Delivering Design:
Performance and Materiality in Professional Interaction Design

By
Elizabeth Sarah Goodman

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Committee in charge:
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Professor Massimo Mazzotti
Professor Kimiko Ryokai
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Abstract
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Elizabeth Sarah Goodman
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Interaction design is the definition of digital behavior, from desktop software and mobile applications to components of appliances, automobiles, and even biomedical devices. Where architects plan buildings, graphic designers make visual compositions, and industrial designers give form to three-dimensional objects, interaction designers define the digital components of products and services. These include websites, mobile applications, desktop software, automobiles, consumer electronics, and more. Interaction design is a relatively new but fast-growing discipline, emerging with the explosive growth of the World Wide Web. In a software-saturated world, every day, multiple times a day, billions of people encounter the work products of interaction design.

Given the reach of their profession, how interaction designers work is of paramount concern. In considering interaction design, this dissertation turns away from a longstanding question of design studies: *How does interaction design demonstrate a special form of human thought?* And towards a set of questions drawn from practice-oriented studies of science and technology: *What kinds of objects and subjects do interaction design practices make, and how do those practices produce them?*

Based on participant observation at three San Francisco interaction design consultancies and interviews with designers in California's Bay Area, this dissertation argues that performance practices organize interaction design work. By "performance practices," I mean episodes of storytelling and narrative that take place before an audience of witnesses. These performances instantiate — make visible and tangibly felt — the human and machine behaviors that the static deliverables seem unable on their own to materialize. In doing so, performances of the project help produce and sustain alignment within teams and among designers, clients, and developers.

In this way, a focus on episodes of performance turns our concerns from cognition, in which artifacts assist design thinking, to one of enactment, in which documents, spaces, tools, and bodies actively participating in producing the identities, responsibilities, and capacities of project constituents. It turns our attention to questions of political representation, materiality and politics. From this perspective, it is not necessarily how designers *think* but how they stage and orchestrate performances of the project that makes accountable, authoritative decision-making on behalf of clients and prospective users possible.

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Acknowledgements

> Every thing we design and make is an improvisation, a lash-up, something inept and provisional. We live like castaways. But even at that we can be debonair and make the best of it (Pye, 1964, p. 12).

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My interest in the practices of performance emerges from nearly a decade of work as a costume designer. More so than what I read in books, the knowledge I absorbed from actors, directors, designers, and stage managers about the craft and philosophy of the theater have never left me. In particular, I thank with respect and fondness my supervisors and teachers Lora Dole, James Luce and Eden Miller. They would all likely be surprised to discover that their demonstrations, suggestions, and downright commands stuck with me years after I left professional theater work. And I continue to be challenged, inspired, and egged-on by the creative work of my longtime theater collaborator and partner in crime, Maya Gurantz.

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To my family —
those who are with me now,
those who are no longer here,
and those yet to come.

CHAPTER 1

Introduction

It is midway through a website redesign project at a San Francisco design consultancy, and I have just asked the supervising interaction designer if I can watch him work. *Oh, I'm not doing any real work on the project any more,* he responds casually. *My part is just emails and doing the handwaving with the client.* He suggests instead that I watch a junior designer draw up website interface schematics. She is, he says, *doing most of the work right now.* In the studio, surrounded by diagrams etched on glowing screens, scrawled on whiteboards, and scattered on tables like paper snowdrifts, I take his offhanded response for granted. It is only after the project is over that I begin to ask myself: *What is the "real work" of interaction design? Why isn't handwaving a part of "real work" if a senior designer does it? And just what* is *"handwaving," anyway?*

Interaction designers specify how digital systems work, from desktop software and mobile applications to components of appliances, automobiles, and even biomedical devices. Where architects plan buildings, graphic designers make visual compositions, and industrial designers give form to three-dimensional objects, interaction designers specify the digital components of products and services.[1] They decide functionality, how users control it, and how the software responds. Interaction designers frequently describe their object as the *behavior* of digital systems (Fabricant, 2009; Moggridge, 2007; Saffer, 2009). "Behavior" includes programmatic, functional logic, the temporal rhythms of human input and machine output, as well as kinaesthetic interface elements such as animations, sound, or vibration (A. Cooper, Reimann, & Cronin, 2007; Rogers, Sharp, & Preece, 2011). Yet interaction designers do not usually do the programming themselves. Instead of production-ready software code, they often produce documentation — plans, prototypes, and specifications for others to implement.

1 For some interaction designers (e.g. Baty, 2012), the scope of interaction design includes non-digital concerns, such as services and environments. However, most definitions of interaction design (e.g. that of Löwgren, 2013) concern digital objects.

Interaction design is a relatively new but fast-growing discipline, emerging with the explosive growth of the World Wide Web. The first university-level interaction design programs began turning out graduates in the 1990s. Today, every time you pick up a mobile telephone to make a call or send a text message, you are encountering the results of interaction design. Every time you check your email or search for information online, you are using an interface first mapped out by an interaction designer. Driving a recent model car, withdrawing cash from a banking machine, washing your clothes…those encounters too are likely shaped by interaction designers. Interaction designers work in Internet giants, global advertising agencies, and electronics and appliance manufacturers.[2] Journalists credit interaction designers with the popularity of much-hyped start-ups and the success of new smartphones (e.g., Kuang, 2012). In a software-saturated world, every day, multiple times a day, billions of people encounter the work products of professionals very like the designers we just met. In this dissertation, I hope to show that the work of interaction designers, contrary to a dominant narrative of design as individual cognition, depends very much on performance activities like our senior designer's "handwaving with clients."

"Handwaving" is a commonly used term in design studios. It is a metonym for the ensemble of hand gestures and spoken words that designers use to represent the activity of software code and its human users in the absence of a working system. In the context of presenting an idea to an influential decision-maker, "handwaving" often takes on a faintly pejorative tone, as the senior designer's words imply. Handwaving, like the flourish of a magician's wand, can imply a dishonest act of obfuscation, distraction, or fakery. Yet in its combination of gestures, words, and audience participations, handwaving resembles other common activities in design studios that unquestionably count as "real work."

Let us return to the website redesign project for an example of a seemingly very similar activity that the senior designer and many others would define as part of the "real work" of professional interaction design. Just before my conversation with the senior designer, the design team reviews the website schematics together. During that review, the junior designer physically acts out the website's responses to human input. She taps her finger on a diagram to indicate a mouse click. She moves one printed page to cover another to indicate how the website would load new data, and sketches boxes in the air to mimic the movement of animated screen interface elements. As

2 What follows is a brief list of companies in various sectors that employ interaction designers, as identified from my recruiting efforts, fieldwork, and online job postings. Given the need for brevity, this list includes only the most dominant companies in each sector. In computing technology: Google, Facebook, Microsoft, Apple and Yahoo!. In media companies: Viacom, News Corp, Walt Disney, Bertlesmann, AOL Time Warner, and Vivendi Universal. In global advertising agencies: Dentsu, Young and Rubicam, and Ogilvy & Mather. In electronics, appliance, and automobile manufacturers: Sony, Samsung, Intel, General Electric, Ford Motors, Toyota, and BMW.

she moves the pages and her hands, she orally describes the prospective activity. After my conversation, when the team shows the revised schematics to their clients, the senior designer performs similar, albeit more rehearsed, movements and uses similar words. Both senior and junior designer are engaging in *performing* the behavior of systems and users — the junior designer for the benefit of the team, and the senior designers for the benefit of the client.

This dissertation will argue that both activities are a form of performance, and that both are necessary to the success of the project. These performance activities respond to a common problem of action and representation. The difficulty for many interaction designers is that the standard representational formats — whether paper- or software-drawn — are non-coded and static. Hence, as I argue in Chapter 4, these standard formats are notoriously ineffective at imitating the behavior of working software. Touching underlined hyperlinks in static documents does not load new information; transitions from one state to another are not animated; they provide no kinaesthetic feedback. Whether at client presentations or routine team meetings, conventional interaction design drawings seem unable to communicate the stakes of technical decisions on their own. Exploring different scenarios for user navigation and action requires redrawing, whether with a pencil or mouse. Interaction design concerns itself with the material behaviors of software, yet static drawings *do not behave* (Arvola & Artman, 2007).

Handwaving for clients, then, is just one example of a broader set of activities by which humans instantiate otherwise hard-to-grasp behavior and properties of digital systems and their human users before an audience of witnesses. In this way, a problem of technical representation is also a political problem of project governance: how to make accountable decisions about design proposals in the absence of a working system. For individual interaction designers rarely bring the proposed systems to fruition as deployed, working code on their own. Often, they need to coordinate work in teams, as with this senior designer and the junior designer. Moreover, interaction designers are rarely expert software developers. Nor are most interaction designers the owners or managers of the products they make.

So it is a rare commercial interaction designer who does not need the continuing support of company managers and developers if the deliverables are ever to be turned into working code and distributed to users. The static documents are necessary in communicating the functionality, interface components, and programmatic logic of digital systems within teams and to external partners (Brown, 2010). Yet because they do not behave, static documents do not provide a sufficient ground on which to assess past actions, generate new plans, and make informed decisions for the future. Interaction designers must behave — or perhaps *handwave* — on the documents' behalf.

But, despite the ubiquity and importance of the activity, the senior designer's comment reminds us that the term "handwaving" often takes on faintly pejorative connotations.[3] Especially in the context of client encounters, "handwaving" labels activities that may not count as "real work." This dissertation will argue that, to the contrary, performance activities like handwaving are central to the professional work of interaction designers. However, this dismissal of handwaving as not "real work," I will argue, echoes a long intellectual tradition which treats good design as a matter of proper cognition.

Over the past fifty years, scholars of design have come to define their subject as a matter of individual human cognition — whether modelled as visionary inspiration, rational rule-following, thoughtful reflection, or a singular "way of knowing." Each model, in turn, has offered prescriptions for improving design practice. Commercial interaction design companies often also promote their ways of working in terms of cognition. *Change by Design,* the 2009 manifesto by Tim Brown, one founder of the global design consultancy IDEO, describes how "design thinking transforms organizations and inspires innovation." Brown was not alone in his promises. The late 2000s have seen a flood of business books and articles promising financial salvation from combining rational analysis and inventive intuition into "design thinking."[4]

In this dissertation, I present a contrasting position: that we should not treat design as a singular, universal type of thought but a constellation of local practices centered on the politics of materials — here, digital interactions. To summarize recent calls for practice-oriented design research (Goodman, Stolterman, & Wakkary, 2011; Kimbell, 2011; Roedl & Stolterman, 2013; Tonkinwise, 2011), a theoretical and methodological focus on analyzing "thinking" as the property of individual designers may not help account for some activities of day-to-day project work: learning and teaching expert aesthetic judgment; managing the relationships of designers to the clients who pay them; and making ethical and informed decisions on behalf of future human users. The trouble for those who wish to intervene in the practice of interaction design practice — whether as critics, as teachers, or as designers themselves — is that models that do not take many everyday activities may not supply workable prescriptions for improving them.

3 For example, the Wikipedia page on handwaving (as of July 2013) described handwaving as "the action of displaying the appearance of doing something, when actually doing little, or nothing."

4 Consider *The Design of Business: Why Design Thinking is the Next Competitive Advantage* by business school professor Roger Martin (2009). Titles of articles in the business press include "Innovation as a Learning Process: Embedding Design Thinking" (Beckman & Barry, 2007) and "CEOs Must Be Designers, Not Just Hire Them" (Nussbaum, 2007).

This dissertation will develop a more specific claim about interaction design: that *as practiced*, professional work depends upon situated, embodied performances. We will turn away from a long-standing question of design studies: *How does interaction design demonstrate a special form of human thought*? And towards a set of questions drawn from practice-oriented studies of science and technology: *What kinds of objects and subjects do interaction design practices make,* and *how do those practices produce them?* I am proposing to answer these questions by attending to the role of *performance practices* in interaction design. Attending to the making of objects and subjects through performance practices will help us reconsider common prescriptions intended to make designers more efficient, more ethical, and more imaginative.

To begin, however, the rest of this chapter will examine the profession of interaction design. It will describe the origins and spread of interaction design through the growth of the "new media" industry of software and website development. It will summarize three definitions of "interactions" as material objects of design: as the elements of user interfaces; as digital transactions and the data structures that support them; and as the human relationships within which software takes on meaning. Crucially, however, designers cannot materialize any of the types of interactions on their own. They are dependent on the help of engineers, managers, and other professionals. As we will see, designers are also dependent on users. The chapter's introduction to interaction design concludes with an examination of the role of the user-centered design agenda in effecting communication and the flow of resources among the various actors in the making of interactions. Finally, the chapter will introduce a central proposition of this dissertation: the new analytic leverage gained by studying interaction design as practices of performance rather than as an exemplar of a unique form of human cognition.

1.1 A brief history of interaction design

Many histories of interaction design locate the origins of the discipline in the development of computing — and human-computer interfaces — during and after World War II (Saffer, 2009). But "interaction design" as a self-defined profession emerged in the 1980s. In 1981, a small startup in Silicon Valley hired British industrial designer Bill Moggridge to work on a prototype for the device we now call a "laptop." Moggridge found himself fascinated not just by the contours of the plastic casing but by what he saw on its screen. More than three decades later, he recalls (all quotations in this paragraph and the next from Moggridge, 2007, pp. 13–14):

> I found myself immersed for hours at a time in the interactions that were dictated by the design of the software and electronic hardware. My frustrations and rewards were in this virtual space.

Recently arrived from London, Moggridge found a sympathetic, well-established group of "human-computer interaction specialists" in Silicon Valley. This group, supported by a burgeoning computing industry, included not just computer programmers but also psychologists. But Moggridge found the methods of human-computer interaction (HCI), drawn from cognitive science and engineering, too limiting. The resulting products, he felt, were "incremental" rather than exciting. And so he looked for an alternative:

> I felt that there was an opportunity to create a new design discipline, dedicated to creating imaginative and attractive solutions in a virtual world, where one could design behaviors, animations, and sounds as well as shapes. This would be the equivalent of industrial design but in software rather than three-dimensional objects. Like industrial design, the discipline would be concerned with subjective and qualitative values, would start from the needs and desires of the people who use a product or service, and strike to create designs that would give aesthetic pleasure as well as lasting satisfaction and enjoyment.

With the help of a colleague, Bill Verplank, Moggridge eventually settled on "interaction design" as an improvement on the HCI label of "interface design." "By the end of the eighties," Moggridge writes, "We were starting to feel that we had momentum, and that we could declare ourselves to be interaction designers." Indeed, one prominent computer scientist proclaimed in 1997 the "ascendancy (and independence) of interaction design" from HCI (Winograd, 1997, p. 156).

Moggridge and his colleagues in Silicon Valley were not the only advocates of bringing "subjective and qualitative values" to software engineering during the 1980s. In London, graphic designer Gillian Crampton Smith was turning the typography principles she had developed for print to the challenge of page-layout software (Crampton Smith, 2007). In 1989, she founded the Royal College of Art's Computer-Related Design program ("Gillian Crampton Smith," 2012) (later renamed to "Design Interactions"). In the Netherlands, Utrecht's School of the Arts started a Centre of Interaction Design in 1991, led by faculty from industrial design, graphic design, psychology, and philosophy (Barfield et al., 1994). Many early practitioners in Europe saw in interaction design as a continuation of the Scandinavian political agenda of participatory design (Binder, Löwgren, & Malmborg, 2009). Other American proponents of interaction design, such as designer Marc Rettig (Saffer, 2009, pp. 19–20), define the field as a combination of professions: graphic design, software development, industrial design, and even "a dab of business."

The popularity of approaches like Moggridge's, Rettig's, and Crampton Smith's rose rapidly during successive digital "booms": first the World Wide Web in the mid-to-late 1990s, then mobile devices starting in the 2000s (Löwgren & Stolterman, 2004; Saffer, 2009). Graphic designers, architects, and industrial designers alike sought "hot jobs in cool places" (Pratt, 2002) — such as the design consultancies of San Francisco and Manhattan. With names like Razorfish, Organic, Sapient, and Meta, these consultancies tried to distinguish themselves from the older, more con-

servative engineering companies, such as IBM and Xerox, that had characterized North American computing technology in the past. They had open-plan offices that resembled architecture or graphic design studios, and often promised egalitarian and cooperative management schemes (A. Ross, 2004). They hired graduates of fine arts, humanities, and social science programs along with engineers and computer scientists. And they welcomed "subjective, qualitative" approaches.

In 1994, Carnegie Mellon University introduced a graduate level program in "interaction design" to accompany its existing computer-science oriented degree. The same year, the Association for Computing Machinery, a computer science society, introduced a magazine for members interested in HCI. Its name? *Interactions.* Where the first edition of Alan Cooper's classic textbook advertised *The Essentials of User Interface Design,* the second edition promised *The Essentials of Interaction Design.* And in 2003, a group of New York designers founded what became the Interaction Design Association (IxDA). By 2004, the IxDA had organized events in London, the San Francisco Bay Area, Boston and Pune, India (Petroff, 2006). So while university courses, job titles, and industry publications still tout "interface design" and "web design," interaction design has taken on many of the appurtenances of other, older design disciplines — textbooks, university certifications and a professional association. A "new design discipline" is here to stay.

Reliable statistics are hard to come by for this new profession. But we can take the membership of the IxDA as a rough proxy for the geographic distribution of self-identified members. As of 2013, more than 65,000 members in 145 local chapters around the world have registered themselves publicly on the IxDA's website. More than one-third of those chapters are in the United States, with another one-fourth in Central and South America (most in Brazil) and one-fourth in Europe. There are ten chapters across Asia (most in China and India), with two in Africa (in Lagos, Nigeria, and Cape Town, South Africa). Unsurprisingly, there are large branches located in "global cities" (Sassen, 2001) such as Shanghai, London, and New York. There are also branches in "urban design centers" (Scott, 2000) such as Milan, Montreal, and Amsterdam. A smaller, but still significant, number of branches occupy less globally famous but still economically vibrant "regional agglomerations" (Saxenian, 1996) of education and commercial investment in software development, such as Canada's Waterloo and the Netherlands' Utretcht.

The IxDA website paints a portrait of an industry that is globally distributed but nonetheless concentrated in clusters. This portrait matches other studies of the "creative industries" in economic geography.[5] In summarizing this literature, Reimer et al. write,

> Creative sectors show extraordinarily high degrees of geographic agglomeration of actors, often in cities, and especially in centres with global status. Indeed, considerations of the geography of cultural industries have been dominated by the theme of agglomeration and the formation of dense clusters of firms within cities (2008, p. 153).

This dissertation follows this pattern by examining the work practices of one celebrated cluster (Grabher, 2002; Moggridge, 2007; Pratt, 2002) in the San Francisco Bay Area. Interview participants all live and work within the region; the projects observed all take place within the longstanding, tight-knit cluster of design consultancies in San Francisco's South of Market (SoMA) neighborhood. Chapter 3 describes the fieldsites for this dissertation in more detail.

Yet the boundaries of interaction design as a discipline remain fuzzy. Despite the proliferation of conferences, university programs, and business cards, many who practice interaction design "don't call themselves interaction designers and may not be aware of the discipline" (Saffer, 2009, p. 3). Many central, committed members of the association treat the discipline as a loosely-bound "community of practice," (Wodtke, 2002), rather than an organized profession in the traditional sociological sense.[6] One "brief history of the IxDA" in 2006 places the current status of the association at "community building," with "professionalism" proposed as a future step rather than a past achievement (Petroff, 2006). "Interaction design" is a family of related job titles, activities, and tools, a going concern held together by the continuing efforts of self-declared members. It is a group still openly debating its mission and boundaries.

5 Reasons given for this pattern of concentration in digital industries include the buildup over time of hard-to-match "pools" of specialized expert service organizations and workers, along with communication and transportation infrastructure (summarized by Grabher, 2002). As well, there is the social "networking" among professionals that helps the transiently employed find their next contracts (Christopherson, 2002; Neff, 2012) as well as the geographic proximity to client organizations that helps designers more easily make and sustain close relationships with those clients (summarized by Reimer, Pinch, & Sunley, 2008). However, Reimer et al. also cast doubt on the "much lauded" links between personal commercial creativity and engagement with arts and culture activities in large cities, finding few tangible links between the two.

