" button

Then I should see "FreeArticle1" on the home page

And I should not see "PaidArticle1" on the home page

...

BDD Stories: Imperative Scenarios (cont.)

...

Scenario: Subscriber with a paid subscription can access "FreeArticle1" and "PaidArticle1"

Given I am on the login page

When I type "paidPattya@example.com" in the email field

And I type "validPassword123" in the password field

And I press the "Submit" button

Then I should see "FreeArticle1" and "PaidArticle1" on the home page

BDD Stories: Abstraction Levels

- BDD scenarios can specify steps using the domain vocabulary (**declarative scenarios**) or an interaction vocabulary (**imperative scenarios**).
- **Imperative** scenarios (**lower** abstraction level) are useful to go **step-by-step** through the multiple interactions required to perform a given task.
- **Declarative** scenarios (**higher** abstraction level) are more straightforward, wrapping all these interactions up into a single step usually referring to a **domain** concept.

Quality attributes for BDD scenarios (Oliveira et al., 2019)

- Essential
- Focused
- Singular
- Clear
- Complete
- Unique
- Ubiquitous
- Integrous

Conceptual Models

Conceptual Model (Johnson & Henderson, 2012)

*“The user interface is a **projection of some conceptual model**, whether that conceptual model was intended or not and whether it is coherent or not.”*

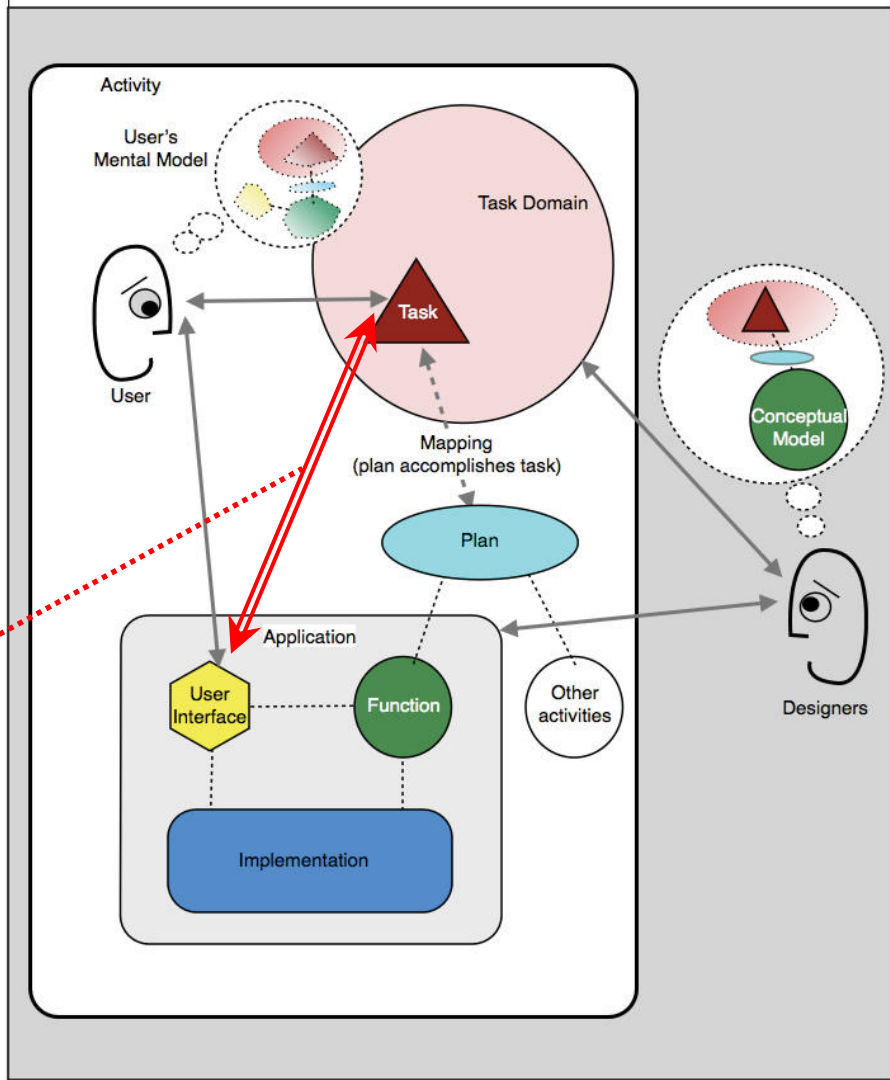
- Ideal **mental model** of the function of the application.
- Designers and users have **different** mental models of the application.
 - ❖ The conceptual model should **bridge** this gap.

