CHAPTER

14 Generative Design: Ideation, Sketching, and Critiquing

In the beginning the Universe was created. This has made a lot of people very angry and been widely regarded as a bad move.

– Douglas Adams, The Restaurant at the End of the Universe

Highlights

- Preparing for design via immersion.
- The role of synthesis.
- Ideas: the building blocks of design.
- Ideation:
  - Ideation informers.
  - Ideation catalysts.
  - Ideation techniques.
- Sketching.
- Critiquing.
  - Rules of engagement.

14.1 INTRODUCTION

14.1.1 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. 14-1). In this chapter, we get into the UX design process, starting with generative design or design creation.

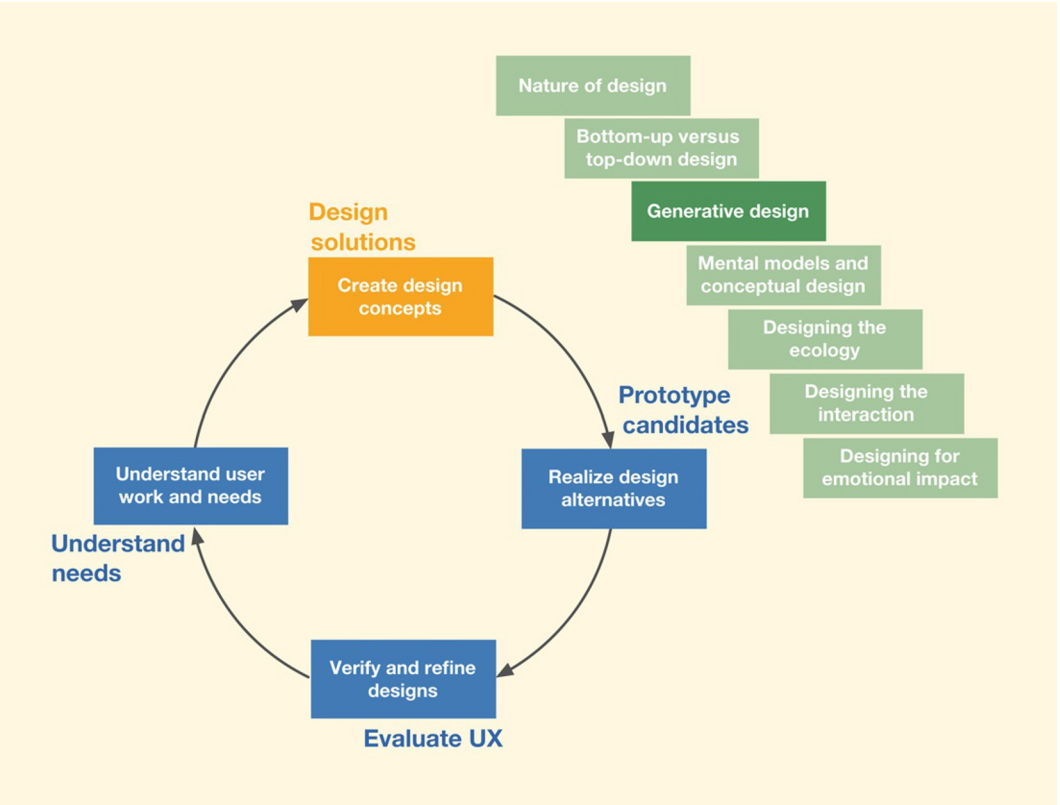

Fig. 14-1

You are here in the chapter on the subactivity of creating UX designs within the Design Solutions lifecycle activity, in the context of the overall Wheel UX lifecycle.

In this chapter we describe processes, methods, and techniques relating to design creation. The overarching objective of design creation is to formulate a plan for how the system will be structured to satisfy the ecological, interaction, and emotional needs of users (Section 12.3).

Compared to the usage research in Part 2, design is a less procedural and a more creative activity. While usage research was about observation and understanding things as they currently are, design is about lateral thinking and generating new ideas to make things better.

14.1.2 Preparing for Design Creation: Immersion

Designers, like usage researchers, need immersion—a form of deep thought and analysis—to understand a problem and to be able to make connections among the different aspects of it.

To set the stage for ideation, immerse yourself within a design-support milieu, a "war room" of working artifacts as inputs and inspiration to ideation. Get it all out there in front of you to point to, discuss, and critique. Fill your walls, shelves, and work tables with artifacts, representations of ideas, images, props, toys, notes, posters, sketches, diagrams, mood boards, and images of other good designs.

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).

Immersion starts by getting reacquainted with all the models and inputs to design we created during usage research. It is a prerequisite to participating in activities for generating new ideas and concepts.

Now the UX studio really shines. The UX studio (Section 5.3) is a good way to house your immersive environment. The different artifacts trigger ideas and bring to surface the connections and relationships among various entities in the work domain. Any questions designers may have about the work domain can be readily answered by walking up to the appropriate model on the studio walls. The very context of a design studio puts you in a creative frame of mind.

14.1.3 The Role of Synthesis

At its base, design is an approach to problem solving based on synthesis, which involves integrating disparate inputs and insights; satisfying a variety of technical, business, and cultural constraints; achieving a variety of stakeholder goals; managing tradeoffs; etc., to create a single unified design.

Synthesis

The process of integrating diverse inputs, facts, insights, and observations of parts of a concept to make conclusions that characterize and aid understanding of the whole concept (Section 8.9).

It's about putting together known or existing ideas in new ways to form new concepts. While an analytic approach can suffice to improve existing designs, synthesis is required to make the leap to brand new ideas. Design synthesis is "… the epitome of the breakthrough idea, the ability to pull together disconnected ideas and arrive at something new and meaningful" (Baty, 2010).

14.1.4 Overview of Generative Design: Intertwining of Ideation, Sketching, and Critiquing

Following immersion into usage data and the synthesis of other design inputs, designers perform *generative design, an approach to design creation involving ideation, sketching, and critiquing in a tightly coupled, but not necessarily structured, iterative loop for exploring a design idea* (Fig. 14-2).

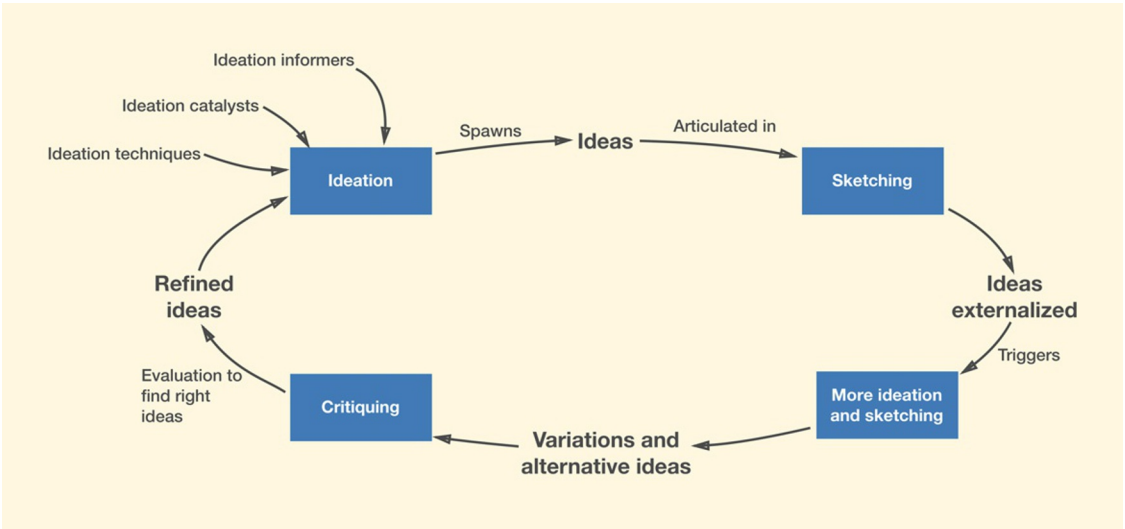

Fig. 14-2
Ideation, sketching, and critiquing activities for exploring design ideas.

These generative design activities include:

- Ideation: The activity where ideas are spawned. A cognitive technique to create varying and innovative design possibilities (Section 14.2).
- Sketching: An externalization activity that captures those ideas in concrete representations (Section 14.3).
- Critiquing: An analysis activity to evaluate the emergent design ideas for tradeoffs (Section 14.4).
- Refining: An activity (usually iterative) where ideas are adopted, modified, or discarded.

When people think of ideation they also think of the term "brainstorming," which is another term for this process of ideation, sketching, and critiquing. And, even though we describe these activities separately for clarity, they are inextricably intertwined and occur as a rapid iteration of tightly coupled and overlapping activities, often essentially performed simultaneously. Each of these activities supports and stimulates the others.

For example, the activity of sketching is a simple and immediate way to capture an idea, which in itself can incite further ideas. A sketch gives something tangible to refer to in discussion (critiquing). Similarly, the postulation (genesis) of an idea, for example, is often followed by a burst of reasoning or analysis (critiquing).