6 As defined in Macdonald (1995). This notion of "professionalism" and "professionalization" is elsewhere central (Kennedy, 2011; Kotamraju, 1999, 2002) to investigations of web design work. Grabher (2002, p. 1914) argues that many such new "skill profiles" of digital work "seem to lack the sharp contours of professions." But see Christopherson (2002) on the tension between notions of self-reliant entrepreneurs and collective governance implied by the name "profession."

1.2 The objects of interaction design

Three definitions of the object of interaction design have emerged since the origins of the discipline in the 1980s. The first is the "look and feel" of digital *interfaces*. Beginning in the 1990s, designers argued instead that their medium was *transactions*: how digital systems responded to human actions. More recently, calls for "user experience design" have described interaction design as the shaping of ongoing human *experience*. All of these concerns, to some degree, persist today.

Interface "look and feel"

Designers in the 1980s often described their job as designing *graphic user interfaces* (GUIs) (Samuelson & Glushko, 1989).[7] They specified the types of data input mechanisms available to users, and how computers would display the results of those actions back to humans (Bannon, 1991). Interface designers in the 1980s styled the "look" of a software application or website. They chose colors and typefaces, created iconic symbols, and arranged elements into a visual composition. They often selected words to label functionality, such as "save" or "paste." Interface design also included some aspects of film and animation. Machines with speakers could play audio files, adding sound to the toolkit of interface design. Unlike objects on a paper page, digital objects in a GUI could transform dynamically. They could change color, appear and disappear, and move around the screen, giving them a dynamic "feel." Their concerns were the comprehensibility of the interface to users and, to a lesser extent, its aesthetic appeal.

Today, the "look and feel" responsibilities of interaction designers include not just visual components of a screen-based interface, but sounds, temporal qualities (such as responsiveness to input, animation, or the rhythms of clicking or typing), and tangible output (such as vibration, robotic movement, or warmth) (A. Cooper et al., 2007). Chapter 6 and 7 of this dissertation describe, in part, contemporary interface design practices.

7 These concerns of interface design became famous — or infamous — during rounds of "look and feel" lawsuits launched in the 1980s (described by Samuelson & Glushko, 1989). Apple Computer first sued Microsoft and Hewlett-Packard for copyright infringement of the Macintosh software's look (graphic design) and feel (dynamic interface animation). Xerox then sued Apple for copying elements of the Macintosh interface from Xerox inventions. Apple's lawsuit turned on a holistic definition of "look and feel": that what was important was not the appearance and behavior of any single element but the effect of the ensemble. The courts rejected this holistic definition for the purposes of legal judgment, instead basing its decision on whether specific elements in Microsoft GUIs were materially "virtually identical" to those in Apple's. The lawsuits were all largely unsuccessful. But they helped establish "look and feel" as a consequential concept for professional work.

Digital behavior

> Just as architects give form to space, and product designers give form to 3D objects, interaction designers give form to the behavior of products, services, environments, and systems (Carnegie Mellon University Interaction Design Program, n.d.)

The 1990s brought an expansion of the concerns of interaction designers beyond interface aesthetics and legibility. As designer Dan Saffer argues in his interaction design textbook:

> Interface design is the experienced representation of the interaction design, not the interaction design itself. The interface is what people see, hear, or feel, and while it is immensely important, it is only a part of interaction design (2009, p. 170).

A second definition of interaction design focuses on what systems do in response to human input (Fabricant, 2009; Oney, 2009). Interactions take place as humans and machines exchange data in sequential transactions. As the 1995 edition of the classic textbook *About Face: The Essentials of Interface Design* advises, "The look and feel of your program is not as much an aesthetic choice as much as it is a behavioral choice" (A. Cooper, 1995, p. 152). The notion of behavior expands interaction design beyond the surface of a two-dimensional screen to the organization of content and the execution of functionality.

A behavioral stance includes both the programmatic logic of software and the data organization that enables it. Interaction designers, writes Jesse James Garrett in his seminal handbook, define the "patterns and sequences in which options will be presented to users" (2002, p. 87). They also define the information architecture, the "organizational and navigational schemes that allow users to move through site [or system] content efficiently and effectively" (Garrett, 2002, p. 84). Designers conceptualize these schemes as effectively four-dimensional, possessing length, breadth, depth, and temporal rhythms. Breadth and depth come from the categorizing of content into nested hierarchies or matrices, which one can traverse laterally or vertically. Temporal order and rhythms emerge from stepping through sequences of content to accomplish tasks.

Meaningful experiences

> We call this domain "interaction design" because we are focusing on how human beings relate to other human beings through the mediating influence of products (Buchanan, 2001, p. 12).

In recent years, however, advocates of the "meaning-making" position on interaction design have argued that the word "interaction" is a misnomer. What designers must shape is "experience" or "activities" (Buchanan, 2001) — not what machines do but how they afford humans new pos-

sibilities to act and feel.[8] The Design Interactions Department of the Royal College of Art puts it this way: "Interaction may be our medium […] but people are our primary subject" (n.d.). The aesthetic qualities of interaction design are not only objectively perceivable visual and haptic attributes; they include experiential judgments formed only in human use, such as awkwardness or delight (Arvola, 2006; Petersen, Iversen, Krogh, & Ludvigsen, 2004). Chapter 7 will examine the making of these judgments in more detail.

This *semantic turn* (Krippendorff, 2005) turns interaction design away from the mere optimization of functionality and towards experiential meaning-making. What interaction designers do is "about making connections between people through these products, not connecting to the product itself" (Saffer, 2009). For interaction designer Robert Reimann (2008), this expands the responsibilities of the designer in two ways: (1) to "anticipating how the use of products will mediate human relationships and affect human understanding" and (2) "exploring the dialogue between products, people, and contexts (physical, cultural, historical)." So what interaction designers shape, from this perspective, is how *humans* behave with people and things (Kolko, 2011).

1.3 A user-centered discipline

Orienting technical decisions to envisioned users and uses has long been central to the definition of interaction design as a discipline. Moggridge's manifesto for the profession advocates that designers "start from the needs and desires of the people who use a product or service" (2007, p. 14). Or, as the forward to one influential professional handbook concludes,

> Our point of departure is relentlessly human-centered, rather than technology-centered. Interaction design is a tool for "Knowing what the user wants" (A. Cooper et al., 2007, p. xx).

In 2001, Richard Buchanan, then dean of one of the first graduate programs in interaction design, argued for interaction design as a "new domain of design thinking" that would directly address the "living experience of human beings, sustaining them in the performance of their own actions and experiences" (2001, pp. 11–12). In doing so, this "new design" was to "transform the design professions and design education" by centering decision-making on the anticipated activities

8 It is from this perspective that many designers (e.g., Baty, 2012; DeVylder, 2011) expand the concerns of interaction design beyond digital objects into services and environments.

and needs of future users. This agenda is often known as "user-centered," or "human-centered"[9], design (UCD). Put most simply,

> Every step of the way take the user into account as you develop your product. [….] Everything the user experiences should be the result of a conscious decision on your part" (Garrett, 2002, p. 19).

Though drawing upon diverse traditions from psychology, political philosophy, anthropology, organization studies, and software engineering, what unifies the various positions within UCD is a normative stance — that technologies must be designed, manufactured, and managed "to support the capabilities, needs, and aspirations of their human users" (Garrety & Badham, 2004, p. 194). The designer is to discover those attributes of human users, then consciously use what she discovers to motivate design decisions (Goodman, Kuniavsky, & Moed, 2012).

But who is this user? User-centeredness rests on a number of tenets about the identity of designers and users. A general definition is "the active agent in information system use […,] an atomic individual with well-articulated preferences and the ability to exercise discretion in ICT choice and use, within certain cognitive limits" (Lamb & Kling, 2003, p. 198). In practice, however, "active agent" generally functions as a synonym for a human consumer — an individual not responsible for design and manufacture (as in Norman, 2002).

"User," then, is a label for a particular position within contemporary technology production, in which those who make a product and those who buy and employ the product are often distant in time, place, and personal acquaintance (Suchman, 2006). Two related concerns motivate UCD. The first is ethical, and rests on an *a priori* distinction between humans and machines (Berg, 1998). Technology must be made *humane*; it should not endanger existing human values and practices (G. Cooper & Bowers, 1995). We can see this concern on the portfolio website of Kicker, a San Francisco interaction design consultancy, which prominently declares: "We make technology speak human" (n.d.).

A second is economic. In the words of interaction design consultancy Cooper, the point of UCD is to "uncover opportunities that fit your business and inspire your customers" ("About: Introduction," 2013). User-centered products are held to be more profitable because they meet the expecta-

9 For many practitioners, "human-centered" and "user-centered" are synonymous terms. For example, the Usability Professionals Association defines "user-centered design" by reference to ISO 13407: Human-centred design process ("What is User-Centered Design?," n.d.). Others, such as Gasson (2003), contrast the terms, with "user-centered design" describing an interface-centric, and "human-centered design" describing an orientation to a holistic experience.

tions and capacities of their intended users (Garrett, 2002). In this way, UCD presents itself an obligatory passage point (Callon, 1986) to an ethical, profitable, and prestigious design occupation.[10]

However, in commercial UCD, representatives of the users are themselves frequently physically absent from the studio for much or all of a design project (as described by Goodwin, 2009; and Ivory & Alderman, 2009). Nor do the tenets of user-centered design require the active participation of user representatives in design decision-making (Bannon, 1992). Instead, UCD requires that designers instantiate users' interests and needs, ideally through empirical research (Stewart, Williams, & Rohracher, 2005). As participatory design educator Elizabeth Sanders writes, "The user is not really a part of the team, but is spoken for by the researcher" (2004, p. 1) Or, as a practitioner writes, "This process is user-centered, but not user-led or user-driven" (Kitson, 2011).

If users are not physically present during design work to participate in "user-centered" decisions, representations of users must be constructed to serve in their place (Sharrock & Anderson, 1994). Designers materialize these representations in image, text, and speech (Akrich, 1995), as well as gestures and other bodily forms of roleplay (Simsarian, 2003; Tuikka, 2001). Yet the capacities, habits, and responsibilities of users do not exist naturally in the world; they must be *configured* to serve the purposes of the project (Oudshoorn, Rommes, & Stienstra, 2004). Designers inscribe those attributes into the product — resulting in a mutual configuring of the product in terms of its user, and the user in terms of the product (Grint & Woolgar, 1997). Mobilized in decision-making, the represented user asserts the legitimacy of political work of the UCD-oriented designer in the development process as the representative of autonomous, stable (but absent) human users (G. Cooper & Bowers, 1995).

UCD textbooks provide a number of conventional methods for, as one handbook title puts it, "Keeping People in Mind Throughout Product Design" (Pruitt & Adlin, 2006). These step-by-step methods, such as personas (portraits of user types) and scenarios (stories of use), are intended to produce *explicit* user representations based on direct engagement with user representatives (Akrich, 1995). However, as Akrich also points out, *implicit* representations are often persuasive than explicit ones. One controversial example of these implicit representations, which we will investigate in Chapter 7 is the "I-method," in which designers take their own preferences, capacities, activities and the like as representative of their prospective users (Akrich, 1995; Oudshoorn et al., 2004).

10 There are many salient criticisms of UCD's binary separation of humans from technology (Berg, 1998; Garrety & Badham, 2004; Suchman, 2006). There are also salient criticisms of the assumption that UCD is successful when the user correctly "reads out" the meaning that the designer has unambiguously "written in" to the product (Gaver, Beaver, & Benford, 2003; Stewart, Williams, & Rohracher, 2005) Given the definitional importance of UCD to interaction design, I will take these criticisms as read, and instead investigate the mobilization of users and UCD in practice.

In scholarly studies of technological development and innovation, the rhetorical figure of the "imagined user" crops up frequently in stories of failure.[11] Unempirically derived from unquestioned cultural imaginaries or the I-method, the imagined user influences design decisions through individuals' persuasiveness and through collective political convenience rather than a truthful correspondence to actual human users (Ivory & Alderman, 2009; Neven, 2010). When such an unempirically represented user motivates decision-making, the resulting artifact is often shown to be a *chimera* (Akrich, 1992) — a mythical beast which cannot thrive outside the storytelling of its makers. The chimera is a direct product of a failure to engage user representatives directly. The culprit in these cautionary tales is the trust in an ungrounded, imagined user — a persuasive but empirically non-existent rhetorical construct that, if inscribed into artifacts, results in failure when the artifact leaves the hands of its builders.

The interaction design consultancies I encountered all professed allegiance to Garrett's basic ideal of UCD. However, they implement it with varying degrees of methodological standardization. What I consider "hard" UCD consultancies, such as San Francisco's Cooper, advocate systematic, step-by-step methods for discovering user capabilities and perspectives and integrating them into design processes. "Soft" UCD consultancies, such as IDEO, advertise instead toolkits of recombinable and adaptable tactics. UCD serves both types of consultancies, as Garrett's definition suggests, as a source of accountability in decision-making — both in terms of designers' professed responsibility to users, and the explanations they offer to outsiders for their ways of working.

To sum up, UCD works as a kind of theory-methods package (Fujimura, 1992) to help bind together interaction design as a going concern. A theory-methods package is, as the name suggests, an interpretively flexible conceptual framework combined with standardized tools and methods. In Fujimura's case study, a successful line of cancer research thrived among multiple disciplines by combining underspecified concepts (e.g., "genes" and "cancer,") with standardized tools and techniques (e.g., recombinant DNA sequencing). When adopted by members of different groups, a theory-methods package is a means for communication or interaction. It facilitates the movement of resources such as skills, ideas, and tools among social worlds, across organizational and disciplinary boundaries. Through these packages, scientists can

> Define their areas of expertise and power [,…] constrain work practices and define, describe, and contain representations of nature and reality (Fujimura, 1992, p. 205).

11 Perhaps the best known example is Oudshoorn et al.'s story of "configuring the user as everybody" in the design of an urban information system (2004); see also Hyysalo on the design of emergency alert systems (2006), Ivory and Alderman on designing educational workspaces (2009) and Neven (2010) on the design of robots.

Standardized packages can facilitate both movement of resources and the stabilization of facts across boundaries because they are "gray-boxed"; they scaffold loose and ambiguous concepts with structured techniques. The theory of UCD as a package is a normative position: that ethical and economically successful action requires using truthful representations of users to inform design decisions. These decisions are not just made by designers; for UCD to work, designers must also communicate effectively across disciplinary and possibly organizational boundaries with product managers, developers, marketers, lawyers, and the like. So UCD supplies various tools for constructing and mobilizing users: ways of conceptualizing and talking users; more-or-less organized methods of empirical engagement with user representatives; formats for representing them in documents; and standards for decision-making. But defining a user, as I have described, is a twisty and uncertain task. "User," like "gene," is a concept with multiple definitions. Nevertheless, UCD insists upon the expertise, power, and necessity of *designers* as legitimate spokespeople for future users (G. Cooper & Bowers, 1995; P. Ross, 2011)…if those designers can successfully mobilize the users in project work. Chapter 7 examines the work of materializing users and their interactions.

1.4 What interaction designers make — and do not make

Working as consultants or within larger product organizations, interaction designers cannot allocate the necessary organizational resources of time, labor, and money to build, deploy, and maintain the software they envision. Instead, designers must convince others, such as business managers, developers, and other information technology specialists, to implement their plans. Business managers allocate money, time, and computing resources to support the proposals. Visual designers "push pixels" into legible and aesthetically pleasing interface typefaces and graphics. Developers write, rewrite, and debug software.[12] Marketers and business development specialists make deals with the online "app stores," bricks-and-mortar retailers, and other distributors who will make the software available to users. Lawyers draft the customary licensing agreements, and so on. Interaction designers, to realize their specifications as deployed software, must enlist other professions and design disciplines into their plans.

For, like architects, interaction designers often do not themselves build the software code that produces "interactions" as the objects of their field (Winograd, 1997). What interaction designers

12 The debate following a question (Silvia, 2011) to an IxDA discussion forum illustrates a crucial distinction between the understood spheres of "design" and "development." Designers may "know how to code" in order to make interactive prototypes and to communicate with developers, but they are not typically expected to be expert programmers (Myers, Park, Nakano, Mueller, & Ko, 2008).

make is words and images that describe future systems and the people who use them. These descriptions are integrated into documents, known as "deliverables," that situate the specifications within the development of a business or product (D.M. Brown, 2010). The resulting documents usually circulate as digital presentation files or word processing documents — what many interaction designers call "slideware" in contrast to "software." Emailed, uploaded, and downloaded, the documents move among the designers, developers, and clients servers, intranets and inboxes. Yet at each transition, they are almost always accompanied by an in-person "handwaving" meeting to discuss and review the deliverables' contents and relationship to the project (K. Goodwin, 2009).

Working within these partnerships, then, interaction designers face constraints on what sorts of words and images they produce, and how they produce them. In practice, the time and money available for design and software development work is generally limited. Skilled designers adapt their own methods to those limits, as when the designers of MediumFirm and LittleStudio alter their preferred methods to meet short schedules and tight deadlines (see Chapters 5 and 7). Skilled designers also take anticipated programming resources into account , taking care to avoid making technical demands that will be practically undoable with the proposed schedule and budget. Chapter 6 follows one team's attempt to simultaneously limit their own responsibilities and the anticipated responsibilities of future programmers in light of a short schedule and tight budget for design and development.

Managing what designers produce, and the activities that produce it, requires attention not just to the expected capacities of software and hardware but the organizational dynamics and economic relations at stake in producing it. When design proposals challenge established long-settled "technological frames" (Aibar & Bijker, 1997) or "practice-bound imaginaries" (Hyysalo, 2006), designers may encounter resistance from decision-makers to interface or functionality changes. The designers of MediumFirm fear they face just such a conflict in reframing a mobile ticketing application as a vacation planning tool. Such frames or imaginaries also include expectations for how designers work, and what kinds of rationales for decisions count as credible and legitimate (Hommels, 2005)[13]. The designers of LittleStudio, for example, attribute some of their client problems to speaking *different languages* from their accountant client. They solved their problems, they tell me, by moving from *looser, more exploratory* meetings to *more organized* ones (Fieldnotes, January 24, 2010).

Following the UCD agenda, anticipating the conditions of use also plays a role in limiting the kinds of technical requirements designers are likely to propose. Depending on prospective situations of use, designers must account for different constraints on processing power, data storage

13 For this reason, professional handbooks (e.g., Monteiro, 2012) often include advice for explaining and justifying design team decisions to external partners.

and network connectivity. For example, the designers of MediumFirm fear that users will reject a mobile application for international tourism that depends intermittent, unreliable, and expensive data access while traveling. The designers of LargeAgency, by contrast, anticipate that the likely users of a website selling handmade ceramics will be salespeople who are never far away from secure and stable wireless networks. Instead, the LargeAgency designers are more concerned with how to ensure that skilled artisans who are often far away from computers update the website's inventory information frequently enough to please the customers and salespeople who will consult it.

The economics of software development and maintenance work also play a part in what interaction designers deliver. Websites like the one redesigned by LargeAgency can be cheaply and easily revised because a single copy of their code is stored a central servers. Ensuring that thousands or millions of devices download an updated program correctly is somewhat more complicated and less frequent. And revising an entire operating system, such as Apple's iOS or Microsoft's Windows, is an even more complicated and less frequent chore, given the complexity of operating systems and their interdependencies with the myriad programs and peripheral devices they are expected to support.

The vaunted fluidity and flexibility of digital media (as in Grabher, 2002; Lunenfeld, 2000), then, are not invariably or stably present properties. Instead, what matters about the technical capacities of computing to interaction design projects changes with each project. The technical requirements and capacities of the project platform, the money available to pay for specialist skills, the proposed situation of use, the desired schedule — all play a role in limiting what kinds of interactions are practically available to designers.

