4 Nature of UX Design

Syllabus

The nature of UX design, Bottom up versus Top-down Design Generative Design : ideation, sketching, critiquing Prototype candidate design.

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4.1 Nature of UX Design

4.1.1 Introduction

4.1.1.1 Moving across the Gap from Analysis to Design

- We shift our focus from usage research to design in this section of the book. This entails shifting our focus from the current work domain and practise to the desired design domain and practise.
- The move to design is frequently viewed as the most difficult step in the UX lifecycle process, and it should be.
- Another way to put it is that design isn't just a translation exercise; it's not about reproducing workflows from existing work practices using technology assets.
- That would not alleviate any of the current failures, issues, or inefficiencies, but rather would impose more constraints as a result of the new technology. A shift in thinking is required to focus on developing new solutions.
- The transition to design, according to Larry Wood, is a step where magic happens.

4.1.1.2 Universality of Design and Relationship to Other Fields

- Design is a general term that refers to the process of developing products and experiences using various media with the objective of assisting humans in meeting a variety of requirements.
- In many other creative fields, design is the central activity. Fashion is concerned with the design of clothing, which serves to shield humans from the elements on a practical level. But it is about a lot more than that. Colors, fabrics, and shapes are used by fashion designers to create infinitely different fashion experiences.
- Industrial design is likely the most similar to what we do in UX of all the design professions. With the spread of affordable technology in the form of hand - held and wearable gadgets over the last decade, industrial design and user experience have grown inexorably linked.
- A smartphone or smartwatch's user experience is determined not just by the software user interface, but also by the shape, texture, materials, and form factor of the object that "holds" that user interface.
- Regardless of the field, the essential process activities of understanding, designing, prototyping, and evaluating are shared by all of these design attempts. The vocabulary and domain knowledge of each profession may differ, but the end goal is to create products that solve issues and meet human needs.

4.1.1.3 Relationship to Design in Architecture

- Architecture is a field that prioritizes design and serves as a source of inspiration for UX. Architecture is the art of creating environments that support people and their needs, as well as maintain and even glorify life and working. Cities, neighbourhoods, houses, communal spaces, and offices, as well as the infrastructure that connects them, are all considered spaces in this context.
- Great architectural designs may create lively communities and elicit strong emotional responses in addition to providing shelter. When people see the scenario in this image on the sixth floor of Bloomberg's Global Headquarters in New York City, they get a sense of movement and astonishment.
- Visitors to the Bloomberg building describe a high - energy, fast - paced environment. This is due to the fact that every feature in this area was meticulously crafted by architects to evoke a sense of dynamism and interconnectedness.
- As you enter this central atrium, the constant movement of people and digital screens providing the latest financial statistics, weather, and breaking news generate a sense of vitality. The large area and high ceilings, as well as the curving glass encircling an imposing courtyard, give the place a sense of grandeur.

4.1.1.4 Interdisciplinary Nature of Design

- User experience is defined as "the sum of all the impacts perceived by the user from what the user sees, does, hears, and feels, as well as all the behaviours of the artefact during contact and communication between them". Given this diversity, UX design teams are required to include a diverse set of skills and expertise, including :
  - Expertise in problem solving, analysis, and reasoning.
  - Expertise in constraint solving and optimization.
  - Expertise in product development, including estimation, budgeting, and timelines.
  - Subject matter expertise in work domains and design platforms.
  - Design expertise in particular technologies.
  - Expertise in art, culture, liberal arts, and social sciences.

4.1.2 What is Design ?

- Design, what it is, and how to accomplish it have all been researched in a variety of fields. It is possible that it was the first embodied skill of humans, beginning with the transformation of items into tools.

- Design studies have remained relevant over time, as evidenced by a diverse range of ideas, approaches, and concerns. On the design team, a graphic or visual designer could consider design in terms of emotion, joy, and art.
- A usability analyst might consider design from a diagnostic standpoint. Consultants and design firms may examine design from the standpoint of what sells, who pays for it, and how to budget for it.
- Another popular viewpoint is that design is all about form and function.

4.1.2.1 Two Ways the Word "Design" is Used

- Most English dictionaries describe design in two ways: as a verb and as a noun.
- The click wheel of an iPod Classic, for example, is an element that was formed as a result of a creation process. The straightforward relationship between various ways of using the term "design" is shown in Fig. 4.1.1.

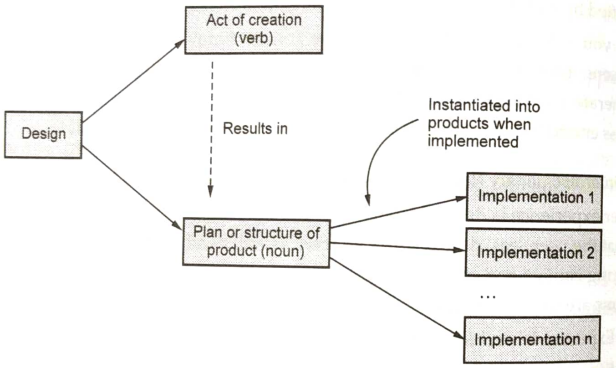

Fig. 4.1.1 Design as noun and design as verb

Design as a noun

- The concept or plan for a product or system is a noun definition of design. It is concerned with the arrangement, composition, or structure of elements to be completed or built. When someone says, "I like this design" or "this design is horrible," they are referring to the product's design concept.
- To expand on this meaning, design as a noun refers to an abstract construct that symbolizes the way a product is envisaged by its designer, as well as a description of the product's plan or structure.

- It is not about a physical manifestation of that construct, such as a tangible thing or system, which could be considered one possible execution of the design. In truth, when instantiation is tried, not all designs are realized.
- When put into effect, some plans are defective or expose themselves to be such. Unexpected limits, unforeseen technical limitations, or other yet - to - be - discovered omissions may cause these plans to be revised.

Design as a verb

- As a verb, design refers to the act of creating something that has never existed before solutions to known issues and solutions in search of problems. Within the entire lifecycle, the Design Solutions box is where designs are developed.
- There are two ways to look at this box :
  - The basic nature of the actions involved.
  - The outputs' growing fidelity with each succeeding round of this activity.
- The design box is a sublifecycle, a microcosm of the wider lifespan, in the first perspective, and it follows the following fundamental activities (top of Fig. 4.1.2) :
  - Considering and synthesising inputs (act of analysis).
  - Ideation to help you come up with design proposals or ideas.
  - Creating sketches to capture these concepts.
  - Examining design suggestions or ideas for tradeoffs and feasibility
- The design box is also a sublifecycle in the second perspective, this time of the expanding scope and fidelity of the designs (noun) developed (Fig. 4.1.4) :
  - Developing thoughts for design features, capabilities, concepts, metaphors, and themes.
  - Taking intriguing ideas and turning them into conceptual designs.
  - In the form of intermediate design, increasing the fidelity and detail of the leading candidates.
  - Creating precise design requirements for the selected candidates, which will be passed on to Software Engineering (SE) responsibilities for implementation.

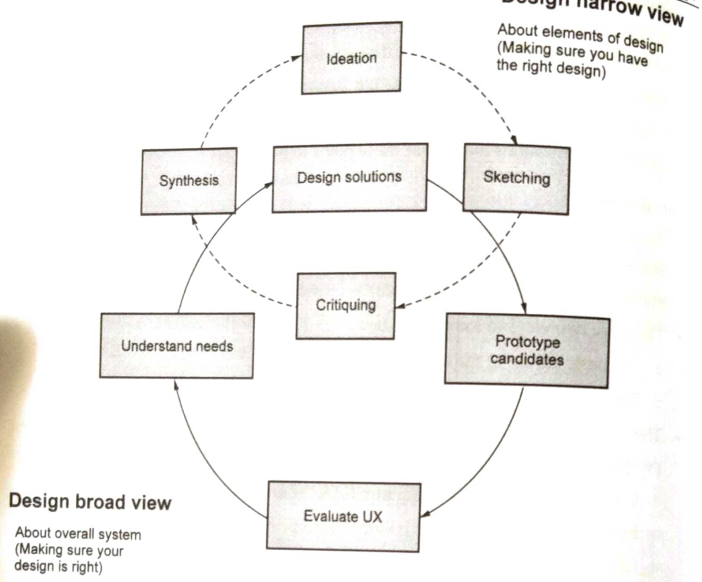

Fig. 4.1.2 Design sublifecycle

4.1.3 Purpose of Design

- Design can be discussed in two contexts as below :
  - The types of human demands that design can meet.
  - The design elements that should be prioritized in order to achieve these requirements.

4.1.3.1 Pyramid of Human Needs

- In the end, the objective of design is to benefit the user in the context of a work practise. Aid, support, capacities, service, and even the delight the system brings to the user are all included. We give a paradigm for thinking about user needs in this section, with the goal of setting the ground for a later discussion about designing for those needs.

- At the very least, a design must satisfy the following three categories of human needs :
  - **Ecological :** Needs to be able to participate and thrive in the ecology of the work domain.
  - **Interaction :** Needs to be able to perform required tasks in the ecology of the work domain.
  - **Emotional :** Needs to be emotionally and culturally satisfied and enriched as they use the product, including the need to be able to form long-term emotional relationships with the product, which we call meaningfulness.
- Designers are frequently forced to consider these categories in that order since they build on one another, as illustrated by the pyramid of human needs in the context of UX design (Fig. 4.1.3). When designers work in one of these layers, they do it from the standpoint of that layer : ecological, interactional, and emotional.
- The basic layer of the pyramid is ecological needs, which must be met before any other sort of need can be met. Similarly, a design cannot meet users' emotional needs without first addressing their ecological and interaction requirements.

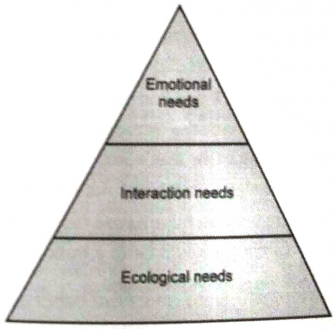

Fig. 4.1.3 Pyramid of human needs

4.1.4 Information, Information Design and Information Architecture

- We can not describe about the nature of design without including information, information architecture, and information design. These ideas are intricately linked and provide overlapping insights from various fields of study.

4.1.4.1 What is Information ?

- There are various definitions, but in the broadest sense, it is anything that informs, as the name indicates. This comprises everything users sense, perceive, comprehend, and act on in the environment from an ecological standpoint.
- The study of information is extraordinarily wide in this respect. We employ a design-specific view of information surrounding the user in this book, and we take a similarly broad view of UX.
- Other, more focused information conversations include, but are not limited to :
  - **Information encoding :** About the symbols that are used to represent data and how they are communicated.
  - **Information detection :** Missing or making a false positive judgement vs identifying the existence or absence of a stimulus in the environment.
  - **Information processing :** Perception, cognition, memory, attention, and behaviours are all studied in relation to how humans perceive stimuli in the environment.

4.1.4.2 Information Science

- Information science is a sibling issue of UX that focuses on "the analysis, gathering, classification, manipulation, storage, retrieval, transportation, dissemination, and protection of information" in the context of design.
- This discipline predates HCI and UX and has the same purpose of assisting people with their requirements, but from the standpoint of information. Some UX specialists believe that everything in the user's surroundings is information in some way or another, and that UX design is therefore primarily about information.
- They even regard architecture to be an information field, in the sense that concerns like how big a corridor or entryway should be in a building constitute information since users perceive and use the space accordingly.

4.1.4.3 Information Architecture

- Information architecture is another subject of study that has its roots in information science and architecture. Richard Saul Wurman, a trained architect who chose to work as a graphic designer, is credited with coining the term "information architecture."
- "The practise of selecting how to arrange the elements of something to be understandable," according to the Information Architecture Institute. Take note of

the emphasis on enabling comprehension, as well as the wide range of contexts in which this might be applied, including nondigital ones.

- The understanding portion of this description encompasses everything a user perceives in an environment or design, including clickable buttons, levers that can be pulled, auditory prompts that can be heard readable displays.
- Information architecture is the design of information structures for organising, storing, retrieving, displaying, modifying, and exchanging data. Design for labelling, searching, and navigating information is also part of information architecture.

4.1.4.4 Pervasive Information Architecture

- Pervasive information architecture is a term used by information architects to describe the organization and design of information that spans many devices that people interact with.
- A pervasive information architecture is a structure for organizing, storing, retrieving, presenting, modifying, and exchanging data that ensures information is always available throughout a vast ecosystem.
- Those considerations are referred to as "ecological design" in our own language.

4.1.4.5 Information Design

- Information design is concerned with how "a system's objects and actions are represented and structured in a way that aids perception and understanding".
- As a result, this is a key area of UX practise, with the goal of assisting users in making sense of the information contained within the system and its ecosystem. Everything from screens, dialogue boxes, symbols, and voice prompts to haptic feedback falls under this category.
- Traditional themes in this area included gestalt psychology, information visualizations and visual metaphors, all of which focused on how humans interpret and make meaning of information.