14.2 IDEATION

14.2.1 The Creative Role of Ideation in Design

If the roof doesn't leak, the architect hasn't been creative enough.

– Frank Lloyd Wright (Donohue, 1989)

Ideation is the most important generative aspect of design; it is the leading edge of the act of creation. Ideation is the process of creating various and innovative proposals for ecological, interaction, and emotional designs. This is a hugely creative and fun phase.

Diversity in the design team helps with ideation because it brings varied perspectives. If only team members with similar backgrounds participate in ideation, they will bring to the table only ideas, concepts, and constructs from that background and experience.

Ideation is the time to get clients and users to participate, too. There have been a number of participatory design (Muller, 2003) schemes in the past to actively involve all stakeholders to get the broadest range of design ideas and to be sure all needs are considered. For more about participatory design and its history in human-computer interaction, see Section 19.2.

Participatory Design

A democratic process for UX design actively involving all stakeholders (e.g., employees, partners, customers, citizens, users) to help ensure that the result meets their needs and is usable. Based on the argument that users should be involved in designs they will be using, and that all stakeholders, including and especially users, have equal input into UX design (Section 11.3.4).

14.2.2 Ideas: The Building Blocks of Design

14.2.2.1 What is an idea?

In this context, *an idea is a visualized design proposal that can include visions of new ecologies, interactions, emotional responses, and capabilities in a system or product.*

Ideas are conjured by the human mind or borrowed from observations of nature, and are triggered by focused activity or unexpected catalysts. For example, looking at a breakdown in a flow model can trigger ideas on how to circumvent or mitigate it. Similarly, looking at an inspiring image or artifact in the design studio can trigger a new idea about colors or graphics for the visual design of a product.

Sometimes ideas occur as "eureka moments," springing up at unexpected places and unexpected times. They can even occur when we are not actively seeking them (during idea "incubation").

Whatever their provenance, ideas by their very nature are delicate and need to be cultivated to grow. They need to be captured as soon as they occur or they may be lost forever. And they need to be nurtured. Without an environment or culture of openness, ideas can be cut down by premature judgment.

Incubation

Continuation of work in the background by the brain on a problem during a break after a period of deep thinking about the problem. Can result in fresh perspectives after returning to focus on the problem (Section 14.2.8.4).

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).

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).

Sprint

A relatively short (not more than a month) time period within an agile software engineering schedule in which a working and releasable product increment is implemented. It is a unit of work being done in an agile SE environment; an iteration associated with a release (to the client and/or users) (Sections 3.3, 29.3.2, and 29.7.2).

Work Activity Note

A brief, clear, concise, and elemental (relating to exactly one concept, idea, fact, or topic) statement used to document a single point about the work practice as synthesized from raw usage research data (Section 8.1.2).

Ideas can work together to generate a single design concept. For example, having a circular ring that is touch sensitive is an idea. Using that ring to scroll through a list of items is another idea. These two ideas were instantiated into a design feature on the iPod Classic.

And finally, some ideas can be reused in different situations; we call such ideas design patterns.

14.2.3 Ideation Scope

In the early part of the agile UX funnel, ideation is usually wide in scope because the goal is to create the overarching conceptual designs for the entire system. In the latter part of the funnel, ideation can be localized to focus on the designs for a particular sprint. The constraints of the broader conceptual design and what was delivered in previous sprints usually reduce the scope of ideation during these latter sprints.

14.2.4 Ideation Informers, Catalysts, and Techniques

There are three types of inputs to ideation (Fig. 14-2): ideation informers, catalysts, and techniques (Sections 2.4–2.6 and 14.2.4).

Ideation informers. Ideation informers provide information about usage, requirements, targets, and goals, and are part of immersion. Ideation informers are not building blocks; you don't just take them and put them together to make a design. Rather, they inform by pointing to design-oriented aspects, such as task descriptions or user personas, to consider or take into account in the design. Ideation informers are usually derived from the usage research data as a process step and manifest themselves as usage data models and, possibly, an affinity diagram of work activity notes (Section 8.7). See Section 14.2.4 for more on ideation informers.

Ideation catalysts. In contrast, ideation catalysts are design inspirers, design-oriented flashes that inspire creative design solutions. A catalyst in general is something that precipitates an event or change without itself being affected or changed. An ideation catalyst is not something a designer can do; it just happens and that happening can spawn a new design idea. See Section 14.2.4 for more on ideation catalysts.

Ideation techniques. In contrast, an ideation technique is something a designer can do to foster the spawning or nurturing of a design idea. Brainstorming, framing, and storytelling are examples of ideation techniques. See Section 14.2.8 for more on ideation techniques.

14.2.5 Doing Ideation

Setting the stage with immersion. As we said in Section 14.1.2, immerse yourself within a design-support milieu.

Ideation as a group activity. Even though ideation can be performed by designers on their own, it can be more effective when undertaken as a group with members from different backgrounds. When undertaken as a group activity, it is a common to start with an overview discussion to establish background and parameters and agreement on goals of the ideation exercise.

Mechanics of ideation. The goal here is to have intense rapid interactions to spawn and accumulate large numbers of ideas about characteristics and features. Write ideas on a whiteboard or use marking pens on flip charts. Or write your ideas on sheets of paper so that you can move them around to organize them.

Start with the ideation. The social, flow, artifact, and physical models are all visual, which makes them ideal for informing and inspiring design. We suggest that you organize some of your ideation sessions around each of these models by making each the focal point of design thinking and ideation before moving on to the next.

Proceed to ideation techniques. For example, ask yourself what the design would create if you had a magic wand. Look at the abstract work activity to see what ideas it triggers.

Use teamwork and play off each other's ideas while "living the part of the user." Talk in scenarios, keeping customers and users in the middle, telling stories of their experience as your team weaves a fabric of new ideas for design solutions.

Make the outputs of your ideation as visual and tangible as possible. Intersperse an outline with sketches, sketches, and more sketches. Post and display everything all around the room as your visual working context. Where appropriate, build physical mockups as embodied sketches. You can include examples of other systems, conceptual ideas, considerations, design features, marketing ideas, and experience goals. Get all your whacky, creative, and off-the-wall ideas out there. The flow should be a mix of verbal and visual.

When the fountain of new ideas seems to have run dry for the moment, the group can switch to critiquing mode.

Ideation Informer

Informative inputs to design that help establish designs appropriate to the work practice, including all the usage research data models and user personas (Section 14.2.6).

Design Thinking

The mindset of getting organizations to think like designers, applying design principles and practice to businesses and business processes (Section 1.8.1).

Ideation

An active, creative, exploratory, highly iterative, fast-moving, and usually collaborative brainstorming process for forming ideas for design (Section 14.2).

Abstract Work Activity

A description of the fundamental nature of work in a particular work domain, stripping it to its essentials (Section 13.3.2).

Example: Ideation at IDEO

In IDEO's "deep dive" approach, a cross-disciplinary group works in total immersion without consideration of rank or job title. In their modus operandi of focused chaos (not organized chaos), "enlightened trial and error succeeds over

Physical Mockup

A tangible, three-dimensional prototype or model of a physical device or product, often one that can be held in the hand and often crafted rapidly out of materials at hand, used during exploration and evaluation to at least simulate physical interaction (Section 20.6.1).

Critiquing

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

the planning of lone genius." Their designing process was illustrated in a well-known *ABC News* documentary (ABC News Nightline, 1999) with a new design for supermarket shopping carts, starting with a brief user research inquiry where team members visited different stores to understand the work domain of shopping and issues with existing shopping cart designs and use.

Then, in an abbreviated user research analysis process, they regrouped and engaged in debriefing, synthesizing different themes that emerged in their user research inquiry. This analysis fed parallel brainstorming sessions in which they captured all ideas, however unconventional. At the end of this stage they indulged in another debriefing session, combining the best ideas from brainstorming to assemble a design prototype. This alternation of brainstorming, prototyping, and review, driven by their "failing often to succeed sooner" philosophy, is a good approach for anyone wishing to create a good user experience.

Example: Ideation for the Ticket Kiosk System

We brainstormed with potential ticket buyers, students, MU representatives, and civic leaders. Here we show selected results of that ideation session with our Ticket Kiosk System design team as a consolidated list with related categories in the spirit of "verbal sketching." As in any ideation session, ideas were accompanied with sketches. We show the idea part of the session here separately to focus on the topic of this section.

Thought questions to get started:

- What does "an event" mean? How do people treat events in real life?
- An event is more than something that happens and maybe you attend.
- An event can have emotional meanings, can be thought provoking, can have meaning that causes you to go out and do something.

Data artifacts:

- Tickets, events, event sponsors, MU student ID, kiosk.

Things people might want to do with tickets:

- People might want to email tickets to friends.

Possible features and breadth of coverage:

- We might want to feature customized tickets for keepsake editions.
- Homecoming events.
- Parents weekend events.
- Visiting speakers on current topics.
- Visitor's guide to what's happening in town and the university.
- Christmas tour of Middleburg.

View Christmas decorations on historic homes.

Walk Main Street to see decorations and festive shops.