As in the construction of a building (Cuff, 1992; Gieryn, 2002), the experiential qualities eventually perceived by end users cannot be the sole product of designerly vision. It is instead the result of negotiations among designers, clients, users, developers, managers, and the like — not to mention negotiations among software code, intellectual property laws, Internet servers, telecommunications standards, network infrastructures, and so. But it is the design specifications, as delivered in documents and presentations, that set the initial terms for this process of development. In order for the project to continue, design specifications should still be — or at least appear — feasible within the project's expected schedule and budget (Goodwin, 2009). Part of what interaction designers must do, then, is manage negotiations not just over what they will accomplish but what other groups will do. Chapter 4 discusses these constraints and the political tensions they produce in more detail.

1.5 Interaction design through a performance lens

This dissertation argues for performance as a central part of how designers craft interfaces, behavior, and human experiences. By performance, I mean an episode structured as a temporal sequence of: (1) gathering of participants; (2) playing out of a series of actions before spectators;

(3) dispersal (Schechner, 2013, p. 176). Notions of performance foreground *display* — "not simply a doing but *a showing of a doing*" (Schechner, 2013, p. 114, emphasis mine). My approach originates from participant observation of everyday interaction design activities. Performance-type episodes of display punctuate projects — from the high-stakes live client presentations that begin and end projects, to the improvisational roleplay of proposed users and computer systems during daily team walkthroughs, to continuing debates over the telling (and selling) of a convincing "story" of the product, project, and designers themselves. These episodes require not just skilled human action, but also specialized architectural arrangements, craft tools, and so on.

As we will see, interaction designers spend a lot of time *showing* doing: showing themselves and clients what the project will do. Interaction design performances bring together a number of different elements of such showing. Communication and display technologies, such as networked screen-sharing software, make action visible to an audience. Technologies of stage-setting, as well as the spatial arrangements of studios and conference rooms, help enact boundaries among different kinds of human participants (such as spectators, writers, performers, and technicians). Continuing debates over what story to tell and how to tell it emphasize the importance of narration and script, and the role of imitative and rehearsed physical behavior. Watching live performances, even digital, reminds us of the necessity of embodied skill in acting out behavior and managing the technologies of staging. And following their outcomes reminds us of the efficacy of the performance in precipitating and resolving collective crises.

In the process, these episodes materialize the project. Performance episodes in team reviews of documents and workshops with clients invoke project concerns (such as the divisions among designers, clients, and systems), name them, bound them, assign them attributes and capacities. These concerns come to matter outside the studio as they guide future discussion, document product specifications to be passed to engineers and developers, and ratify authoritative commitments of money and other organizational resources. Performances in the studio guide future action outside it, and failed performances have material consequences for livelihoods and professional reputations.

This performance-oriented position stands in contrast to a dominant "canon of design thinking" (Coyne, 2005, p. 5). This canon defines successful design work as a problem of human understanding. Debates often turn on how individual designers reason, and studying design then means studying patterns of thought. Critics of the canon's positions (e.g., Kimbell, 2011; and Telier, 2011) argue that focusing on the cognitive styles of individual designers can obscure questions about the organizational, institutional, and industrial dynamics of power and participation enacted as designers engage with the materials of their trades. It can also unduly privilege the power of designers to define products' form and use over that of clients, manufacturers, or end consumers (Shove, Watson, & Ingram, 2008). And such positions can lead to assumptions that designers from dif-

ferent design disciplines, working on diverse projects, will exhibit similar habits of thinking and working (Roedl & Stolterman, 2013).

In turning to performance, I am building upon an alternative tradition in studying design that focuses on action: practice theory. In the past thirty years, multiple disciplines have taken a "practice turn" in studying the ordering of human life (Schatzki, 2000). The central explanatory concept in practice theory is neither individual decisions and attitudes, nor permanent structures and systems. It centers on *practices* as durable clusters of human behaviors, meanings, tools, which enact order only as they are repeated (Bräuchler & Postill, 2010; Reckwitz, 2002).

The approach I follow is rooted in studies of embodied and generative knowledge-making in science and technology (e.g., Knorr-Cetina, 1999). From this perspective, for example, the design of a bridge or a new building requires not just grappling with the physics of mass and tension but also with the public response to the proposals (Gieryn, 2002; Suchman, 2000). And from this perspective, the *building* as well as the architect is an active agent in furthering or disrupting construction (Yaneva, 2008). Practice, then, turns our attention to the specific materials, politics, and skills enacted through design in action, rather than general theories of thought. Chapter 2 returns to these arguments about design as cognition, design as practice, and design as performance in more detail.

In this way, attention to performance practices forces us to grapple what can go so easily unnoticed by studying design as individual cognition: the material politics of ordering work. This dissertation discusses three types of material politics in play during interaction design projects. First, I mean how humans negotiate collaborative work with the material anchors (Hutchins, 2005) of otherwise abstract concepts such as "user needs" and "business processes." Chapter 5 examines cooperative manipulations of Post-it notes, and Chapter 7 examines the articulation of digital structures in human gestures. Second, I mean how collaborative work by designers and clients shapes decision-making. In Chapter 8, I describe project governance as *negotiating agency.*

Finally, by "material politics" I mean the characteristic politics of user-centered design as a theory-methods package (Fujimura, 1992) for interaction design. The logic of performance narratives (as in Chapter 7) often turn on granting human users stable capacities and preferences independent of the designers roleplaying them. Narratives often figure other entities, such as interface elements, as dependent, malleable, and hypothetical propositions, contingent on the decisions of users and other solid and stable project constituents. Which entities are performed as autonomous, solid, and stable? And which are performed as insubstantial, hypothetical, or unfolding? Chapter 9 will argue that user-centered interaction design depends upon enacting stability and malleability in performances. Figuring "users" as real and autonomous stabilizes "user-centered" digital systems that, until working code is written, only exist in all-too-editable deliverables.

1.6 A map of this dissertation

The next three chapters of this dissertation will provide some background to my argument for the role of performance practices within professional interaction design. Chapter 2 will review in more detail the conflicts between two positions that motivate this dissertation: a dominant narrative which defines design as a form of human cognition, and an alternative perspective which engages with theories of practice. It further details this dissertation's conceptual orientation to performance practices. Chapter 3 will describe the methods by which I studied interaction design as practice, particularly participant observation. It grounds them in the science and technology studies (STS) tradition of "laboratory studies" (surveyed by Knorr Cetina, 1995) and the qualitative research tradition of constructivist grounded theory (Charmaz, 2006; Corbin & Strauss, 2007). Then, Chapter 4 will briefly introduce the places, people and objects that populate the rest of the dissertation, as well as three recurring political tensions in project work that spur performances.

The central chapters in this dissertation follow the work of materializing designers, clients, systems, and users over the course of an ideal-type[14] interaction design project. Chapter 5 is an account of an early project workshop, in which designers and clients together make a list of features to implement by moving Post-its on a whiteboard. It introduces the dissertation's central concerns of material politics, showing practices, and project alignment. Chapter 6 follows the work of scoping, as the designers transform Post-its into diagrams that will tell a compelling story. It follows the production of project and product scope in examining classic design-as-cognition questions of drawing, planning and thinking. Chapter 7 examines how designers evaluate and make changes to such deliverables in team meetings. It examines how designers materialize the behavior of users, clients, designers, and systems in roleplaying use, and the professional production of *feelings* as a legitimate resource for decision-making. Finally, Chapter 8 describes a series of interim client encounters in which designers review the project with their clients. It argues that successful project requires not just artful presentation of ideas but the effortful assembling of an authoritative, decision-making audience. In this way, each central chapter also introduces a different aspect of performance practice. While each central chapter uses one project as a central case study, each builds upon an observation of practices repeated within projects and across firms.

The last chapter of this dissertation will return to the question that animates this dissertation: the leverage provided by taking performance practices seriously. It will argue that interaction de-

14 Both consultancies and in-house work exhibit similar activities in a similar order, albeit with very different amounts of time allotted, and different economic and organizational relationships at stake.

sign performances have something to tell studies of science, technology, and design about long-standing concerns of agency and representation.

The process of specifying behavior requires defining identities and distributing responsibilities for action among humans and machines. It requires deciding what users should do and what machines should do — not to mention what designers should do and what clients do. Interaction design projects, then, must cope with ontological politics:

> A struggle over what after all is appropriate and inappropriate behaviour in relation to what the thing actually is and who or what should act in what ways towards it (Woolgar & Lezaun, 2013, p. 334).

The result is a set of local agreements about what clients are like, what users are like, what the system is like, and what the designers are like. Those agreements can, and often do, collapse in development or use. But successful performances of the project materialize its constituents by twisting them together into a coherent, aligned whole. Hence the products of interaction design are not just systems. They are people: users, clients, and designers themselves (Mack
ay, Carne, Beynon-Davies, & Tudhope, 2000; Nickelsen & Binder, 2008). My contention in this dissertation is that systems, designers, clients, and users come to matter in interaction design projects through local, contingent episodes of performance.

CHAPTER 2

Design as cognition and design as practice

This chapter sets out the conceptual framework for this dissertation: the role of performance practices in organizing interaction design work. By "performance," I mean physical activities of storytelling and narrative that take place before an audience of witnesses. My definition avoids deploying the dramaturgical metaphors of stages and theaters. It is also more specific and concrete than the frequent sociological equation of performance with enactment. As a means to describe what designers *do*, I take performance seriously: not as a figurative device, but as a category of activity. In doing so, I extend a practice-oriented approach to design work.

In the 1970s, multiple disciplines took a "practice turn" in studying human behavior (Schatzki, 2000). Observers moved away from analyses of individual decisions and attitudes, and from structural explanations rooted in concepts of permanent systems. For practice theorists, this turn has two components: first a definition of *practices*, plural, as durable clusters of human behaviors, meanings, tools, and so on; second, a concern for *practice*, singular, as the ongoing enactment of order by those clusters of activity. The approach I follow, rooted in studies of embodied and generative knowledge-making in the sciences (e.g. Knorr-Cetina, 1999), takes practice as a site of contingency and change, in which non-humans as well as humans are active participants.

The practice approach is in contrast to a dominant tradition in the field of design research, which takes diverse design traditions as instances of a single form of human cognition. It is hard to appreciate the urgency and self-declared novelty of calls to study design work as practice (e.g. Kimbell, 2011; Tonkinwise, 2011; Yaneva, 2009) without at least a brief introduction to the cognition-centered tradition of twentieth-century design scholarship. This chapter will first summarize how four models of design scholarship have defined design as a matter of individual human cognition — whether a matter of romantic inspiration, rational rule-following, thoughtful reflection, or a singular "way of knowing." It will then outline what theories of practice can tell us about professional design work, particularly interaction design. Finally, it will explore the dimensions of performance activities that will help us account for interaction design project work in consultancies.

2.1 Design as cognition

For the past fifty years, a group of mostly Anglo-American design researchers[1] have largely defined design as a form of human cognition. Debates over how to describe the *kind of reasoning* designers — from architects to industrial engineers — exhibit have come to dominate the field. The result of this half-century of scholarship is a "canon of design thinking" (Coyne, 2005, p. 5). This section situates my argument for practice in the historical context of design scholarship by reviewing the four models of human thought that comprise the canon: *romantic vision*, *rational rule-following*, *situated reflection*, and *designerly knowing*. To summarize recent calls for practice, the problem is that the canon's focus on the individual mind obscures important professional concerns: aesthetics and the nuances of trained taste; the governance of relationships between designers and the clients who pay them; and the practical ethics of making decisions in the name of prospective consumers. And when cognition-centered models do not take important aspects of everyday work into account, they may not provide usable prescriptions for improving it.

One common way of periodicizing the history of design research is to play what design philosopher Rabah Bousbaci (2008) calls "the generations game" of design methods. Thus "first generation" methods (1960s) give way to "second generation" methods (1970s) and finally "third generation" methods (1970s–1980s). In this story, the game ends with the public repudiation of design methods by their greatest champions and the triumphant establishment of a new, better paradigm in the 1980s (the nature of that paradigm is still debated). For Bousbaci, the term "generations" ignores the underlying organizing logic of these methods. For him, each generation relies on a different "model of man" that define humans as designing entities. He divides these models by their philosophical commitments to concepts of human thought and action.

Coyne and Snodgrass (1995) treat the history of design studies as a series of "problem regimes," in which what defines the field is successive disputes over the most pressing problem facing design, and how best to combat it. The two schemes are compatible: the "problems" are only meaningful within the context of the imagined designer who faces them. However, neither model of pro-

1 The field of design studies has developed over the past forty years, largely from a split group of scholars writing from British art schools and American research universities. This field takes as its object designers at work, as opposed to those who see "design" through the lens of finished industrial goods and approach it through concepts of material culture, taste, and consumption (such as B. Martin & Sparke, 2004). My story here focuses on two major journals — *Design Issues* and *Design Studies* — as well as a series of books and conference presentations given by and for this relatively small international group of scholars over the past forty years. Here I am less interested in how industrial design, graphic design, fashion design and so on changed as professions over these thirty years and more interested in disciplinary history: the multiple articulations of the work of professional designers by a group of scholars.

gression questions the basic chronology of the "generation game." The following account, then, consciously traces this canonical path. I will treat each "generation" as mini-narrative of pressing problems, modelled designers, proposed solutions and, inevitably, a backlash.

Romantic vision

Sometimes called the "traditional" or "genius" model, the romantic model (Bousbaci, 2008; Buchanan, 2001; Coyne & Snodgrass, 1995; Fallman, 2003), places the designer's personal experiences, creativity, and taste at the center of professional work. Romantic designers are "imaginative masterminds equipped with almost magical abilities of creation" (Fallman, 2003, p. 225).[2] In one often-quoted description, the romantic designer is a "black box" — an agent who cannot account for his results (Jones, 1970). The romantic model motivates those scholars who place "more emphasis on the designers than the products, on the *ideas* than the modes of production" (Riccini, 1998, p. 49, emphasis mine). In turn, defining the genesis of designed products as ideational "spirit" and "vision" abstracts the work of design from both skilled craftwork and the labor of production (Coyne & Snodgrass, 1995).

The usual example given of the problem regime under the romantic model is art historian Nikolaus Pevsner's aptly-titled *Pioneers of Modern Design* (Clark & Brody, 2009, p. 8). It chronicles the seemingly inevitable moral and aesthetic triumph of heroic modernist architects and furniture designers over stultifying "Victorian stuffiness" (Pevsner, [1936] 2009, p. 12). The problem for the romantic model, then, is the defense of artistic freedom against compulsion, and the protection of excellence against mediocrity. Hence the role of those who teach and study designers is to celebrate outstanding individuals and exemplary artifacts, not to increase organizational productivity or work for societal improvement as in the later rational or situated models.

In 1970, design theorist J.C. Jones claimed "a world-wide dissatisfaction with traditional procedures" (p. xi) — that is, with the romantic model. For critics like Jones, the problems of industrial management, urban planning and infrastructure rebuilding that post-war Europe and North America faced were essentially problems for design. It was a new definition of design. Where Pevsner's designers styled individual objects, Jones' designers would plan interconnected systems. Yet single individuals (no matter how visionary) could not apprehend the details of mass transit systems or factory production processes in the detail needed to plan them adequately. Moreover, being both unpredictable and autonomous, the black box designer could not easily be integrated

2 The genius model, many interaction designers argue, is alive and well in popular "great men" narratives of the roles of Jonathan Ives and Steve Jobs in Apple's success, exemplified in Walter Isaacson's 2011 biography of Jobs.

into an efficient team. Instead of high art, systemic problems of industrial and social planning would require what economist Herbert Simon (1969) famously called a "science of the artificial."

Rational mechanisms

The Anglo-American "design methods" movement of the 1960s and 1970s articulated a rationalist model of design action as logical planning (Bousbaci, 2008; Dorst & Dijkhuis, 1995; Fallman, 2003).[3] Designers would make new "systems" and "mechanisms" as well as useful and beautiful objects (Coyne & Snodgrass, 1995). For Jones, one of the originators of the movement, the role of design is "*to initiate change in man-made things.*" He writes,

> Our simple but universal definition of the expanding process […] formerly took place on a drawing board but now includes 'R and D', purchasing, design for production, product planning, marketing, system planning and other things besides (1970, p. 4).

Herbert Simon's often-quoted definition in *Sciences of the Artificial* echoes this new, more expansive conception of design: "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (1969, p. 55). In rejecting the romantic model, the rationalists deliberately expanded the proper scope of design beyond the "machines, goods, and buildings into what Jones (1970, p. 4) calls "human futures." Urban planners, city managers, economists, politicians, and activists are also designers. Thus the problems of managers, planners, and other professionals were problems of design. Under this model, then, the function of design is to solve complex societal problems.

The design science movement proposed technical rationality: the following of "rules" for efficient problem-solving (Dorst & Dijkhuis, 1995). Post-World War II design science drew upon British and North American wartime investments in behavioral science, ergonomics, and operations research (Bayazit, 2004), quantitative analytics and systems theory (Coyne & Snodgrass, 1995), and the new technology of computers (Dorst & Dijkhuis, 1995). Where the romantic model sees designers as artists, the rationalist model sees them as scientists or engineers (Bousbaci, 2008). These new methods were also compatible with philosophies of architecture and design advocated in pre-war modernist academies of architecture and design. As Dutch architect Theo van Doesburg writes in *De Stijl*, 1923 (quoted in Cross, 2007a):

> The new spirit, which already governs almost all modern life, is opposed to animal spontaneity, to nature's domination, to artistic flummery. In order to construct a new object we need a method, that is to say, an objective system.

3 The rationalist account of design continues today in the discipline of "concurrent engineering," which attempts to manage the output of multidisciplinary engineering teams.

For the proponents of a "design science," design was a system with regular, discoverable laws (Cross, 2007b). During the war and after, state investments in scientific and engineering research produced not just new theories of organization and human behavior, but also university departments and other institutions that might support design method research and pedagogy. For the rationalists, the systems and mechanisms developed by these new institutions would solve the new complex social problems of post-war industrial development. Design methods produced in these new institutions often resemble the idealized scientific method: a linear process of hypothesis production, experimentation and evaluation. Problem solving activities iterate, in the canonical view, over three phases (usually shown in a flowchart-style diagram): analysis, synthesis, and evaluation (Coyne & Snodgrass, 1995). The result is a Fordist model of designer-as-factory, in which methods, like a conveyor belt, mentally process undefined problems to finished solution.

A good rationalist designer, writes Fallman (2003), is not a genius or internally creative visionary. Instead, the designer follows the rules. The new disciplines of computing suggested two modes of rule-following (Jones, 1970). A designer might be a "glass box" — a follower of clear, step-by-step procedures whose logic is visible to all. Or the designer act more like a self-regulating control system, using information from the environment to select the most optimal response from a number of options, then taking in more information. Here, a design solution is less envisioned than computed (Simon, 1969).

By the end of the 1960s, an aggressive backlash against the methods and values of the design methods movement was brewing. The first criticism came from the designers who tried to use the methods in professional work. Surveying case studies of design projects, Fallman (2003) finds that designers largely did not follow the flowcharts, nor would it have been practically possible for them to do so. Coyne and Snodgrass (1995, p. 51) describe the neat boxes labelled "analysis," "synthesis," and "evaluation" as:

> incomprehensible when compared to experience. Where does the client fit in? What is the social and environmental context?

After trying to make the methods work, architects, urban planners, and engineers often found the results unsatisfactory (Cross, 2007a; Gedenryd, 1998). Architect Christopher Alexander, once a proponent of design methods, revises his influential design methods manifesto *Notes on a Synthesis of Form* (1970) to include some caveats. For Alexander, the methods often failed to help designers balance the conflicting needs of individual people and groups in a principled way. Moreover, simply "following the rules" tended to produce generic solutions that did not fit local physical conditions or aesthetic preferences. *The intended users did not like what they got.* And many designers, like Alexander, blamed the new methods.