Conceptual Model

(Johnson & Henderson, 2012)

Metacommunication
(semiotic engineering)

Cognitively taxing problem-solving task → relates to “the gulf of execution” (Norman & Draper, 1986).



Conceptual Model (Johnson & Henderson, 2012)

- Designers should design new technology to support **how people want to think about doing their tasks**.
 - ❖ The **concepts** users will think about when using the application, and
 - ❖ How those concepts fit together into a **structure** (***structural** representation as opposed to behavioral representation*).
- ❖ Focused on the **users' tasks**, i.e., the **functional** aspects (requirements) of the application.

Conceptual Model (Johnson & Henderson, 2012)

- A conceptual model **is not** an implementation architecture.
 - ❖ It describes only objects **that people must understand** to operate it and operations that they can do with it.
 - ❖ The user interface **should not** expose to users concepts that are not related to the task domain.
- Conceptual models are **independent** of any specific user interface.

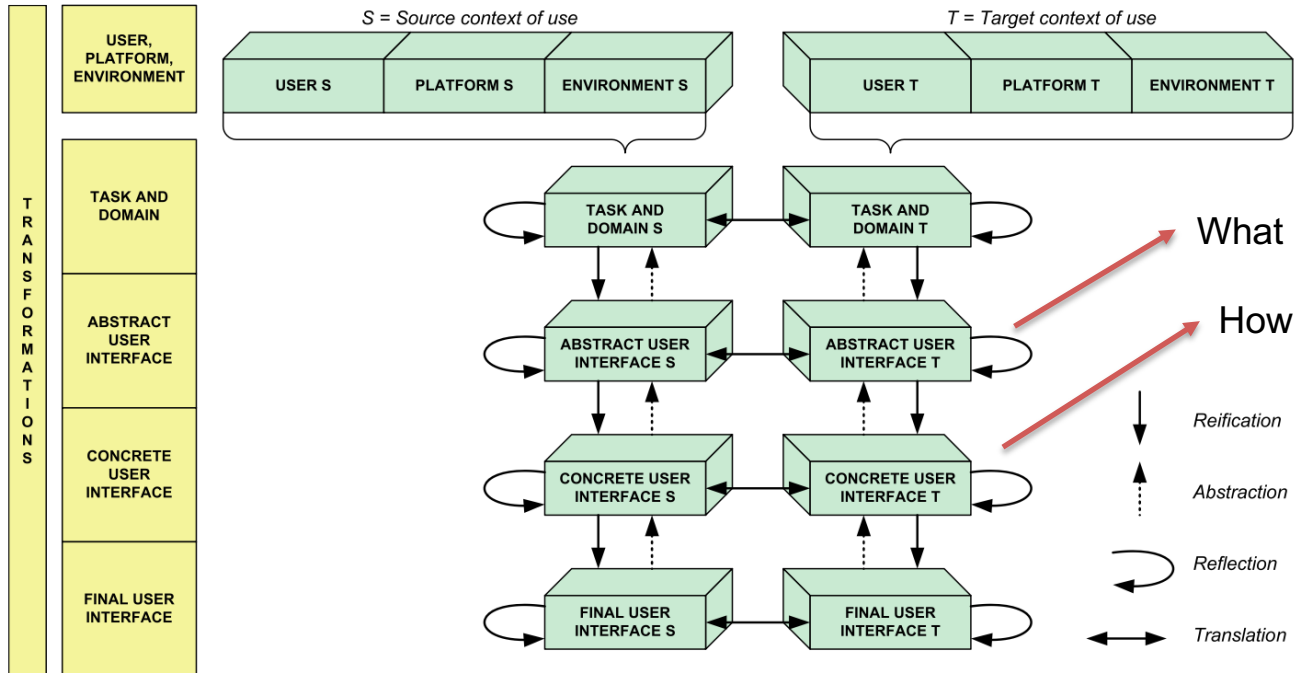
Conceptual Model (Johnson & Henderson, 2012)

- Conceptual models should include the **objects** and their **operations**, **attributes**, and **relationships**.
- These can be represented in multiple ways:
 - ❖ Outline consisting of object-types and sub-types, each with operations and attributes
 - ❖ Table or spreadsheet, with objects in rows and actions and attributes in columns
 - ❖ Computer-interpretable modeling languages such as UML
 - ❖ Object-relationship diagram
 - ❖ Concept map
 - ❖ Ontologies

Conceptual Modelling of Interaction (Aquino et al., 2011)

- Conceptual models **is** (or **can be**) the code.
- The whole system (including the user interface) can be **generated** from conceptual models → *model-driven engineering* (MDE).
 - ❖ This requires **user interface conceptual models**.