Types of events:

Action movies, comedy (plays, stand-up), concerts, athletic events, specials.

Special themes and motifs:

Motif for the Ticket Kiosk System could be "Adventures in Entertainment," which would show up in the physical design (the shape, images and colors, the aesthetic appearance) of the kiosk itself and would carry through to the metaphor pervading the screen, dialogue, buttons, and so on in the interaction design.

Complete theme package: Football game theme: brunch, tailgating parties, game tickets, postgame celebrations over drinks at select places in town, followed by a good football movie.

Date night theme: Dinner and a movie, restaurant ads with movie/event tickets, proximity information and driving/public transportation directions, romantic evening, flowers from D'Rose, dinner at Chateau Morrisette, tour some of the setting for the movie *Dirty Dancing*, stroll down Draper Road under a full moon (calendar and weather driven), watch *Dirty Dancing* at The Lyric Theater, tickets for late-night wine tasting at The Vintage Cellar, wedding planner consultation (optional).

Business consideration:

Because it is a college town, if we make a good design, it can be reused in other college towns.

Competition: Because we are up against ubiquitous websites, we have to make the kiosk experience something way beyond what you can get on a website.

Emotional impact:

Emotional aspect about good times with good friends.

Emphasize MU team spirit, logos, etc.

Entertainment event tickets are a gateway to fun and adventure.

Combine social and civic participation.

Indoor locations could have immersive themes with video and surround sound.

Immersive experience: For example, indoor kiosk (where security is less of a problem) at the University Mall, offer an experience "they cannot refuse," support with surrounding immersive visuals and audio, ATM-like installation with wraparound display walls and surround sound, between ticket buyers, run preview of theme and its mood.

Minority Report style UIs.

Rock concerts for group euphoria.

Monster trucks or racing: ambience of power and noise, appeals to the more primal instincts and thrill-seeking.

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).

Other desired impact:

- Part of university and community "family."
- Ride on the emerging visibility of and talent at MU.
- Collective success and pride.
- Leverage different competencies of MU and community technologies.
- Patron-of-the-arts feeling: classiness, sophistication, erudition, feeling special.

Community outreach:

- Create public service arrangements with local government (e.g., could help advertise and sell T-shirts for annual street art fair).
- Advertise adult education opportunities, martial arts classes, kids camps, art and welding courses.

Ubiquitous locations:

- Bus stops.
- Library.
- Major dorms.
- Student center.
- City Hall building.
- Shopping malls.
- Food courts.
- Inside buses.
- Major academic and administrative buildings.

Design Thinking

The mindset of getting organizations to think like designers, applying design principles and practice to businesses and business processes (Section 1.8.1).

Exercise 14-1: Ideation About Aircraft Flight Recorders

This is a team design thinking exercise, so gather into your team, go to a quiet place (your UX studio, if you have one) and start ideation and sketching, using what you know of the domain.

When planes crash, we often hear that the flight recorder box, which has the most recent flight and pilot data on magnetic tape, is the key to understanding the cause. However, we also often hear that the flight recorder box cannot be found or is found in damaged condition.

Taking into account available technology and the broadest context and ecosystem in which planes and flight recorders operate, come up with a conceptual design of a much better way to do it.

14.2.6 Ideation Informers

Ideation informers are informative inputs to design that help establish designs appropriate to the work practice. They include all the usage research data models and user personas.

14.2.6.1 User work roles

User work roles help identify the types of users and work that the design should support and a way to carve out subsystems in the overall ecology. For example, the ticket buyer work role and the event manager work role help designers think of two separate designs and capabilities. The work these two roles do has almost no overlap and consequently the designs for these roles will not either. This points to two subsystems that need to be built, each with different interaction designs and emotional impact aspects but sharing the same overall ecology.

Ecology

In the setting of UX design, the ecology is the entire set of surrounding parts of the world, including networks, other users, devices, and information structures, with which a user, product, or system interacts (Section 16.2.1).

14.2.6.2 Personas

We talked about constructing personas in Section 7.5.4.1. Personas work best to channel the act of creation toward supporting a particular archetype of a work role in the work domain. Without personas, the inputs designers need to deal with could be overwhelming and often competing or contradictory.

Where personas work best. Personas work best in design situations where the work domain is broad and unconstrained (i.e., projects on the left side of the system complexity space of Fig. 3.1). When personas are used in designing commercial products or systems in such situations, they help account for the nuances and activities in the personal lives of the various work roles.

Persona

A narrative description of a specific design target of a UX design for a user in one work role, a hypothetical but specific "character" in a specific work role (Section 9.4).

In such systems, personas provide inferences that take the conclusion a bit beyond just what is explicit in the raw data. For example, Mary is a very busy 35-year-old soccer mom who balances the management of three kids, a household, and a career. You know immediately that a design solution for a calendar management app, for example, cannot require her to focus for long periods, sitting in front of a computer. The solution needs to have mobile components and we need to include various kinds of alerts (calendar alarms, text messages) because she is already overstretched in terms of time management and will be at risk of forgetting important calendar events responsibilities.

Goals for using personas in design. As we will see, designers often come up with more than one possible user persona for a work role (Cooper, 2004). The idea behind designing for these multiple personas is that the design must make the primary persona very happy while not making any of the selected personas unhappy. Buster will love it and it still works satisfactorily for the others.

System Complexity Space

A two-dimensional space defined by the dimensions of interaction complexity and domain complexity, depicting a spectrum of system and product types with a broad range of risk versus needs for rigor in lifecycle activities and methods (Section 3.2.2.1).

Personas also provide inputs into emotional aspects because they describe personal traits and preferences of users.

Personas also provide a way to evaluate whether the design matches the target user. It is a concrete way of level setting as we develop designs. It is a way to check evolving design plans.

Using personas in design. Start by making your design as though Rachel, your primary persona, is the only user. Team members tell stories about how Rachel would handle a given usage situation. As more and more of her stories are told, Rachel becomes more real and more useful as a medium for conveying requirements.

In Fig. 14-3, let us assume that we have chosen persona P3 as the primary persona out of four selected candidate personas. Because Design(P3) is a design specific to just P3, Design(P3) will work perfectly for P3. Now we have to make adjustments to Design(P3) to make it suffice for P1.

Then, in turn, we adjust it to suffice for P2 and P4. As you converge on the final design, the nonprimary personas will be accounted for via Design(P1), Design(P2), and Design(P4), but will defer to the primary persona, Design (P3), in case of conflict. If there is a design tradeoff, you will resolve the tradeoff to benefit the primary persona and still make it work for the other selected personas.

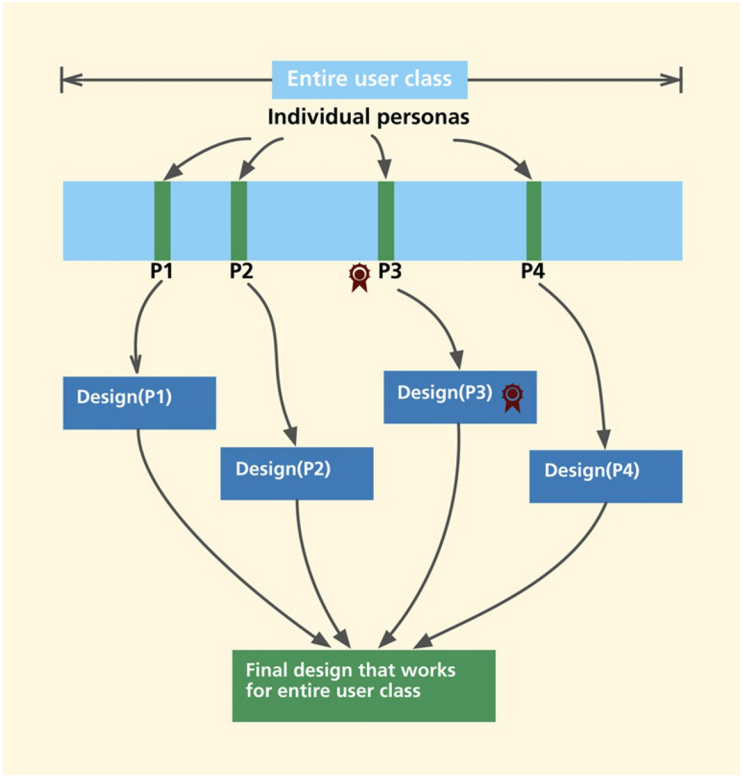

Fig. 14-3
Adjusting a design for the primary persona to work for all the selected personas.

Example: Cooper's In-Flight Entertainment System

Cooper (2004, p. 138) describes the successful use of personas in a Sony design project for an in-flight entertainment system called P@ssport. In addition to the work roles for system maintenance and the flight attendants who set up and operate the entertainment system, the main users are passengers on flights. We call this main work role the Traveler.

The user population that takes on the role of Traveler is just about the broadest possible population you can imagine, including essentially all the people who travel by air—almost everyone. Users will have very diverse characteristics. Cooper showed how the use of personas helped mitigate the breadth, vagueness, and openness of the various Traveler user class characteristics.