For Jones and others (e.g. Rittel & Webber, 1973; Schön, 1983), the practical failure of the design methods in use echoes a failure of the modernist project of mechanized progress and unbounded rationalism.[4] By the late 1970s, Jones himself rejects the "methods" agenda he had helped promote:

> I dislike the machine language, the behaviourism, the continual attempt to fix the whole of life into a logical framework (1977).

What both the working designers and the scholars of design wanted was not a universal scientific method but a way to explain how designers achieve practical understandings of their situations.

Situated reflection

Writing after the collapse of the design methods movement, Donald Schön argued for a similarly broad definition of "design" as management or planning. However, he diagnosed a "crisis of confidence" for architects, planners, and other professionals rooted in skepticism about their "actual contribution to society´s well-being" (1983, p. 13). For Schön and those following him (such as Nelson & Stolterman, 2003), technical rationality is not the solution to, but the source of, this professional and societal crisis. Early in his classic *The Reflective Practitioner*, Schön outlines the difficulty:

> From the perspective of Technical Rationality, professional practice is a process of problem solving. Problems of choice or decision are solved through the selection, from available means, of the one best suited to establish ends. But with this emphasis on problem solving, we ignore problem setting, the process by which we define the decision to be made, the ends to be achieved, the means which may be chosen. In real-world practice, problems do not present themselves to the practitioner as givens. They must be constructed from the materials of problem situations which are puzzling, troubling, and uncertain (1983, p. 40).

What competent designers and other professionals employ actually employ, then, is not a universal method but a loose "epistemology of practice" to situationally frame problems and solutions (Schön, 1983, pp. 49–68). Arguments for the reflective model often reference phenomenology (Coyne & Snodgrass, 1995), American pragmatists such as John Dewey (Melles, 2008) and theories of embodied cognition (Arnheim, 1995; Gedenryd, 1998). Calls for systematic, universal, and abstract techniques for solving problems will only hamper more important attempts to set problems situationally — to identify, name, and bound them.

4 These critics produced a set of "second generation" design methods which emphasized the limits of rationality, such as Horst Rittel's argument-based processes and Alexander's example-based "pattern language" (Bousbaci, 2008). However, as Bousbaci argues, the second generation of design methods continues the values of objectivity, rationality, and logic which characterize the first.

In Schön's epistemology, knowledge of problems and solutions emerges through *reflection-in-action*, or conscious analysis of activity. Knowledge in action is often *tacit*. A designer may not be able to explain what he is is doing or why he is doing it; he may be unaware that he is choosing from alternatives; he may be even unable to recall learning how to make those decisions at all. How, then, can he improve upon what he is doing? The answer lies in conscious, but not necessarily systematic, *reflection*. In reviewing his own actions, the designer can "surface and criticize his initial understanding of the phenomenon, construct a new description of it, and test the new description" (Schön, 1983, p. 63). The phenomenon — or "product milieu" (Margolin, 2002) — is the ensemble of entities (human and otherwise) encountered in framing a problem. It includes not just physical objects but emotions, strategies for action, expectations for behavior, and so on.

Reflection-in-action occurs as the designer constructs a representation of the situation, steps back, interprets its "backtalk" (or multiple meanings), and then uses the model to reassess the situation. So design is still cognition, but it is neither a systematic method nor a romantic, individual vision. Instead, it is a conversational art of sense-making. "Doing extends thinking," writes Schön, "in the tests, moves, and probes of experimental action, and reflection feeds on doing and its results. Each feeds the other, and each sets boundaries for the other" (1983, p. 280) Iterative sketching sessions, not internal vision or standard guidelines, are the paradigmatic means of design cognition (Arnheim, 1995; Goldschmidt, 1991). Reflection on representations grants the designer critical distance to assess the situation. The designer is not using universal guidelines but rather a personal repertoire of principles, heuristics, metaphors, and other interpretive devices developed through his own experience and learning from others. The good designer, then, is a sensitive and thoughtful listener and watcher of his own actions within a changing situation.

A continuing argument against the situated model is its narrow definition of the situation of design. In concentrating on processes of iterative sketching and reflection-in-action, it can dislocate professional design work from the history, politics, and economics of mass industrial production (Whitehouse, 2009; Woodham, 2005). Tony Fry (1989) argues, for example, that a "clean and celebratory" approach to studying design erases colonialism and "the mess of history" from narratives of industrial progress. Moreover, it can naturalize what Fry calls a "geography of power": a methodology for design studies that unquestioningly takes the North Atlantic as its center and the

studio (not the client office, the home, or the factory) as its site.[5] Such studies also presume that questions of gender, national origin, and ethnicity are unimportant to the profession of design and the results of projects (Suchman, 2006). In doing so, they can often reproduce an oversimplified account of professional design's place in the world.

Unique knowledge

In the 1990s, a group of scholars began to celebrate what they saw as designers' unique way of knowing the world. One influential article by Nigel Cross proposes:

> There are forms of knowledge peculiar to the awareness and ability of a designer, independent of the different professional domains of design practice. (Cross, 2007b, p. 46)

Calling for "design thinking"[6] (Buchanan, 1992, 2001) or "designerly ways of knowing" (Cross, 2006) this new model defines professions such as fashion, graphic, and industrial design as a knowledge-making culture distinct from traditional humanities and sciences. It is from this perspective that Buchanan describes interaction design as a source of the "new learning of our time" (2001, p. 7). Similarly, Glynn argues, "It is the epistemology of design that has inherited the task of developing the logic of creativity, hypothesis innovation or invention that has proved so elusive to the philosophers of science" (1985, p. 125).

The "dual knowledge" of designers has two characteristics (Coyne & Snodgrass, 1995). Like situated reflection, it proceeds by making tangible representations. Designers, unlike scientists or philosophers,[7] think through "the concrete interplay and interconnection of signs, things, actions, and thoughts" (Buchanan, 1992, p. 20). Second, designerly knowledge (like romantic vision)

5 This is not to say that the field of design studies only includes Britain and the United States. There is a strong European tradition (surveyed in Dilnot, 1984), an active Australian community of scholars (such as Tony Fry) and increasingly, participation from scholars across south and east Asia in disciplinary conferences. However, following critical commentary (e.g. Fry, 1989) (Woodham, 2005), I would argue that the consensus narrative's geography of central events, themes and figures resembles a map of the North American Treaty Organization (NATO).

6 In the late 2000s, consultants and business thinkers popularized "design thinking" as a prescription for solving management and business problems (Brown, 2009; R. L. Martin, 2009; Nussbaum, 2007). Kimbell (2011) analyzes these prescriptions critically and at length from an organizational studies perspective. Concepts common to both academic and business arguments for design thinking, such as "abductive reasoning" (Lawson, 2006; R. L. Martin, 2009), suggest shared intellectual foundations. However, Kimbell finds no direct connection between the scholarly and the business calls for "design thinking."

7 Chapter 3 summarizes a tradition of studying science and technology studies that has throughly questioned this portrait of objective scientific knowledge-making, and of facts as "natural."

relies upon intuitive deployment of "first principles" and a repertoire of "tricks" or "design gambits" (Cross, 2006). In this way, the "designerly way of knowing" thesis integrates Schön's notion of expert reflection-in-action with the Pevsnerian language of individual genius. Yet, unlike the rational and romantic models, the design knowing model holds that both intuition and logic are equally necessary and legitimate. Unlike the situated model, it maintains a firm distinction between "intuition" and "rationality," but holds that design thinking alone can reconcile them.

"Design knowing," then, selectively integrates components from the three previous models into its description of a unified and unique epistemic stance. The design thinking model thus claims design as a major field of human endeavor, parallel to both art and science (Cohn, 2008). Hence "design thinking," unlike the rational model, rejects scientific reasoning as a model. Science appears here as the domain of universal laws, of objective, natural facts, and of certainty. Scientists, from this perspective, must accurately describe reality. Design, however, is intended to produce new objects. As Stolterman summarizes, "In contrast to the scientific focus on the universal and the existing, design deals with the specific, intentional and non-existing" (2008). The act of designing is, as a result, an inherently speculative act. It is not required to produce truth but rather stories or plans for the future (Margolin & Buchanan, 1995).

Many criticisms of situated reflection — such as its forgetfulness of alternatives to the mass industrial status quo — also apply to the unique knowledge model. More recently, critics like Lucy Kimbell (2009, 2011, 2012) have begun to argue that the celebration of "design thinking" separates design from the conditions of actual design *doing*. It does not account for the objects and materials — products, systems, and services — with which professional designers grapple. As Kimbell writes, "Objects are central to the work of professional designers, but theories of design have moved away from objects" (2009, p. 5). In avoiding questions of doing, the model of design knowing avoids professional concerns such as project management and organizational politics. Correspondingly, it overemphasizes the ability of designers, versus managers, manufacturers and consumers, to determine both the form of a design outcome and the effect of a product in the world. So, as with the rational model, treating design professions too strictly as exemplars of a unified, unique epistemic mode may undermine both adequate description and workable prescription.

The consequences of defining design as cognition

In this way, a mostly Anglo-American group of design scholars between 1962 and 1995 has transformed questions of making into dilemmas of knowing. Studies of design cognition often locate thought primarily in individual designers (Kimbell, 2011). They focus on idea generation, rather than the fate of those design proposals within groups and organizations. The preoccupation with individual creative reasoning narrows methodological and theoretical attention to designers

working alone or in small groups during "concept-formation" and "problem-solving" phases of the project (Telier, 2011). It has particularly concentrated study on practices of sketching (i.e. Gedenryd, 1998; Goldschmidt, 1991). Moreover, it can dislocate accounts of designers and design work from organizations and institutions (Margolin, 1995). Chapter 3 examines the methodological consequences of this approach in more detail.

Models of thought processes can also abstract design work from its materials. That is, they lose sight of how variability in tools and environments might affect how designers might generate concepts and solve problems. Henderson's study (1998) of a move from paper drawing to computer-assisted drafting (CAD) in design engineering analyzes how the switch affected not just how designers drew on their own but how they worked with others — not always to the benefit of the final product. They can also lose sight of how design decisions emerge from turning the tangible properties of design objects to the advantage of design goals — why one might use slinky silk versus bulky brocade for an evening gown, or space out a line of text to compensate for the blotchy spread of ink on newsprint.

In focusing on *designers*' thinking, all four models tend to privilege the power of designers to define products' form and use over that of clients, manufacturers, or end consumers. In particular, they blind observers to the renegotiating and reconstituting of products in use (Shove, Watson, & Ingram, 2008; Suchman, 2003). They also miss another material dimension of design: the active role that tools and environments take in supporting (or impeding) coordination among project actors (Schmidt & Wagner, 2004). Tracing the cognitive processes of individual designers can thus also obscure questions about organizational and institutional dynamics of politics and participation. How is access to and use of tools and materials regulated? What kinds of influence and status relationships among project constituencies such as designers and clients do those acts of regulation produce? What kinds of prospective relations among designers, clients, and users are configured (Grint & Woolgar, 1997) in the process of designing these prospective technologies? What possibilities for later action, as a result, are inscribed (Akrich, 1992) into them?

Hence, despite the differences among the four models I have presented, one thing remains constant: the figuring of design work as a problem of human understanding, solved by individual genius, rational method, situated conversation, or unique way of knowing. All the models insist upon what Richard Buchanan has called the "critical but often blurred distinction between design thinking and the activity of production or making" (1992, p. 18). In these models, what defines "design" is less what designers do than how they think. As historian Carolyn Miller (1989) writes of Simon's science of the artificial, they render design as a problem of proper thinking rather than effective action. As Dana Cuff writes of architecture studies, "The neglected domain is the territory of practice itself" (1992, p. 11).

2.2 Design as practice

Since the 1980s, a number of scholars and designers have argued for redefining design not by how designers think, but by what designers do. That is, they argue for defining design as *practice*. Since the 1970s, the "practice turn" (Knorr Cetina, Schatzki, & Savigny, 2000) has come to label a constellation of concerns across philosophy (e.g. Dreyfus, 2000)], sociology (e.g. Bourdieu, 1972), cultural theory (e.g. Foucault, 1977), and science and technology studies (e.g. Pickering, 1995). This turn[8] set itself against duelling explanatory agendas: on the one hand, individuals' thoughts and direct (inter)actions; and on the other hand, permanent systems, structures, discourses, institutions, and so on. There is, as Schatzki writes in his influential summation, "No unified practice theory approach" (2000, p. 11). Practices, Schatzki (2000) writes, are in the broadest sense "arrays of activity": clusters of physical actions connected by shared purposes, assumptions, or goals. So any practice is a composite, including potentially "forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge" (Reckwitz, 2002, p. 249)[9]. What holds practice theory together is an insistence that these composites — as opposed to direct interpersonal interactions, normative types of thought, or durable macrosocial structures — organize human life.

There is, however, a noticeable division in how practice theorists understand the practice itself (Law, 2009). As Pickering writes,

8 Postill (2010) describes a "first generation" of practice theory between the 1970s and 1990s. This first generation includes work from Bourdieu (1972), Giddens (1986) and Foucault (1977). Theodore Schatzki and others included in the classic *The Practice Turn in Contemporary Theory* (2000) would then be the second generation. We can logically extend this chronology to call Postill himself, Couldry (2012), Shove (2012) and other analysts of media consumption, leisure pastimes, and online participation a "third generation."

9 At first glance, practice theory appears to resemble activity theory, a framework drawn from psychology (Engeström, Miettinen, & Punamäki-Gitai, 1999). However, activity theory and practice theory (especially as taken up in science and technology studies) are quite different. Activity theory emphasizes conscious, reflective human action, the agency over humans over objects, and the necessity for macro-scale concepts of culture and society (Kaptelinin & Nardi, 2006) — all concepts questioned or rejected by variants of practice theory (Knorr Cetina et al., 2000). Activity theory has been productive as the source of prescriptive frameworks for interaction design practice (see Nardi, 1996 for examples). However, in departing from the design-as-cognition agenda, I have found activity theory's concern for "intention, imagination, and reflection as core human cognitive processes" (Kaptelinin & Nardi, 2006, p. 10) less analytically productive than a practice-oriented concern for the components of action.

> One sense of "practice" is […] the work of cultural extension and transformation in time. The other sense of "practice" relates to specific, repeatable sequences of activities. […] Thinking about science bifurcates in the act of deciding whether 'practice' has a plural or not (1995, pp. 4–5).

The latter approach takes *practices*, in the plural, as origins of social stability. Such "bodily and mental routines" (Reckwitz, 2002, p. 256) have an "unconscious, automatic, un-thought character" (Swidler, 2000, p. 83). Through repetition, practices pattern human life.[10] This *structuration* is not imposed externally; rather, order emerges from ongoing activities (Giddens, 1986). Practices *condition* the possibilities practically available in action, but they do not possess the "the *sui generis* existence and near omnipotence" (Schatzki, 2000, p. 14) granted to structures and systems. Repetition, however, reinforces practiced patterns and makes their continued reproduction difficult to avoid (Reckwitz, 2002). These patterns then incorporate themselves into the human body as semi-permanent *habitus,* or embodied expectations for conduct (Bourdieu, 1972). So practices tend to reproduce social order precisely as they go unconsidered. The improvisational possibilities of action are always constrained by the ingrained dispositions of their human participants. Taking practices as stability, then, implies analyzing everyday activities in terms of routinization, familiarity, and repetition.

A contrasting approach, with diverse antecedents but rooted in studies of knowledge-making and embodied craft in the sciences (e.g. Suchman, 2000) emphasizes instead the possibility of contingency and change. This approach takes "practice," in the singular, not as a multiplicity of distinct routines, but as the site of cultural negotiation. From this perspective, even patterns of life that appear permanent cannot be taken for granted. They are the result of effortful *enactment* rather than routine *reproduction*. As Pickering writes of the "mangle of practice,"

> Every single element or stratum of scientific culture — material, conceptual, social — is revisable in practice: the material contours of machines and instruments and their performances; facts, theories and mathematical formalisms; the scale of social actors and their relations with one another; skills, disciplines, plans and intentions; norms, standards, rules; you name it. All of these evolve open-endedly into the future (1993, p. 415).

If practices-as-stability tends towards the analysis of structuring and patterns, practice-as-enactment tends towards an analysis of transformation and turn-by-turn, improvisational interactions. This tradition of practice theorizing defines practice as *generative* rather than *conservative*. It originates in part with arguments for the constitution of bodies, actions, and identities by disciplinary practices such as imprisonment and hospitalization (Foucault, 1976, 1977). It also originates from science and technology studies' ethnomethodological tradition (e.g. Lynch, 1985; Suchman,

10 I am using a generic vocabulary of "patterns" in order to encompass the early and influential arguments of Bourdieu (1972) and Giddens (1986) without necessarily adhering to either.

1988). From the distinctive perspective of ethnomethodology, even the most permanent-seeming pattern of activity cannot be anything but a situated and effortful accomplishment,

> Being everywhere, always, only, exactly and entirely members' work, with no timeout, and with no possibility of evasion, hiding out, passing, postponement, or buyout (Garfinkel, 1996, p. 11).

If the establishment of regularity requires unceasing labor, then change is always a possibility.

Most versions of practice theory (as summarized by Bräuchler & Postill, 2010; and Schatzki, 2000) center on the human body. For practices are tangible and material. They are not constituted by

> Some abstract stuff in people's heads which might or might not cause their action. Rather cultural practices are action, action organized according to some more or less visible logic (Swidler, 2000, p. 85).

Without physical activity — skilled or inexpert, deft or clumsy, committed or distracted — there can be no practices. An attention to embodied action turns our attention away from autonomous cognition "in the head," and towards witnessable activities in the world. As Mol argues,

> The ethnographic study of practices does not search for knowledge in subjects who have it in their minds and may talk about it. Instead, it locates knowledge primarily in activities, events, buildings, instruments, procedures, and so on (2002, p. 32fn).

Yet though they are integrally tied to more-or-less skilled and committed human bodies, practices themselves are not individual possessions. Instead, practices are distributed in environments and objects, and collectively produced, performed, and judged.

Various approaches in Science and Technology Studies (STS) have taken up the challenge of examining the role of *non-humans* in practices. Emerging in the 1970s (Hackett, Amsterdamska, Lynch, & Wacjman, 2007), STS (often used as well as an acronym for Science and Technology in Society) "starts from an assumption that science and technology are thoroughly social activities" (Sismondo, 2010, p. 11). That is, science and technology are social because they rely on practices learned and judged in communities. Science and technology are also social in that practitioners do not work alone; in order for their plans and ideas to succeed, practitioners must induce others to support them. An interest in "how the things it studies are constructed" (Sismondo, 2007, p. 14) differentiates the agenda of STS from that of the history, philosophy, and sociology of science and technology in general (see Chapter 3 for more on this distinction). That is, STS projects characteristically attempt to account for the *making* of knowledge and objects as well as the institutional

or cultural conditions which shape those activities. Indeed, understanding the complex relations among humans and non-humans are central to the work of STS.

From the perspective of many studies in science and technology, if practices are indeed material configurations of people, objects, environments, skills and so, then their outcomes depend on *all* their components hanging together[11]. Hence practices cannot only be "rooted directly in the human body," as more human-centered perspectives would have it (Schatzki, 2000, p. 18). They are also rooted in tools, buildings, weather, and so on. We can think of this participation as a "dance of agency" (Pickering, 1995, p. 22). Law (2009) summarizes two perspectives on this dance. The first, exemplified by arguments for the social construction of technology (e.g. T. J. Pinch & Bijker, 1984), take these non-human components of practices as relatively passive. The material properties of objects, such as hardness, color, and so on can be used as a neutral "standing reserve" (Law, 2009, p. 3) to which humans attribute different meanings. The objects resulting from engineering and design activities then express "cultural practices and prejudices," as with Pinch and Bijker's well-known example of the struggles of the "safety bicycle" to appeal to self-identified daredevils. As the "social construction" label suggests, practices are relatively stable once debate has ended among human participants over what they mean. "Construction," after all, typically is understood as a one-time event.