Cameleon framework (Calvary et al., 2003)



GUI Prototyping

UI Prototypes (Beaudouin-Lafon & Mackay, 2012)

- A prototype is a **concrete** representation of part or all of an interactive system.
 - ❖ A prototype is a tangible artifact, **not an abstract description** that requires interpretation.
- Prototypes can be focused on a specific part of the UI, but must still present a full-size display and interaction techniques.
- Most successful prototypes **evolve into the final product** and then continue to evolve as new versions of the software are released (**prototypes as design artifacts**).

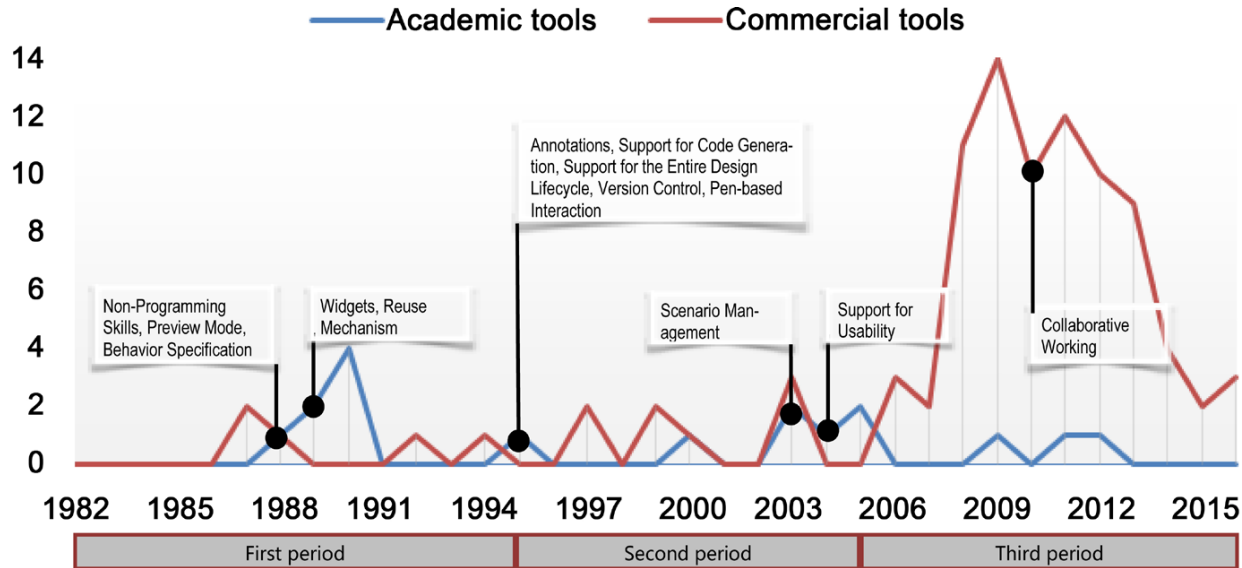
UI Prototypes: Dimensions (Beaudouin-Lafon & Mackay, 2012)

- **Representation:** describes the form of the prototype, such as sets of paper sketches or computer simulations (**offline** and **online** prototypes).
- **Precision:** describes the **level of detail** at which the prototype is to be evaluated, such as informal and rough or highly polished (**low-** and **high-fidelity** prototypes).
- **Interactivity:** describes the extent to which the user can actually **interact with the prototype**, such as “*watch only*” or *fully interactive*.
- **Evolution:** describes the **expected lifecycle of the prototype**, such as *throwaway* or *iterative*.

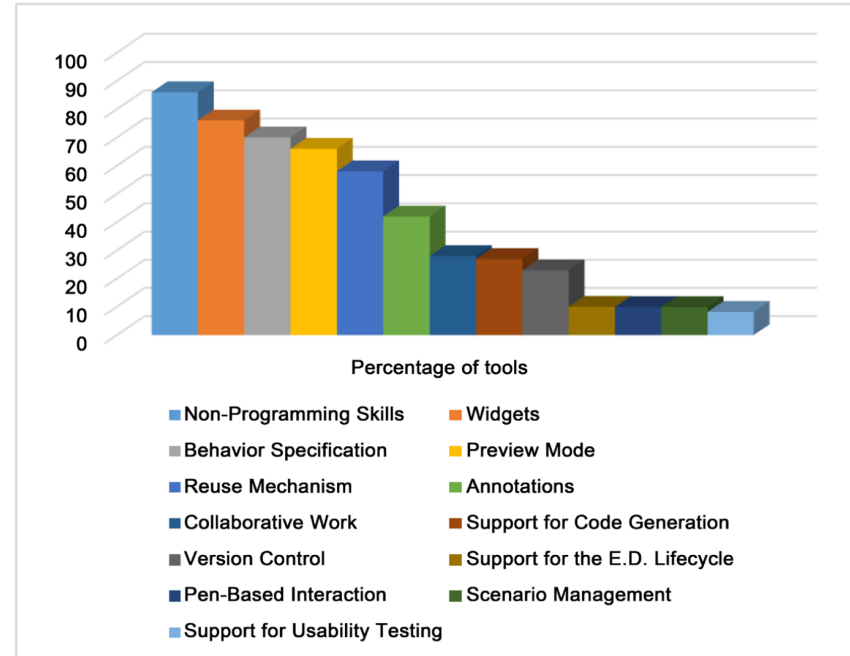
UI Prototypes (Beaudouin-Lafon & Mackay, 2012)