4.1.5 Iteration in the Design Creation Sublifecycle

- In the overall UX lifecycle, the design creation box unfolds as a series of iterative sublifecycles or activities. Buxton and Sniderman were among the first to discuss iteration in interaction design.
- A succession of those activities is depicted in Fig. 4.1.4.

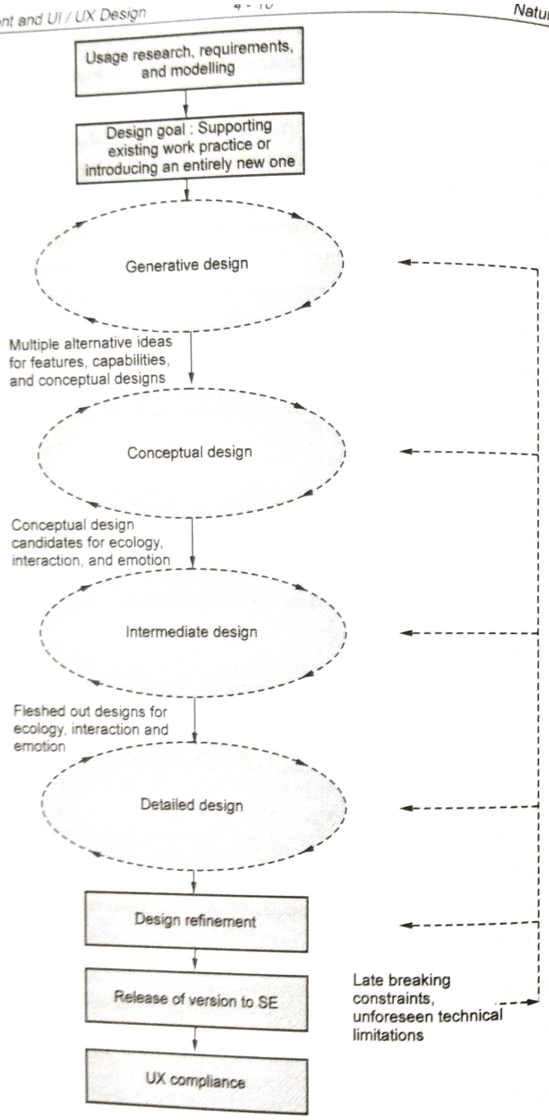

Fig 4.1.4 Lifecycle activities in design

- The ongoing series of repeated loops in Fig. 4.1.4 can be conceived of as a spiral lifecycle notion, as the alert reader will notice. Each loop handles a higher level of depth and fidelity than the one before it.

4.1.5.1 Deciding on the Design Goal

- This step is all about deciding on a goal for all following design iterations. Is the purpose of design to produce a solution that will complement current work practices, or is it to create a solution that will dramatically revolutionize work practices ?

4.1.5.2 Generative Design Iteration

- This stage of the design process focuses on generating as many design ideas and proposals as feasible. The iteration for generative design-a quick, loosely structured process for exploring design ideas-is shown in Fig. 4.1.5. Synthesis, brainstorming, sketching, and critiquing are all part of this activity, which is a mini lifecycle in and of itself.
- Sketches fulfil the job of prototype, while conversation and criticism fulfil the duty of evaluation. For each level of the demands pyramid, generative design produces a set of possibilities for conceptual designs and other capabilities or patterns, mostly in the form of annotated rough sketches or storyboards

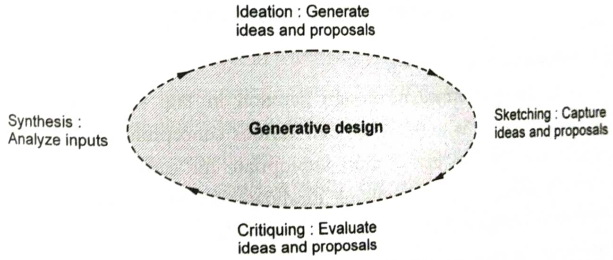

Fig. 4.1.5 Generative design iteration

4.1.5.3 Conceptual Design Iteration

- This iteration entails fleshing out the details of the high-level design theme or metaphor that emerged from the generative design phase for each step of the needs pyramid.
- We depict the early stages of this phase in Fig. 4.1.6, where you iterate on

conceptual design candidates. Storyboards and early wireframes play the role of prototype. Wireframes are essentially stick figure-like sketches of interaction screens comprised of lines, arcs, vertices, text, and minimal images.

- Storyboards may emphasize conceptual designs for one or more layers of the pyramid, depending on the project environment. Users or their representatives, business, software engineering, and marketing are usually highly involved at this stage. You are laying the groundwork for how the system will be designed in the future.
- The sort of evaluation used here is mainly storytelling to key stakeholders via storyboards.

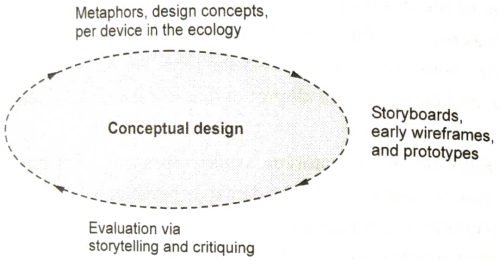

Fig. 4.1.6 Conceptual design iteration

4.1.5.4 Intermediate Design Iteration

- We demonstrate intermediate design iteration in Fig. 4.1.7. The first goal of intermediate design is to select through various conceptual design candidates in order to find the one that is most appropriate for ecological, interaction, and emotional designs. After identifying candidate conceptual ideas, we go on to intermediate design to flesh out the features of each candidate.
- For example, at least two conceptual design choices for the kiosk's interface design were investigated further for the Ticket Kiosk System. One is the typical "drill-in" idea, in which customers are offered a list of available categories and must select one.
- The user is offered further alternatives and details based on the choice made on the initial screen, and can return to the category view by using the back button and/or "bread crumb" trail if necessary.

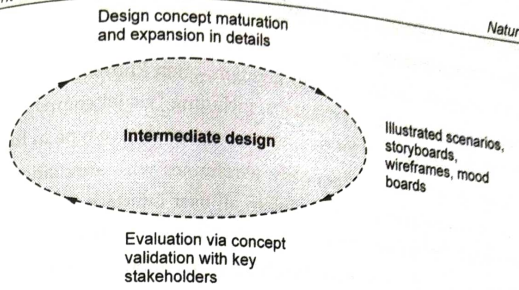

Fig. 4.1.7 Intermediate design iteration

- The most time-consuming part of the design process is intermediate design. The purpose of intermediate design is to flesh out themes for emotional effect, build logical flows of intermediate-level navigational structure and screen designs for interaction, and iron out the intricacies of the envisioned ecology.
- All layout and navigation components are fully developed during this phase. Wireflows, graphical scenarios, click-through mockups, and mood boards all serve as prototypes.
- Key workflows are depicted using wireflows, or sequences of wireframes, which describe what happens when a user interacts with the various user interface items in the design. Click - through prototypes are commonly used to show parts of the workflow or each task sequence in wireframe sets.
- Visual design styles, iconography, tone, typography, animation frameworks, and auditory styles are all fleshed out in the same way.
- Illustrated scenarios, which mix the visual communication capabilities of storyboards and screen sketches with the ability of textual scenarios to communicate specifics, are one of the finest ways to describe sections of your intermediate interaction design in a document.
- The end product is a fantastic tool for sharing and conveying design concepts with the rest of the team, as well as management, marketing, and other stakeholders.
- It's easy to create illustrated scenarios; simply use graphical storyboard frames and/or screen sketches as figures to illustrate the narrative text of a design scenario. Sketches or early wireframes might be used as storyboards in early illustrated scenarios.
- Mood boards, images of sample screens, typographic palettes, and sound libraries are the finest ways to communicate intermediate concepts for emotional impact.

4.1.5.5 Detailed Design Iteration

- Fig. 4.1.8 depicts the detailed design iteration, often known as design production. You finalize screen and layout elements, including "visual comps" of the "skin" for the look and feel appearance for each screen on each device type in the ecology.
- At this level, prototypes are frequently wireframes with annotations and/or high-fidelity interactive mockups. They contain all user interface items and data pieces, which are more detailed and annotated with call - out language.
- A visual designer who has been involved in ideation, drawing, and conceptual design makes visual "comps," which are either comprehensive or composite layouts, as a side project. All user interface elements are represented, and they now have a highly distinct and detailed graphical look and feel.
- A pixel-perfect mockup of the graphical "skin," containing objects, colours, sizes, shapes, fonts, spacing, and position, as well as visual "assets" for user interface elements, is called a visual comp.
- A visual element, as well as all of its defining qualities as specified in style definitions such as cascading style sheets for a website, is referred to as an asset. All of this is cast to be consistent with the company's logo, style guides, and visual design best practices.

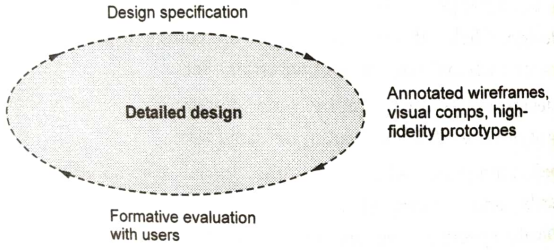

Fig. 4.1.8 Detailed design iteration

- The design will be completely established at this point, including detailed descriptions of behaviour, appearance, and information on how all workflows, exception scenarios, and settings will be handled.

4.1.5.6 Design Refinement Iteration

- The goal of the design refinement iteration is to make changes to the ecological, interaction, and emotional designs based on the results of the formative assessment .

- In practise, assuming the previous iterations were carried out with sufficient review and participation from relevant stakeholders, this phase rarely results in significant modifications. This is the final step of the UX lifecycle before merging into the bigger SE + UX lifecycle .
- The designs are shown to SE developers during this stage to gain comments on feasibility, platform constraints, and other necessary revisions before being officially "handed over" to them in the next phase.

4.1.5.7 SE Implementation

- The SE counterparts begin implementation in this phase. The UX result in the early funnel would be a massive system-level specification. It would be at a feature level in the late funnel.
- In practise, the SE position may discover late - breaking constraints or unforeseen technical limitations, causing the design specifications to be returned to the UX team. UX designers may need to make modifications and return to an earlier iteration stage depending on the severity of the problem.
- For severe system - level concerns, the UX team may need to go back and make revisions to the conceptual design decisions. The most usual alterations at this stage, on the other hand, are at the detailed design level and only necessitate minor changes.

4.1.5.8 UX Compliance Phase

- The UX role evaluates the final implementation after the SE role completes it to ensure that SE faithfully implemented the UX design they were provided during the "hand off."
- The goal of this step is to guarantee that the UX standards are implemented without any misconceptions or misinterpretations. Before distributing to users, any variations from the specification will be identified and fixed during this step.

4.1.6 Design Lifecycle for the Agile UX Funnel

- What role does this sublifecycle of design creation play in the agile UX funnel model? Another variation in the design sublifecycle is iteration in each slice of the agile UX funnel, as shown in Fig. 4.1.9.
- As shown in the diagram, each slice of functionality in the funnel is designed by iterating the procedures in Fig. 4.1.4. Work in the early funnel takes a broad view of the product or system and so has a broad scope.
- This means more time will be spent on the generative design and conceptual design phases, as the decisions made in these iterations will have a significant impact on the funnel's later slices.
- As we get closer to the bottom of the funnel, the focus of generative design and other iterations will shift to smaller slices of functionality, which will be further constrained by prior conceptual design decisions.

