CHAPTER

The Nature of UX Design

12

Highlights

- Switch in mode of thinking from usage research to design.
- Universality of design and relationships to other fields.
- Definition of design as a noun and as a verb.
- The purpose of design: To satisfy human needs.
- Information, information design, information architecture, and their role in UX design.
- The overall design creation lifecycle to illustrate expanding fidelity (the substance and richness of detail) through iterations of:
  - Generative design.
  - Intermediate design.
  - Detailed design.
  - Design refinement.

12.1 INTRODUCTION

12.1.1 You Are Here

We begin each process chapter with a "you are here" picture of the chapter topic in the context of The Wheel, the overall UX design lifecycle template (Fig. 12-1). In this chapter, we introduce the UX Design Solutions lifecycle activity with a discussion of the nature of design.

While user research data elicitation (Chapter 7) is empirical, user research data analysis (Chapter 8) is inductive, and user story and requirements extraction (Chapter 10) is deductive, design is integrative.

This chapter contains a descriptive discussion of the characteristics of design, especially UX design. The how-to part of design is in subsequent chapters.

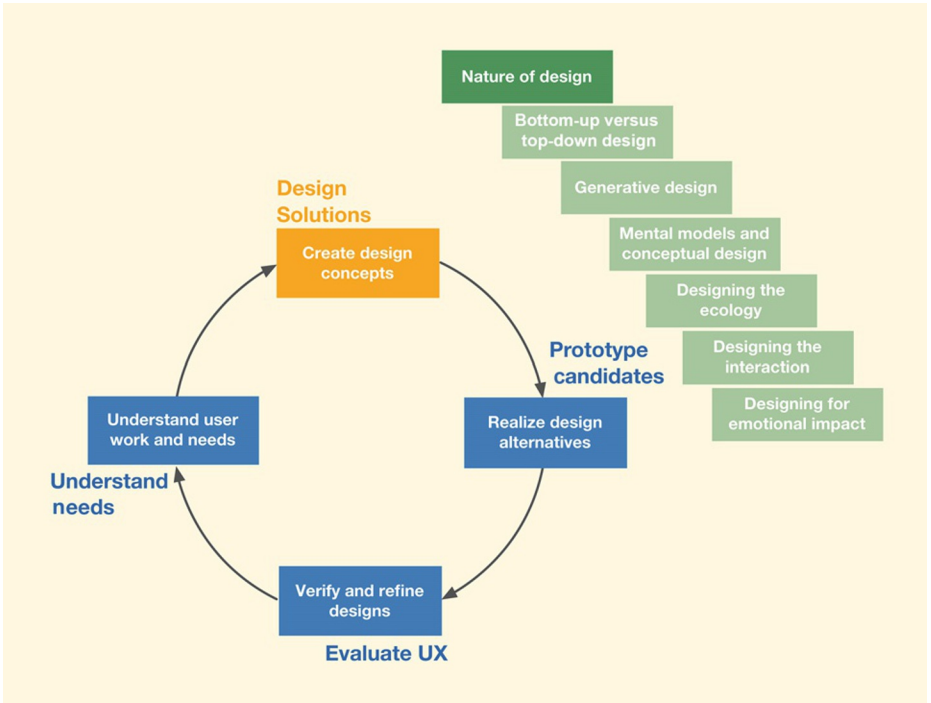

Fig. 12-1

You are here in the chapter describing the nature of design within the Design Solutions lifecycle activity, in the context of the overall Wheel UX lifecycle.

12.1.2 Moving Across the Gap from Analysis to Design

In this part of the book, we switch our focus from usage research to design. This involves changing our perspective from the existing work domain and work practice to an envisioned design domain and work practice. The transition to design is often regarded as the most difficult step in the UX lifecycle process, and we should expect it to be difficult. Beyer and Holtzblatt (1998, p. 218) remind us that, "The design isn't explicit in the data. The data guides, constrains, and suggests directions" that design "can respond to."

Another way to say this is that design is not simply a translation exercise; it is not about taking workflows in existing work practice and recreating them using technology artifacts. That would not address any of the existing breakdowns, problems, or inefficiencies, and would only add more constraints because of the newly introduced technology. There needs to be a switch in the mindset to focus on creating new solutions.

Larry Wood calls the transition to design a step where magic happens (Wood, 1998). In this same book, a number of authors share their own experiences and methods at making that transition.

12.1.3 Universality of Design and Relationship to Other Fields

Design is universal; it is about creating products and experiences using different media with the goal of helping humans satisfy a variety of needs.

Design is the core activity in many other creative fields. Fashion is about the design of clothes, which at a functional level is about protecting humans from the elements. But it is also about much more. Clothing designers use colors, fabrics, and shapes to create fashion experiences in infinite variations.