The second perspective, exemplified by the actor-network perspectives of Latour (2005), Mol (2002) and Law himself, upends this portrait of non-human passivity in two ways. Objects can preserve and extend practices in cases where those practices might otherwise shift and alter. "Immutable mobiles" (Latour, 1986) — such as texts, images, and instruments — do not change as they move in space. Their reach and durability can carry and shape practice. Nurses complain about paperwork, for example, but "they structure their care so that the required forms get filled out," write Bulechek and McCloskey (1989, p. 406), as quoted by Bowker and Star (1999, p. 272). The combination of forms as immutable mobiles and managerial requirements directs how nurses work. Nevertheless, as Law (2009) points out, the reach of such immutable mobiles depends upon a correspondence between their origins and their destinations. The forms have no weight outside the hospital and the organizational management of nursing work. However, an object need not be stable to support and extend practice. Widespread and persistent practices may depend on objects whose components locally shift and alter, as in the study of a highly adaptable Zimbabwean water pump by De Laet and Mol (Laet & Mol, 2000) as described by Law (2009).

11 Actor network theory, which often draws on theories of practice (Reckwitz, 2002; Schatzki, 2000), is replete with case studies of non-human resistance, from oysters (Callon, 1986) and historic buildings (Yaneva, 2008) to lighting fixtures (Akrich, 1992) and ocean navigation (Law, 1987).

Objects can also resist easy integration into human practices. Observers of scientific practice such as Karin Knorr Cetina (1995, 1997) have traced how the objects of science may be characterized not by their objectively present qualities but by their *lacks* — by what scientists desire to know about them, but do not. The practices of science, then, must cope with this persistent epistemic uncertainty. The position of interaction designers echoes that of scientists: as more than one designer complained to me, *I don't know what it* [the system] *wants to be yet.* Objects in the midst of design projects, like the objects of scientific inquiry, do not necessarily have any accepted properties upon which designers can unquestioningly rely. But even less exotic objects than quarks or mobile phone applications can resist integration into human practices. Yaneva (2008) describes how old buildings under renovation can reveal unexpected aspects of their original construction that challenge architects' plans for renovation.

So if we take the action of non-humans seriously, there is no way to divide social practice as a realm of purposeful humans neatly from non-human, passive materials. Imagine a highway in a storm. The roads get slippery; rain obscures drivers' vision. Successfully "driving in the rain" is a cooperative practice of human drivers, wet asphalt, braking mechanisms, and rubber tires, as well as road signs and traffic signals. It emerges from simultaneous, interweaving interactions among all its components. Driving in the rain may be a repeated and routine activity, but the ever-present car accidents suggest the unavoidable uncertainty of outcomes as conditions change. As Law writes of a strawberry market,

> Buyers, sellers, notice boards, strawberries, spatial arrangements, economic theories, and rules of conduct, all of these assemble and together enact a set of practices that make a more or less precarious reality (2007, p. 13).

Practices, then, must be enacted cooperatively by humans and non-humans *together.* And the fate of practices — and thus the order that practices engender — depends on that continuing cooperation.

Taking the "practice turn," the occupations we typically label "design," (e.g. graphic design, fashion design, industrial design, and so on) should not be defined by a shared process of thinking. Instead, what characterizes this "family of activities" (Lyytinen, 2004, p. 222) is what they all do: specify "sociomaterial *arrangements* within, or with which, *others* can act" (Suchman, 2004 emphasis mine). Designing as a contemporary industrial occupation means "describing, inscribing, prescribing, and proscribing how, why, when, and where others live their lives." (Orlikowski, 2004, p. 92). In the case of interaction design, the mass distribution of software over the Internet means that specifications produced by a single interaction designer or small team can have consequences for millions of people around the world.

Design for mass production engages at least three domains of practice: the professional activities of designers, the everyday habits of consumers or users, and the labor of manufacturing and

production. In an age of mass production, designers usually work at a distance from the objects they make and the people who encounter those objects (Pye, 1964). "A separation of conception and execution" characteristically divides "the time, place, worldviews, norms, interests, values, discourses and practices" (Orlikowski, 2004, p. 91) of designers and users and designers and manufacturers. Architects, for example, work apart from both from construction workers and from the prospective inhabitants of the as-yet unbuilt structure (Cuff, 1992). Neither the prospective object nor its worlds exists at the time of design, and the designers cannot control either the chain of material transformations that turns a specification into an object (Mackay, Carne, Beynon-Davies, & Tudhope, 2000), or the world into which the envisioned object will be launched (Akrich, 1992).

The way that designers can work at a distance is twofold: first through the making of specification documents as "conscription devices" that enlist other professionals into production (Henderson, 1998); second through telling convincing stories of prospective futures, often using those specifications (Bucciarelli, 1994; Krippendorff, 2005). Designers must imagine not just an object or service but a prospective world in which it will operate (Wilkie & Michael, 2009). So what designers are doing is, sometimes literally, heterogeneous engineering (Law, 1987, as cited by Nickelsen & Binder, 2008): using representations such as diagrams or models to make a future world of images, technologies, infrastructures, human users, manufacturers and the rest *believable* so that others will make it *real*. In studying how designers order the lives of others, then, we study how designers convincingly materialize prospective futures. The question, then, is how we might map the possibilities for extension and transformation in designers' practices.

A prevalent cognitive definition of exemplary design is creativity, or the generation of new ideas (as in Dorst & Cross, 2001). However, if we accept that professional design demands believable *ordering*, then successful design perhaps does not only depend upon the production of novel ideas. It might require as well the ability to rearrange existing materials and present them persuasively. As Suchman writes,

> The study of how new technologies emerge shifts, on this view, from a focus on invention to an interest in ongoing practices of assembly, demonstration, and performance (2002, p. 163).

Descriptions of professional design practices offer a rich vocabulary for activities of assembly, including "configuring" (Grint & Woolgar, 1997), "gluing together" (Henderson, 1998), "morphing" (Telier, 2011) and "scaling" (Yaneva, 2005). However, we lack a similarly rich vocabulary for activities of demonstrating and performing. This dissertation responds to that lack.

This dissertation is organized around the definition of "practices" as repeated clusters of action. Its central chapters define practices such as the generating of product attributes, scoping of project work, sketching and drawing, presenting to clients and so on. This approach builds upon existing practice-oriented approaches to everyday design work. Studies of model-making in archi-

tecture (Cuff, 1992; Yaneva, 2005) and sketching in design engineering (Henderson, 1998) often closely describe such "routinely performed activities" (Cuff, 1992, p. 4) as a way to avoid undue emphasis on accounts of normative "designerly" mental processes abstracted from the day-to-day concerns of professional designers.

Decentering individual thought directs attention to physical dexterity, expert skills, commitment to the activity, and so on (Bräuchler & Postill, 2010; Reckwitz, 2002; Schatzki, 2000). A practice theory perspective, then, sensitizes us to how human reasoning might be embodied — that is, sensorially coupled with the environment in physical action (Lakoff & Johnson, 2003), and likely distributed among human, tools, and environments (Hutchins & Klausen, 1998). It asks us to consider how practitioners might gradually develop expertise and commitment over time, through ongoing participation in everyday activities (Lave & Wenger, 1991). In this way, the practice approach allows us to avoid treating the designer either as the opaque black box of the romantic model or the transparent "glass box" of the rationalist model. A close attention to activities in turn focuses this account of interaction design on what is tangibly present in the studio: tools, designed artifacts, bodies. Moreover, software as a design object is often treated as "virtual," or immaterial (Blanchette, 2011). One task of this dissertation, then, lies in making visible the materiality of interaction design as located in bodies, tools, and spatial arrangements.

The overall agenda of this dissertation, however, follows the "practice as enactment" approach. It examines how the responsibilities, capacities, and identities of not just human but non-humans in design projects — designers, users, software tools, and so on — might be constituted in moment-to-moment action rather than pre-given (Haraway, 1997). As a consequence, my methods rely on fine-grained readings of short segments of conversation in order to trace the interactional accomplishment of order. For example, in Chapter 7 I analyze the movement of hands, drawings, and pencils to discover how sketches of websites, like buildings under construction (Yaneva, 2008), can surprise human designers by presenting unexpected barriers to their plans.

Taking practice as productive focuses analysis not on generalizable routines but local specificities and contingent arrangements. It also prompts us to consider how those arrangements might be workable — or not — for the humans entangled in them (Shove et al., 2008; Suchman, 2006). And it turns our attention to moments of disruption and resistance in design work (such as those described in Chapter 8) and the unpredictability of even the most seemingly routine design project.

We have now travelled far from the minimal notion of practices as arrays of human activity which began this section. These questions about humans, non-humans, and practice inform this dissertation indirectly by prompting the kinds of questions I ask about a group of professionals who often describe themselves as "human-centered." In studying design, practice-as-enactment helps us move on from the concerns that have defined cognition-oriented design research. It turns us away from *how does interaction design demonstrate a special form of human thought*? And to-

wards *what kinds of objects and subjects do interaction design practices make,* and *how do those practices produce them?* I am proposing to concretely and productively answer these questions through attending to the role of *performance practices* in interaction design.

2.3 Practice and performance

The term "performance" has a long history in the study of practice, both as an evocative dramaturgical metaphor (Goffman, 1959) and as a signal of a commitment to treating practice as enactment. Though both senses of "performance" are undeniably intellectually productive, this dissertation avoids both of them. I deliberately draw a more limited definition of "performance" as episodic action before an audience of witnesses. "Performance," begins one anthology of performance studies, "describes certain embodied acts, in specific sites, witnessed by others (and/or the watching self)" (Diamond, 1996, p. 1). My use of a definition grounded in studies of performance practices (e.g. Schechner, [1977] 2013)[12] is intended to turn our attention to interaction design *in particular* rather than design or practice *in general.* By treating performance as a concrete activity, I can ground this story of design more richly and tangibly in observations of how the objects and subjects of design are materialized in the studio.

For the purposes of understanding interaction design, we can distill from the vast literature on "performance behaviors" three important themes: *boundedness*, *display,* and *narrative. Boundedness* means that performances are limited in time and space. In the projects I observed, performances are not indefinitely located. Participants assemble at a specific site, they play out and react to events, and then they disperse (Schechner, [1977] 2013, p. 176). I identify and characterize specific performances, then, by analyzing spatially and temporally bounded *episodes* rather than texts or ongoing conditions.

Performances are also *display* — "not simply a doing but a showing of a doing" (e.g. Schechner, [1977] 2013, p. 114). So audiences "fundamentally constitute" any performance and its meaning (Al-

12 Performance Studies, like practice theory, is often described in terms of its diversity of approaches to embodied, event-based activities (Kirschenblatt-Gimblett, 2004). This dissertation draws largely from the "broad spectrum" approach pioneered by Richard Schechner (2004). The broad spectrum approach takes human action before audiences as a means to study not just the arts but history, social relationships, and culture more generally. The broad spectrum of performance can include not just organized theater but sports events, religious rituals, surgical procedures, and so on.

lain & Harvie, 2012, p. 132). The audience participates in the performance[13] too, especially in bearing witness to it. Defining performance through showing to an audience underlies this dissertation's take on longstanding questions of vision and visibility. Design is not just a problem of an individual who "sees, moves, and sees again" (Schön & Wiggins, 1992, p. 135) — it is a problem of *skillfully communicating to an audience what there is to see, and how to see it*. That skillful show relies not just on human competences but often on objects and carefully arranged and constructed environments (Kirschenblatt-Gimblett, 2004, pp. 48–49). And there is a further implication that this dissertation will explore: that the efficacy of the performance depends on how designers induce assent, or permission for further action, from their audiences.[14]

Performances, for the purposes of this research, further involve *narrative*, or storytelling. In summing up definitions of narrative, Carr (1991) offers two dimensions that are particularly relevant to interaction design performances. First, stories unfold in time but they are bounded; they have a beginning, middle and end. Second, stories also insist upon the distinction between

> Characters in the story, the teller of the story, and the audience to whom the story is told. Further nuances involve distinctions between the real and implied narrator and the real and implied audience of a story (p. 5).

Telling stories brings together words, gestures, images, and resources in the surrounding environment in order to conjure what linguists call "narrated spaces" (Haviland, 2000). That is, stories materialize "a specific 'there and then' in this particular 'here and now'" (Schechner & Appel, 1990, p. xvii). Design is often analyzed in terms of drawing or sketching (e.g. Goldschmidt,

13 Note that this definition departs from that motivating analyses of the "presentation of self" (Goffman, 1959) as performance. Goffman (and hence those following him) defines performance as "the activity of an individual […] before a particular set of observers" (1959, p. 13). My definition of performance does not treat it in terms of the individual human and explicitly includes spectators, objects, spaces, and anything else that provokes, conditions, or reacts to witnessable action.

14 The *efficacy* of a performance is generally defined as the "ability to effect a transformation in the status of participants" (e.g. Schechner, [1977] 2013, p. 116). This transformation may reaffirm the status quo through ritual provocation and resolution of crisis, transgress it through external breach or rupture of expectation, or subtly resist it by subverting expectations from within (McKenzie, 2001, pp. 39–43). Efficacy can be partial; the performance can fail to achieve the expected or desired result. Changing the definition of efficacy from transgression to subversive resistance, Mckenzie argues, has accompanied a shift from the theater to *theorizing* as the site of efficacious cultural performance, and the substitution of semiotics for anthropology as the source discipline of Performance Studies in the 1990s. Following Mol (2002), Barad (2007) and other scholars of science and technology, this dissertation reverses that discursive turn, returning to the materials of interaction design (including human bodies) as productive of efficacy.

1991); narration prompts us to consider other kinds of embodied expertise may be necessary to materializing credible futures. Narration also prompts us to consider another form of efficacy: whether a story of a product and its futures is practically tellable to this audience, in this time and place (Simakova, 2013).

Theatrical metaphors such as the "staging" or "actor" have been undeniably useful to the study of science and technology[15]. Consider how an extensive deployment of dramaturgical metaphor rhetorically underwrites Latour's revisionist account of agency and action:

> To use the word "actor" means that it's never clear who and what is acting when we act since an actor on stage is never alone in acting. […] If we accept to unfold the metaphor, the very word actor directs our attention to a complete dislocation of the action, warning us that it is not a coherent, controlled, well-rounded, and clean-edged affair (Latour, 2005, p. 46).}

There is no explanation of what a stage is, the fictional nature of the action being played out, the resources characteristic to theater organizations (lighting, backstage crew, prompter, and so on). Latour's appeal rests, in short, on evoking a shared notion of "the theater." In this way, Goffman's popularization of what he called "dramaturgical metaphors" for explanation of the "presentation of self" (1959) has led to one of the great contributions of Performance Studies (McKenzie, 2001): as a rich source of evocative metaphors for other fields.

In this dissertation, however, "performance" largely serves to indicate a specific type of behavior rather than as a source of evocative allusion. My use of "performance" is less colloquial and analogical than the dramaturgical metaphor. And I will not take up Goffman's signature concern with the self and its performance. Instead, the analytic leverage of this dissertation will emerge from detailed descriptions of episodes of performance, rather than from impressionistic evocations of a shared theatrical imaginary. For example, the roleplay described in Chapter 7 is not analogically "like" a theatrical performance. In roleplay, designers use words, gestures, and documents to work through hypothesized actions and their results. Which is to say that, based on the dimensions of performance I just introduced, roleplay is a form of performance. This dissertation will attempt to identify and describe precisely how and where interaction design consultancies exhibit certain sociomaterial relations that scholars have named "performance," and to what ends.

I also move away from another widespread use of "performance": this time as a generic synonym for "enactment" or "doing" (Mol, 2002, p. 34fn–43fn). To Mol, performance indicates *doing* and action, whether in accomplishing an immediate task or acting out a given role. So it is a logical word to evoke a multifaceted sense of practice as repeated, situational, and generative. However,

15 Examples include: science as public drama (Hilgartner, 2000) and technology demonstrations as theaters of proof (Simakova, 2010) or theaters of use (Smith, 2009).

as Mol points out, the multivalence of "performance" so used is both useful and problematic. It implies simultaneously theatrical roleplay, the successful completion of effortful tasks, and a linguistic argument for how words "do things" (as in Austin, 1975). She is suspicious, however, of the way in which conflating dramaturgical metaphor and Austin's performative grammar can permit theorists such as Judith Butler (1993, 1999) to grant discursive acts supremacy over material bodies. As another critic writes, this "excessive power granted to language to determine what is real" (Barad, 2007, p. 133) makes it difficult to trace how bodies — blood vessels, organs, and all — might produce and resist language. In the end, Mol rejects the "buzzword" of performance and the resulting "controversies" in favor of the term "enactment" (Mol, 2002, p. 41fn).

Used as a synonym for "enactment," "performance" signals a commitment to theorizing practice as unavoidably contingent and transformational. This dissertation takes up that commitment. However, a continuing problem for the design-as-cognition agenda has been the generalization of conclusions drawn from one design occupation to *all* forms of design. So, like Mol, I will try to avoid using "performance" when I mean "enactment." Limiting the definition of "performance" to a family of specific, concrete relations and activities reinforces this dissertation's modest, bounded and local approach. As well, by focusing on performance *practices,* I can extend a continuing discussion in STS of the role of performance events such as demonstrations and experiments.

What I take from these studies is, first, a distinction between performances with planned, assured outcomes and performances with uncertain, unpredictable outcomes. In arguing for an ethics of public display in science, Collins (1988) lays out the distinction[16]. Experiments are skillful, but unpredictable: they are "inexplicable and therefore potentially fallible" (p. 726). Demonstrations, however, are rehearsed; they "have the power to convince because of the smoothness of performance, distancing the audience from the untidy craft of the scientist" (p. 728). Studies of design as cognition, drawing on Schön's description (1983) of design as a procession of experiments, have largely focused on those activities that seem more unpredictable, such as generating ideas by sketching. But much of designers' time is, in practice, taken up by preparing

16 Pinch (1993) advances another type of performance, the *test*, which also involves unpredictability before witnesses. Tests are less relevant to the study of interaction design than experiments or demonstrations. While "usability tests" are routinely conducted during interaction design projects, they are not core to practitioners' definitions of the disciplines and I did not encounter many in my field research.

for, conducting, and then analyzing activities which resemble *demonstrations*[17]: the high-stakes presentations to clients which punctuate projects.

Second, I have learned from an emphasis on the need for assent from the proper audience of witnesses. As Shapin and Schaffer write of Boyle and his experiments,

> The capacity of experiments to yield matters of fact depended not only upon their actual performance but upon the assurance of the relevant community that they had been so performed (2011, p. 55).

The relationships of designers we will meet and their clients are not so different from the relationships of scientists to patrons in 18th century Britain. As I describe in Chapter 8, designers present their intermediate work to client representatives so that the representatives can make decisions about the project. For those decisions to be effective, the audiences of those presentations must actually have the standing to enforce them. To solidify a tentative proposal into detailed specifications and then working code, the "relevant community" for the project must give assent. Those presentations, as I describe in Chapter 6 and 7, are planned and rehearsed beforehand as designers attempt to anticipate and pre-empt objections from the audience. But, as we learn in Chapter 8, identifying and assembling the relevant audience of witnesses — much less gaining their assent — is no simple matter.

2.4 Conclusion: From cognition to performances

The overall argument of this dissertation is that attending to "performance activities" will help us move beyond the models of design as cognition in understanding how interaction designers work. Treating design as a form of cognition has produced a rich and extensive literature over the past fifty years. However, the cognitive models of design have excluded objects of concern to working designers from the methodological and theoretical attention of much design research. Defining thought as creativity leads to a focus on the generation of new design proposals and the solving of technical problems. It directs attention away from client presentations and other communication activities that in project work demand considerable time and anxiety. Taking designers as the prime movers of design obscures the roles of clients and users — two figures which, as we will see in Chapter 4 loom large in the lives of interaction designers. And taking thought as a property of individual humans makes it difficult to ask questions about the organizational politics of project work and the role that tools and built environments play in enacting them.