- A prototype is also an **important tool for requirements engineering** as it mediates the communication within the design team as well as with users.
- **Prototyping Strategies:** Horizontal Prototypes, Vertical Prototypes, Task-oriented Prototypes, and Scenario-based Prototypes.
- **Rapid Prototyping:** Paper and Pencil, Mock-Ups, Wizard of Oz, Video Prototyping, Noninteractive and Interactive Simulations, Scripting Languages.
- **Iterative and Evolutionary Prototypes:** UI Toolkits (coding the UI), UI Builders (drag-and-drop features), and UI Development Environments (combining both).

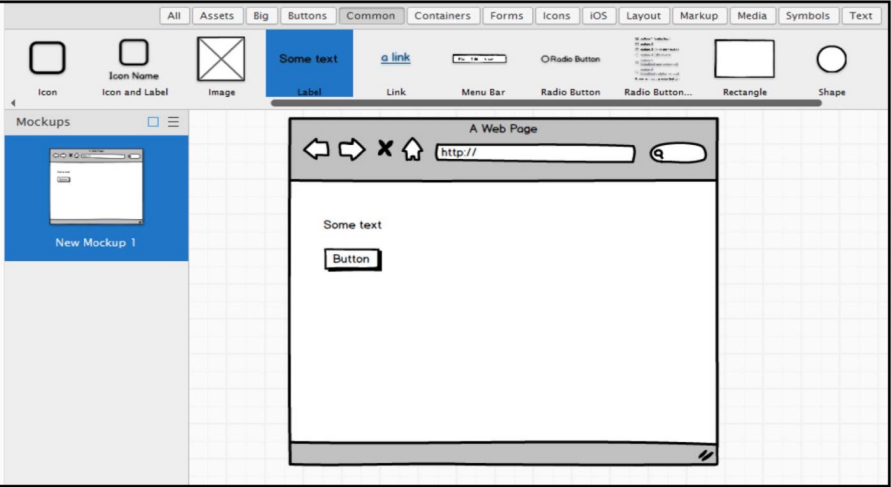
GUI Prototyping Tools (Silva et al., 2017)



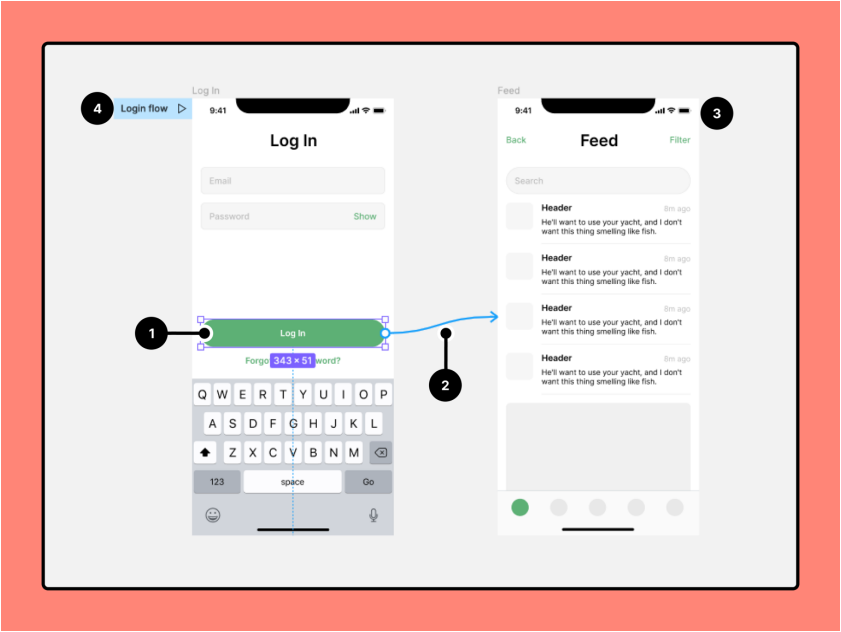
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Balsamiq



Figma



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