Of all the design fields, perhaps industrial design is the one closest to what we do in UX. In the last decade, with the proliferation of affordable technology in the form of hand-held and wearable devices, industrial design and UX have become inextricably bound. The user experience of a smartphone or smartwatch is derived not just from the software user interface but also the shape, texture, materials, and the form factor of the product that "houses" that user interface.

No matter what the field, all these design endeavors share the same fundamental process activities of understanding, creating, prototyping, and evaluating. Each discipline's vocabulary and domain knowledge may be different but they are all ultimately about creating products to solve problems and satisfy human needs.

12.1.4 Relationship to Design in Architecture

Architecture is a field in which design is foremost, a field that stands as an inspiration for UX. Architecture is a discipline about designing spaces to support humans and their needs, to sustain— and even glorify—living and working. Spaces in this context include everything from cities, neighborhoods, houses, community places, and offices as well as the infrastructure that connects them.

Great designs in architecture do not just provide shelter; they have the potential to spawn vibrant communities and induce strong emotional responses. For example, when people walk on the sixth floor of Bloomberg's Global Headquarters in New York City (where Pardha used to work) and see the scene in this image (Fig. 12-2), they encounter a feeling of movement and awe.

Visitors to the Bloomberg building say they experience a feeling of high energy and fast pace. This is because every element in this space was carefully designed by architects to evoke that experience of dynamism and connectedness. The constant movement of people through the space and digital displays showing the latest financial indicators, weather, and breaking news create a sense of energy as you walk into this central atrium. The expansive space and high ceilings combined with the curved glass surrounding an imposing courtyard injects a sense of grandness.

Fig. 12-2
Beautiful space in the Bloomberg building designed to evoke dynamic energy.

12.1.5 The Interdisciplinary Nature of Design

In Section 1.2.5.2, we said that user experience "is the sum total of all the effects felt by the user from what the user sees, does, hears, and feels and all the behaviors of the artifact during contact and communication between them." Given this breadth, it is expected that UX design teams have a wide variety of skills and backgrounds, 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.

12.2 WHAT IS DESIGN?

The topics of design, what it is, and how to do it have all been studied in many different domains. It is perhaps the original embodied skill of humans, starting with the fashioning of artifacts into tools.

The study of design has retained its relevance through time, as manifest in a wide variety of perspectives, practices, and issues. A graphic or visual designer on the design team may think about design in terms of emotion, joy, and art.

A usability analyst may think about design from a diagnostic perspective. Consultants and design agencies may look at design from the perspective of what sells, who is going to pay for it, and how to budget for it. Another common view is that design is about form (shape of the product) and function (purpose of the product). These perspectives aside, in this book we focus on two ways of thinking about design.

12.2.1 Two Ways the Word "Design" is Used

Most English dictionaries define the word design along two main dimensions: as a verb (the act of creating) and as a noun (the resulting concept of, or plan for, a product or system). For example, the click wheel on an iPod Classic is an element (design as a noun) that was created as the result of a process of creation (design as a verb). Fig. 12-3 shows the simple relationship between these ways of using the term "design."

12.2.1.1 Design as a noun

A definition of *design as a noun is the concept or plan for a product or system.* It is about the organization, composition, or structure of elements to be executed or constructed.[1] When we hear someone say, "I like this design" or "this design is bad," they are referring to the design concept behind the product. Unpacking this definition further, design as a noun is specifically about an abstract

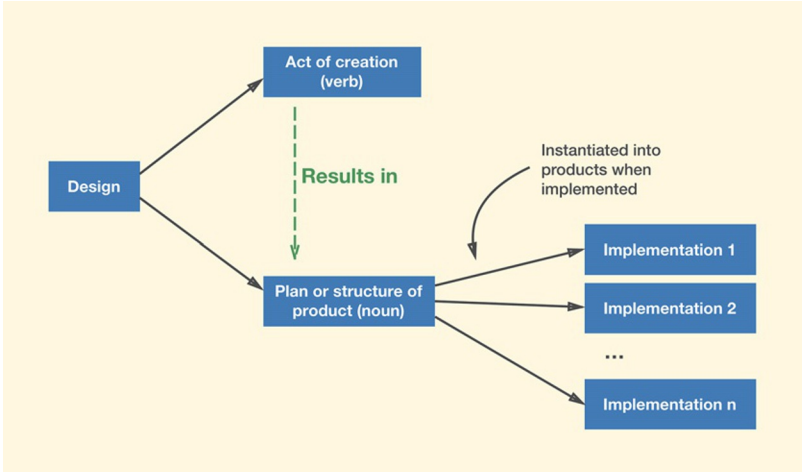

Fig. 12-3
Design as a noun and design as a verb.

[1] https://www.merriam-webster.com/dictionary/design.

construct that represents the way a product is conceived by its designer, a *description* of the plan or structure of the product.