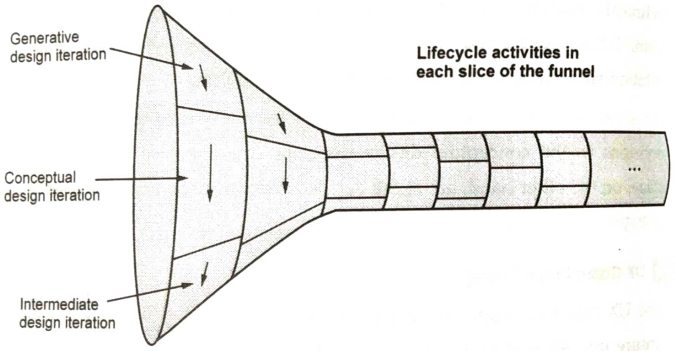

Fig. 4.1.9 Design creation sublifecycle in Agile UX Funnel

4.2 Bottom - up Versus Top - down Design

4.2.1 Introduction

- Bottom up versus top down design stage of the overall UX design lifecycle template is shown in Fig. 4.2.1. There are two distinct approaches to design generation : bottom-up design and top - down design

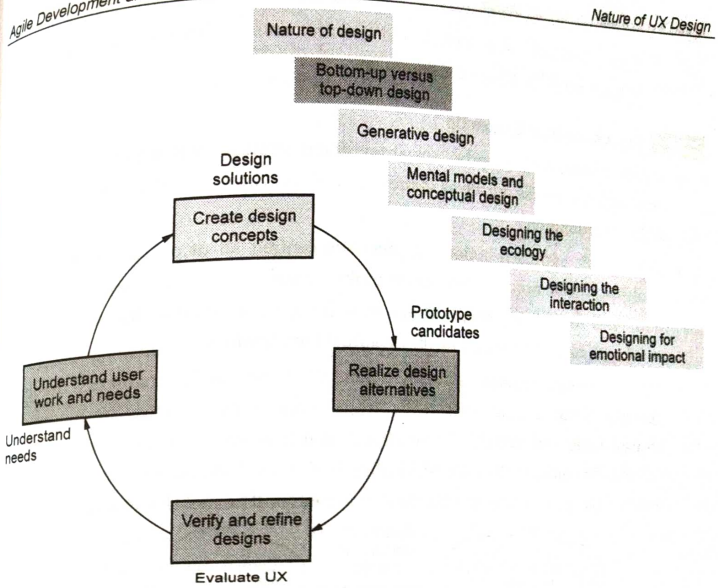

Fig. 4.2.1 UX design lifecycle template

4.2.2 Bottom - up Design

- Bottom - up design is a method of designing that begins with information about the work domain, work practices, and how a product or system is and will be used. The design is then constructed in such a way as to accommodate this well - known usage pattern.

4.2.2.1 Recap of our Process Steps thus Far

- The following steps in the act of UX design are covered :
  - Briefing and start of the project : The client presents the design team with a "issue."
  - Usage research data elicitation Inquire about the users (e.g., work roles), the nature of the job, the artefacts used, the obstacles encountered, and the breakdowns that occurred.
  - Usage research data analysis and modeling : Represent what designers have learnt about today's work environment.

- Usage research user stories and requirements : Extracted actionable user requirements for design consideration.

4.2.2.2 Process so far is Bottom Up

- As the overview of the processes above demonstrates, what we've done so far in this book is immerse ourselves in present work practices with the goal of building a bottom-up solution.
- We call this approach bottom up since we centred all of our investigations and analyses on data acquired from users in their current work practices, excluding any additional insights or inputs. Users were involved to ensure that what we were doing was consistent with how they conduct their business.
- This bottom-up technique is mostly a translation process that involves a number of changes along a path that leads from work activity notes to models, UX requirements, and design. The concept is that if these needs are addressed in the new design solution, the users' difficulties in this work practise will be solved, users will be more productive, and business mandates will be met (Fig. 4.2.2).

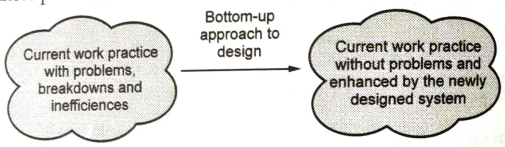

Fig. 4.2.2 Nature of bottom-up approach

4.2.2.3 Human - centered Design or User-centered design : Common names for Bottom - up design

- In the field of human-computer interaction, the words "human-centered design" (HCD) and "User-Centered Design" (UCD) are well - known.
- Norman and Draper invented the term "usercentered design" in 1986. The plain English definition of the word "user-centered design" is that it places the user at the centre of the design process, which is true in some manner for all approaches to UX design. This is a goal that no UX designer would reject. As a result, taking the phrase at face value, it does little to distinguish between approaches.
- However, like with so many other phrases in the subject, the term is given far more significance by various researchers and practitioners.

- To begin with, the HCD/UCD concept is founded on a thorough understanding of user needs, as well as empathy for their aims and aspirations. It is all about tailoring technology to the user rather than the other way around.
- UCD is "a framework of processes in which the needs, wants, and limits of end users of a product, service, or process are given substantial attention at each stage of the design process".
- Many people think of HCD/UCD as a process rather than a user-centered approach. Usage research and UX evaluation/ testing are commonly used to describe UCD.
- This means that the majority of UCD is a bottom-up approach based on current work practices. Despite the fact that the term includes the word "design," there is frequently minimal emphasis on design.

4.2.2.4 Designing for Existing Work Practice is Practical

- The most practical technique is frequently bottom-up design, which involves designing for existing work practices. The introduction of the design solution solely solves problems and removes breakdowns in the existing work practise, so there are no disagreements or friction with stakeholders. There are no major changes or disruptions in the way work is currently done.
- Users and present stakeholders are the experts in that work domain, and they know best how work should be structured, according to the principle underlying this method. With the solution we are presenting, we as designers are merely supporting that broader work framework.
- It is simple to see why there was such a strong push for user-centeredness when HCI was first established. It was necessary to persuade designers to put users and their needs first.
- The danger was that introducing concepts that were not backed up by user data would lead to designers creating solutions that they thought were excellent for users but were not.
- Even skilled designers are influenced by the weight of history and tradition to limit their scope to producing solutions that support existing users and how they function.
- As we move on to the concept of restrictions and biases, remember that it is easier and more practical to simply create something that meets the requirements of the first design brief rather than taking a chance on something boldly different.

4.2.2.5 Role of Biases and Constraints

- A bias in the UX design process occurs when whatever the analyst knows outside the data has an impact on the data, how it is obtained, or how it is seen and analyzed.

Bias and inertia from existing usage and user preferences

- The ceiling is set by looking at current user behaviour and work practices, current revenue, current product, and current organizational biases and ways of doing things while designing for existing work practices.
- Even an experienced designer's enthusiasm for adopting what they believe is a better design can be dampened by client preference bias. Going against such strong preferences also goes against the idea that "you are not the user" and the requirement for empathy for consumers.
- And you will need to convince your entire team, including product managers, developers, and salespeople, why you're going with an idea that goes against what users desire.
- Take the Blackberry smartphone, for example. Blackberry phones were by far the market leaders in smartphones prior to the arrival of the iPhone. Despite the fact that they were never recognized for their ease of use, they became the smartphone of choice.
- The first fully functional smartphone for a working professional, unbreakable security, and physical keyboards all contributed to their rise.
- Apple would have discovered a consistent and nearly unanimous preference for a physical keyboard if they conducted use research and study of current work practices. This desire was so strong that it was widely reported that Blackberry users would never adopt the iPhone, which was largely dismissed as a toy by many.
- It must have required superhuman persuasion skills to persuade Apple's design team, sales, engineering, and top executives that the touch paradigm is the way of the future, despite existing preferences for the familiar !
- It will be extremely difficult for a designer who is used to working in a framework that prioritizes customer and user satisfaction to avoid succumbing to the biases and pressures imposed by usage data and other organizational and cultural trends.

Bias and inertia from market success

- When a product becomes popular and successful in the market, there is a natural urge to stick with what works and tweak the design line incrementally over time. This can lead to design complacency, which can stifle innovation. The demise of Blackberry is a good illustration of established market success acting as a barrier to further design innovation.

- The case of Kodak, the market leader in film photography and the originator of the digital camera, is perhaps the most prominent illustration of this kind of prejudice. Film photography was a less flexible and expensive work practise than the later digital work practise, which provided instantaneous feedback and the ability to rectify any faults right away.
- However, because of their market success, Kodak's bias and inertia prevented them from embracing the new digital technology. They could not bring themselves to put their thriving business of selling film, paper, and other film photography supplies, which had been their bread and butter for over a century, at jeopardy.
- As a result, they missed out on an incredible future. Regrettably, the rest is history. In today's photography market, Kodak is largely irrelevant.

Effects from advances in technology

- Existing work practices are frequently constrained by the capabilities of yesterday's technology. Technological advancements can offer up a whole new universe of application possibilities in the workplace.
- Solid-state battery technology is only now becoming a stable power source, and it is beginning to overturn traditional fuel sources in a wide range of devices, including lawn mowers, snow blowers, recreation vehicles, and automobiles, at the time of this writing. However, compared to the common internal combustion engines, they are more expensive and difficult to fix.
- Incremental advancements in current technology can reach the critical mass required to make a product concept viable, practicable, and profitable. The iPhone and iPod were not the first efforts at such devices, but they debuted at a time when technological developments favoured better touchscreen dependability, device size and weight reduction, improved battery life, and considerably expanded storage capacity.

4.2.3 Abstract Work Activities

- The problem must be tackle differently, from the top down, to produce a new design that accomplishes more than just improve an existing work practice. To grasp this, we must first examine the nature of labour and work practise. Top-down design is based on the concept of an abstract labour activity.

4.2.3.1 Nature of Work and Work Practice

- The term "work practise" has two meanings :
  - The nature of what needs to be done.
  - How it gets done.

- *Nature of what needs to be done*
  - This is the problem, the work's essence. It is a distillation and abstraction of the reason for the existence of the work practise. It includes the practice's ultimate purpose.
- *How this work gets done ?*
  - Tradition, history, legislation, limits, accessible tools, corporate goals, culture, people, and evolution all influence the solution, which is a question of process and protocol.
  - The essence of labour may be comparable in two distinct workplaces, yet each has its own set of working practices. To further explain this distinction, we present the concept of an abstract work activity.

4.2.3.2 Abstract Work Activity

- An abstract work activity is a statement of a work activity's underlying essence in a certain subject, stripped down to its essentials. It is the essence of work in that domain, involving only the primary work functions, with the simplest description possible, free of biases and limits imposed by historical, business, political, or other factors.
- It's about the work, not the way it's done-what the work is, not how it's done. The abstract perspective of voting, for example, is that it is simply a matter of individuals choosing between candidates.

4.2.3.3 Work Activity Instances

- A generic work activity can be translated into a variety of work practices. Each is a solution to the abstract problem of work activity, a method of carrying out the task. It is the manner in which that work is carried out in a specific situation.
- A work activity instance is more precise and specific, encompassing all job duties, which we strive to capture in the complex and even overlapping models we create throughout our user research phase.

4.2.3.4 Importance to Start Top - down Design with Abstract Work Activities

- Abstract work activities are a good method to get started with top - down design since they :
  - *Give you a better knowledge of what you are doing*
    - Abstract work activity descriptions aid understanding of the work domain at a level that is free of constraints and biases. The process of characterizing an abstract labour activity gets to to the heart of the matter (Fig. 4.2.3).

  - *Identifying potential design targets*
    - In most cases, a bottom-up design approach will result in a design aim that supports current work practices. Top-down design will almost always result in design aims that have the ability to drastically alter work practices (Fig. 4.2.4).

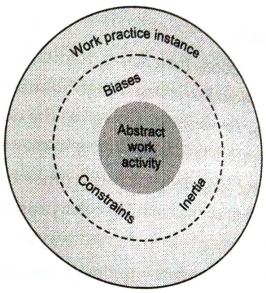

Fig. 4.2.3 Abstract work activity

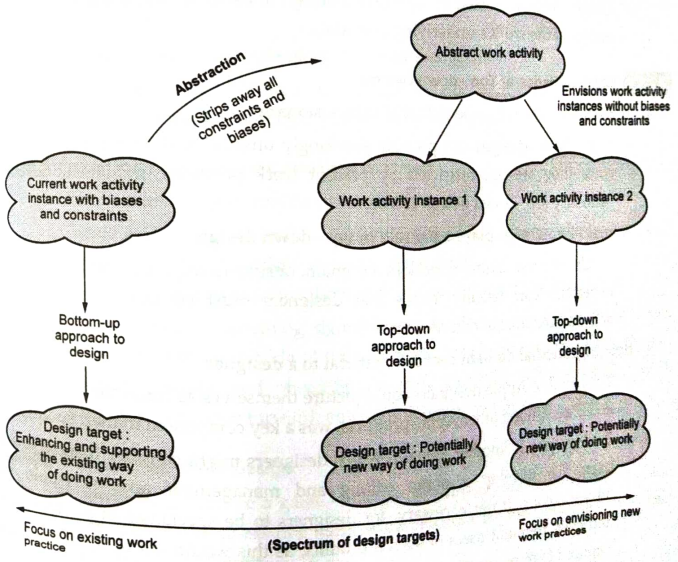

Fig. 4.2.4 Different design targets

4.2.4 Top - down Design

- In a top-down UX design method, you start with abstract descriptions of work activities that are stripped of knowledge about current work practise and work toward the best design solution regardless of current viewpoints or prejudices.