17 Do not take this comparison too strictly. For interaction design consultancies, client "working sessions" such as the one described in Chapter 5 are often intended to have unpredictable, generative results. As a general rule, however, the final presentation of a project is choreographed and rehearsed so that, the designers hope, it goes as smoothly and predictably as a public demonstration of an accepted scientific fact.

CHAPTER 3

About this research project

This dissertation results from four main research activities. First, I observed in-person project work and online communication at three San Francisco design consultancies. Second, I conducted supplementary interviews with San Francisco interaction designers. Third, I attended professional conferences and educational events organized or attended by participants. Fourth, I analyzed texts, images, and videos produced by participants or recommended to me as good reference material for aspiring interaction designers. As such, methods differ from those typical of studies of designerly decision-making in Human-Computer Interaction (HCI) and design studies. Instead of conducting interviews, evaluating structured design exercises, or documenting my own design projects, this dissertation follows in the tradition of "laboratory studies" (Knorr Cetina, 1995) within science and technology studies (STS). In practically conducting such a study, however, I drew on the methods of constructivist grounded theory (Charmaz, 2006; Corbin & Strauss, 2007). One might call this dissertation, then, a refashioned "studio study" approach.

3.1 Studies of design decision-making

In 2002, sociologist Rosalind Gill complained that web designers and other digital workers are "invoked rhetorically all the time but rarely studied" (p. 75). Echoed by others (e.g. Kennedy, 2011; Ross, 2004), Gill's complaint remains relevant more than ten years later. Moreover, for the past twenty years, scholars have noted a dearth[1] of practice-oriented studies of designers at work not just in web design, but also in engineering and architecture (Bucciarelli, 1994; Kimbell, 2011;

1 This absence of other observational studies is usually invoked as a motivation for the author's own observational study. So these complaints also must remind us of a continuing tradition of ethnographic studies of engineering (Ball & Ormerod, 2000; Bucciarelli, 1994; Henderson, 1998; Lloyd & Deasley, 1998; Vinck, 2003), architecture (Cuff, 1992; Schmidt & Wagner, 2004; Yaneva, 2009), and museum exhibit design (Heath & vom Lehn, 2008; Lee, 2007). Yet Gill's point still stands (2002, p. 75). There are relatively few ethnographic studies of the design of digital interfaces and behaviors.

Lawson, 2004; Yaneva, 2009). I take these recurring complaints as symptomatic of a more general trouble for the scholarship of design: that the main methods employed to study the thinking of designers, whether architects or software designers, tend to elide the mundane contingencies, material difficulties, and diversity of professional practices.

Though the past decades have seen a turn to studying "design as it is actually practiced in commercial and industrial settings," Matthews and Heinemann argue, "even so, such naturalistic, in-situ studies are hardly the dominant form of empirical design research" (2012, p. 650). Most studies of the material techniques and strategies of design work employ one of four main methods.[2] The empirical methods that characterize publications in design studies, particularly those of architecture, industrial design, and mechanical engineering design, are retrospective interviews and protocol studies (as described in Lawson, 2004, pp. 15-17). Student cases are also a rich source of data. The field of HCI, by contrast, relies largely on autobiographical narratives of the development of digital technologies, which offer detailed descriptions of motivations and process.[3]

In *retrospective interviews*, the researcher asks experienced designers to describe how they work, often using artifacts from current or past projects as prompts.

Protocol studies are controlled design exercises. Designers are given a few minutes to a few hours to solve a problem or complete a task. They may not take breaks, and often must speak their thoughts aloud as they go. Protocol studies usually limit the resources that designers can reference, and forbid participants contact with clients, potential users, consultants, vendors or policymakers. The event is usually videorecorded, with the recording and any artifacts made during the process closely analyzed. The goal is to control environmental variables in a manner similar to a classic scientific experiment.

Student cases (e.g. Arvola & Artman, 2007; Fleming, 1998; Vyas, Heylen, Nijholt, & Veer, 2009) allow design scholars to observe project or meeting trajectories without imposing the external constraints typical of protocol studies. Because the participants are students, researchers avoid the problems of business confidentiality.

All of these methods have drawbacks. Both retrospective interviews and protocol studies take only a few hours per participant and require relatively little access to clients or confidential working documents, they are relatively easy to conduct. However, retrospective interviews can prompt "just-so" stories of process and outcome, occluding false starts and conflicts. And they cannot give

2 I derive this analysis from published reviews of design studies (Cross, 2006; Lawson, 2004, 2006; Purcell & Gero, 1998) and from performing my own review of design studies in HCI (Goodman, Stolterman, & Wakkary, 2011).

3 Gaver et al. (2010) provide an admirably thoughtful example.

any reliable view into moment-to-moment sketching and conversation during project work. Both interviews and protocol studies may also dislocate designers from the organizations within which they work, losing sight of the role of the organizational priorities, politics, and infrastructures that shape work. Protocol studies, by contrast, produce immense amounts of empirical data on the interplay of talk and drawing (Purcell & Gero, 1998). However, there are considerable questions about the value of excluding relevant actors such as users and suppliers, and of demanding artificially fast and uninterrupted work (Lawson, 2004). Student examples by definition examine situations of learning and apprenticeship. The relationship of student to teacher differs from the relationship of designer to paying employer or client; the skills, techniques, and tools of students likely differ in some ways from those of experts. Studying students introduces some of the same practical concerns as protocol studies.

Published autobiographical narratives, like retrospective interviews, are unreliable witnesses to the process of making objects. Like scientific papers, they offer cleaned-up diagrams and idealized, post-hoc accounts of process. Moreover, the conditions under which their researcher-protagonists work are often unlike those of in-house or consultancy designers in terms of time constraints, sources and amount of funding. Indeed, HCI venues publish[4] autobiographical narratives that meet criteria quite different from those faced by professional design projects: clear demonstration of technical novelty, citation of previous published research, valid and credible evidence for knowledge claims, and word limits, to name only a few! So, as Roedl and Stolterman contend from their comparative analysis of HCI papers and interviews with design professionals (2013), autobiographical narratives may provide inspiration for designers outside the confines of universities or corporate research laboratories, but they cannot be taken as evidence of the day-to-day work of many professionals.

A few sociologists, such as Rosalind Gill, often take up digital design as a paradigmatic case[5] of contemporary creative labor. They use ethnographic means to describe the financial precariousness of short-term jobs (Gill & Pratt, 2008; McRobbie, 2004); continual work of reskilling (Kotamraju, 1999, 2002); the "hidden costs" at even seemingly humane design workplaces (Ross, 2004); negotiations of authority through gender or employment status (Gill, 2002; Moeran, 2009); and the entrepreneurial "networking" tactics that help professionals get "cool jobs"

4 As a long-time reviewer and program committee member for HCI conferences, I draw here on both my knowledge of the official standards for publication and their application in practice.

5 A number of observers have argued that temporary, goal-defined project work characterizes not just interaction design but contemporary information work in general (Button & Sharrock, 1996; Christopherson, 2002).

(Neff, Wissinger, & Zukin, 2005). However, such ethnographic labor studies usually address[6] the economic, organizational, and affective conditions under which designers labor. They have little to say about the mundane technical work of making objects, particularly digital objects. In fashioning my own practice-oriented approach to the study of interaction design, I turned to an analogous situation in the history of another field: the emergence of laboratory studies in the 1970s as a response to the sociology of science.

3.2 Laboratory studies

In the 1970s and 1980s, a number of studies argued for scientific knowledge as socially *constructed* rather than objectively discovered. Instead of assessing the relationships among knowledge claims or describing the macrosocial circumstances of scientific work (e.g., the distribution of funding), they would account for the "hard core" (Knorr Cetina, 1995, p. 140) of knowledge production: the content of theories and the technical tasks that produce and validate them through observing "science in action" (Latour, 1988). The 1970s emergence of laboratory studies took place in context of a new, distinct approach to studying science that called itself the sociology of scientific knowledge (SSK). SSK set itself against philosophical or historical accounts of science that, proponents felt, did not sufficiently take into account the local settings and processes of knowledge production (Knorr Cetina, 1995, pp. 140–141). As well, SSK rejected an existing sociology of science (i.e. that of Merton, 1979) which defined science as adherence to generalized ideals such as "disinterestedness." Accepting the *content* of scientific knowledge as a neutral description of objective reality, this style of sociology limited itself to explaining the *conditions* of scientists and the "dynamics and social standing of a scientific enterprise that was itself conceived of as a black box" (Shapin, 1988, p. 595). In contrast, SSK proponents argued that the hard core of theoretical and technical content should not be taken for granted as a neutral description of objective reality (Hess, 1997). Instead, "scientific knowledge itself had to be understood as a social product" (Pickering, 1992, p. 1). To explain controversies and their resolution, SSK would use the tools of ethnography (and ethnomethodology, c.f. Lynch, 1985) to describe in detail "what scientists actually do" (Pickering, 1992, p. 2), emphasizing the non-technical factors at work.

6 Kennedy (2011) is the rare anthropological exception: an in-depth ethnographic treatment of how the evolving tools, technological standards, and professional standard-bearers web design articulate shared professional values, such as meritocracy and the accessibility of technology to all.

Laboratory studies draw upon SSK's critique of the rationality of scientific knowledge. The canonical 1970s–80s laboratory studies[7] described the production of credible knowledge through in-depth case studies of specific places, times, and problems. The methods of laboratory studies were distinguished by close observation of "real-time processes" and close readings of lab publications (Knorr Cetina, 1995, p. 141). Laboratory studies often kept within the confines of the lab and its publications (e.g. Latour & Woolgar, 1986), with brief detours to scholarly conferences, fundraising meetings, and other sites of professional scientific engagement. They often examine the interrelation of knowledge, machines, and images, emphasizing the processes such as graphic selection, mathematization, and simplification in negotiating what counts as visual evidence through craft work and shop talk (Knorr-Cetina, 1981; Lynch, 1985).

In part, this dissertation draws on the laboratory studies tradition as a response to similarities between the design-as-cognition narrative and dominant positions in studies of science in the 1970s. The recurring criticisms (Dilnot, 1984a, 1984b; Dorst & Dijkhuis, 1995; Kimbell, 2011; Tonkinwise, 2011) of a universalist, normative definition of design that I introduced in Chapter 2 echo early SSK criticisms of a studies of ideal-type science detached from the situated, material making of facts:

- A separation of "design thinking" from design doing and design acting;
- A concurrent preference for prescriptive, generic frameworks over descriptive accounts of contingent decision-making;
- An exclusion of historical contingencies, economic relations, organizational politics and the like from accounts of professional work;
- Unitary, idealized definitions of design that elide practical differences in how distinct disciplines and fields work.

Like laboratories, many types of design studios are clearly bounded spaces through which people, supplies, and documents circulate. Like lab scientists (Latour & Woolgar, 1986), the interaction designers I met produce not so much working objects but diagrams and other inscriptions. Like architect's blueprints, these inscriptions are intended to guide action outside the studio. In

7 I do not claim that the category of "laboratory studies" is homogeneous in theoretical bent or objects of analysis. Since its inception, however, the phrase "laboratory studies" has served as a convenient rallying cry for a cluster of related research agendas (notably those I quote in this brief survey) and their critics. I will not dwell on the differences among laboratory studies approaches (see Lynch, 1997, pp. 92–102 for a differentiation of the ethnomethodological from the "constructivist" stance) in this brief section, since the family resemblances are more useful in explaining my own methods.

this studio study, I too follow the making of images — here, components of the documents that interaction design consultancies deliver to clients — and the tools that make them. In doing so, I borrow two methodological considerations from laboratory studies: (1) A commitment to observing moment-to-moment interactions during project work, instead of reliance on retrospective interviews or protocol studies. And (2) an interest in material, visible activities, particularly image-making and -manipulation. As Yaneva writes in an ethnography of one architecture firm:

> There are no pre-given explanations of design, no established scales, no recognized-by-all conceptual frames; instead, we need to devote ethnographic attention to what it means to design, to the many local arrangements from which creativity springs (2009, pp. 25–26).

This "studio studies" approach has already proven productive in earlier STS-oriented studies of architecture, engineering design, and the development of digital products (Bucciarelli, 1994; Coopmans, 2011; Ewenstein & Whyte, 2009; Henderson, 1998; Simakova, 2013; Vinck, 2003; Yaneva, 2009).

3.3 Grounded theory

Grounded theory is a method of qualitative research in which iterative rounds of empirical investigation and comparative analysis inductively develop strong theoretical frameworks "intimately linked to data" (Glaser & Strauss, 1967, p. 4). Its originators, Barney Glaser and Anselm Strauss, disliked what they considered *ungrounded* theory — grand abstractions distanced from concrete circumstances of human life (Bryant & Charmaz, 2010). As first introduced in the 1960s, grounded theory married two twentieth-century positions on empirical social research: positivist, quantified sociology and pragmatist qualitative field research (Hess, 1997). The goal of this original formulation of grounded theory was the systematic generation of theoretical concepts inductively, from data, rather than the validation of existing theories by empirical data collection. Grounded theory emerges over time from a continual interleaving of analysis, development of theory, and fieldwork. This iterative process relies on what is called "theoretical sampling" — the systematic, evolving choice of comparative cases for testing evolving theories through seeking out variation.

A complete "grounded theory" should (1) describe a single social or social psychological process, its causes, and its consequences, (2) introduce new concepts to describe the process and (3) identify the properties and relationships of the concepts (Charmaz, 2006). Today, grounded theory approaches continue to emphasize the action of individuals within collectives; temporal processes rather than stable structures; and localized concepts rather than generalized frameworks.

Since its inception, however, grounded theory has split into a "family of methods" (Bryant & Charmaz, 2010, p. 12), notably a more positivist wing (e.g., Glaser) and a constructivist wing strongly identified with symbolic interactionism (e.g., Strauss). Positivist grounded theory identifies patterns of action that are "abstract of time, place, and people" (Glaser, 2008, p. 23); the con-

structivist tradition emphasizes the provisionality of theorizing, action as situated within specific contexts and as contingently negotiated in interaction (Clarke & Friese, 2010). This practice-oriented dissertation follows the flexible set of principles, tactics and techniques offered by the constructivist tradition. Constructivist grounded theory methods directed my attention to local, material interactional processes of negotiation, bargaining, and coercion as designers worked within and remade the local arrangements of the studio. Traces of this "action-centered"[8] (Clarke, 2003, p. 558) approach show themselves in this dissertation through the framing of practices as actions (e.g., "performing the project" in Chapter 8).

Clarke (2005)'s cartographic analytic techniques have proven particularly useful in directing my attention to elements of interaction design practices. *Situational maps* categorize lists of human and non-human actors. *Social worlds/arenas maps* spatially diagram the individual and collective human and non-human elements that constitute the situation of research (Figure 3.1). *Positional maps* spatially organize discursive positions taken by actors in the situation. For Clarke, this relative mapping of positions allows her to look concertedly for "sites of silence" : entities invisible or unheard, or positions *not taken*. These maps are intended to shape iterative, multisite research, in acknowledgement of its reflexive, partial, political nature.

Clarke's call to look for "sites of silence" in discursive positioning has sharpened my attention to the differences between the definition of "presentation skills" articulated in job postings and textbooks to the everyday responsibilities that designers encounter in managing client meetings (Chapter 8). Positions taken on interaction design success, for example, include: "the job of the designer is to please the client"; "the job of the designer is to make well-crafted work"; "the job of the designer is to serve the needs of the user." Clarke's sensitivity to who or what is given voice has also sharpened my attention to the means by which users are made tangible — or dematerialized — in making design decisions (Chapter 9).

Figure 3.2 is an example of a social worlds map created for this dissertation. In conjunction with written memos, the social worlds map helped me identify the variable constellation of human and non-human elements that make up a project. In particular, it helped me challenge a conventional emphasis in design research on individual humans (outlined in Chapter $n:chapter:review) by tracing the complex relationships among tools (e.g., for production), organizations (e.g., professional associations and client corporations), and spatial regions (e.g., SoMA). Initially sketched during early analysis stages, the map went through successive revisions as part of iterative memoing. Other situational maps (not pictured) explore the world of interaction design in more detail,

8 As Clarke (2003) points out, grounded theory studies often feature gerunds like "formalizing," "crafting," "organizing," and the like.

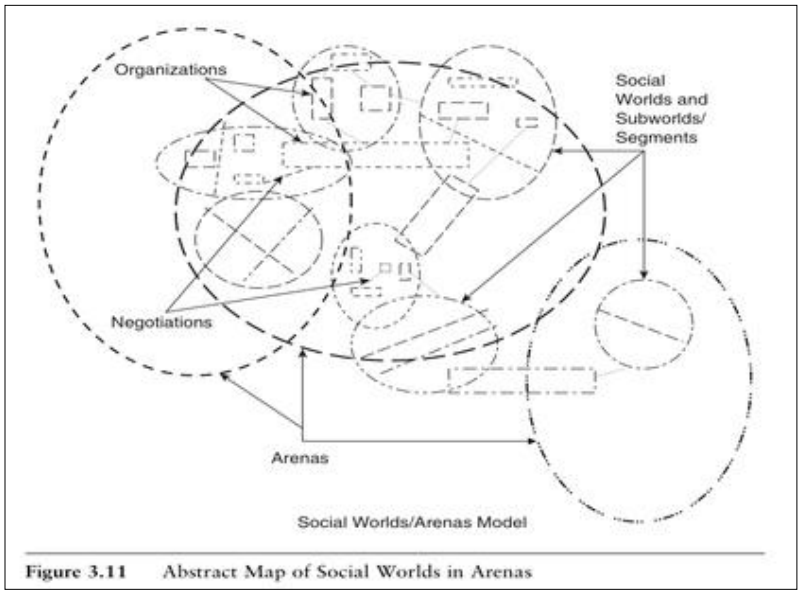


Figure 3.1. Clarke's example social worlds/arenas map (2005, Fig. 3.11)

including the relationships among constituents of the boxes-and-arrows vocabulary, such as drawing surfaces, implements (discussed further in Chapter 4).

As I worked on the social worlds map in Figure 3.2, I modified Clarke's visual syntax. Less committed to the analytic framework of social arenas, worlds, subworlds, and segments, I simplified her taxonomy elements in order to make it easier to see relations among groups, tools, and places more evident. This map does not indicate segments, and visually de-emphasizes arenas (the unshaded light grey circles). However, unlike Clarke's map, it visually highlights the relationships among organizations (light grey rectangles) and social worlds (darker grey circles).

Second, my map adds to Clarke's visual vocabulary. Clarke uses only rough spatial proximity to indicate only affinity among arenas and worlds. This map adds vertical and horizontal axes to highlight two dimensions of interest to the interaction design project as a unit of analysis. The first dimension is time: to what extent are the negotiations among the world indefinitely extended or temporally limited? This dimension emerged from an attempt to separate relations that are project-centered and hence time-limited (i.e., relations with clients and user research participants) from those that are likely to continue over a designer's career (i.e., relations with tools and with other professionals). This dissertation largely focuses on the latter, with the former briefly introduced in Chapter 4. The second dimension traces likely relations of conflict in goals or interests. This dimension emerged from a concerted attempt to "follow the conflict" (as described later in this chapter). Finally, Clarke's map is monochrome; as I eventually came to focus on the project as a unit of analysis I added red shading to help visualize the specific relations of interest that make up the project — and this dissertation.