You could come up with dozens or more personas to represent the Traveler, but in that project the team got it down to four personas, each very different. Three were quite specialized to match the characteristics of a particular type of traveler while the fourth was more general: An older guy who was not technology savvy and was not into exploring user interface structures or features—essentially the opposite of most of the characteristics of the other personas.

They considered designs for each of the first three personas, but none of those designs would have worked for the fourth. In the end, they came up with an initial design for the fourth persona and then adapted it to work well for all the other personas without sacrificing its effectiveness for the target persona.

Exercise 14-2: Creating a User Persona for Your System

Goal: Get some experience at writing a persona.

Activities: Select an important work role within your system. At least one user class for this work role must be very broad, with the user population coming from a large and diverse group such as the general public.

- Using your user-related contextual data, create a persona, give it a name, and get a photo to go with it.
- Write the text for the persona description.

Deliverables: One- or two-page persona write-up.

Schedule: You should be able to do what you need to learn from this in about an hour.

14.2.6.3 Flow models and physical models

Flow models and, in some cases, physical models, provide insights into envisioning a new ecology for the work practice. Using them as guides, look for

Flow Model

A simple graphical diagram giving a big picture or overview of work by representing how information, artifacts, and work products flow among work roles and system components within the work practice of an organization (Section 9.5).

Physical Work Environment Model

Pictorial representation of the milieu in which work gets done, including the physical layout of work locations, personnel, equipment, hardware, physical parts of the ecology, communications, devices, and databases that are part of the work practice (Section 9.9).

Activity-Based Interaction

Interaction in the context of one or more task thread(s), a set of, or possibly sequences of, multiple, overlapping, and related tasks, often involving more than one device in an ecology (Sections 1.6.2 and 14.2.6.4).

ideas to eliminate flows, roles, and redundant data entry. For those flows that cannot be eliminated, look for ideas to make them more efficient and to avoid ecology-level breakdowns and constraints.

14.2.6.4 Activity-based interaction and design

As we said in Section 1.6.2, an activity is one or more task thread(s), a set or possibly sequences of multiple overlapping tasks that go together in a way they is seen in real usage. It can involve a set of related tasks performed on one device or interaction across devices in the user's ecology.

Look at activity-based interaction for ideas to support workflows that span multiple devices in the ecology. For each device in the ecology, look for interaction design ideas. For example, what is the best way for a user to "access" event tickets? Does it require interacting with physical tickets or can the user somehow get them on their phones? What are some ideas for the buyer to pay for the tickets?

14.2.6.5 Task structure and sequence models

Look in these models for ideas for interaction design flows. What are different ways to support the different tasks in a sequence model? How should the design support interruption of a sequence? What are the best interaction design patterns for each task sequence in these models?

From the task interaction models, look for ideas to reduce and automate steps while avoiding redundant data entry and unnecessary physical motions.

These models can also provide clues toward emotional design concerns. For example, for repetitive and monotonous tasks, think of ideas such as gamification and positive reinforcement with task milestones in the interaction design.

14.2.6.6 Artifact model

Look at the artifacts in the artifact model and design requirements (Chapter 10). Identify metaphors that can relate the system to the artifacts people see and use daily in the work practice.

In Section 7.5.4.1, we talked about the student team that collected restaurant order-form artifacts. They can be a great start for an ideation exercise by asking questions such as: How can we make the experience for the customer placing an order in the restaurant more fun, engaging, and informed? Wouldn't it be cool if each dining table contained an embedded interactive touch screen? Diners can even browse the menu or read the biosketch of the new chef. Users could also pass time by playing games or surfing the web.

This interactive table feature can also help overcome an important problem in ordering food: Textual descriptions on a paper menu don't convey what the eating experience will be like. Paper menus do not leverage the potentially rich human sensual connection to the food! Why not let the customer, using an interactive tabletop, ask questions about ingredients and see images of the dish being served? Then it's only a small step to let customers place their orders themselves.

14.2.6.7 Information architecture model

An information object is an internally stored, structured or simple, article or piece of information or data that serves as a work object. Information objects are often data entities central to work flow being operated on by users; they are organized, shared, labeled, navigated, searched and browsed for, accessed and displayed, modified and manipulated, and stored back again, all within a system ecology.

Look for all the information objects in the current work practice that need to be managed in the design. As these information objects move within the envisioned ecology, they are accessed and manipulated by people in various work roles. In an enterprise human resources application, for example, information objects might be employee work history forms and other objects such as paychecks that are created, modified, and processed by users. Look for ideas on how to structure the various information objects in the design (i.e., ideas for the information architecture of the objects). Think about what kinds of operations or manipulations will be performed.

What are the different points in the ecology where a certain information object will be accessed? What aspects of that object will be preserved in each of the devices in the ecology? This is where you start defining it and laying out the information structure for the ecology. This is called pervasive information architecture (Resmini & Rosati, 2011), which provides ever-present information availability across devices, users, and other parts of a broad ecology.

14.2.6.8 Social models

Look for ideas to help with emotional needs. What are some concerns and issues you identified with the culture and inter-actor influences in the work practice? Think of ideas to mitigate them in the design. In your user research data, look for work activity notes about places in the work practice that are drudgery so you can invent fun ways to overcome these feelings. Use these issues as springboards to your design scenarios, sketches, and storyboarding. Find ways, using the social model as a guide, to increase communication, reinforce positive values, address concerns of people in work roles, and accommodate influences.

System-Spanning Interaction

A kind of activity-based interaction, often involving multiple parties in multiple work/play roles, multiple devices, and multiple locations (Section 1.6.3).

Artifact Model

A representation showing how users employ, manipulate, and share key tangible objects (physical or electronic work practice artifacts) as part of the flow in their work practice (Section 9.8).

Work Artifact

An object, usually tangible, that plays a role in the work flow of a system or enterprise—for example, a printed receipt in a restaurant (Section 9.8).

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).

Information Architecture

Design of information structures for organizing, storing, retrieving, displaying, manipulating, and sharing. Information architecture also includes designs for labeling, searching, and navigating information (Section 12.4.3).

Work Activity Note

A brief, clear, concise, and elemental (relating to exactly one concept, idea, fact, or topic) statement used to document a single point about the work practice as synthesized from raw usage research data (Section 8.1.2).

14.2.6.9 Requirements

In Chapter 10, we talked about capturing design requirements from the usage research data. The statement of a requirement in itself can trigger or inform a design idea. How do other systems support such a requirement? What are some problems or downsides with such an idea. Is there a better idea to support that requirement?

14.2.7 Ideation Catalysts

Ideation catalysts are phenomena that incite the creation of ideas. An ideation catalyst is not something a designer can willfully plan for and do, but something that arises spontaneously, possibly from brainstorming or storytelling. A catalyst can trigger a spark or inspiration that can lead to a "eureka moment," unlocking the power of ideation and making it fruitful. Ideation catalysts were important inputs for great inventors like Thomas Edison and great thinkers like Albert Einstein.

Example of a Design Idea Catalyst: Velcro

A good example of this is seen in the now well-known story (Brown, 2008) of George de Mestral, an engineer who, on a walk in the country, got those little round burrs stuck to his sweater. The nondesign thinker just gets irritated. But this guy was thinking like a designer and he envisioned a material that could stick together and be pulled apart many times without damage. And so he invents Velcro.[1]

The burrs were a design catalyst. They just happened and that spawned a design idea.

14.2.7.1 The eureka moment

Boling and Smith (2012), citing Krippendorff (2006), describe a crucial event in design creation: "When designers work, no matter what process they follow or type of thinking they employ, *they inevitably face the moment of invention* [emphasis ours]. This is the point at which no theory, guideline, example, or statement of best practice can tell the designer or the design team specifically what to do." This moment of invention is precisely the point where a design idea is created, something is conceived that didn't exist before. A design catalyst facilitates this moment of invention to help spawn the genesis of an idea.

Sometimes ideas occur spontaneously or involve a "muse," something that inspires or guides creativity. It definitely involves insight, instinct, intuition, and a natural ability to think outside the box and see "it," an aptitude Malcolm Gladwell (2007) says can be honed in a designer.

[1] https://en.wikipedia.org/wiki/George_de_Mestral.

When "it" happens, something triggers an "aha" moment and a design idea emerges. For example, sitting in a bath tub is supposed to have produced the spark that triggered Archimedes' idea of how to measure the volume of an irregular solid.[2]

Example: An Industrial Engineering Story

This is a story about the production line in a toothpaste factory. Credit goes to an unknown person who started this (possibly apocryphal but illustrative) story circulating through the Internet.

The factory had a problem: They sometimes shipped empty boxes, without the tube inside. This was due to the way the production line was set up, and people with experience in designing production lines will tell you how difficult it is to have everything happen with timing so precise that every single unit coming out of it is perfect. Small variations in the environment (which can't be controlled in a cost-effective fashion) mean you must have quality assurance checks smartly distributed across the line so that customers all the way down to the supermarket don't get upset and buy another product instead.