4.2.4.1 Top - down Design Goal

- Regardless of present practices, preferences, traditions, or limits, the purpose of top-down UX design is to provide the best design solution that enhances and supports the core nature of work. The designer, as well as the designer's knowledge, abilities, experience, and intuition, are the major drivers in the top-down approach to design.
- User/work/usage/domain knowledge, on the other hand, may and is utilized to inspire design creation, but it does not drive the process. Usage study is required in both techniques, but it is carried out in distinct ways :
  - Usage research is used in bottom - up design to assess and model existing work practices in order to improve them.
  - Usage research is used in top - down design to establish and grasp the abstract notion of the work's underlying essentials.

4.2.4.2 Characteristics of Top - down Design

- Top - down design has the potential to be visionary
  - Top - down designs can provide shockingly unusual and even futuristic ideas since they are not restricted by present work practices, demonstrating how visionary top - down design can be.
- **Domain knowledge plays a big role in top - down design**
  - To abstract the nature of work in a domain, designers require significant domain expertise. This usually means that designers must consider multiple work activity scenarios in that domain.
- **Being a potential domain user is beneficial to a designer**
  - The fact that Apple designers could picture themselves as consumers of the iPod and iPad, among other Apple products, was a key component in their success.
  - Photography is another arena in which designers might consider themselves as users. To develop a photo editing and management app, it would be advantageous, if not necessary, for designers to be specialists in photography and even frequent users of such a product, as this would aid in the immersion required to think creatively about the challenge.

4.2.4.3 Top - down Design is not Always Practical

- Constraints, customs, regulations, history, and traditions, can, nevertheless, be too tough to overcome in practise at times. They could even be mandated by law.
- ***Business constraints may take priority***
  - As an example of business "constraints," all parties who profit from the current system, such as voting booth vendors, electronic voting machine makers, and possibly even candidates on the ballot, will oppose any new ideas.
- ***Can be incompatible with human comfort derived from familiarity***
  - Humans aren't naturally receptive to radical change. It disturbs and unsettles established habits and practices. Harmony and consistency are preferred by our evolutionary nature above change and disruption.
- ***Can work against short - term objectives***
  - Designing for the abstract work activity frequently causes disturbance due to the upheaval of work practise. It may be more costly and take longer to implement. This goes in the face of the persistent push for shorter - term returns and a reluctance to take on longer projects, which has become a business ethos in recent years.
- ***Constraints imposed by technology can limit innovation***
  - Occasionally, the required technology is not quite ready. The available technology must be thoroughly investigated by UX designers.

4.2.4.4 Easing the Transition for Customers and Users

- ***Take it slow and easy to avoid any potential trauma***
  - Clients and users who value stability and naturally oppose change may find redesigning work practices stressful. As a result, you may find yourself in a position where you must justify your intentions to all stakeholders.
  - You're changing something significant in the lives of your clients and users, forcing them to go outside of their comfort zones in a way that can be chaotic, disruptive, costly, and off-putting to staff. Carefully and respectfully tread. Before you can move forward, you must first acquire buy - in.

4.2.4.5 Extreme Top - down Design

- Top-down design can be a game - changer in terms of innovation. Because of the possible disturbance to existing users' work practices, the top-down method entails a significant risk of failure.

- When a design arrives at the right time and in the right place, and the benefits of going through the upheaval outweigh the discomfort of change, it becomes a disruptive idea that propels the status quo to the next level of innovation.
- As a result, top-down design can sometimes produce an inventive next-generation product (e.g., the iPod) while bottom-up design would have solved problems that consumers aren't even aware of. To put it another way, a good bottom-up design fills a niche, but a good top-down design can create one.

4.3 Generative Design

4.3.1 Introduction

- Generative design stage of the overall UX design lifecycle template is shown in Fig. 4.3.1. Generative design stage is also known as design creation.
- We'll go over design creation processes, approaches, and strategies in this chapter. The main goal of design creation is to devise a strategy for structuring the system to meet users' ecological, interaction, and emotional needs.
- Design is a less systematic and more artistic endeavour than the usage research. While usage research was about observing and understanding things as they are, design is about thinking outside the box and coming up with fresh ways to improve things.

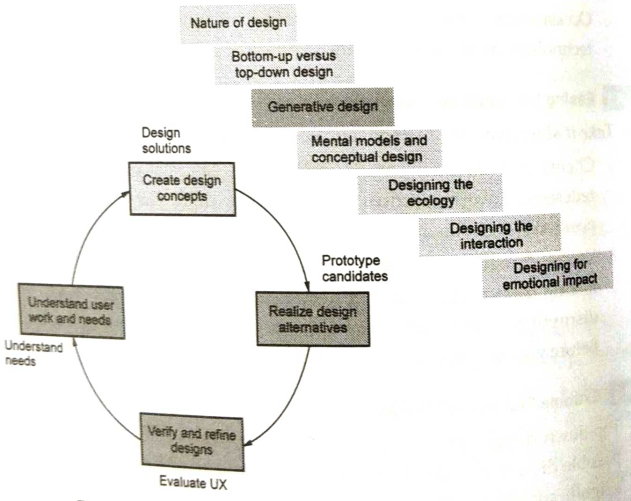

Fig. 4.3.1 Generative design stage - UX design lifecycle template

4.3.1.1 Preparing for Design Creation : Immersion

- Designers, like usage researchers, require immersion-a type of deep thought and analysis to comprehend a topic and draw connections between its various parts.
- Immerse yourself in a design-support milieu, a "battle room" of working artefacts as inputs and inspiration to ideation, to set the atmosphere for ideation.
- Get everything out in front of you so you can point to it, debate it, and analyse it. Artifacts, representations of ideas, photos, props, toys, notes, posters, sketches, schematics, mood boards, and images of other good designs should all be displayed on your walls, shelves, and work tables.
- Immersion begins with a review of all of the models and design inputs we developed throughout usage research. Participating in activities aimed at producing new ideas and concepts requires it.
- The UX studio is now very spectacular. Your immersive environment can be housed in the UX studio. The diverse artifacts spark thoughts and reveal links and interactions between various things in the work area.
- Walking up to the right model on the studio walls can quickly answer any questions designers may have regarding the work domain. The environment of a design studio automatically puts you in a creative mindset.

4.3.1.2 Role of Synthesis

- At its most basic level, design is a synthesis-based approach to problem solving that entails combining disparate inputs and insights, satisfying a variety of technical, business, and cultural constraints, achieving a variety of stakeholder goals, managing tradeoffs, and so on to produce a single unified design.
- It's all about combining known or current ideas in novel ways to create new notions. While analytic methods can be used to improve current designs, synthesis is required to create completely new concepts. "The epitome of the breakthrough idea, the ability to bring together disparate ideas and arrive at something new and meaningful," according to design synthesis.

4.3.1.3 Overview of Generative Design

- Designers use generative design, a technique to design creation that involves brainstorming, drawing, and criticising in a tightly tied, but not necessarily structured, iterative loop for exploring a design idea, after immersing themselves in usage data and synthesizing other design inputs (Fig. 4.3.2).

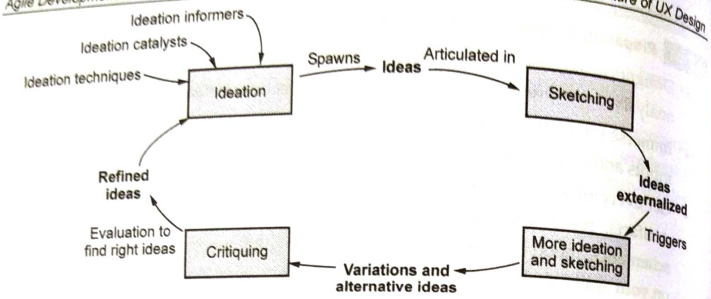

Fig. 4.3.2 Exploring design ideas

- The following are some examples of generative design activities :
  - **Ideation :** The process of generating new ideas. A cognitive strategy for generating a wide range of creative design options .
  - **Sketching :** An activity that captures those ideas in physical representations through externalization.
  - **Critiquing :** An activity for analyzing emergent design ideas for tradeoffs.
  - **Refining :** An activity in which ideas are adopted, modified, or discarded.
- When people think of ideation, they also think of "brainstorming," which is another word for the ideation, sketching, and critiquing processes.
- Even though we separate these actions for clarity, they are intimately linked and occur as a rapid iteration of tightly related and overlapping processes, which are frequently fundamentally executed at the same time. Each of these activities complements and enhances the others.
- Sketching, for example, is a quick and easy technique to capture an idea, which might spark new ones. A sketch provides a tangible reference point for discussion. Similarly, the birth of an idea is frequently followed by a burst of reasoning or analysis.

4.3.2 Ideation

4.3.2.1 Creative Role of Ideation in Design

- Ideation is the most significant generative part of design; it is at the forefront of the creative process. Ideation is the process of coming up with new and different ideas for ecological, interaction, and emotional designs. This is a very creative and enjoyable stage.

- Because it introduces a variety of perspectives to the design team, it aids in ideation. Only ideas, concepts, and constructions from that background and experience will be brought to the table if only team members with similar experiences participate in brainstorming.
- Ideation is also the moment to enlist the help of clients and users. In the past, there have been a number of participatory design plans to actively involve all stakeholders in order to obtain the largest variety of design concepts and ensure that all demands are met.

4.3.2.2 Ideas : The Building Blocks of Design

- An idea is a visualized design concept in this context, and it can include ideas of new ecologies, interactions, emotional responses, and capabilities in a system or product.
- Ideas are generated by the human mind or derived from natural observations, and they are sparked by focused action or unanticipated catalysts.
- Looking at a breakdown in a flow model, for example, can spark ideas about how to avoid or reduce it. Similarly, in the design studio, looking at an inspiring image or item can spark a fresh concept about colours or graphics for a product's visual design.
- Ideas sometimes appear as "eureka moments," appearing in unexpected locations and at unexpected times. They can even happen when we aren't looking for them.
- Ideas, regardless of where they come from, are delicate by nature and must be nurtured in order to thrive. They must be caught as soon as possible or they will be lost forever. They must also be nurtured. Ideas can be stifled by early judgement in the absence of an open atmosphere or culture.
- A single design concept can be created by combining ideas. A touch-sensitive circular ring, for example, is a good idea. Another concept is to use the ring to scroll through a list of items. These two concepts were turned into an iPod Classic design feature. Finally, some concepts can be repeated in a variety of settings; these ideas are referred to as design patterns.

4.3.2.3 Ideation Scope

- Ideation is frequently broad in scope in the early stages of the agile UX funnel because the goal is to generate the overall conceptual designs for the entire system. Ideation can be localized in the funnel's latter stages to focus on the concepts for a specific sprint.

- During these later sprints, the constraints of the broader conceptual design and what was provided in previous sprints frequently limit the scope of ideas.

4.3.2.4 Ideation Informers, Catalysts and Techniques

- Ideation informers, catalysts, and procedures are the three types of inputs (Fig. 4.3.2).
- *Ideation informers*
  - Ideation informers are those who can help you come up with new ideas. Ideation informers are part of immersion and give information regarding usage, requirements, targets, and goals. Ideation informers aren't like building bricks in that you can't merely put them together to create a design. Rather, they inform by referring to design-oriented features to consider or take into consideration in the design, such as task descriptions or user personas.
  - Ideation informers are typically derived as a process step from usage research data and manifest as usage data models and, in some cases, an affinity diagram of work activity notes.
- *Ideation catalysts*
  - Ideation catalysts, on the other hand, are design inspirers, or design-oriented sparks that inspire innovative design solutions. In general, a catalyst is something that causes an event or change to occur without being impacted or modified.
  - An ideation catalyst is not something a designer can control; it just happens, and it can lead to a new design concept.
- *Ideation techniques*
  - An ideation techniques, on the other hand, is something a designer can do to encourage the spawning or fostering of a design concept. Ideation strategies include brainstorming, framing, and narrative.

4.3.2.5 Doing Ideation

- As a group exercise, brainstorming. Although designers can execute ideation on their own, it is more effective when done in a group with individuals from various backgrounds. When doing an ideation exercise as a group, it is typical to start with an overview talk to establish context and parameters, as well as consensus on the exercise's aims.
- Ideation mechanics. The goal is to have a lot of quick encounters in order to spawn

and collect a lot of suggestions about traits and features. On flip charts, write ideas on a whiteboard or use marking markers. Alternatively, write your ideas on sheets of paper and move them around to organize them.

- Begin with the brainstorming. The visual nature of the social, flow, artefact, and physical models makes them great for educating and inspiring design. Before going on to the next model, we recommend that you structure part of your brainstorming sessions around each of these models by making each one the focus point of design thinking and ideation.
- Then you can move on to brainstorming techniques. Consider what the design might seem like if you had a magic wand at your disposal. Examine the abstract labour activity to observe what kinds of concepts it generates.
- While "living the part of the user," use teamwork and bounce ideas off one other. As your team weaves a fabric of fresh ideas for design solutions, talk in scenarios, keeping customers and users in the midst and relating tales about their experiences.
- Make your ideation's outcomes as visible and tangible as possible. An outline should be interspersed with sketches, sketches, and more sketches. As your visual working context, post and display everything all over the room.
- Build physical mockups as embodied sketches where applicable. Other systems, conceptual concepts, concerns, design elements, marketing ideas, and experience goals can all be included. Put all of your crazy, brilliant, and out-of-the-box ideas on the table. There should be a combination of verbal and visual elements in the flow.
- The group can switch to critiquing mode when the well of new ideas appears to have run dry for the time being.