It is *not* about an *instantiation* of that construct in the form of a tangible object or system, which can be thought of as one possible implementation of the design. In fact, not all designs come to fruition when instantiation is attempted. Some plans are flawed, or are revealed as such, when put into action (either by simulating the result using a prototype or by constructing a real implementation). Unexpected constraints, unforeseen technical limitations, or other omissions yet to be discovered may force revisions to these plans.

12.2.1.2 Design as a verb

Design as a verb refers to *the act of creating something that did not exist before—solutions to known problems and solutions looking for problems.* This is the Design Solutions box in the overall lifecycle, within which designs are created.

This box can be viewed using two perspectives:

- The fundamental nature of activities involved.
- The increasing fidelity (increasing depth of detail) of outputs with each subsequent iteration of this activity.

In the first perspective, the design box is a sublifecycle, a microcosm of the larger lifecycle, which follows the following fundamental activities (top of Fig. 12-4):

- Considering inputs and synthesizing them (act of analysis).
- Ideation to facilitate the genesis of design proposals or ideas (act of creation).
- Capture of these ideas in the form of sketches (act of lowest fidelity prototyping).
- Critiquing the tradeoffs and feasibility of design proposals or ideas (act of evaluation).

Metaphor

An analogy used in design to communicate and explain unfamiliar concepts using familiar conventional knowledge. A central metaphor often becomes the theme of a product, the motif behind the conceptual design (Section 15.3.6).

We cover this perspective in the chapter on "generative design" (Chapter 14).

In the second perspective, the design box is also a sublifecycle, this time of the expanding scope and fidelity of the designs (noun) created (Fig. 12-6):

- Generating ideas for features, capabilities, concepts, metaphors, and themes for the design (Chapter 14).
- Developing promising ideas further in the form of conceptual designs (Chapter 15).
- Increasing the fidelity and detail of the leading candidates in the form of intermediate design.
- Generating detailed design specifications of the chosen candidates to hand off to software engineering (SE) roles for implementation.

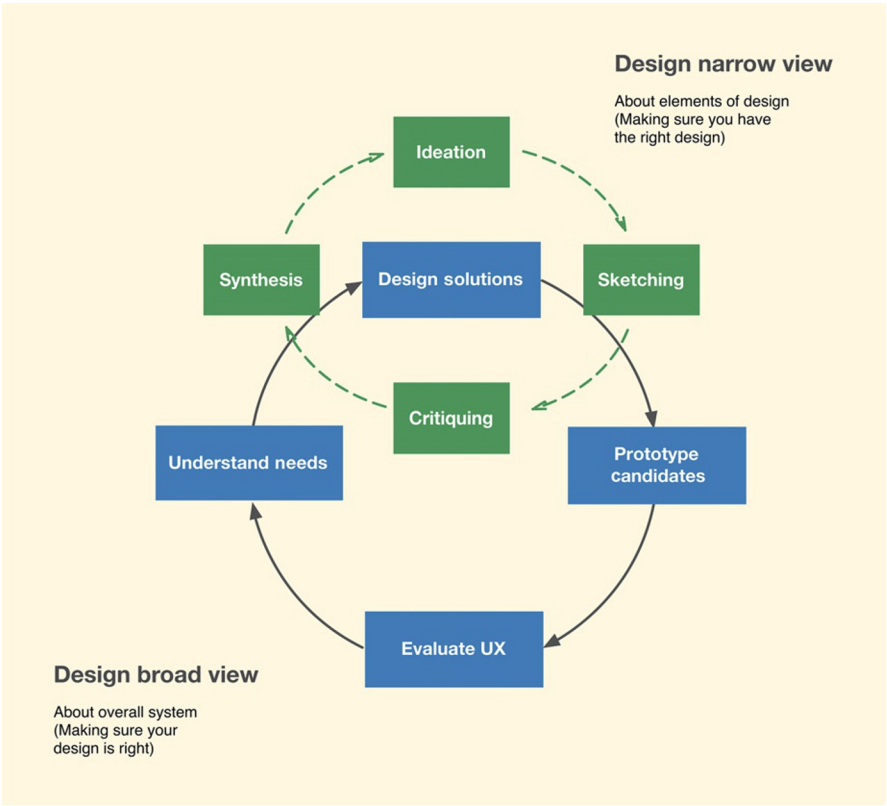

Fig. 12-4
The sublifecycle for doing synthesis, ideation, sketching, and critiquing within the Design Solutions lifecycle activity.

12.3 THE PURPOSE OF DESIGN: SATISFYING HUMAN NEEDS

We talk about design along these two contexts:

- The kinds of human needs to satisfy with design (next section).
- The design aspects to focus on in order to meet these needs (later chapters).

12.3.1 A Pyramid of Human Needs

The purpose of design is, ultimately, about what it does for the user in the context of a work practice. It includes aid, support, capabilities, service, and even the joy the system provides the user. In this section, we provide a model for thinking about user needs with the objective of setting the stage for later discussion where we will talk about designing for those needs.