Understanding how important that was, the CEO of the toothpaste factory got the top people in the company together. They decided to start a new project in which they would hire an external engineering company to solve their empty box problem, as their own engineering department was already too stretched to take on any extra effort.

The project followed the usual process: budget and project sponsor allocated, RFP issued, third-parties selected, and six months (and $180,000) later they had a fantastic solution—on time, on budget, high quality. and everyone in the project had a great time.

They solved the problem by using high-tech precision scales that would sound a bell and flash lights whenever a toothpaste box weighed less than it should. The line would stop; someone would walk over and yank the defective box off it, pressing another button when done to restart the line.

A while later, the CEO decides to have a look at the return on investment of the project: amazing results! No empty boxes ever shipped out of the factory after the scales were put in place. Very few customer complaints, and they were gaining market share. "That's some money well spent!" he said, before looking closely at the other statistics in the report.

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[2] https://en.wikipedia.org/wiki/Archimedes%27_principle.

It turns out that, after three weeks of production use, the number of defects picked up by the scales was zero. It should have picked up at least a dozen a day, so maybe there was something wrong with the report. He requested an inquiry, and after some investigation, the engineers come back saying the report was actually correct. The scales really weren't picking up any defects because all boxes that got to that point in the conveyor belt were good.

Puzzled, the CEO traveled down to the factory, and walked up to the part of the line where the precision scales were installed. A few feet before the scale, there was a cheap desk fan, blowing the empty boxes off the belt and into a bin.

"Oh, that," says one of the workers, "one of the guys put it there because he was tired of walking over here every time the bell rang." Sometimes the best idea is spawned in the simplest way.

14.2.8 Ideation Techniques

Ideation techniques are skill-based UX practices that UX designers can do to support ideation, sketching, and critiquing while fostering new design ideas. Ideation techniques are the more general UX design techniques (Section 2.4) as applied to ideation.

14.2.8.1 Framing and reframing

Framing

The practice of posing a problem within a particular perspective based on a pattern or theme that structures the problem and highlights the aspects you will explore (Section 2.4.10).

Framing and reframing represent a design technique that poses the design problem along a particular dimension to spark a hitherto-unconsidered analysis of tradeoffs. It is a technique to look at an aspect of the work domain along a particular dimension, making it easy to talk about that aspect of the problem. Framing acts as scaffolding because it has a structure and you use that structure to help in analysis.

As Cross (2006) puts it: "Designers tend to use solution conjectures as the means of developing their understanding of the problem." Creating frames is a way to focus not on the generation of solutions but on the ability to create new approaches to the problem situation itself (Dorst, 2015).

14.2.8.2 Abstraction: Getting back to the basics

In Chapter 13, we talked about using *abstraction, which is the process of removing extraneous details of a work activity and focusing on the irreducible constructs of the problem to identify what is really going on, ignoring everything else.*

14.2.8.3 Magic wand: Asking "what if?"

Another ideation technique is the magic wand technique where you ask "what-if" questions to temporarily set aside known constraints. This technique helps with

lateral thinking and to generate ideas that, while impossible as is, shed light on other related ideas that are possible.

In the toothpaste factory example, if we had a magic wand, what would we do? We might ask for the ability to see through the cardboard box to know if it is empty. This idea of seeing through a box can now be modified to bring it out of the realm of magic by ideating on techniques to make this possible. An X-ray or sonogram machine mounted on the belt would provide the same outcome as the magical see-through idea.

14.2.8.4 Incubation

Another kind of ideation technique is incubation. Idea incubation can occur if you take a break after a period of deep thinking about a problem. Your brain can work on the problem in the background as you back off and give it a rest, resulting in fresh perspectives after you return to the problem. Even though we are not actively working on the problem during this break, our brains have the capacity to incubate ideas in the background and come up with ideas at unexpected times, typically while doing some other activity.

14.2.8.5 Design patterns and experience

A design pattern is a repeatable solution to a common design problem that emerges as a best practice, encouraging sharing, reuse, and consistency. See also Section 17.3.4.
Sometimes design patterns from other disciplines help trigger ideas. For example, when Rex and I were discussing the problem of the toothpaste factory, we thought of another domain that solves a different problem using weighing scales that could be used here. We remembered how Amazon packing centers use exact weight calculation to know if a package being prepared on an automated conveyor belt has all the products the customer purchased. If the calculation was off more than a small margin of error, the package is pushed off the conveyor belt and flagged for further analysis and human intervention. When we reuse that knowledge, we call it a design pattern and it can be applied to the problem of the toothpaste factory, proposing a solution that pushes off a toothpaste box that doesn't weigh enough.

14.2.8.6 Traverse the different dimensions of the problem space

This ideation technique is to methodically traverse each dimension of the problem space to look for ideas that were previously missed. In this technique, designers systematically traverse the design space in search of ideas.

In the toothpaste factory example, one can traverse the different dimensions of the problem, such as mass/weight, volume, and opacity, to lead us to the following ideas:

- Mass of the product:
  - Ascertaining the mass is what it should be by weighing.
  - Ascertaining the mass is what it should be through resistance to force.
- Volume occupancy:
  - Internal sensor in the box.
  - Displacement of fluid (air) in the box.
- Seeing inside:
  - Visual inspection by manually opening each box.
  - Sensing by X-ray.
  - Sensing by sonogram.

Note how this traversal was done by framing the problem around the toothpaste box. Another framing could be the manufacturing process itself. Perhaps there is a different technique that wraps the box around a tube instead of building them separately and inserting one into the other?

14.2.8.7 Seek opportunities for embodied and tangible interaction

Embodied Interaction

Interaction with technology that involves a user's body in a natural and significant way, such as by using gestures (Section 6.2.6.3).

Tangible Interaction

Interaction involving physical actions between human users and physical objects. A key area of focus in Industrial design, pertaining to designing objects and products to be held, felt, and manipulated by humans. Closely related to embodied interaction (Section 6.2.6.3).

This ideation technique is about bringing physicality and embodiment into design. It is about weaving the fabric of interaction to include not just the digital realm with its windows, icons, and menus but also the physical world where things can be touched, grabbed, turned, held, and otherwise manipulated using noncognitive senses.

Simply stated, embodiment means having a body. So, taken literally, embodied interaction is about using one's physical body while interacting with the surrounding technology. But, as Dourish (2001) explains, embodiment does not simply refer to physical reality but "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."

As a result, embodiment is not about people or systems per se. As Dourish puts it, "embodiment is not a property of systems, technologies, or artifacts; it is a property of interaction. Cartesian approaches separate mind, body, and thought from action, but embodied interaction emphasizes their duality."

Although tangible interaction (Ishii & Ullmer, 1997) seems to have a following of its own, it is very closely related to embodied interaction. You could say that they are complements to each other. Tangible design is about interactions

between human users and physical objects. Industrial designers have been dealing with it for years, designing objects and products to be held, felt, and manipulated by humans. The difference now is that the object involves some kind of computation. Also, there is a strong emphasis on physicality, form, and tactile interaction (Baskinger & Gross, 2010).

Physicality

Referring to real direct physical interaction with real physical (hardware) devices like in the grasping and moving of knobs and levers (Section 30.3.2.4).

More than ever before, tangible and embodied interaction calls for physical prototypes as sketches to inspire the ideation and design process. Through physical prototypes, we can collaborate, communicate, and make meaning through physically shared objects in the real world.

In designing for embodied interaction (Tungare et al., 2006), ideate on how to involve hands, eyes, and other physical aspects of the human body in the interaction. Supplement the pure cognitive actions that designers have considered in the past and take advantage of the user's mind and body as they potentiate each other in problem solving.

Example: Embodied and Tangible Interaction in a Board Game

If we were to try to make a digital version of a game such as SCRABBLE (example shown below), one way to do it is by creating a desktop application where people operate in their own window to type in letters or words. This makes it an interactive game but not embodied.

Tangible Interaction

Interaction involving physical actions between human users and physical objects. A key area of focus in Industrial design, pertaining to designing objects and products to be held, felt, and manipulated by humans. Closely related to embodied interaction (Section 6.2.6.3).

Another way to make SCRABBLE digital is the way Hasbro did it in SCRABBLE Flash Cubes (Fig. 14-4). Hasbro Games has used embedded technology in producing an electronic version of the SCRABBLE. They made the game pieces into real physical objects with built-in technology. Because you can hold these objects in your hands, it makes them very natural and tangible and contributes to emotional impact because there is something fundamentally natural about that.

The fact that players hold the cubes, SmartLink letter tiles, in their hands and manipulate and arrange them with their fingers makes this a good example of embodied and tangible interaction.

At the start of a player's turn, the tiles each generate their own letter for the turn. The tiles can read each other's letters as they touch as a player physically shuffles them around. When the string of between two and five letters makes up a word, the tiles light up and beep and the player can try for another word with the same tiles until time is up.

The tiles also work together to time each player's turn, flag duplicates, and display scores. And, of course, it has a built-in dictionary as an authority (however arbitrary it may be) on what comprises a real word.

For more about embodied interaction (interaction with technology that involves a user's body in a natural and significant way, such as in gestures) and tangible interaction (interaction that involves physicality in user actions), see Section 19.3.