4.3.2.6 Ideation Informers

- Ideation informers are design inputs that help establish designs that are suited for the work environment. They include all of the user personas and usage study data models.

User work roles

- User work roles are a means to identify the types of users and work that the design should enable, as well as a way to segment the broader ecology into subsystems. The ticket buyer and event organizer work roles, for example, assist designers in considering two distinct designs and capabilities.
- Because the work that these two professions do is nearly identical, the designs for these roles will be as well. This indicates the necessity to construct two subsystems,

each with its own interaction design and emotional impact, but sharing the same general ecology.

Personas

- Personas function best to channel the process of creation toward supporting a particular archetype of a work role in the work domain. The inputs that designers must deal with without personas can be daunting, and they are sometimes competing or contradicting.
- Where personas are most effective - in design settings when the work domain is vast and unrestricted, personas work best. In such cases, using personas to create commercial products or systems can help account for the intricacies and activities in the personal lives of diverse professional roles.
- In such systems, personas provide inferences that go beyond what is explicit in the raw data to reach a conclusion. Mary, for example, is a highly busy 35 - year - old soccer mom who juggles three children, a family, and a work.
- You know right away that a design solution for a calendar management tool, for example, cannot compel her to sit in front of a computer for long periods of time.
- Because she is already overworked in terms of time management, the solution must incorporate mobile components and various types of warnings, as she is at risk of forgetting crucial calendar events and duties.
- Designing using personas has a number of objectives. As we will see, designers often come up with multiple user personas for a given job. The goal of designing for these numerous personas is to keep the primary persona happy while avoiding making any of the other personas dissatisfied. Buster will adore it, and the rest of the family will enjoy it as well. Because personas describe users' personal traits and preferences, they also provide emotional input.
- Personas can also be used to see if the design is appropriate for the intended audience. As we build designs, it's a solid means of levelling things out. It's a technique to keep track of how design plans are progressing.
- Designing using personalities. Begin by designing as if Rachel, your primary persona, is the only one who will utilize it. Members of the team share anecdotes about how Rachel would manage certain usage scenarios. Rachel becomes more real and helpful as a medium for transmitting requirements as more of her experiences are revealed.

- Assume that we have picked persona P3 as the primary persona out of four potential personas in Fig. 4.3.3. Design (P3) will function perfectly for P3 because it is a design that is exclusive to P3. Now we must make changes to Design (P3) in order for it to meet the requirements of P1.
- Then we tweak it to meet the needs of P2 and P4. The nonprimary personas will be accounted for via Design (P1), Design (P2), and Design (P4) as you converge on the final design, but will defer to the primary persona, Design (P3), in the event of conflict. If a design tradeoff exists, you will resolve it in favour of the major persona while still making it work for the other personas.

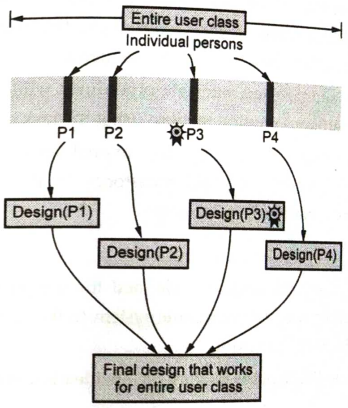

Fig. 4.3.3 Adjusting a design for the primary persona

Flow models and physical models

- Flow models and, in some situations, physical models might help you imagine a new ecology for your work practise. Look for ways to remove flows, responsibilities, and redundant data entry using them as a reference. Look for ways to make such flows more efficient and avoid ecological breakdowns and limitations if they can not be avoided.

Activity - based interaction and design

- An activity is one or more task thread, a set or maybe sequences of numerous overlapping tasks that go together in a fashion that is experienced in real-world usage. It might be a collection of linked actions completed on a single device or interaction between devices in the user's ecosystem.

- For ideas on how to support workflows that span several devices in the ecology, look at activity - based interaction. Look for interface design concepts for each device in the ecosystem.
- What is the ideal way for a user to "access" event tickets, for example ? Is it necessary to engage with real tickets, or may the user acquire them on their phones in any way ? What are the options for paying for the tickets for the buyer ?

Task structure and sequence models

- Look over these models for interaction design flow ideas. What are the various methods for supporting the various tasks in a sequence model ? How should the design accommodate a sequence break ? What are the most effective interaction design patterns for each of these models' task sequences ?
- Look for ways to minimize and automate procedures while eliminating repetitive data entry and superfluous physical motions using the task interaction models.
- These models can also point to issues with emotional design. Consider gamification and positive reinforcement with task milestones in the interaction design for repetitive and monotonous tasks, for example.

Artifact model

- Examine the artifacts in the artefact model and the design specifications. Identify metaphors that can be used to connect the system to the items that people see and utilize on a daily basis in their work.
- They can be a wonderful place to start for an ideation session if you ask them questions like :
  - How can we make the process of placing an order in a restaurant more enjoyable, engaging, and informative for the customer? Wouldn't it be great if each dining table had an interactive touch screen built in? Diners can also look through the menu and read the new chef's bio. Users could also kill time by playing video games or browsing the internet.
  - This interactive table feature can also assist in resolving a significant issue with food ordering : Text descriptions on a paper menu do not accurately describe the dining experience. Paper menus fail to capitalize on the potential for a strong human sensory relationship to food ! Why not use an interactive tabletop to allow customers to ask inquiries about ingredients and see photographs of the food being served ? Then it is just a matter of allowing clients to place their own orders.

Information architecture model

- An information object is a piece of data or information that is maintained internally and serves as a work item. It can be structured or unstructured.
- Information objects are data items that are often fundamental to user-operated work flows; they are structured, shared, labelled, traversed, searched and browsed for, accessed and displayed, edited and manipulated, and stored back into a system ecosystem.
- Look for all the information objects that need to be controlled in the design in your existing work practise. People in diverse labour roles access and alter these information objects as they move around the envisioned ecology.
- Employee work history forms and other objects such as paychecks that are created, changed, and processed by users are examples of information objects in an enterprise human resources application.
- Look for suggestions on how to organize the design's numerous information components (i.e., ideas for the information architecture of the objects). Consider the operations or manipulations that will be carried out.
- What are the various points in the ecology where a particular information object is accessed ? What features of the thing will be preserved in each of the ecology's devices ? This is where you begin describing it and putting out the ecology's information structure. This is known as pervasive information architecture, and it ensures that information is always available across devices, users, and other elements of a larger ecosystem.

Social models

- Seek out suggestions to assist with emotional needs. What are some of your worries and challenges with the work environment's culture and inter-actor influences ? Consider how you can mitigate them in the design. Look for work activity notes regarding spots in the work practice that are drudgery in your user research data so you may come up with fun strategies to combat these feelings. Make design scenarios, sketches, and storyboarding with these issues as a springboard. Increase communication, reinforce positive values, address concerns of people in work roles, and accommodate influences using the social model as a guide.

4.3.2.7 Ideation Catalysts

- Ideation catalysts are natural occurrences that encourage the generation of new ideas. An ideation trigger isn't anything a designer can consciously plan for or execute, but rather something that emerges unexpectedly, such as from brainstorming or storytelling. A catalyst can ignite a spark of inspiration that leads to a "eureka moment," allowing ideation to become more powerful and fruitful. Outstanding inventors like Thomas Edison and great thinkers like Albert Einstein relied heavily on ideation triggers.

The eureka moment

- When designers work, no matter what process they follow or type of thinking they employ, they inevitably face the moment of invention. This is the point at which no theory, guideline, example, or best practice statement can tell the designer or design team exactly what to do. This is the point at which a new design idea is born, something that did not exist previously. A design catalyst aids in the genesis of an idea by facilitating the moment of invention.
- Sometimes ideas come to you on their own or with the help of a "muse," a creative force that inspires or guides you. It certainly requires insight, instinct, intuition, and a natural capacity to think beyond the box and identify "it," which designer can develop.
- Something sparks a moment and a design idea arises when it happens. For example, Archimedes' idea of how to measure the volume of an irregular solid is said to have come to him while he was sitting in a bath tub.

4.3.2.8 Ideation Techniques

- Ideation techniques are skill-based UX approaches that UX designers can use to help in ideation, sketching, and critiquing while also fostering new design concepts. The more general UX design strategies when applied to ideation are referred to as ideation techniques.

Framing and reframing

- Framing and reframing is a design technique that involves posing the design challenge along a certain dimension in order to stimulate previously unconsidered tradeoff analysis. It is a method for looking at a specific feature of the work domain along a single axis, making it simple to discuss that aspect of the problem.
- Because it has a framework, framing works as scaffolding, and you may use that structure to aid in analysis.

- Designers tend to employ solution conjectures as a technique of deepening their grasp of the problem. Creating frames is a means of focusing on the ability to create new approaches to the problem scenario rather than on the generation of solutions.

Abstraction

- Abstraction is the practise of removing superfluous details from a work activity and focusing on the problem's irreducible structures to determine what is truly going on while disregarding everything else.

Magic wand

- The magic wand technique, in which you pose "what-if" questions to temporarily set aside established limits, is another ideation strategy. This technique aids in lateral thinking and the generation of ideas that, while impractical in their current form, illuminate other connected concepts that are feasible. What would we do if we had a magic wand in the toothpaste factory scenario ?
- We might want the ability to look through the cardboard box in order to determine if it is empty. By devising means to make this practical, the idea of seeing through a box can now be adjusted to take it out of the domain of magic. The same result might be achieved with an X-ray or ultrasound machine put on the belt as with the miraculous see-through notion.

Incubation

- Incubation is another method for generating ideas. If you take a pause after a time of intensive pondering about a topic, idea incubation may occur.
- As you step back and take a break from the problem, your brain might continue to work on it in the background, resulting in new views when you return. Despite the fact that we are not actively working on the problem during this interval, our brains have the ability to incubate ideas in the background and come up with ideas at inconvenient moments, usually when doing something else.

Design patterns and experience

- A design pattern is a reusable, reusable, and consistent solution to a common design challenge that emerges as a best practise. Other fields' design patterns can sometimes help spark new ideas. When Rex and I were talking about the toothpaste factory problem, we came up with another domain that solves a different problem with weighing scales and may be utilized here.
- We remembered how Amazon packing centres utilize exact weight calculations to

determine whether a package being produced on an automated conveyor belt contains all of the items purchased by the customer. The package is pushed off the conveyor belt and highlighted for further investigation and human intervention if the calculation was incorrect by more than a tiny margin of error.

- We call that reused knowledge a design pattern, and it can be applied to the toothpaste factory problem by offering a solution that pushes off a toothpaste box that is not heavy enough.

Traverse the different dimensions of the problem space

- The goal of this brainstorming process is to go through each dimension of the problem space step by step, looking for ideas that were previously overlooked. Designers use this technique to search for ideas by traversing the design space in a systematic manner.
- In the case of the toothpaste factory, we can explore the problem's various dimensions, such as mass/weight, volume, and opacity, to arrive at the following conclusions :
  - Mass of the product :
    - Weighing the mass to ensure it is what it should be.
    - Using resistance to force, determine the mass is what it should be.
  - Volume occupancy :
    - Internal sensor in the box.
    - Displacement of fluid (air) in the box.
  - Seeing inside :
    - Visual inspection of each package by manually opening it.
    - Sensing by X-ray.
    - Sensing by sonogram.

Seek opportunities for embodied and tangible interaction

- This method of ideation focuses on incorporating body and embodiment into design. It's about weaving the fabric of interaction to include not just the digital world with its windows, icons, and menus, but also the physical world with things that can be handled, grabbed, twisted, held, and otherwise manipulated with non-cognitive senses.
- Simply put, embodiment refers to the possession of a physical body. As a result, embodied interaction is defined as the use of one's physical body while interacting with technology.