There are at least these three categories of human needs that must be met by a design:

- 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 often have to think about these categories in that order because these categories build on each other, as shown in what we call the pyramid of human needs in the context of UX design (Fig. 12-5). When designers work in one of these layers, they operate in the perspective of that layer: *the ecological perspective, the interaction perspective, and the emotional perspective.*

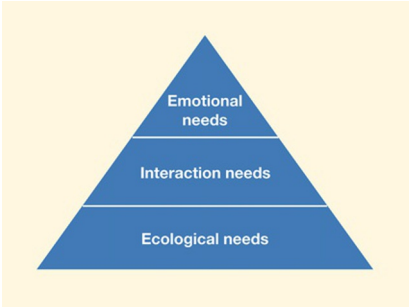

Fig. 12-5
Pyramid of human needs that are the purpose of UX design.

Meeting ecological needs is a prerequisite for meeting any other type of needs and is the foundational layer of the pyramid. Similarly, a design cannot satisfy users' emotional needs without first meeting ecological and interaction needs.

We will talk about designing the ecology (designing for a network or system of devices, physical locations, users, and information across which interactions can span) in Chapter 16, designing the interaction in Chapter 17, and designing for emotional impact in Chapter 18.

12.4 INFORMATION, INFORMATION DESIGN, AND INFORMATION ARCHITECTURE

We cannot discuss the nature of design without also talking about information, information design, and information architecture. These concepts are deeply intertwined and offer overlapping perspectives originating from different fields of study.

12.4.1 What is Information?

There are many definitions but, in the broadest sense and as the word implies, it is *anything that informs*. Taking an ecological perspective, this includes everything users sense, perceive, understand, and act on, in the environment. In this sense, the study of information is extremely broad. In this book, we take a similarly broad view of UX, and use a design-specific view of information surrounding the user.

There are other, narrower discussions of information, including but not limited to:

- Information encoding: About what symbols are used to represent information and how they are transmitted.
- Information detection: Identifying the presence or absence of a stimulus in the environment versus missing or making a false positive judgment (Wickens & Hollands, 2000, Chapter 2).
- Information processing: Looking at how humans sense stimuli in the environment, perception, cognition, memory, attention, and actions (Wickens & Hollands, 2000, Chapter 1).

Ecological Perspective

The design viewpoint taken from the ecological layer at the base of the pyramid of user needs, which is about how a system or product works within, interacts, and communicates with the context of its external environment. It is about how users can participate and thrive in the ecology of the work domain (Section 12.4.1).

12.4.2 Information Science

In the context of design, there is another area of study called information science, a sibling-concern of UX, focused on "the analysis, collection, classification, manipulation, storage, retrieval, movement, dissemination, and protection of information" (Stock & Stock, 2015).

This discipline predates HCI and UX and shares the goal of helping users with their needs, but from an information perspective. Some UX professionals trained in this discipline take the broad view that everything in the users' environment is information in some form or the other and therefore UX design is fundamentally about information. They even consider the field of architecture to be about information in the sense that issues such as how wide a corridor or a doorway should be in a building are information because users perceive and use that space accordingly.

12.4.3 Information Architecture

Another area of study that owes its roots to information science and the field of architecture is information architecture. Richard Saul Wurman, an architect by training and a graphic designer by choice, is regarded to be the inventor of the term information architecture.

The Information Architecture Institutes defines information architecture as *"the practice of deciding how to arrange the parts of something to be understandable."*[2] Note the emphasis on facilitating understanding and the breadth of situations where this can apply, including nondigital situations. The understanding part of this definition covers everything the users sense in an environment or a design, buttons that can be clicked, levers that can be pulled, audio prompts that can be heard, and displays that can be read.

Morville and Rosenfeld (2006) define information architecture as the design of information structures for organizing, storing, retrieving, displaying, manipulating, and sharing. Information architecture also includes design for labeling, searching, and navigating information.

12.4.4 Pervasive IA

Ecological Design

Design that pertains to the foundational layer of the needs pyramid, focused on designing for the overarching system needs of users and how they are supported in broader work practice. Includes designing for activities, the flow, sharing, and communication within the network of devices, other users, systems, and a pervasive information infrastructure (Section 16.2.1).

Information architects refer to the structure and design of information spanning multiple devices that users interact with as *pervasive information architecture* (Resmini & Rosati, 2011). *A pervasive information architecture is a structure for organizing, storing, retrieving, displaying, manipulating, and sharing information that provides ever-present information availability spanning parts of a broad ecology.*

Using our own vocabulary, we refer to those concerns as "ecological design." See Section 16.2.3 for further definition of pervasive IA and Section 16.5 for an extended example of ecological design as a pervasive information architecture.

12.4.5 Information Architecture is so Much More

We cannot begin to cover the many topics under the heading of information architecture. Readers should refer to other books in those areas.