Fig. 14-4
The SCRABBLE Flash Cube game.

14.3 SKETCHING

The idea of sketching as an indispensable part of design goes back at least to the Middle Ages. Consider da Vinci and his famous sketchbooks. Nilsson and Ottersten (1998) describe sketching as an essential visual language for brainstorming and discussion.

14.3.1 Characteristics of Sketching

Sketching is the rapid creation of freehand drawings expressing preliminary design ideas, focusing on concepts rather than details. We credit Buxton (2007b) as the champion for sketching; much of what we say about sketching can be credited to him.

Here are some more defining characteristics of sketching (Buxton, 2007b; Tohidi, Buxton, Baecker, & Sellen, 2006):

- Everyone can sketch; you do not have to be artistic.
- Most ideas are conveyed more effectively with a sketch than with words.
- Sketches are quick and inexpensive to create; they do not inhibit early exploration.
- Sketches are disposable; there is no real investment in the sketch itself.
- Sketches are timely; they can be made just in time, done in the moment, provided when needed.
- Sketches should be plentiful; entertain a large number of ideas and make multiple sketches of each idea.
- Textual annotations play an essential support role, explaining what is going on in each part of the sketch and how.

14.3.1.1 Sketching is essential to ideation and design

Sketching is an indispensable part of design. As Buxton (2007b) puts it, if you're not sketching, you're not doing design. Design is a process of creation and exploration, and sketching is a visual medium for exploration.

Sketching captures ideas into an embodied and tangible form; it externalizes the mental description of an idea for sharing, analysis, and archiving. By opening up new pathways to create new ideas, sketching acts as a multiplier in ideation.

By adding visualization to ideation, sketching adds cognitive supercharging, boosting creativity by bringing in more human senses to the task (Buxton, 2007b).

14.3.1.2 Sketching is a conversation about user experience

Sketching is not art. Sketching is not about putting pen to paper in the act of drawing, nor is it about artistic ability. A sketch is not about making a drawing or picture of a product to document a design.

A sketch is a conversation. A sketch is not just an artifact that you look at; *a sketch is a conversation* about design. A sketch is a medium to support a conversation among the design team.

A sketch is about the user experience, not the product. In a talk at Stanford, Buxton (2007a) challenges his audience to draw his mobile phone. But he does not mean a drawing of the phone as a product. He means something much harder—a sketch that reveals the interaction, the experience of using the phone in a situated context where the product and its physical affordances encourage one type of behavior and experience over another.

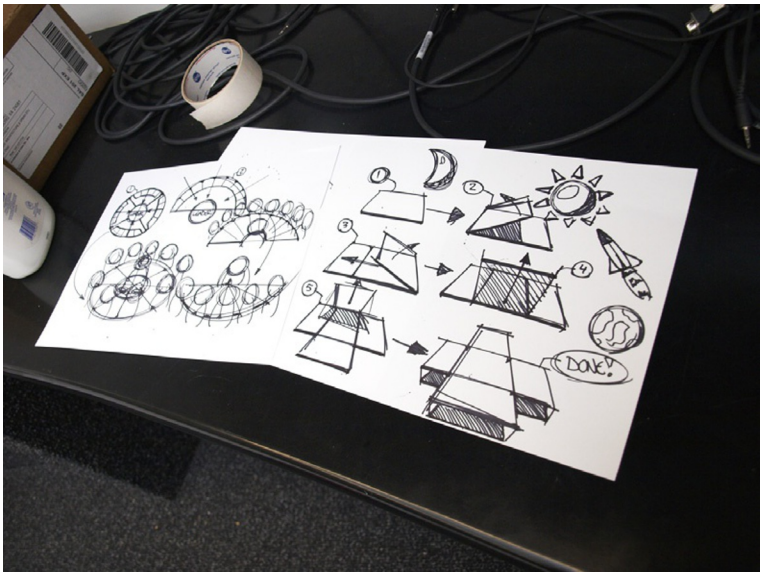

Fig. 14-5

A sketch to think about design (photo courtesy of Akshay Sharma, of the Virginia Tech Department of Industrial Design).

14.3.1.3 Sketching is embodied cognition to aid invention

Designers invent while sketching. A sketch is not just a way to represent your thinking; the act of making the sketch is part of the thinking (Fig. 14-5). In fact, the sketch itself is less important than the process of making it.

The importance of involving your hands in sketching. The kinesthetics of sketching, pointing, holding, and touching bring the entire hand-eye-brain coordination feedback loop to bear on the problem solving. Your physical motor movements are coupled with visual and cognitive activity; the designer's mind and body potentiate each other in invention (Baskinger, 2008).

Physical Mockup

A tangible, three-dimensional prototype or model of a physical device or product, often one that can be held in the hand and often crafted rapidly out of materials at hand, used during exploration and evaluation to at least simulate physical interaction (Section 20.6.1).

14.3.2 Doing Sketching

14.3.2.1 Stock up on sketching and mockup supplies

Stock the ideation studio with sketching supplies such as whiteboards, blackboards, corkboards, flip chart easels, Post-it labels, tape, and marking pens. Be sure to include supplies for constructing physical mockups, including scissors, hobby knives, cardboard, foam core board, duct tape, wooden blocks, push pins, string, bits of cloth, rubber, other flexible materials, crayons, and spray paint.

14.3.2.2 Use the language of sketching

The vocabulary of sketching. To be effective at sketching for design, you must use a particular vocabulary that has not changed much over the centuries. One of the most important language features is the vocabulary of lines, which are made as freehand "open" gestures. Instead of being mechanically correct and perfectly straight, lines in sketches are roughed in and not connected precisely.

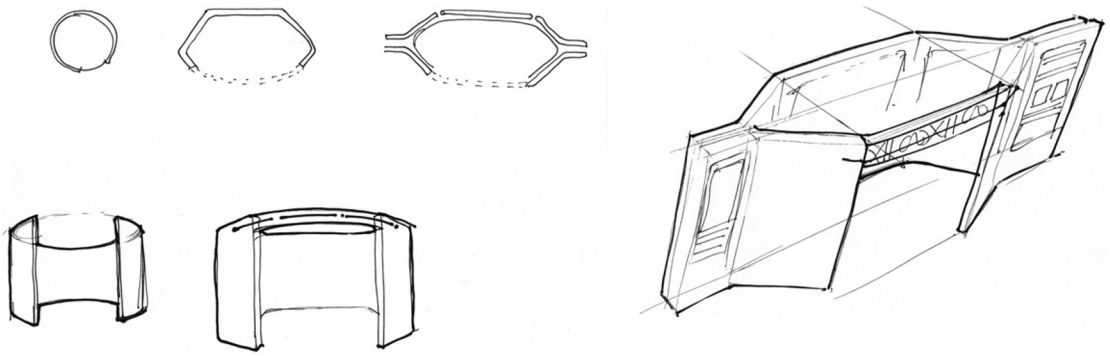

Fig. 14-6

Freehand gestural sketches for the Ticket Kiosk System (sketches courtesy of Akshay Sharma, of the Virginia Tech Department of Industrial Design).

In this language, lines overlap, often extending a bit beyond the corner. Sometimes they "miss" intersecting and leave the corner open a little bit.

An unfinished appearance proposes exploration. The low resolution and detail of a sketch suggest it is a concept in the making, not a finished design. It needs to look disposable and inexpensive to make. Sketches are deliberately ambiguous and abstract, leaving "holes" for the imagination about other aspects of the design. You can see this unfinished look in the sketches of Figs. 14-6 and 14-7.

Keep sketches open to interpretation. Sketches can be interpreted in different ways, fostering new relationships to be seen within them, even by the person who drew them. In other words, avoid the appearance of precision; if everything is specified and the design looks finished, then the message is that you are telling something, "This is the design," not proposing exploration, "Let us play with this and see what comes up."

In Fig. 14-8, we show examples of designers doing sketching.

Example: Sketching for a Laptop Projector Project

The following figures show sample sketches for the K-YAN project (K-yan means "vehicle for knowledge"), an exploratory collaboration by the Virginia Tech Industrial Design Department and IL&FS.4.[3] The objective is to develop a combination laptop and projector in a single portable device for use in rural India. Thanks to Akshay Sharma of the Virginia Tech Industrial Design Department for these sketches. See Figs. 14-9–14-12 for different kinds of exploratory sketches for this project.

[3] www.ilfsindia.com.