- However, embodiment is the way that physical and social phenomena unfold in real time and real space as a part of the world in which we are situated, right alongside and around us in real time and real space as a part of the world in which we are situated, right alongside and around us in real time and real space as a part of the world in which we are situated, right alongside and around us in real time and real space as a part of the world in which we are situated.
- As a result, embodiment is less about people and more about systems. Embodiment is not a feature of systems, technology, or objects; it is a property of interaction. Mind, body, and thinking are separated from action in Cartesian approaches, while embodied interaction underlines their duality.
- Despite the fact that physical engagement appears to have its own fan base, it is inextricably linked to embodied contact. They are, in a sense, complementary to one another.
- Interactions between human users and physical items are the focus of tangible design. For years, industrial designers have been coping with it, creating objects and goods that humans can hold, feel, and handle.
- The difference now is that the item is computational in nature. Physicality, form, and tactile engagement are also heavily emphasized.
- Tangible and embodied interaction necessitates actual prototypes like sketches to inspire the ideation and design process more than ever before. We can interact, communicate, and make meaning through physically shared objects in the actual world using physical prototypes.
- Consider how to include hands, eyes, and other physical components of the human body in the interaction when developing for embodied interaction. Take advantage of the user's mind and body as they amplify each other in issue solving to supplement the pure cognitive acts that designers have explored in the past.

4.3.3 Sketching

- The concept of drawing as a necessary component of design dates back to the Middle Ages. Sketching, is a crucial visual language for brainstorming and conversation.

4.3.3.1 Characteristics of Sketching

- Sketching is the quick creation of freehand drawings to represent basic design ideas, with the emphasis on concepts rather than details.

- More distinguishing features of drawing include :
  - It is not necessary to be artistic to sketch.
  - A sketch is more efficient than words in conveying most thoughts.
  - Sketches are simple to make and inexpensive to buy, and they don't stifle early discovery.
  - Sketches are disposable; no significant investment is made on the sketch.
  - Sketches are convenient because they may be made on the fly, completed in the moment, and sent when needed.
  - There should be a lot of sketches; entertain a lot of ideas and do many sketches of each one.
  - Textual annotations are helpful in clarifying what is happening in each section of the sketch and how it is happening.

Sketching is essential to ideation and design

- Sketching is an essential aspect of the design process. If you're not sketching, you're not doing design, according to Buxton. Sketching is a visual medium for exploration in design, which is a process of creation and exploration.
- Sketching externalizes the mental description of an idea for sharing, analysis, and preservation by capturing it in an embodied and tactile form. Sketching functions as a multiplier in ideation by opening up new paths to generate fresh ideas.
- Sketching adds cognitive supercharging to ideation by bringing in more human senses to the task, which boosts creativity.

Sketching is a conversation about user experience

- *Sketching is not art*
  - Sketching isn't only about putting pen to paper and drawing; it's also not about creative talent. A sketch isn't a drawing or photograph of a product used to document a design.
- *A dialogue is depicted in a sketch*
  - A sketch is more than simply something you look at; it's a dialogue about design. A sketch is a visual representation of a conversation between members of the design team.
- *The user experience, not the product, is the focus of a drawing*
  - Buxton challenges his audience to draw his cellphone during a talk at Stanford. He does not, however, refer to a phone sketch as a product. He's referring to a

sketch that depicts the interaction, the experience of using the phone in an environment where the product and its physical affordances promote one type of behaviour and experience over another.

Sketching is embodied cognition to aid invention

- *Designers come up with new ideas when sketching*
  - A drawing isn't only a technique to convey your thoughts; it is also a part of the thinking process. In reality, the process of creating the sketch is more significant than the sketch itself.
- *The significance of using your hands when sketching*
  - Sketching, pointing, holding, and touching are kinesthetics that bring the complete hand-eye-brain coordination feedback loop to bear on problem solving. Your physical motor motions are linked to your visual and cognitive activity, and the designer's mind and body work together to create new things.

4.3.3.2 Doing Sketching

Stock up on sketching and mockup supplies

- Whiteboards, blackboards, corkboards, flip chart easels, Post-it labels, tape, and marking pens should all be on hand in the ideation studio.
- Include scissors, hobby knives, cardboard, foam core board, duct tape, wooden blocks, push pins, twine, scraps of cloth, rubber, other flexible materials, crayons, and spray paint when making physical mockups.

Use the language of sketching

- *The drawing vocabularies*
  - To be excellent in design sketching, you need to know a specific vocabulary that hasn't changed much over the years. The lexicon of lines, which are formed as freehand "open" motions, is one of the most essential linguistic elements. Lines in sketches are roughed in and not connected properly, rather than being mechanically correct and absolutely straight.
  - Lines overlap in this language, typically going past the corner. They occasionally "miss" intersecting and leave the corner slightly exposed.
- *Exploration is suggested by an incomplete appearance*
  - A sketch's poor resolution and detail indicate that it is a concept in development rather than a completed design. It must appear to be throwaway and low-cost to

produce. Sketches are intentionally ambiguous and abstract, allowing "holes" in the design for the imagination to fill in. The sketches in Fig. 4.3.3 and 4.4.1 show this unfinished aspect.

- *Keep your sketches open to different interpretations*
  - Even by the individual who drew them, sketches can be interpreted in a variety of ways, allowing new relationships to be seen within them. To put it another way, avoid the illusion of precision; if everything is stated and the design appears to be completed, the message is that you are telling something, "This is the design," rather than encouraging exploration, "Let us experiment with this and see what comes up."

4.3.3.3 Physical Mockups as Embodied Sketches

- A physical mockup for ideation regarding a physical equipment or product is a three-dimensional sketch, much like sketches are two-dimensional visual vehicles for creation. Physical mockups as sketches, like any sketches, are created rapidly, are highly disposable, and are built from readily available materials to generate actual props for exploring design visions and options.
- A physical mockup differs from an embodied drawing in that it is a tangible artefact for touching, holding, and acting out usage.
- You may desire a more finished-looking three - dimensional design representation to show clients, customers, and implementers later in the process, once design research is completed.

4.3.4 Critiquing

- Critiquing is the action where design concepts are assessed to find advantages, downsides, and constraints and tradeoffs are evaluated for each proposal.
- Critiquing's overall purpose is to determine whether the design :
  - Meet the design objectives ?
  - Is environmentally friendly ? Is it able to communicate with other devices in the environment ?
  - Is possible to interact with other devices ?
  - Have decent usability ?
  - Have a favourable emotional impact ?
  - Give people a sense of purpose ?

- There are no recognized ways for evaluating generative design; it is never formal. It's a fast-paced, free-wheeling comparison of a variety of options, as well as inspiration for new ones.

4.3.4.1 Include Users in the Critiquing Activity

- Combine the greatest ideas from all of the brainstorming sessions into a single big-picture redesign of how work is done, and explain the new vision to customers and users.
- Bring together a diverse group of people with diverse backgrounds, viewpoints, and personalities for this critical study
  - Display your sketches and ideas with other mockups and models.
  - Allow them to discuss, debate, and criticize.
  - It is your responsibility to pay attention.

4.4 Prototype Candidate Designs

4.4.1 Introduction

- The prototype Candidate UX design lifecycle activity of the overall UX design lifecycle is shown in Fig. 4.4.1. Within the Prototype Candidates lifecycle activity, this section describes the different types of prototypes and how to create wireflow and wireframe prototypes.

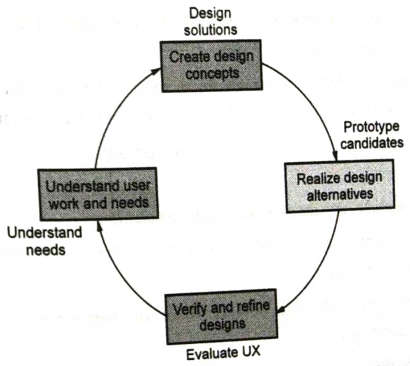

Fig. 4.4.1 Prototype candidate design lifecycle activity

4.4.1.1 Prototyping Intertwines with Other UX Activities

- All lifecycle activity occur together and happen in tandem throughout the lifespan- closely intertwined and interleaved.
- Prototyping is an excellent illustration of this intertwining. The prototyping begins with sketches and continues with wireframes and various forms throughout the rest of the design process.

4.4.1.2 Dilemma and a Solution

- Subjecting your design to UX review is the only way to ensure that it is the proper design and the best design it can be. However, you will have a design but no product or system to evaluate at some time. Changes are far more difficult and expensive to make if you wait until after it has been deployed.
- A prototype allows you to test your ideas before investing time and money to produce the real thing. Prototypes help you to fail more quickly, learn more quickly, and succeed sooner.

4.4.1.3 Advantages of Prototyping

- Prototypes have the following benefits :
  - Provide a platform for user-centered UX review.
  - Provide a robust foundation for user-designer communication.
  - Provide a conversational "prop" to aid in the conveying of topics that are difficult to communicate orally.
  - Allow users to "take the design for a spin" (after all, who would buy a car without first driving it or a sound system without listening to it ?).
  - Provide visibility and buy-in for the project among the client and developer organizations.
  - Encourage early user involvement and participation.
  - Give the impression that design is easy to change because a prototype is obviously not finished.
  - Afford designers immediate observation of user performance and consequences of design decisions.
  - Assist management in selling a fresh product idea.
  - Assist in a paradigm shift from an old system to a new one.

4.4.1.4 Universality of Prototyping

- Prototyping is a timeless and global concept. Automobile designers construct and test mockups, architects and sculptors create models, circuit designers work with "breadboards," artists work with sketches, and aircraft designers construct and fly experimental designs. Prototypes were created by even Leonardo da Vinci and Alexander Graham Bell.
- Thomas Edison is known for creating tens of thousands of prototypes before settling on the perfect design. In each case, the concept of a prototype was critical in allowing the design team and others to get a head start on evaluating ideas, balancing alternatives, and determining what works and what doesn't.
- Alfred Hitchcock, the king of dramatic dialogue design, is well-known for employing prototypes to fine-tune his film storylines. At cocktail parties, Hitchcock would deliver a variety of anecdotes and observe the reactions of his audience.
- He would try out different sequences and procedures for revealing the plot. As an evaluation criterion, listener reactions were used to refine the storey. The film Psycho is a good example of how this strategy might be used.

4.4.2 Depth and Breadth of a Prototype

- Prototypes are intended to offer quick and easy changes to early versions of a proposed UX design. A prototype is a design representation that is less than a full implementation in some ways because it must be updated quickly and readily.
- The options for your prototyping strategy revolve around how to make it less time consuming. One method to make it less is to concentrate just on the system's width or depth.
- A horizontal prototype is created by slicing the features and functionality of a system by breadth. You can also make a vertical prototype by slicing by depth. The relative notions of horizontal and vertical prototyping is show in Fig. 4.4.2.

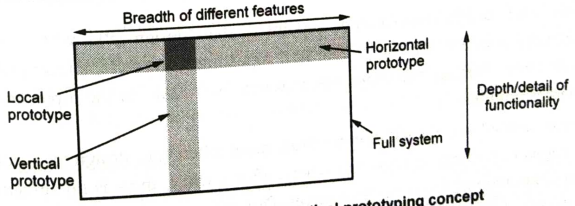

Fig. 4.4.2 Horizontal and vertical prototyping concept

4.4.2.1 Horizontal Prototypes

- A horizontal prototype has a lot of features, but it doesn't go into great detail on how that functionality works.
- A horizontal prototype is a useful place to start prototyping since it provides an overview on which a top-down approach may be built. A horizontal prototype is useful for presenting the product concept and giving managers, buyers, and consumers an early overview of the product.
- Horizontal prototypes, on the other hand, frequently do not support complete workflows due to the lack of details in depth, and user experience evaluation with this type of prototype is generally less realistic. Because of these factors, prototyping in the early funnel is typically horizontal.

4.4.2.2 Vertical Prototypes

- A vertical prototype has additional detail for some functionality, but only for a small number of characteristics.
- A vertical prototype enables for the testing of a restricted number of features, but those that are included have been developed in sufficient complexity to allow for a genuine user experience review. A stub for or a connection to an actual working backend database is frequently included in the functionality of a vertical prototype.
- When you need to depict completely the specifics of an isolated element of an individual interaction workflow in order to understand how those nuances play out in actual usage, a vertical prototype is appropriate. For example, you might want to research a new design for the checkout section of an e-commerce website's process.
- A vertical prototype could depict a task sequence and related user actions in greater detail. Vertical prototypes are most typically employed in the late funnel portion of the process because they are usually about individual features.

4.4.2.3 Local Prototypes

- When your design team reaches a point in their design talks when there is no agreement after a while and people start repeating themselves, a local prototype is the solution. Perhaps the usage research data isn't clear on the topic, and further debate is pointless.
- A local prototype is the solution for those times when your design team encounters an impasse in design discussions where, after a while, there is no agreement and people are starting to repeat themselves. Perhaps usage research data are not clear on the question and further arguing is a waste of time.

- It's time to place the specific design issue on a testing list and allow the user or customer talk to it in a sort of "feature face-off" to help choose amongst the options.
- Local prototypes are utilized independently from other prototypes and are transient and disposable, with short life spans, due to their function in deciding specific concerns.