12.4.6 Information Design

Information design is concerned with how "the objects and actions possible in a system are represented and arranged in a way that facilitates perception and understanding" (Rosson & Carroll, 2002, p. 109). As such, this is a core area of UX practice and focuses on helping users make sense of the information inherent in the system and its ecology. This includes everything from screens, dialogue boxes, icons, and voice prompts to tactile feedback (Rosson & Carroll, 2002).

[2] https://www.iainstitute.org/what-is-ia.

Traditionally, this area focused on how humans perceive and make sense of the information and included topics such as gestalt psychology, information visualizations, and visual metaphors. We cover some design guidelines pertaining to information design in Chapter 32.

12.5 ITERATION IN THE DESIGN CREATION SUBLIFECYCLE

Before we wrap up this chapter on the nature of design, here is a preview of chapters to come.

As a practical matter, the design creation box in the overall UX lifecycle (Fig. 12-6) unfolds as a series of iterative sublifecycles or activities. Among the very first to talk about iteration for interaction design were Buxton and Sniderman (1980).

In Fig. 12-6, we show a sequence of those activities.

The observant reader will note that the progressive series of iterative loops in Fig. 12-6 can be thought of as a kind of spiral lifecycle concept (Boehm, 1988). Each loop, in turn, addresses an increasing level of detail and fidelity.

12.5.1 Deciding on the Design Goal

The focus of this step is to agree on the goal for all subsequent design iterations. The question to answer is this: Is the goal of design to create a solution that will support existing work practice, or is it to create a solution that will radically transform the work practice (for the better)? (Chapter 13).

12.5.2 Generative Design Iteration

The focus of this phase of design creation is to generate as many design ideas and proposals as possible. In Fig. 12-7, we show the iteration for generative design—a fast, loosely structured activity for the purpose of exploring design ideas. This activity, a micro lifecycle within itself, includes synthesis, ideation, sketching, and critiquing.

The role of prototype is played by sketches, and the role of evaluation is carried out by discussion and critiquing. The output of generative design is a set of alternatives for conceptual designs and other capabilities or patterns for each level of the needs pyramid, mostly in the form of annotated rough sketches or storyboards.

We cover generative design (design creation) in Chapter 14.

Generative Design

An approach to design creation involving ideation, sketching, and critiquing in a tightly coupled but not necessarily structured iterative loop for exploring design ideas (Section 14.1.4).

Critiquing

An activity in which design ideas are assessed to identify advantages, disadvantages, constraints, and tradeoffs (Section 14.4).

Storyboard

A visual scenario in the form of a series of sketches or graphical clips, often annotated, in cartoon-like frames, illustrating the interplay between a user and an envisioned ecology or device (Section 17.4.1).