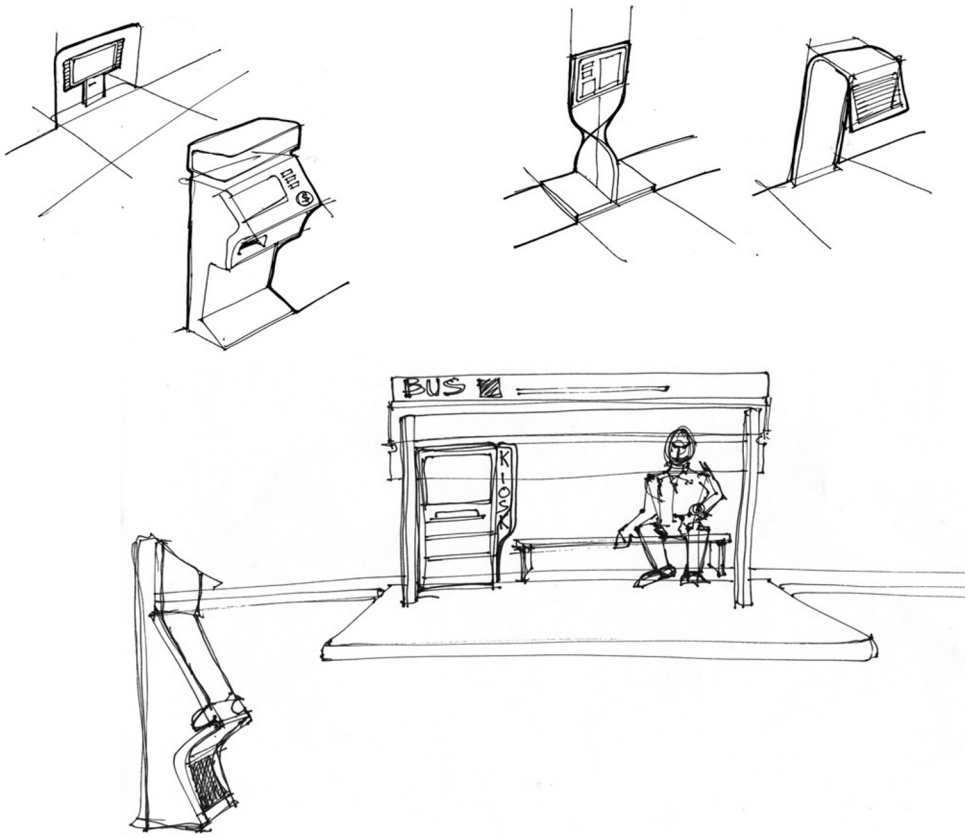

Fig. 14-7

Ideation and design exploration sketches for the Ticket Kiosk System (sketches courtesy of Akshay Sharma, of the Virginia Tech Department of Industrial Design).

Fig. 14-8

Designers doing sketching (photos courtesy of Akshay Sharma, of the Virginia Tech Department of Industrial Design).

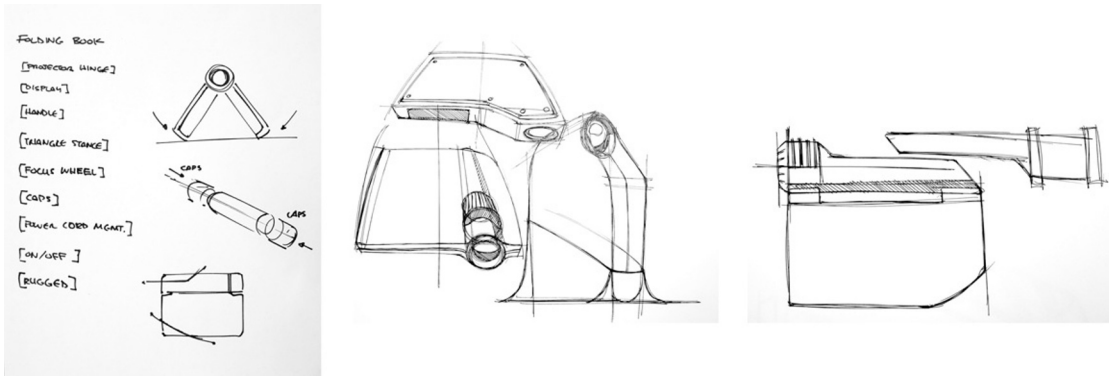

Fig. 14-9

Early ideation sketches of K-YAN (sketches courtesy of Akshay Sharma, of the Virginia Tech Department of Industrial Design).

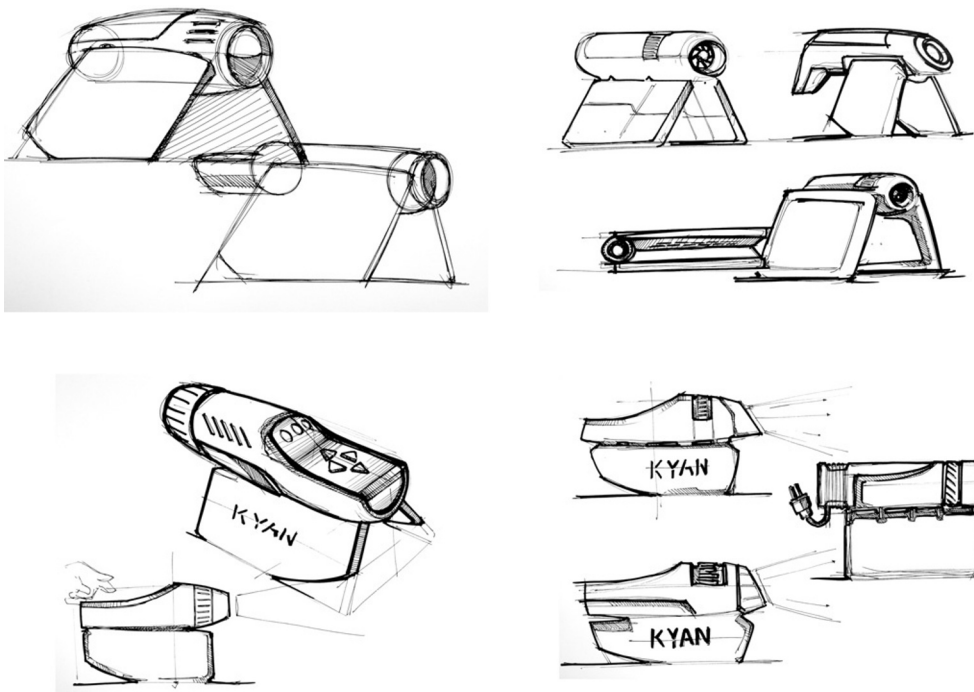

Fig. 14-10

Midfidelity exploration sketches of K-YAN (sketches courtesy of Akshay Sharma, of the Virginia Tech Department of Industrial Design).

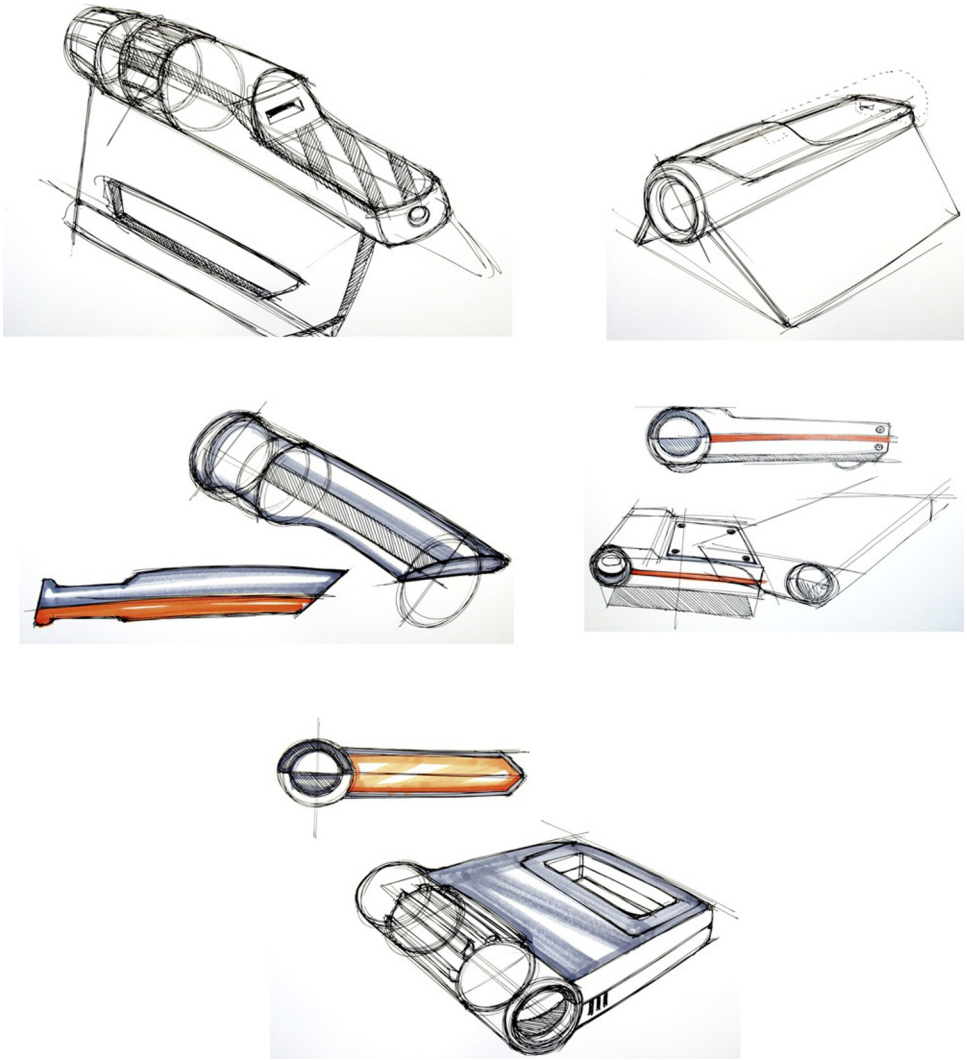

Fig. 14-11

Sketches to explore flip-open mechanism of K-YAN (sketches courtesy of Akshay Sharma, of the Virginia Tech Department of Industrial Design).