4.4.2.4 "T" Prototypes

- A "T" prototype combines the advantages of both horizontal and vertical prototypes, making it a reasonable compromise for design evaluation.
- The majority of the feature breadth is realized at the top of the T, while a few locations are done in depth (the vertical part of the T).
- The T prototype is advised in the beginning since it achieves a fair balance between the two extremes, giving you the best of both worlds.
- In practice, once you've built a system overview in your horizontal prototype, the T prototype is the next step toward obtaining some depth.
- The prototype's vertical extension will be supported by the horizontal base throughout time.

4.4.3 Fidelity of Prototypes

- Aside from depth and breadth, a prototype's level of realism is another dimension where there are tradeoffs in terms of completeness and cost / time. Customers and users judge a prototype's fidelity by how "completed" it appears to be. Being "completed" refers to the completion of content and functionality, as well as the refinement of appearance.
- Lower quality prototypes, on the whole, are less polished but more flexible, and may be built more quickly and for less money. However, as your project progresses through the stages of development, the necessity for fidelity in prototypes grows.
- The amount of fidelity you should aim for is determined by your project's current stage of development and the intended use of the prototype. Levels of fidelity in a prototype have been characterized and used in a variety of ways in the past. The practical role they play in an agile UX approach is the focus of this article.

4.4.4 Wireframe Prototypes

- In UX practise, wireframes are now the preferred prototype method. The majority of the wireframe prototypes will be created as part of the interaction design process.

4.4.4.1 What is a Wireframe ?

- A wireframe is a drawing, graphic, or prototype of a single interaction page or screen.
- Wireframes are two - dimensional sketches or drawings that illustrate the layout of an interaction design for a page or screen. They are made up of lines, arcs, and vertices, as well as some text for labels. The ideal way to create these wireframes is to use a software tool.

4.4.4.2 Wireframe Design Elements

- Low-fidelity wireframes often lack graphical design features like images, precise colours, and typography. A wireframe can incorporate a variety of aspects, such as :
  - Header.
  - Footer.
  - Content areas.
  - Labeling.
  - Menus.
  - Tabs (possibly with drop-downs).
  - Buttons.
  - Icons.
  - Pop - ups.
  - Messages.
  - Navigation bar, navigation links.
  - Placeholders for logo and branding images.
  - Search field.
- For the design, draw on what you've done so far. Use your conceptual design, design scenarios, brainstorming, personas, storyboards, and everything else you have developed to get to this initial physical manifestation of your design concepts.

4.4.4.3 Wireflow Prototypes

- A wireframe is the most frequent phrase used by UX specialists when prototyping with boxes, arrows, and other simple shapes. Although the plural form of that phrase, wireframes, is commonly used in business to refer to flows and sequences of individual wireframes, the more appropriate term is wireflow.

- A wireflow prototype (Fig. 4.4.3), also known as wireflow, is a prototype that depicts navigational flow inside an interface design. A wireflow is a directed graph with the following structure :
  - Wireframes are used to represent the nodes.
  - The arcs are arrows that reflect the wireframes' navigational flow.
- A wireflow prototype is, at its core, a state diagram of user workflow
- The flow arrows lead from interaction elements (such as a button or icon) that users can interact with (e.g., click) within one wireframe to subsequent wireframes.
- Wireflow prototypes, which feature both the individual wireframes and the navigational arrows connecting them, are the most common wireframe configurations used as UX prototypes. We'll refer to the entire prototype using the industry term "wireframes" or "wireframe deck" rather than "wireflow" to keep things simple.

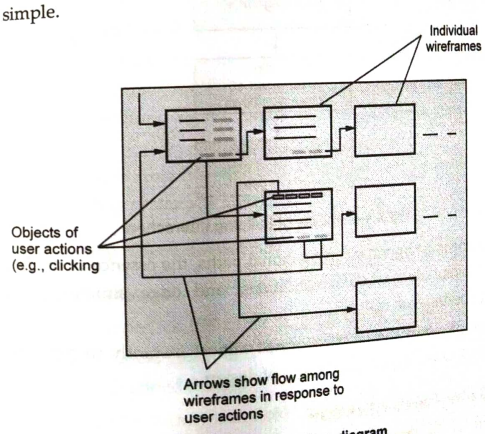

Fig. 4.4.3 Generic wireflow diagram

4.4.4.4 General Process of Representing Interaction

- Fig. 4.4.4 depicts the evolutionary process of building the interaction design for a feature's set of associated tasks.

- Begin by examining the user's workflow and navigation in detail. The flow model is a good place to start. It's a simple graphical representation of how information, artifacts, and work products flow among user work roles and portions of the product or system as a result of user activities.
- More complex task sequence models will add details about user activities and the paths they take as a result of those actions.
- The next stage in prototyping task sequencing and navigation, using your task-sequencing models, is to create one or more state diagrams (next node down in Fig. 4.4.4), which enable us depict specifics of flow and navigation in the interaction perspective of design.

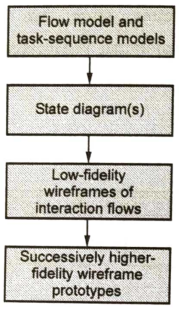

Fig. 4.4.4 Process of building interaction

- Start with the most important navigational paths, the essence of the flow, and leave away irrelevant data, specific conditions, and edge situations, such as error checking, confirmation dialogue, and so on.
- Your state diagrams can be transformed almost instantly into the structure of a wireframe deck during the early stages of design

4.4.4.5 Create a Wireframe for Each State

- Each state of the state diagram, as well as each box in the wireflow diagram, generates a low - fidelity wireframe design for one "screen." You are designing for items that "live" in that state within that screen, such as work places and dialogue to support the linked task. The state diagram's arcs will guide you in adding controls to help you navigate between the wireframes.

- As you work, you'll almost certainly need to add new states and navigation to handle nonstandard dialogue.
- You get a higher-fidelity version to examine the wireframes in the navigational context after you've fleshed out the features of the individual screens.
- We used this high-fidelity wireframe deck as a work item in our UX studio to have design talks. We printed each wireframe on a sheet of paper and taped them together to make the diagram large enough for everyone to read.

4.4.5 Build up Prototypes in Increasing Levels of Fidelity

- In this section, we create a series of prototypes that would be used in a normal UX project to demonstrate an increasing level of fidelity in the context of a UX design.

4.4.5.1 High - level Task Context

- We discussed state diagrams and interaction flow wireframes in the previous section. Such broad depictions of the design are useful for visualizing high-level conceptual design and the scope of the growing design.
- This will move the user from the "home page" or start of an application down through the task hierarchy and into the context of doing various tasks of the feature being built. This section does not have a full task representation; it only provides background.
- Because the context is already well established, much of what we do with adding to or modifying existing systems is unnecessary.

4.4.5.2 Very Low - fidelity Wireframe Sketches

Nature of low - fidelity prototypes

- Low-fidelity prototypes, as the name suggests, are not faithful representations of the intricacies of look, feel, and behaviour, but rather high-level, abstract impressions of the intended design.
- Low-fidelity versions typically lack fixed graphical design components like images, colour, and typography. When design specifics have not been decided or are likely to change, low-fidelity prototypes are appropriate.
- They're adaptable and simple to change, and iterating them costs nearly nothing. As a result, these are essentially sketches that appear and disappear as part of the ideation, sketching, and critiquing process.

First level of fidelity

- Very-low-fidelity wireframe sketches enable ideation and sketching as the UX design team explores design concepts in generative design at the initial level of quality in prototypes.
- Almost always, these quick and "dirty" design representations are essentially hand sketches. They're disposable and short-lived, and they're always changing and evolving.

Decks of wireframes

- A deck of wireframes is a collection of linked wireframes arranged in a logical order. You can navigate through the deck one wireframe at a time to demonstrate the flow of this design, simulating a possible situation by pretending to click on interaction widgets on the screen.
- These page sequences can depict the flow of user activity within a scenario, but they can't show all of the conceivable navigational paths.
- A designer can tell a storey about how user activities influence the navigation in a deck to advance through the related images.

4.4.5.3 Static Low - fidelity Wireframes

- You create a deck of slightly higher fidelity wireframes that represents where you think you are with that design, to summarize and clarify it for yourself in the UX team, once you've gone through initial generative design for a set of screens and have at least initially settled on the most promising candidate design. Simply say "click here" and manually go to the next wireframe on your laptop to simulate navigating.
- While these low-fidelity wireframes are more detailed than the design exploration sketches, they are still merely static designs of screens with no interactivity or navigation.
- To illustrate design concepts to the UX team and others, it's sometimes easier to use paper copies of wireframes and move them around on the tabletop. A prototype "executor" can modify the paper pages to response to simulated user actions during your early design reviews and walkthroughs.
- UX team members can write redesign comments directly on the paper if you show your stakeholders the prototype on paper. You can even go straight to exhibiting the displays on a laptop projected for debate using a projector.

Lower fidelity means initial cost effectiveness

- In terms of user experience acquired per unit of effort expended, the lowest end of the fidelity spectrum is frequently where you get the most value from evaluation. We feel that using a paper wireframe prototype to uncover and fix the majority of the most obvious usability and UX issues early on may be extremely helpful.
- A low-fidelity prototype is substantially less developed, and thus lot less expensive. It can be built and iterated in a fraction of the time that a good high-fidelity prototype would take. Despite the fact that there is a significant gap between a prototype and the final product, low-fidelity prototypes can be surprisingly successful at identifying UX issues in the design.
- However, many UX designers ignore the low-fidelity prototype's potential due to its simplicity and obvious lack of detail. Wireframe prototypes give you the ability to design a group of linked user tasks, build them in a low-fidelity wireflow prototype, test with users, and revise the entire design in a day or two.

4.4.5.4 Increased Fidelity Wireframes

- As you work on the design and present more refined versions to stakeholders, you'll want to gradually improve the fidelity of the wireframes, which you can do by adding more screens and more detail to each one.
- You can add some colour and a branding appearance. Increase quality by employing a static picture (e.g., JPEG) as a basic template that includes a high-fidelity background, colour schemes, and styles.
- Work quickly and effectively. Establish a "library" of reusable forms and templates, as well as preconfigured UI components, to reuse widgets. You can also create a library of specific styles, such as Windows or Mac styles, or your own custom-branded style. In fact, you don't even have to utilize "actual" widgets; simply choose anything that looks similar from your UI object collection.
- The purpose is for the client and users to have a fast glimpse of some of the UX design, usually through design review and walkthrough evaluation procedures. Because of the low fidelity, UX designers will be responsible for "driving" the prototypes. The wireframe identifiers are required for "linking" user actions on interaction objects to future process wireframes.
- The UX team might annotate the paper wireframes with UX issues discovered during the early stages of the evaluation process. You may also hand-draw potential design solutions directly on the prototype and solicit input from people.

- Always choose efficiency over fidelity. If it's not critical that the days and dates on your calendar match the real-world calendar, you can even reuse the calendar grid that already has the dates on it.

Establish a library of templates

- Tools with libraries of interaction and UI styles and UI objects such as icons, buttons, menu bars, pull-down menus, pop-ups, and other UI elements can help you increase productivity while you improve the integrity of your look and feel. Don't waste time creating these interaction objects over and over again.
- Reusing design object templates from a library can help you maintain consistency across designs while also increasing your efficiency. Symbol libraries, which can be created and reused with tools like Sketch, are libraries of such widgets.
- Symbols can be nested and declared to express attributes that are overridden when the object is instantiated. This allows designers to define a button symbol with a generic text label and alter that label every time the symbol is instantiated on the screen, for example.
- Two instances of the same button symbol, for example, can have two labels: "Save changes" and "Discard changes." Furthermore, altering a symbol in the wireframe deck will update all instances of that symbol. If the shape or colour of a button sign is changed, for example, the changes are automatically applied to all instances of the symbol.
- You may be highly efficient and rapid in building detailed wireframe decks once you establish your symbol library for your target platform, or choose to use one of the popular ones already constructed and available as a download. Because of the capabilities of current tools like Sketch, even large-scale updates to big wireframe decks may be made fast.

4.4.5.5 Medium - fidelity Wireframes with Some Navigational Behavior

- When you're ready for your first design reviews with the client, users, and other stakeholders, you connect these low-fidelity wireframes in a deck with some initial "hotspots," links or active buttons that allow you to sequence through screens by clicking to simulate navigational behaviour and demonstrate interaction flow.
- More functionality is not frequently included in these prototypes. These wireframes are now known as click-through prototypes, and they are quick and easy to produce and edit, as well as shareable because they are machine-readable.

- Design reviews and walkthroughs with the UX team and other stakeholders are used to evaluate click-through wireframe prototypes. This is still just moving from one static visual wireframe to the next, but because certain links are now functional, anyone in the room can run the prototype on a laptop and project it onto a screen or TV for group viewing and debate.
- The addition of linkages requires more time and effort to develop, and even more time and effort to maintain as the deck changes, but the extra realism is well worth it. Users and clients have remarked that these are so lifelike that they appear to be the real thing.
- These early design critiques frequently lead to a trip back to the UX studio, where the design is tweaked before being shown to the same audience for confirmation and/or additional comments.