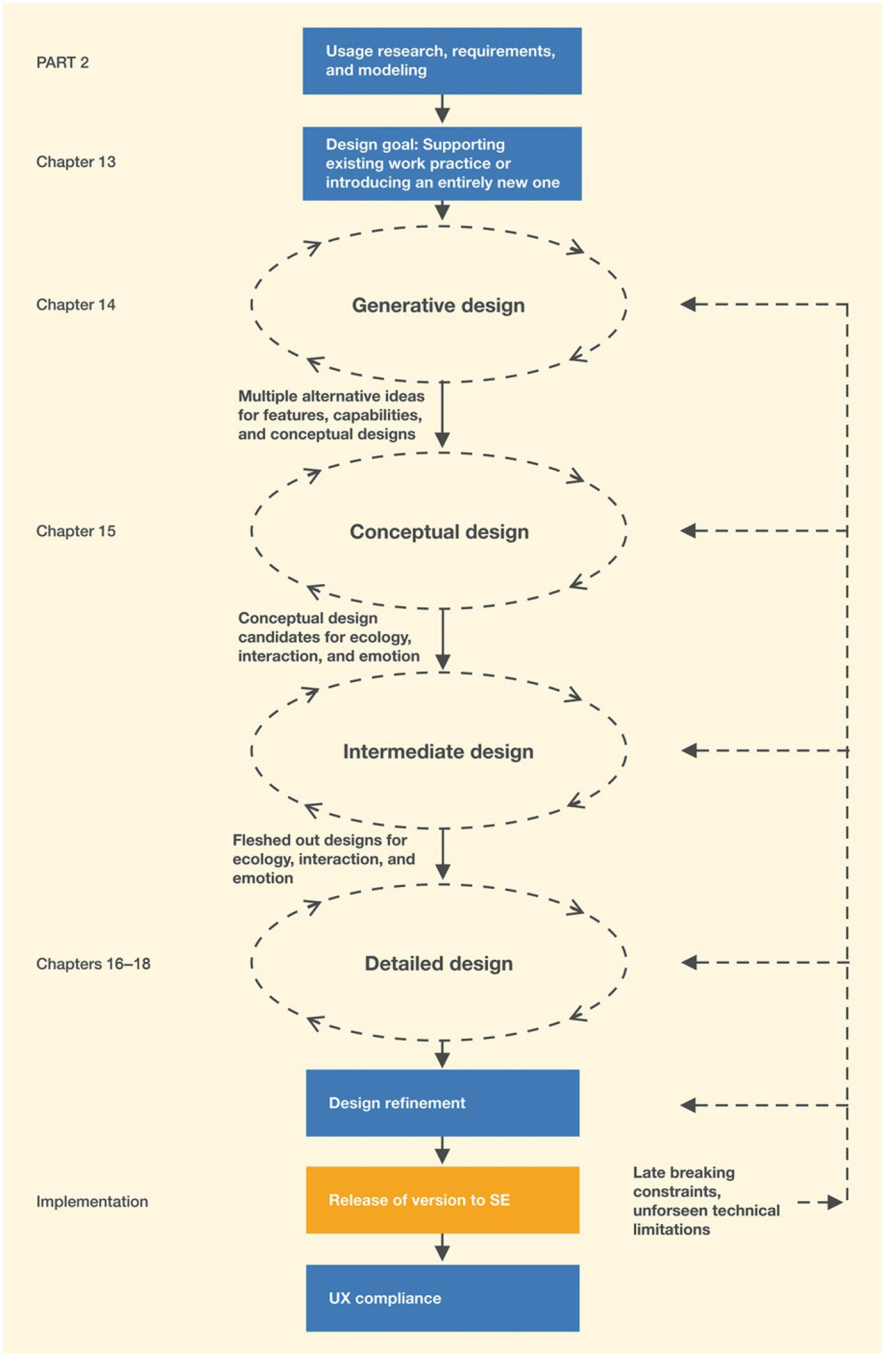

Fig. 12-6
Macro view of lifecycle activities in design.

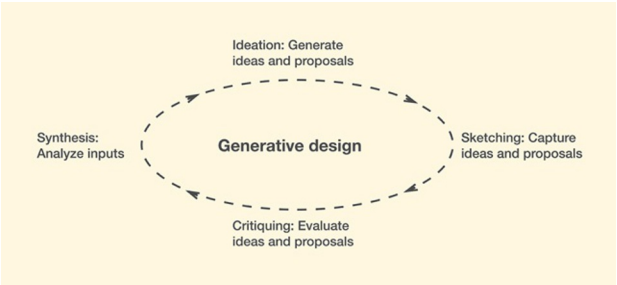

Fig. 12-7
Generative design iteration.

12.5.3 Conceptual Design Iteration

This iteration includes fleshing out the details of the high-level design theme or metaphor for each layer of the needs pyramid that came out of the generative design phase.

In Fig. 12-8, we show the early part of this phase, where you iterate on conceptual design candidates (Chapter 15). The role of prototype is played by storyboards and early wireframes. Wireframes, which will be described in more detail in Chapter 20, are essentially stick figure-like sketches of interaction screens made of lines, arcs, vertices, text, and (sometimes) simple graphics.

Depending on the project context, conceptual designs for one or more layers of the pyramid may be emphasized in storyboards. This is usually the stage where key stakeholders such as users or their representatives, business, software engineering, and marketing must be heavily involved. You are planting the seeds for what the entire design will be for the system going forward.

The type of evaluation here is usually in the form of storytelling via storyboards to key stakeholders. We discuss conceptual design (a high-level model or theme of how the system works acting as a framework to aid users to acquire their own mental model of how the system behaves) in Chapter 15.

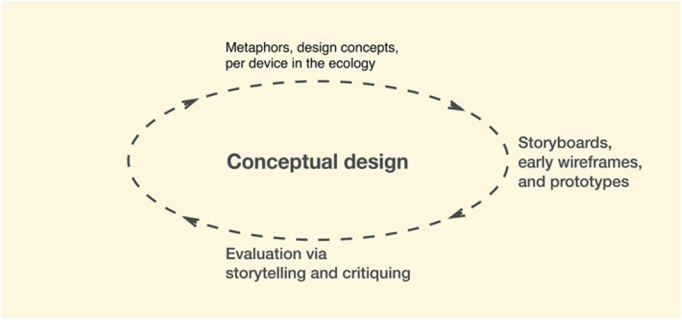

Fig. 12-8
Conceptual design iteration.

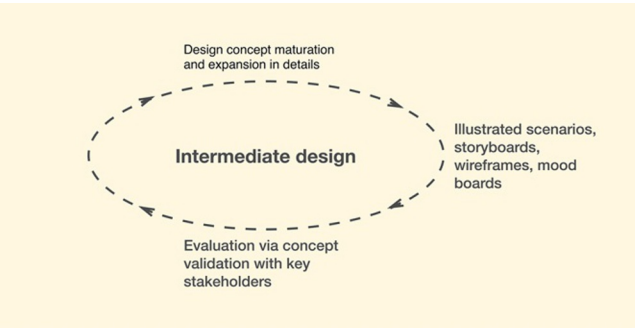

Fig. 12-9
Intermediate design iteration.