14.3.3 Exercise 14-3: Practice in Ideation and Sketching

Goal: To get practice in ideation and sketching for design.

Activities: Doing this in a small group is strongly preferable, but you can do it with one other person.

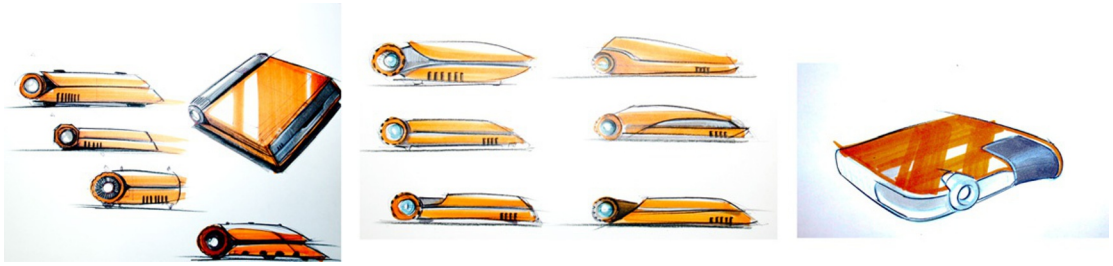

Fig. 14-12

Sketches to explore the emotional impact of the form for K-YAN (sketches courtesy of Akshay Sharma, of the Virginia Tech Department of Industrial Design).

- Get out blank paper, appropriate marking pens, and any other supplies you might need for sketching.
- Pick a topic, a system, or device. Our recommendation is something familiar, such as a dishwasher.
- Start with some free-flow ideation about ways to design a new and improved concept of a dishwasher. Do not limit yourself to conventional designs.
- Go with the flow and see what happens.
- Remember that this is an exercise about the process, so what you come up with for the product is not that crucial.
- Everyone should make sketches of the ideas that arise about a dishwasher design, as you go in the ideation.
- Start with design sketches in the ecological perspective. For a dishwasher, this might include your dining room, kitchen, and the flow of dishes in their daily cycle. You could include something unorthodox: sketch a conveyor belt from the dinner table through your appliance and out into the dish cabinets. Sketch how avoiding the use of paper plates can save resources and not fill the trash dumps.
- Make some sketches from an interaction perspective showing different ways you can operate the dishwasher: how you load and unload it and how you set wash cycle parameters and turn it on.
- Make sketches that project the emotional perspective of a user experience with your product. This might be more difficult, but it is worth taking some time to try.
- Ideate. Sketch, sketch, and sketch. Brainstorm and discuss.

Interaction Perspective

The design viewpoint taken within the interaction layer of the pyramid of user needs, between the ecological layer at the base and the emotional layer on top. The interaction perspective is about how users operate the system or product. It is a task and intention view, in which user and system come together. It is where users look at displays and manipulate controls, and do sensory, cognitive, and physical actions (Section 12.3.1).

Deliverables: A brief written description of the ideation process and its results, along with all your supporting sketches.

Schedule: Give yourself enough time to really get engaged in this activity.

Exercise 14-4: Ideation and Sketching for Your System

Goal: More practice in ideation and sketching for design. Do the same as you did in the previous exercise, only this time for your own system.

14.3.4 Physical Mockups as Embodied Sketches

Just as sketches are two-dimensional visual vehicles for invention, a physical mockup for ideation about a physical device or product is a three-dimensional sketch. Physical mockups as sketches, like all sketches, are made quickly, are highly disposable, and are made from at-hand materials to create tangible props for exploring design visions and alternatives.

A physical mockup is an embodied sketch because it is even more of a physical manifestation of a design idea and it is a tangible artifact for touching, holding, and acting out usage (Fig. 14-13).

For later in the process, after design exploration is done, you may want a more finished-looking three-dimensional design representation (Fig. 14-14) to show clients, customers, and implementers.

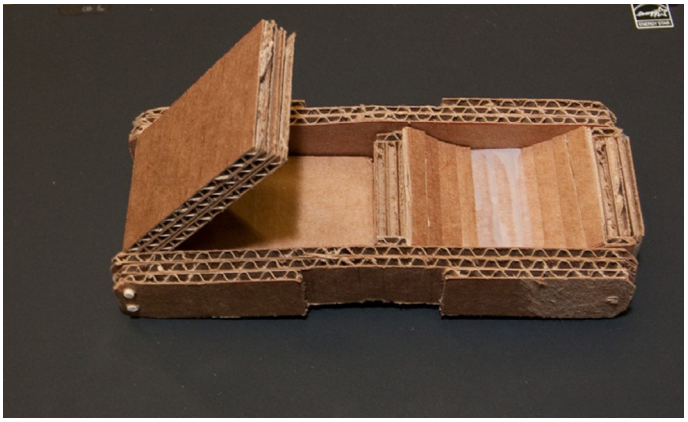

Fig. 14-13

Example of rough physical mockups (courtesy of Akshay Sharma, of the Virginia Tech Department of Industrial Design).

14.4 CRITIQUING

Critiquing is the activity where design ideas are assessed to identify advantages, disadvantages, and constraints and tradeoffs are evaluated for each idea.

At a high level, the goal of critiquing is to analyze if the design:

- Meets design goals?

Fig. 14-14

Example of a more finished looking physical mockup (courtesy of Akshay Sharma, of the Virginia Tech Department of Industrial Design).

- Fits well with the ecology? Communicates seamlessly with other devices in the environment?
- Supports the interaction needed with other devices?
- Provides good usability?
- Evokes positive emotional impact?
- Engenders meaningfulness for users?

This evaluation part of generative design is never formal; there are no established methods. It is a fast, furious, and freewheeling comparison of many alternatives and inspiration for further alternatives.

14.4.1 Include Users in the Critiquing Activity

Pull together the best of all the different brainstorming ideas into a single big-picture redesign of how work gets done and communicate the new vision to customers and users.

For this critical analysis, bring in a huge cross-section of people with broadly varying backgrounds, perspectives, and personalities.

- Show off your ideas and sketches along with other mockups and models.
- Let them talk, argue, and criticize.
- Your job is to listen.

Fig. 14-15

Critiquing within the Virginia Tech ideation studio, Kiva (photo courtesy of Akshay Sharma, of the Virginia Tech Department of Industrial Design).

In Fig. 14-15, we show an example of critiquing in midprocess within the Virginia Tech ideation studio.

14.5 "RULES OF ENGAGEMENT" FOR IDEATION, SKETCHING, AND CRITIQUING

14.5.1 Behave Yourself

The process should be democratic:

- Every idea valued the same.
- Ego-free process.
- No ownership of ideas:
  - All ideas belong to the group.

14.5.2 Be Aware of Which Mode You Are In

Back in graduate school, I (Rex) read a simple paper on "stop-and-go thinking" (Mason, 1968) that has affected my outlook on problem-solving and brainstorming ever since. This paper suggests that, if you keep the creative mindset of ideation separate from the judicial mindset of critiquing, you will get better ideas and make wiser judgments.

Although you will interweave ideation and critiquing throughout the design process, you should know which mode you are in at any given time and not mix the modes. Ideation should result in a pure flow of ideas regardless of feasibility, in the classic tradition of brainstorming. Although we know that, at the end of the day, practical implementation constraints must be considered and allowed to carry weight in the final overall design, saying "Hey, wait a minute!" too early can stifle innovation.

Mason (1968) calls this separation of ideation and critiquing "go-mode and stop-mode thinking." In idea-creation (go) mode, you adopt a freewheeling mental attitude that will permit ideas to flourish. In critiquing (stop) mode, you revert to a cold-blooded, critical attitude that will bring your judgment into full play.

Ideation gives you permission to be radical; you get to play outside the safe zone and no one can shoot you down. Allowing early cries of "that will never work," "they have already tried that," "it will cost too much," "we do not have a widget for that," or "it will not work on our implementation platform" will unfairly hobble and frustrate this first step of creativity.

The design teams at IDEO (ABC News Nightline, 1999) signal premature critiquing by ringing a wrist-mounted bicycle bell to signal the foul of being judgmental too early in design discussions.

14.5.3 Iterate to Explore

Finding the best design ideas requires exploring a large number of possibilities and candidate designs. The best tools for exploring ideas are ideation, sketching, and critiquing, combined with extensive iteration (Buxton, 2007b). Be ready to try, try, try, and try again, rapidly. Think about Thomas Edison and his more than 10,000 experiments to create a usable and useful light bulb.