4.4.5.6 Medium - to High - fidelity Click - through Prototypes

- You might be ready to move on from design review and walkthrough assessments to empirical testing with real users who will drive and operate the prototype if you've resolved on the structure of each wireframe and decided on the colours, with all the text, labels, boxes, widgets, and links in place.
- You may not always have time to do a user-based empirical evaluation these days, but if you do, you should have the correct prototype to support it.
- You may need to advance to a medium- to high-fidelity programmed prototype with more complete representations of designs, including specifics of appearance and interaction behaviour, and maybe even linkages to system operations, to facilitate user-based empirical evaluation or analytic evaluation.
- HTML5 and CSS3 are standard technologies for programmed prototypes, and they're frequently created by a dedicated "prototyper" on the UX team.
- Prototypes with scripts (written in scripting languages) can be used to provide a set of wireframes additional responsiveness to user activities, such as linkages to real or simulated functionality. This new behaviour is restricted only by the scripting language's capabilities, but you're now going into prototype programming, which is normally not a cost-effective road to take.
- Scripting languages are generally simple to learn and use, and because they are high-level languages, they can be used to quickly construct certain types of behaviour, most notably navigational activity. However, they are ineffective tools for adding a lot of functionality.

- Preparing for a user evaluation session will almost certainly necessitate detailing all design states related to the process that will be evaluated.
- In projects needing high rigour and where the stakes for getting it right are high, a high-fidelity prototype, although more expensive and time demanding, can yield to the insight you need; it is still less expensive and faster than producing the final product.
- High-fidelity prototypes can also be used as marketing demos and even to raise venture financing for a company. Apart from these advantages, high-fidelity prototypes are overkill for most projects, particularly agile development initiatives.

Include "decoy" user interface objects

- If empirical testing with real users is the goal, ensure sure the prototypes are accurate representations of the final design. This indicates that they provide horizontal coverage. If you simply include the user interface items required to complete your initial benchmark tasks, users may find it unreasonably simple to do those tasks. User experience testing with this type of early interaction design does not provide a solid indication of the design's ease of use when compared to after it is finished. It also has a large number of user interface objects to pick from, as well as numerous other options to consider during a task.
- As a result, even if they do not do anything, you should include a lot of extra "decoy" buttons, menu choices, and so on, so that participants see more than just the "happy route" for their benchmark activities. Your decoy objects should appear real and, to the extent possible, anticipate other activities and paths. Users completing activities with your prototype will be presented with a more realistic set of user interface components to consider as they make decisions about what user actions to perform next. You get to utilize your "not implemented" message when a user clicks on a decoy item. It's also an opportunity to question customers about why they clicked on that object when it wasn't part of the job sequence you had planned.

4.4.5.7 Medium - to High - fidelity Prototypes

- Finally, wireframes can be utilized as part of interaction design specifications and for design production after the design ideas have been iterated and agreed upon by key stakeholders. Detail the different states of the design and widgets, such as mouse-over states, keyboard inputs, and active focus states, by annotating them.
- It is now possible to define edge cases and transition effects. The idea is to be as complete as possible so that a developer may implement the designs without

having to interpret them. Such UX design standards can be supported with high-fidelity visual comps from graphic designers if the developers don't have authority over colour and branding schemes.

- When it comes time to give this prototype over to the software engineers for implementation, you'll need to work with people from both sides of the UX-SE aisle. The UXdesign is "owned" by the UXpeople, but the software that implements it is not. It's similar to owning a house, but without the land. In both lifecycles, the "hand-off" moment is a critical juncture.
- Now is the time to talk to a developer about it. This is the prototype :
  - Acts as a sort of "contract" for the work to be done.
  - Creates a mock-up for :
    - The viability of implementation is being discussed.
    - Checking for software platform limitations.
    - Examining other features that have already been implemented for consistency.
- Make it clear that you will be back to check the implemented version against this design.
- Because the SE team is not responsible for maintaining a hard-won high - quality user experience in the design, the UX team has a big obligation to make sure their UX design is accurate.
- We coined the term Quality Assurance (QA) to describe this process of comparing the implementation to the final design, which is an important aspect of the agile UX lifecycle in the late funnel. There's no way to know whether the user experience you worked so hard to produce will still be present in the final product if the SE people are the only ones who interpret the process.

4.4.6 Specialized Prototypes

- We outline a few different sorts of prototypes to consider in certain situations, in addition to the wireframe prototypes that are the bread and butter of today's UX design.

4.4.6.1 Physical Mockups for Physical Interactivity

- A physical mockup is a three-dimensional prototype or model of a physical equipment or product that can be held and constructed quickly out of readily available materials, and is used during exploration and evaluation to at least imitate physical interaction.

- If physicality is a primary feature of a product or system, as it is with a handheld device, then an effective prototype will have the same physicality in its interaction.
- Developing new applications for physical devices using real software necessitates a sophisticated and time-consuming implementation on a difficult hardware and software architecture. Physical prototypes are a low-cost approach for designers and others to get a sense of how the product will appear and feel.
- Some products are "physical" in the sense that they are a physical gadget that users can hold. A physical prototype for such things encompasses the entire gadget and goes beyond screen modelling on a computer. Pering offers an older case study of such a method for a handheld communicator device that combines PDA and cellphone functions.
- Make a prototype out of cardboard, wood, or metal that can be held in your hand if the product is to be handheld. A system could also be "physical," such as a kiosk. Physical prototyping is a good fit for the TKS kiosk. Build some cardboard mockups that sit on the floor or the ground, add some physical buttons, and have a cutout for the screen approximately head height after brainstorming the physical design through ideation and sketches.
- You can create a wooden version after settling on the overall look and feel using cardboard, then add physical buttons and a touchscreen from the inside to fill the cutout and provide some genuine interactivity. You can make physical prototypes with realistic hardware using resources you already have on hand. Begin with glued-on shirt buttons and work your way up to genuine push-button switches.
- Push buttons, sliders (for example, from a light dimmer), knobs and dials, a rocker switch, or a joystick from an old Nintendo game are all examples of hardware buttons and other controls that are as near to those in your envisioned design as feasible.
- These prototypes have higher fidelity in certain aspects, even if the details are low fidelity, because they are often three-dimensional, embodied, and palpable. You can physically touch and manipulate them. You can hold them in your hands if they are little. Physical prototypes are also a good tool for assessing emotional impact and other aspects of the user experience that go beyond usability.
- The original Palm PDA's designers carried a block of wood about with them as a physical prototype of the envisioned personal digital assistant. They utilized it to

experiment with the device's physical feel and other requirements, as well as its interaction possibilities.

- Using found objects, "junk" (paper plates, pipe cleaners, and other playful materials) from the recycle bin, thrift stores, dollar stores, and school supply shops, physical prototyping is now being used for cellphones, consumer electronics, and goods beyond interactive electronics.
- IDEO is perhaps most known for its physical prototype for product ideation.
- Wright compares the power of a physical prototype that people can see and hold to visuals on a screen, no matter how strong or fancy the screen graphics are. Users get the distinct impression that this is the product.
- The kind of embodied user experience portrayed by this approach can result in a product that elicits user surprise and joy, media praise, and market must-have cachet.

4.4.6.2 Paper - in - device Mockup Prototype

- Prototypes can be particularly useful for apps on mobile devices, but a paper prototype of a mobile app requires a "executor," a person who acts as a computer and changes displays and does all of the system's other operations in response to the user's actions.
- This intermediary function between user and device will invariably obstruct the user experience, particularly when a substantial part of that experience involves holding, touching, and operating the device itself.
- Bolchini, Pulido, and Faiola and others proposed a technique in which the paper prototype was placed within the device, taking advantage of the a paper prototyping in testing mobile device interfaces with the real physical device. They drew the prototype screens on paper, scanned them, and loaded them into the device as a series of digital images. Users can travel through this sequential navigation during the evaluation by making touches or gestures that the gadget recognizes.
- This is a quick and low-cost technique, according to the authors, who found that even a small amount of interactivity generated useful feedback and discussion among evaluation users. The evolution of pages can also become a design storyboard by adding page annotations about user interactions, possible user thoughts, and other behind-the-scenes information.

4.4.6.3 Animated Prototypes

- The majority of prototypes are static in that they rely on user engagement to demonstrate their capabilities. For concept demos, to imagine new UX designs, and to communicate design ideas, video animation may bring a prototype to life.
- While animated prototypes aren't interactive, they do keep you engaged. An animated prototype is one in which the interface elements are brought to life through animation, usually in video, to demonstrate how the interaction works dynamically and graphically.
- Video animations based on a sequence of sketches can extend the benefits of low-fidelity prototypes into dimensions that a static paper prototype cannot. Animated sketches are still "rough" enough to elicit participation and design ideas, but because they are more like scenarios or storyboards, they can better explain flow and sequencing in the context of use. If you already have a pretty full low-fidelity prototype, you can film it in motion by creating a form of "claymation" frame-by-frame video of its elements moving within an interaction task.

4.4.6.4 Experience Prototyping, the Goal of High - fidelity Physical Prototyping

- You remember something if you see it for yourself. You understand it if you accomplish something for yourself. For some domains, the prototype they use must allow them to actually undertake the activity being designed for, to become involved and immersed in the subjective experience, in order for participants to comprehend the design scenario and context well enough to provide useful feedback.
- Participants must move beyond being passively exposed to a demo or walkthrough of a prototype and become actively engaged in order to appreciate what users will feel. A full flight simulator for a specific aeroplane is a great example that everybody can understand. It is not enough to just stare at screens and have someone explain what's going on. The pilot - in - training must be exposed to flight circumstances that are as realistic as feasible.
- Participants had to simulate usage of several device designs set in the usage context to give full contextual feedback in a project to design an Internet-enabled cardiac telemetry system that included a device to deliver a defibrillating shock to heart patients in the field.
- An experience prototype was employed to support usage research in this scenario. On weekends, participants were given a pager to carry with them. Receiving a page on this device meant that a patient would receive a rather large electrical shock in

order to arrest fibrillation that had been detected by the remote equipment. They were also given a camera to picture their immediate surroundings at the time of the "shock," as well as a journal to write about their experiences, what they were doing, and what it would have been like to be startled by a real defibrillating shock at that very moment.

- Participants soon realized the importance of receiving a warning before receiving a shock, if only for their own safety and to mentally prepare themselves. In addition, a method for explaining the patient's situation to passers-by was required. "High fidelity" in this context refers to bringing the participant as close as possible to the real thing.

4.4.7 Software Tools for Making Wireframes

- Wireframes can be created with any drawing or word processing software that allows you to create and manipulate forms. While many apps are adequate for rudimentary wire framing, we advocate using tools that are expressly built for this purpose. We do all of our drawing in sketch, a drawing app. Craft is a sketch plug - in for In Vision that allows you to export sketch screen designs to In Vision and include hotspots as working connections.
- In "Build mode" of InVision, you work on one screen at a time, creating rectangular overlays that serve as hotspots. You can define which additional screen is displayed when someone clicks on a hotspot in "Preview mode" for each one. When you use InVision, you receive a wonderful bonus: when you click anywhere in an open place in the prototype in the "operate" mode, it highlights all the possible linkages. These utilities are exclusively available on Mac machines, however Windows users can use similar tools.

4.5 Review Questions

1. *What is design ? Explain in detail.* **(Refer section 4.1.2)**
2. *Explain information, information design and information architecture.* **(Refer section 4.1.4)**
3. *Explain iteration in the design creation sublifecycle.* **(Refer section 4.1.5)**
4. *Explain design lifecycle for the Agile UX funnel.* **(Refer section 4.1.6)**
5. *Explain bottom-up design.* **(Refer section 4.2.2)**
6. *Explain abstract work activities.* **(Refer section 4.2.3)**
7. *Explain top - down design.* **(Refer section 4.2.4)**
8. *Explain ideation with example.* **(Refer section 4.3.2)**

9. *Explain sketching with example.* **(Refer section 4.3.3)**
10. *Explain critiquing with example.* **(Refer section 4.3.4)**
11. *What is prototyping ? Explain its advantages.* **(Refer section 4.4.1)**
12. *Differentiate between horizontal vs vertical prototype.* **(Refer sections 4.4.2.1 and 4.4.2.2)**
13. *Explain local prototypes.* **(Refer section 4.4.2.3)**
14. *Explain "T" prototypes.* **(Refer section 4.4.2.4)**
15. *Explain wireframe prototypes.* **(Refer section 4.4.4)**
16. *Explain specialized prototypes.* **(Refer section 4.4.6)**