12.5.4 Intermediate Design Iteration

In Fig. 12-9, we show intermediate design iteration. The initial purpose of intermediate design is to sort out possible multiple conceptual design candidates and to arrive at the one most viable for ecological, interaction, and emotional designs. Once candidate conceptual designs are identified, in intermediate design, we proceed to flesh out the details of each candidate (more below).

For example, for the Ticket Kiosk System, at least two conceptual design candidates for the kiosk's interaction design were explored further. One is a traditional "drill-in" concept where users are shown available categories (e.g., movies, concerts, MU athletics) from which they choose one. Based on the choice on this first screen, the user is shown further options and details, navigating with a back button and/or "bread crumb" trail, if necessary, to come back to the category view. A second conceptual design is the one using the three-panel idea described in Fig. 17.2.

Intermediate design is the activity that usually takes the longest. The goal of intermediate design is to work out the details of the envisioned ecology, create logical flows of intermediate-level navigational structure and screen designs for interaction, and flesh out themes for emotional impact.

During this phase, all layout and navigation elements become fully developed. The role of prototypes is played by wireflows, illustrated scenarios, click-through mockups, and mood boards. Using wireflows, or sequences of wireframes, key workflows are represented while describing what happens when the user interacts with the various user interface objects in the design. It is not uncommon to have wireframe sets represent part of the workflow or each task sequence using click-through prototypes.

Similarly, all emotional impact issues such as visual design styles, iconography, tone, typography, animation frameworks, and auditory styles are all fleshed out.

Mood Board

A collage of artifacts and images showcasing a theme of emotional impact to be embraced within a UX design (Section 18.3.2.1).

One of the best ways to describe parts of your intermediate interaction design in a document is through illustrated scenarios, which combine the visual communication capability of storyboards and screen sketches with the capability of textual scenarios to communicate details. The result is an excellent vehicle for sharing and communicating designs to the rest of the team, and to management, marketing, and all other stakeholders.

Making illustrated scenarios is simple; just intersperse graphical storyboard frames and/or screen sketches as figures in the appropriate places to illustrate the narrative text of a design scenario. The storyboards in initial illustrated scenarios can be sketches or early wireframes.

The best way to communicate intermediate designs for emotional impact is through mood boards, visuals of sample screens, typographic palettes, and sound libraries.

12.5.5 Detailed Design Iteration

In Fig. 12-10, we show the detailed design iteration, often called design production. You iterate on the details of the design and finalize screen and layout details, including "visual comps" of the "skin" for the look and feel appearance for each screen on each device type in the ecology.

The prototypes at this stage are usually detailed and annotated wireframes and/or high-fidelity interactive mockups. They include all user interface objects and data elements, represented with higher fidelity and annotated with call-out text.

As a parallel activity, a visual designer who has been involved in ideation, sketching, and conceptual design now produces what we call visual "comps," meaning variously comprehensive or composite layout (a term originating in the printing industry). All user interface elements are represented, now with a very specific and detailed graphical look and feel.

A visual comp is a pixel-perfect mockup of the graphical "skin," including objects, colors, sizes, shapes, fonts, spacing, and location, plus visual "assets" for

Wireframe

A visual template of a screen or webpage design in the interaction perspective, comprised of lines and outlines (hence the name "wire frame"). A skeletal representation of the layout of interaction objects such as tabs, menus, buttons, dialogue boxes, displays, and navigational elements (Section 17.5).

Scenario

A description of specific people performing work activities in a specific work situation within a specific work context, told in a concrete narrative style as if it were a transcript of a real usage occurrence. Scenarios are deliberately informal, open ended, and fragmentary narrative depictions of key usage situations happening over time (Section 9.7.1).

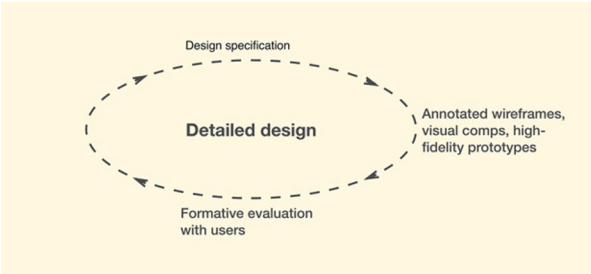

Fig. 12-10
Detailed design iteration.

user interface elements. An asset is a visual element along with all its defining characteristics as expressed in style definitions such as cascading style sheets for a website. The visual designer casts all of this to be consistent with company branding, style guides, and best practices in visual design.