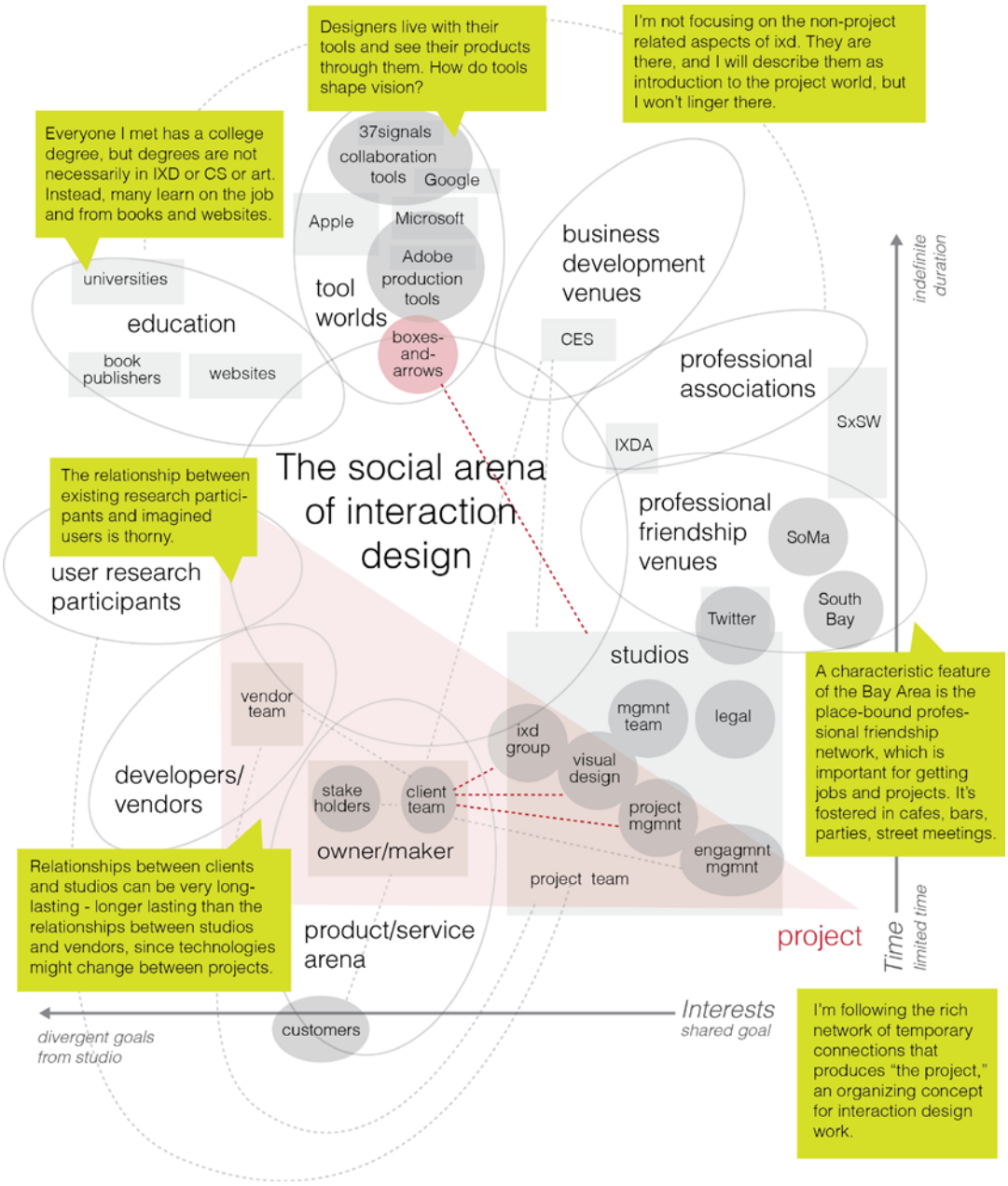


Figure 3.2 My take on a social worlds map, with samples of related short memos. This map shows interaction design from the entry point of SoMA consultancies. Circles label social worlds; squares label organizations; blue dotted lines indicate connections among worlds. This dissertation focuses on what is highlighted with red lines: the project and its negotiations. The green regions are post-hoc annotations that summarize example conclusions and questions I drew from the map.

3.4 Methods and materials

At the heart of this dissertation are four case studies (three discussed in depth) at three design consultancies in San Francisco. Laboratory studies and grounded theory are both case-study oriented — though often to different ends. STS scholars have pursued cases to emphasize the disunity of science and the interpretive flexibility of technology in use (Beaulieu, Scharnhorst, & Wouters, 2007). Grounded theory as a method depends on iteratively seeking out contrasting cases in order to empirically identify and pursue themes that might otherwise remain unknown or unexplored. Both aspects of case study-based research are relevant to this dissertation. Studying multiple interaction design companies emphasizes not only *inter*-disciplinary disunity of design (differences among interaction design and the more well-studied disciplines of architecture and engineering), but also *intra*-organizational diversity among companies. Following the tenets of grounded theory, my plan was to set logical initial criteria for the types of companies and projects I would pursue, then iteratively adjust my criteria and recruiting strategies. Even in a single discipline, I anticipated difference. Pursuing this strategy resulted in changes to both the types of organizations I asked to host me, and the types of projects I asked to observe.

Finding participants

I first sought out design groups with recognized expertise in the field. I assembled initial criteria for expert designers from (1) shop-talk I heard as a working interaction designer and (2) through an analysis of company websites. Part of the work of interaction design consultancies is finding clients; the publicly accessible company website or printed promotional booklet is one way in which companies try to attract clients. The kinds of information that interaction design companies present in their own websites and the sort of printed matter they display in waiting areas suggested a preliminary list factors that firms themselves value:

- Prestige of clients[9] (Fortune 100, Fortune 500, start-ups with a lot of "buzz")
- Responsibility for widely used or award-winning products
- Prominence of individual employees, as indicated by:
    - Educational credentials or teaching appointments at post-secondary educational institutions

9 For example, the author biography in one handbook mentions that "his clients have included Fortune 100 companies, government agencies, and startups" (Saffer, 2009, p. xii).

› Awards, fellowship in professional societies, or other honors

› Conference participation as panelists, organizers, or keynote speakers

› Book authorship

As a first step, I asked San Francisco representatives of the International Interaction Design Association (IxDA) as well as my own personal contacts for recommendations. When companies refused to host me, I asked contacts to recommend other sites. Many of those companies, I realized, were located in a single neighborhood: SoMA.

Continuing analysis led me to adjust my criteria for individuals, firms, and projects. Initially, I sought projects with technically novel end products. I reasoned that tools and routines formed around long-conventional types of systems, such as e-commerce websites, might prove unsuited to relatively new design objects, such as digital magazines or interactive televisions. Grappling with such unfamiliar objects, I supposed, might prompt ruptures in established practice — making such practices more visible. Observing such breaches of expectation at three or more different companies would then surface commonalities and differences in practice. However, I did not have any specific criteria for the type of organizational arrangements I would observe — in-house at a large corporation, teams at small businesses, or consultancies.

After an initial project observation and starting interviews with designers, I grew less concerned with technical novelty. The interaction designers I met used the same tools and delivered the same sorts of final documents whether designing digital magazines, desktop applications, or websites. The more important analytic theme then became not unfamiliarity and novelty but *familiarity and persistence*: the pervasiveness of tools such as Post-its and the consistent production of what one of my interview participants called "the standard deliverables." I then found two more familiar projects — an e-commerce website and an iPhone application — to help me explore where and how interaction design might be standardized and slow-changing rather — as is so often claimed[10] — fast-changing and free-wheeling.

Fieldsites

I gradually came to concentrate on consultancies. Before beginning fieldwork, I solicited participation from both consultancies and in-house design teams at startups and large companies all over the Bay Area. Analysis of early interviews with in-house designers and fieldwork at

10 From very different theoretical concerns and methods, Pratt (2002), Ross (2004), and Kennedy (2011) analyze the discursive construction of digital design as new, fast-paced, and creatively heterogeneous.

LittleStudio suggested that consultancy work exemplifies and intensifies two tensions present throughout the profession:

Limited influence. Interaction designers are rarely granted final say over what users finally receive. Product managers approve or reject design proposals; programmers implement specifications. Interaction designers do not usually write production-ready code or oversee product launches. Influence over the execution of their plans often rests in persuasively explaining design decisions to who do have more control. Those limitations are felt especially by consultancy designers, who must often toss specifications 'over the fence' to client representatives for future development. After the project is over, their only chance to affect the product is to induce the client to hire them again.

Accountability across boundaries. Interaction designers often find themselves explaining their past actions and future plans to non-designers, whether product managers, company executives, or engineers. In communicating with non-designer clients and programmers, consultancy designers often work across an organizational as well as disciplinary boundary. Yet short-term contracts grant consultancy designers limited time in which to gain expertise not just in their clients' design problems but in how to communicate with them.

Project-based work at consultancies was more likely, I decided, to offer a window into these tensions. Consultancy designers told characteristic war stories of project controversies, ruptures, and resolutions that were also present — but often expressed less explicitly — in the work narratives presented by in-house designers. Project work seemed to invite such reflection and explanation, as it demanded repeated adjustment to new clients, new systems, and new problems. Varying the size and age of the consultancies would then allow me to explore how similar practices might vary across more- or less-heterogeneous organizations. LittleStudio, for example, did not even have a dedicated employee to handle project administrative work, while LargeAgency had an on-site legal staff to handle disputes. Stories of consultancy work offer a more diverse and changing cast of non-designers — contracts and budgets, company blogs, sales teams, project managers, and clients — who configure and reconfigure the designers (Mackay, Carne, Beynon-Davies, & Tudhope, 2000). Consultancy projects, then, appeared to offer more possibilities for reconsidering design practice.

In the end, the case studies for this dissertation all take place within a historically and symbolically central site for interaction design: consultancies in the south of Market, or "SoMA," neighborhood of San Francisco. "Shops," or consultancies, that serve established corporations and struggling startups alike are prominent in narratives (Moggridge, 2007; Saffer, 2009) of the rise of interaction design as a discipline. In these narratives, the tiny neighborhood of SoMA, once known as "Multimedia Gulch," was and is disproportionately visible as a site of "creative," rather than "engineering" design work (Grabher, 2002; Pratt, 2002). The well-known SoMA consultancy Adaptive Path organizes three wildly popular (and profitable) $1000-a-day conferences for designers, managers,

and corporate executives each year ("Events," 2013). Two organizers of 2010's annual IxDA conference worked a small firm just a block away from Adaptive Path. The San Francisco office of IDEO, known for evangelizing "design thinking," is located near SoMA as well. There are other regional clusters of interaction design firms world-wide — from London and Berlin to Delhi and Singapore (Petroff, 2006). It is hard to match SoMA's history as a "center of the madness," (Moggridge, 2007, p. 454) from the initial frenzy of web design in the 1990s to a more recent mobile "app" goldrush.[11]

I found my host consultancies by taking advantage of industry social and educational events. I chatted up casual acquaintances, gathering business cards at cocktail evenings, holiday parties, and talks. At trade shows such as the Consumer Electronics Show (CES), I asked my acquaintances to introduce me to representatives of any Bay Area design firms doing business development there. I asked the people I met to suggest other companies, using snowball sampling to construct a list of potential interview and observation participants. If initial enthusiasm failed to win support from company management, I checked back periodically to see if any changes in situation might allow them to host me. Over the course of a year, these efforts produced three fieldsites, all in SoMA. Appendix A presents fuller descriptions of these fieldsites.

Recruiting host sites proved unexpectedly difficult. I easily located an enthusiastic small boutique, LittleStudio, and a mid-size shop, MediumFirm. But recruiting a larger consultancy stymied me. Time after time, my proposals met initial enthusiasm from my contacts, only to face rejection from legal departments or discouragement from the middle levels of management who could not approve my presence themselves but would not pass the request along. After a year, I finally succeeded. One of my earliest interview participants had moved to a senior position at a large company, LargeAgency. He personally proposed my research to the CEO, and permission from the legal department swiftly followed.

It was this unexpected slowness in finding three companies that allowed me to reconsider my initial criteria of technical novelty and center my attention on boundary negotiations among clients and team members. I also noticed that LittleStudio and MediumFirm were located a block away from each other, shared former employees, and used similar vocabulary to describe their services. So in looking for another consultancy and project, I sought a clear contrast. LargeAgency fit the bill. It was only a few years older than MediumFirm, but it was nearly three times larger. And

11 Many of the consultancies have battered wooden floors that bear witness to a history of small scale manufacturing in the 20th century — and the jobs that once supported San Franciscans without college degrees and chic shoes. The contrast between those jobs and these is striking, as others have noted (Ross, 2004). As Andrew Ross points out, in New York's Silicon Alley, those jobs and factories may well be gone. In SoMA, however, those small factories and sweat shops are less visible but still there.

unlike the other two companies, it used language drawn from marketing, particularly branding, to describe what it did. And LargeAgency had a small project about to start that suited my needs: the redesign of an e-commerce website.

Interviews

Before finding LittleStudio, and then in the long gap between MediumFirm and LargeAgency, I conducted rounds of interviews with individual designers unrelated to the field sites. The choice of SoMA as an entry point, and in particular the small but well-connected firm of LittleStudio, had lasting consequences. Dave, a founder of LittleStudio, had worked previously at MediumFirm. Through Jess, another founder of LittleStudio, I met René, my sponsor at LargeAgency. René, I discovered, used to work with Jaron, a designer I observed during project work at MediumFirm. As I traced this web of acquaintances, neighbors, and co-workers, I grew worried about the blind spots or "sites of silence" (Clarke, 2005) I might be missing by remaining within it. I used these interviews to follow up on questions prompted by participant observation, and to seek for absences or positions not taken by the main firms. I also used them to as sources for more site recommendations.

To select designers to interview, I asked my growing list of friendly interaction designers, not all of whom were based in SoMA, for introductions to:

- Designers in-house at start-ups and large corporations to balance the consultancies
- Designers with backgrounds in psychology and engineering to balance those with backgrounds in fine arts-based design fields
- Consulting designers working outside of SoMA, who might have correspondingly different professional affiliations

In semi-structured interviews, I asked interview participants for career biographies, descriptions of memorable projects, and explanations of preferred tools and deliverables. The supplementary interviews (Appendix B has a detailed list) do provide some contrast. However, this dissertation will mostly discuss the geographically and interpersonally bound network of professionals I met through LittleStudio. In making choices about which actors to follow and where to follow them, this dissertation (like my study participants) rarely leaves SoMA for long.

Following the work of designers

Common units of analysis in studying design work include the individual designer, the firm, or the profession. A methodological focus on exemplary *individuals* is common within design studies and HCI (e.g. Cross, 2002). As I argued earlier in this chapter, studies centered on the skill-

ful thinking of individual designers can lose sight of how organizational or geographic dynamics shape work practice.[12] The opposite is true of geographic or sociological studies of *regional clusters* or *professional groups* in design. As I argued in section 3.1, however, such studies usually concern the economic (Grabher, 2002), organizational (Gill, 2002; Moeran, 2009), geographic (Neff et al., 2005; Reimer, Pinch, & Sunley, 2008), and affective (Gill & Pratt, 2008; McRobbie, 2004) conditions of work. They have little to say about the technical and aesthetic craft of design. Observational case studies of design *firms* are often used to trace continuity and change over time, across projects, as in Jevnaker's study of longterm relationships between furniture designers and their clients (2005) and Ross' study (2004) of changing managerial practices at one firm during the rise and collapse of the New York dot-com boom. While these studies have influenced this dissertation, they necessarily favor breadth over depth. By contrast, in-depth narratives of selected project activities can help my account of the causes, dynamics, and effects of *specific* performance techniques remain grounded in *specific* situations.

The primary unit of analysis in this study is the project. Projects in interaction design consultancies are often called "engagements," which emphasizes the client-consultancy relationship. Clients *engage* consultants temporarily to fulfill certain goals that the clients could not accomplish on their own. Projects in interaction design consultancies typically (though not invariably) comprise a client organization and its representatives, a team and its members, perhaps an external subcontractor, and documents prescribing what all parties will provide.

I have chosen the project as a unit of analysis because of its centrality to the lives of consultancy designers. In day-to-day consultancy interaction design, it is the project that structures conversations, the number of hours worked, the tools used, and the spaces occupied.[13] Each project is assigned its own combination of workers. Independent freelancers are often hired on a per-project

12 But see Sunley et al. (2011) for a study of individual London-based designers used to analyze "medium-strength" professional ties within a bounded geographic region.

13 It is fair to say, following Law, that this dissertation itself exhibits "project-ness": "The idea (which is also a performance) that many technologies and other social arrangements are properly narrated and organized as 'projects' [….] These are objects that are somewhat linear, chronologically chained, and more or less centrally and teleologically ordered" (Law, 2002, p. 7). The "project" need not be taken as a natural or necessary part of interaction design work. But as doing project-ness configures and reconfigures design spaces, organizations, and careers, this dissertation follows its subjects.

basis to fill out gaps in longterm employees' skills.[14] Larger consultancies employ specialists, often called "engagement managers," to negotiate the terms of the contract and build longterm interpersonal relationships with clients in the face of changing teams. Projects also reshape work spaces. Temporary, goal-oriented arrangements produces schemes for managing temporary, goal-oriented spaces. Longterm projects may be assigned their own separate rooms; shorter and smaller projects may colonize walls and whiteboards with collections of documents. MediumFirm, for example, used rolling whiteboards as walls in a large open space, allowing employees to expand or contract their "project room" as they chose.

Previous studies centered on projects suggest that studying projects can lend itself to three tactics of this dissertation: (1) in-depth qualitative analysis of activities and events (e.g., Gasson, 1999); (2) examination of multiple sites (Berends, Reymen, Stultiëns, & Peutz, 2010); (3) explanation of recurring structures across projects (Hales, 1985).

While this study treats interaction design as a relatively stable going concern, one cannot make any assumptions about project organization. People who unofficially refer to themselves as "interaction designers" may officially possess any one of an "acronym soup" of job titles, such as IA, IxD, HCI, UE and UX (Saffer, 2009). Whatever their official job title, interaction designers take on different responsibilities from firm to firm and project to project. In smaller firms and projects, activities often performed by a client engagement team may be handed off to one of the designers. Instead of preselecting one or more spaces or job descriptions of design, this research instead began with the category of action that seemed to matter in initial interviews with designers: the decision.

Particularly, it began with an attention to decision-making interactions that shape the course of design projects. Picking up on the "tracking strategies" advocated by Marcus (1995), I followed the trajectories of multiple decisions, including the artifacts, instruments, resources, people, and money they require and produce. The day-to-day questions I asked study participants included: How are decisions made? Who makes them? How are they justified — and how do justifications change? What difference did the decision make in the situation? I was particularly interested in moments when the design question and process is unsettled, making decisions particularly visible as sites of uncertainty, anxiety, or debate (Löwgren & Stolterman, 2004). In turn, this temporary

14 Much cultural and sociological study of the "creative class" focuses on the precarious work conditions of workers like the interaction designers I met (Christopherson, 2002; Gill & Pratt, 2008). Neither blue-collar nor white-collar but "no-collar" (Ross, 2004), these fields of "venture labor" (Neff, 2012) require continual maintenance of existing skills and acquisition of new ones (Kotamraju, 1999, 2002). I acknowledge the importance of the oft-cited "pleasure-pain axis" (McRobbie, 2004)created by careers that people love but that provide only an insecure living. What motivates this dissertation, however, is a desire to carefully and respectfully analyze the pleasures of skillful design work rather than the precariousness of design careers.

visibility of conflicted decisions makes it easier to trace what and who constitute "a decision," and how decisions act in the design process. What resources come into play during the settling of design uncertainties and debates?

Decisions can take place in a variety of workplaces — from the office, to a design research field site, to restaurants. In order to have a better chance of observing decision-making in progress, I used a number of activities, including:

- Observation of design activities as classically understood, such as working sessions, data analysis, sketching/prototyping, and concept reviews
- Attendance at team meals or coffee breaks
- Semi-structured biographical interviews about team member's career to locate self-identified sites of decision-making
- Visual analysis of intermediate design products and representations

I used post-hoc interviews after the project to follow how — or if — highly debated decisions are reframed over time. However, my goal is not to generate generalizable explanations for project success or failure. Rather, the projects serve as a starting point for tracing the development of relationships between people, organizations, and artifacts through decisions.