At this stage, the design will be fully specified with complete descriptions of behavior, look and feel, and information on how all workflows, exception cases, and settings will be handled.

12.5.6 Design Refinement Iteration

The goal of the design refinement iteration is to make modifications, or adjust details of, the ecological, interaction, and emotional designs in response to findings from the formative evaluation (UX evaluation for the purpose of finding and fixing UX problems and thereby refining the design, Chapter 21) activity. In practice, if the previous iterations were conducted with the right amount of evaluation and involvement of key stakeholders, this phase usually does not result in drastic changes. This is also the last iteration within the UX lifecycle, before we merge into the larger SE+UX lifecycle (Chapter 29).

As part of this stage, the designs are presented to SE developers to get feedback about feasibility, platform constraints, etc., plus any necessary changes before an official "hand off" to them in the next phase.

12.5.7 SE Implementation

Early Funnel

The part of the funnel (agile UX model) for large-scope activity, usually for conceptual design, before syncing with software engineering (Section 4.4.4).

Late Funnel

The part of the funnel (agile UX model) for small-scope activity, for syncing with agile software engineering sprints (Section 4.4.3).

In this phase, the SE counterparts start the implementation. In early funnel, the UX output would be a large system-level specification. In late funnel, it would be at a feature level (see next section for more).

In practice, late-breaking constraints or unforeseen technical limitations may be discovered by the SE role that kick the design specifications back to the UX team. Depending on the severity of the issue, UX designers may need to make changes and go back to an earlier iteration stage. For deep system-level issues, the UX team might have to go as far back as revisiting the conceptual design decisions and make adjustments. The most common changes at this stage, however, tend to be at the detailed design level and require small adjustments.

12.5.8 UX Compliance Phase

After the SE role completes the implementation, the UX role checks the final implementation to ensure that SE faithfully implemented the UX design they were given in the "hand off." The objective of this phase is to ensure that there

were no misunderstandings and misinterpretations of the UX specifications as they got implemented. Any deviations from the specification will be caught and corrected in this phase before releasing to users.

12.6 DESIGN LIFECYCLE FOR THE AGILE UX FUNNEL

How does this design creation sublifecycle fit into the agile UX funnel concept we discussed in Section 4.4? In Fig. 12-11, we show another variation in the design sublifecycle: iteration in each slice of the agile UX funnel.

As you can see in the figure, designing each slice of functionality in the funnel entails an iteration of the steps in Fig. 12-6. Work in the early funnel addresses a global view of the product or system and, therefore, has a large (system-wide) scope. This translates to more time spent on the generative design and conceptual design phases because the decisions of these iterations will have a major impact on the later slices of the funnel.

As we progress to the narrower end of the funnel, the focus of generative design and other iterations will be on smaller slices of functionality (smaller scope features), further constrained by conceptual design decisions already made in previous slices.

Scope (of Delivery)

Describes how the target system or product is "chunked" (broken into what size pieces) in each iteration or sprint for delivery to the client and users for feedback and to the software engineering team for agile implementation (Section 3.3).

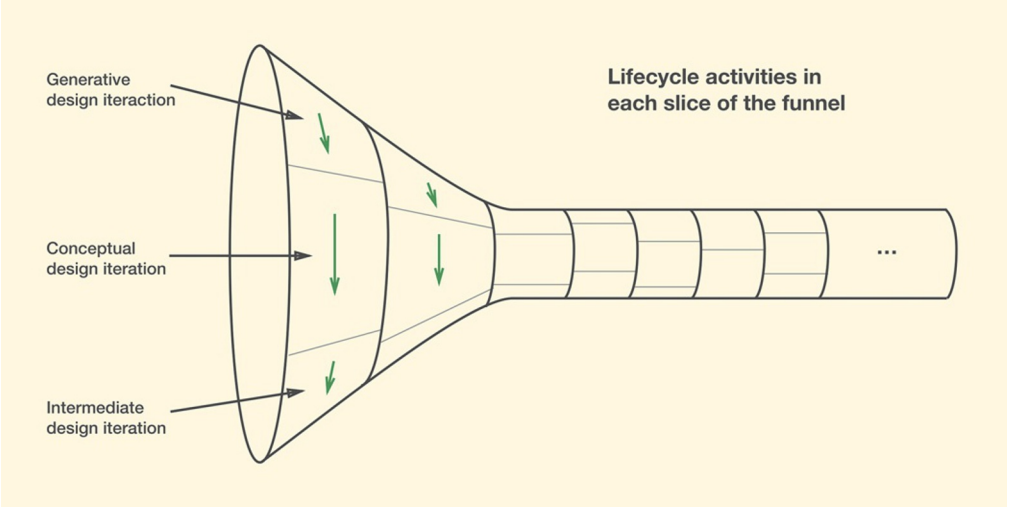

Fig. 12-11

Design creation sublifecycle in the agile UX funnel.