My access and methods were tailored each project and team. In all three cases, I largely limited my visual observations to the project space as defined by participants: first because I wanted to honor client privacy; second, because project spaces are often "where the action is" in terms of project-specific work. Marcus (1995) describes a number of "tracking strategies," many of which I employed as situations prompted them.

I began by following members of the firms wherever I could. I followed LittleStudio in 2010 as they solicited clients at CES in Las Vegas. There, I encountered representatives of LargeAgency, as well as examples of design work from LittleStudio. I also met some of my interviewees while socializing with designers there. Over the next two years, I volunteered at three conferences organized by LittleStudio, and one organized by MediumFirm. I also followed studios online. I took screenshots of public portfolio websites and collected firm's public tweets and blogposts for the duration of my visits there. I checked them periodically after my visits ended to compare the tenor of later tweets/posts to those I collected.

Second, I tried to "follow the thing." Chapter 5 results from one such exercise: tracking the movements of Post-its from whiteboard to whiteboard during a client workshop at MediumFirm. The biography of a wireframe in Chapter 6 results from another: tracking the material changes to a single diagram in an iPhone application over the course of two weeks. In particular, during my

observations of solo work, I videorecorded and took detailed notes on the mundane activities of adding, deleting, and moving onscreen digital elements.

Much digital work is silent. In an open office, it can be inappropriate or disruptive to have a conversation when everyone else is silently working, or when there is a client or other visitor in the office. At those times, it is common to communicate via instant messaging rather than speech — even with a co-worker sitting an arm's reach away. Depending on the site and the activity, I initiated regular instant messaging exchanges with participants as a way to work around any informal prohibition on speech. I had no set schedule for these chat requests, but I tried to scatter them throughout the day if I otherwise would have little opportunity to follow laptop work. In this way, I often followed designers and their objects from a slight distance.

Educational resources and activities are another source for this dissertation. I began by asking participants what books, websites, or educational events they recommended to aspiring designers or that they relied on themselves. As well, I read books, blog posts, and presentations by participants on interaction design. I accompanied designers from MediumFirm and LargeAgency to lectures at a local art school, browsed LittleStudio and MediumFirm's book collections, and attended educational talks given at a local design school by members of MediumFirm.

Third, I "followed the metaphor." In particular, I followed the metaphor of "zooming," or changing one's field of view. "Zooming" is pervasive in studio talk and studio action. As I moved from project to project and firm to firm, I started to trace it as well. Zooming, as "conceptual equipment" (MacKenzie, 2008) and technical operation, undergirds the scoping practices described in Chapter 6.

And finally, I "followed the conflict." Conflicts are not unusual, as attested by the many war stories I heard. As debates broke out among designers or tensions rose between designers and clients, I tried to track their origins, development, and outcomes. This approach serves as the basis for Chapter 8, which uses the story of a disastrous misunderstanding between client and designers to argue for redefining presentation skills.

Notes and recording

In order to investigate the interrelationship of spatial arrangements, bodies, drawing practices, and talk, I video-recorded and photographed where permitted. I used a small digital still and video camera, usually hand-carried in view of participants. The choice between a fixed or personally carried, "roving" camera poses theoretical and methodological decisions (Heath, Hindmarsh, & Luff, 2010). Two relevant concerns for this study follow:

Intrusiveness versus consent Participants may more easily forget the presence of fixed cameras, making them potentially less likely to induce self-conscious performances from research partici-

pants. However, none of the projects I observed took place in enclosed rooms. A continuously recording fixed camera was likely to capture non-consenting employees and visitors. Manually activating (and deactivating) a fixed camera on a tripod would likely distract participants. A hand-carried camera, however, could be easily switched off and on without bothering anyone. Moreover, participants could see when I was holding the camera and approximately where I was pointing it. They could tell me to stop recording — or give me permission to start — at any time. This was particularly important for LittleStudio, where multiple project teams shared a single room, and multiple clients might visit each day. A hand-held camera was also reassuring to participants anxious about the confidentiality of client documents. I used low-resolution cameras whose image quality degraded rapidly over distance, and that could be visibly laid aside or turned off.

The practical difficulties of "full" coverage Project work took place in spaces that were often large and irregularly shaped. MediumFirm, for example, made expanding 'rooms' out of movable partitions. The fixed-placement options available to capture the unpredictable movements of designers in such a space were practically unfeasible. Ceiling-mounted cameras require specialized mounting hardware, especially in high-ceilinged, brick-walled converted factories. I did not want to be responsible for damage to rented offices. Multiple cameras on tripods were likely to block high-traffic areas (such as hallways). And they would still miss movement from one region and another. Neither one of those solutions, moreover, solve the problem of capturing both body orientation to wall-size whiteboards *and* the smaller movements of eyes and hands in up-close work. Even with a camera mounted on the wall, I would have had to use a hand-held camera to document the details of interaction with paper notebooks, computer screens, and other essential artifacts.

The problem resembles that faced by Dant (2004) in a study of automobile mechanics: the focusing and placement of a fixed camera framing the entire car would necessarily exclude activities relating to small, inaccessible, or visually obscured car parts. Like Dant, I chose to use a hand-carried camera. Such selectively framed video should use participants' own orientation to spaces and material artifacts as the basis for framing. My logic followed Charles Goodwin's:

> We can use the visible orientation of the participants as a spotlight to show us just those features of context that we have to come to terms with if we are to adequately describe the organization of their action. This has methodological as well as theoretical implications. For example the participants' visible orientation provides a guide for what should be included within the frame of the video image (2000, p. 1509).

The "visible orientations" of participants guided how I framed video. Initially, I used theoretical sampling from my readings of design studies to define key episodes to selectively record. I defined my focus as project-based "decision-making" mediated by engagement with visual representations including:

- Micro-interactions with tools while making digital deliverables
- Interactions with clients (where permitted)
- Conversations between peers on design teams, especially those facilitated by image-making

Each project team, consultancy, and client had different preferences not just for *what* I could observe, but also *how* I could record it. LittleStudio and LargeAgency form a particularly vivid comparison. LittleStudio permitted me to observe and videotape anything that took place within their open office. They gave me a desk particularly well-situated for observation, and brought me along to their client's office. They allowed me to visit all day, every day, to sit next to them as they worked. They invited me to birthday lunches and to join them at trade shows. The designers of LargeAgency placed more restrictions on what I could see and record. The team members were scattered within a warren of small cubicles. There was no comfortable "visitor's desk" for me to appropriate and no available chair in crowded cubicles. After initial visits to the warren proved disruptive, I limited my presence to team meetings. Moreover, LargeAgency's management was anxious that I not encounter any of their clients, so I could not show up routinely or unexpectedly at the studio. And, despite assurances of confidentiality, many of the designers did not want their faces recorded.

As I interviewed designers and visited workplaces, memos prompted an informal, evolving "shooting script" (Suchar, 1997) that guided my initial video and camera footage of workplaces. Over time, I generated a library of examples of similar spaces and activities for the kind of iterative comparative analysis recommended by Corbin and Strauss (2007). I did not videorecord a number of episodes and events that, in analyzing my fieldnotes, retroactively appear significant. However, given the limits to my visits and what I could observe, there was no practical way for me to record every event of interest — particularly because so many of those events took place online.

My choice of hand-held over fixed camera participates in a longstanding theoretical debate. Pink usefully sums up two main approaches (2006, pp. 120–123). One approach is scientific-realist, demanding "reliable visual evidence." The reflexive approach, in contrast, takes the stance that complete and objective visual documentation is impossible, and "demands attention be paid to the context in which the images are produced." My commitment to selective, hand-held video emerges from this second tradition of ethnographic research, which rejects an impartial "view from nowhere" as a premise for observation and explanation (Suchman, 2003). Fixed, continuously running, wall-mounted cameras like those recommended by Heath et al. (2010) can provide what appears to be an authoritative view from above, erasing the negotiations responsible for their placement. In contrast, my shaky, intermittent, human-carried footage makes obvious my own participation in the action, as well as choices to frame or exclude certain activities. Video files, supplemented by written fieldnotes, maps, and memos, here serve as consciously constructed "*rep-*

resentations rather than visual facts" (Pink, 2006, p. 103). In rejecting the possibility of a view from nowhere, I also accept the necessity — and even the desirability — of a partial perspective.

Negotiations over what and how I videorecorded prompted discussions of confidentiality and disclosure practices. Explanations to clients prompted still more reframing of my presence. MediumFirm introduced me to the client as a local documentary-maker. LittleStudio, on the contrary, described me as a PhD candidate at a well-known university. Both explanations figured me into existing narratives of the firms and their work articulated by websites, blog posts, and promotional materials. LittleStudio's founders were proud of their role in professionalizing interaction design through teaching university courses and active participation in an industry association; MediumFirm's events and books emphasized the company's power as a tech industry industry "thought-leader," a model of best practices that understandably would be featured in any documentary of the field. Being overtly, physically tied to a video camera in this way allowed me to "explore how video technology is made meaningful locally" (Pink, 2006, p. 102) as part of disclosure practices and identity work.

I audio-recorded only if image-taking was not permitted. Where I could not take video, I noted gestures, gaze, screen navigation, and body orientation. I then combined audio transcription with the notes to re-assemble a partial account of what I had seen. I archived my instant messaging exchanges with participants into typed fieldnotes. As part of my "shooting script" (Suchar, 1997) I also took (when permitted) shots of email and instant messaging programs to document what I could of digital communication tools in use.

Transcription and illustration

I ended up with roughly 80 hours of recorded media along with written fieldnotes. After each project, I reviewed the media files and prioritized them for transcription. I transcribed all client meetings and organized team meetings, as well as video or audio of impromptu work conversations. My goal presenting such originally recorded material within this dissertation is to create textual evidence that is easily readable while still calling attention to its original status as talk rather than written text.

To that end, I largely include quotations from my transcriptions verbatim, keeping minor grammatical errors and repetitions intact. However, I insert conventional punctuation marks wherever grammatically sensible. Occasionally, I delete confusing or extraneous words and mark the omission with a bracketed ellipsis: "[…]". To avoid confusion with ellipses, very brief pauses of less than a second are indicated with "(.)," noticeably longer pauses with "<*pauses*>." I similarly describe laughter and other non-verbal but audible communication.

Anything in quotation marks can be taken as the product of transcription or *in situ*, verbatim field notes. Any words italicized in a sans serif typeface represent paraphrases from fieldnotes that

are reasonably close but likely not verbatim: e.g. *I don't think that's right*, Audra says. Words in ALL CAPS mark periods of higher volume or other vocal stress. Words in parentheses within quotations indicate unclear audio. Within transcribed quotations, gestures and any objects they implicate are placed within italicized angle brackets at roughly where they occurred in talk. E.g., *I don't think* <points to navigation menu> *that's right,* Audra says.

My goal is not to exactly replicate, in text, the talk and interactions I witnessed. Rather, to quote Duncan and McNeill (n.d.), I hope that:

> 1) other analysts who make use of the annotated transcript, or add to it, later will be able to accurately infer previous analysts' decision-making process, in regard to parsing gesture phrases and phases, and inferring gesture meanings.
>
> 2) the annotated transcript will serve as a "visualization tool" for multi modal analyses of language that focus on how speech and gesture mesh, both at moment-to-moment and extended discourse levels of analysis.

Similar goals guide the illustration style. Like paraphrases, the illustrations are reasonably close to what I saw. Out of concern for the NDAs I signed and the changing definitions of "confidential information," there are few photographs in this dissertation. Instead, I have digitally redrawn most photographs as illustrations. These illustrations replace much of the visible text with "X's" (handwritten text in a simulated "handwriting" typeface, computer-rendered text in an Apple-default sans-serif). They also replace human faces and bodies with silhouettes. I made them using a tool (Adobe Illustrator) and graphic style (simple, largely black-and-white line-drawings) common in interaction design projects. Illustrations composited from multiple photographs (often when individual photographs were out-of-focus or unhelpfully framed), are labelled as such in captions. My hope is that the line drawings attack any lingering assumptions of the images' status as neutral observation, making my own decisions about what I watched and recorded more visible. At the same time, their graphic sparseness is intended to support my analysis by calling attention to what they do include: the words not replaced with X's, the relative position of Post-it notes, the orientation of silhouette'd bodies and faces.

Coding and analysis

My approach to analysis draws on the grounded theory tradition, particularly the iterative methods described by Corbin and Strauss (2007). Initial free coding and memoing of written fieldnotes took place as soon as I had time to write. Initial coding of media files took place as I transcribed them. Some of observations from these initial memos — such as the metaphor of deliverable as theatrical prop or musical instrument — have made their way into the dissertation. Others — such an early attempt in LittleStudio to grapple with the always-open instant messaging windows and

Twitter feeds — prompted me to reconsider my early methodological assumptions about where I could observe decision-making in action. As part of memoing, I also made social world maps, as recommended by Clarke (2005). An evolving "project constellation map" (Figure 3.3) shaped the focus of this dissertation, leading me to concentration on the tangle of temporary connections that forms a project. As I worked, I also inductively developed new categories and schemes to guide new questions for observation participants and recruitment for supplementary interviews. In particular, I came to ask more pointed, recurring questions about client management and project success — and to realize I needed to recruit more in-house designers. Those questions in turn led to more memoing, more maps, more structured coding, more questions, and finally to the conceptual cluster of practice as performance (see Chapter 1) that informs this dissertation.

Hand gestures and body orientation can pose particular difficulties for transcription, analysis, and publication, but are particularly significant for design practice. McNeill 's taxonomy lists four semiotic dimensions of gesture: iconic (representing concrete objects); metaphoric (representing abstract concepts); deictic (pointing); and beats (signaling the relative importance of utterances) (2008, pp. 39–41). To this I add the notion of enactive, or pantomimic, gestures, which indicate action *upon* an object (Barten, 1979). Common gestures in design work include deictic pointing-at and placing-for (Clark, 2003) movements connecting hands and graphic representations, enactive hand motions during storytelling, as well as stand-alone metaphorically or iconically representational gestures (Becvar, Hollan, & Hutchins, 2005; McNeill, 1992).

I have adapted Duncan and McNeill's descriptive-analytic method (n.d.), which outlines how to make visible relations among spoken words and bodily movement; to it I have added my own annotation practices to aid in tracing how designers make, edit, and manipulate images onscreen and on paper. Following Duncan and McNeill, I revisited selected video clips multiple times, each time adding more detailed transcription of speech and description of gestures. For gestures that indexed or modified specific regions of a graphic field, I marked that region in a photograph or video still and assigned it a unique code, then added the code and a description of the gesture to the transcript.

In this way, following Pink's description of her own stance towards visual and textual analysis:

> The photographs do not simply illustrate the field notes, and the video is not simply evidence of conversation, interviews or actions. Rather, images and words contextualize each other, forming not a complete record of the research but a set of different representations and strands of it (2006, p. 120).

On a next pass, I used McNeill's taxonomy (2008) to code the gesture's semiotic dimensions. My goal was not to attribute an objective function to the movement. Rather, I used McNeill's schema to jumpstart interpretive coding and memoing. This approach proved particularly fruitful in the analysis of gesture in Chapter 7, leading me to the concept of roleplay. Multiple reviews accreted

layers of textured annotations on particularly productive photographs or video stills. This visual accumulation, as a signal of analytic productivity, is one of the factors I used in deciding which images to include in this dissertation.

Confidentiality

Design consultancies, as we will see in Chapter 4, carefully manage what outsiders can see and hear. But unlike a hospital or school, the regulations covering what counts as "confidential" information in design consultancies are often unwritten, situational, and contingent on changing professional relationships. It is obvious why clients might carefully protect technical information about future products. But while some businesses who hire design consultancies trumpet the relationship, others do not want it made public. Some project documents can be safely made public; others, seemingly identical, must never be revealed or even photographed.

However, open plan studios make it hard for even a casual visitor like myself to avoid hearing names and seeing drawings. Studios had to trust me, personally, as a competent practitioner of non-disclosure. Before observing any project work, I signed formal non-disclosure agreements (NDA). Many studios required my signature before I could enter open work areas. I explained to everyone I met that my university would punish me severely if I did not respect their requests for confidentiality and/or anonymity. But the designers I met tended to treat written NDAs as toothless niceties. *No one ever gets sued for breaking an NDA,* one senior designer told me. Moreover, it was often unclear how a generic NDA might apply to changing project contingencies. What starts as a public relationship could swiftly turn secret; the feature first deemed top-secret would be loudly touted after product launch. I often heard cheeky circumlocutions such as, *We did a project for a client I can't name, but who is a major software manufacturer in Redmond.*

The demand for the NDA, even toothless, draws boundaries between what information can permissably travel from "inside" to "outside" projects and teams (Simakova, 2010). My requests to observe projects often seemed like a kind of breaching experiment — not shockingly violative of expected practices, but still unexpected enough to prompt discussion and reflection on what my presence would mean as a non-employee and non-client. Anticipated or present relations with clients governed how and when firms were willing to host me. Even if enthusiastic about my study, firms still had to make sure clients would welcome or at least tolerate my presence in the project room.

The projects that I was then allowed to witness all fit into a category of "safe to observe" projects. Determining what constituted such a safe project motivated further questions and analysis. I will explore boundary-making practices further in Chapter 4. The designers I met trusted their professional and financial security less to a written NDA than to the informal understanding often

called a "FrieNDA.""Client confidentiality" in the world of the studio does not mean the absolute protection promised by a university's Institutional Review Board. It rather indicated expert *situational* evaluations of what information could be disclosed to whom, when, and how, without harming professional relationships. For example, every participant I asked (and I asked all those who told me that significant team decisions had been made online) refused me access to their project-related instant messages and email. From this perspective, it is easy to see why it took me more than a year to recruit three host companies. Given the contingencies of consultancy work, company managers needed to trust that I would operate under, if not FrieNDA, then professional standards of situational disclosure.

Membership and belonging

I have been a working interaction designer since 2003, with two degrees in design (one in graphic design, one in interaction design), multiple articles in industry magazines, and have even written a textbook on a related subject. I have given many talks at interaction design-identified events, and have received awards for my work. I myself belong to IxDA and attend its events. During the course of this project, one of the study participants asked me to serve as a jury member for an industry competition. I am married to a co-founder of a well-known SoMA consultancy, and knew many interaction designers socially before starting this study. However, I have never worked in a consultancy, so I expected to find — and found — some of the specifics of their work unfamiliar.

It was a mixed blessing that I started this project as a member of the group of practitioners I planned to observe. On the one hand, my affiliations with interaction design in the Bay Area helped me gain extensive access to companies and eased my entrance into projects. The workplace where I knew the fewest people was also the workplace that most overtly discouraged frequent visits and independent exploration. On the other hand, I entered fieldwork with professional and personal predispositions. I like and respect many of the interview and observation participants, and felt professionally in debt to them for furthering my dissertation. I wanted to approve of their decisions and value their work. Yet, as a working designer, I had and have my own well-formed aesthetic preferences and familiar work practices.

Having neither the means or desire to erase my past experiences, I avoided acting as a project team member. Unlike other students of technology development (i.e. Grint & Woolgar, 1997; Simakova, 2013), I did not take a project-related role (such as project manager or intern) in order to observe work. I avoided offering work-related opinions or advice unless directly asked. After each project ended, I used repeated post-project interviews to crosscheck my own assessment of its outcomes against participants'. These interviews proved particularly valuable, as participants' assessments of project success sometimes contradicted my own.

We can think of this strategy as "inside out" rather than "outside in." I did not begin as an outsider and then find my way inside the group. Instead, my observation of project work was only made possible by my insider status — as an interaction designer, a spouse of a well-known designer, and a recognized fixture at San Francisco design events. The task I gave myself, instead, was to find my way out of this cozy niche analytically; to work at systematically identifying what was strange to me and to defamiliarize what I knew well.

3.5 Conclusion

The term "grounded theory" can describe both a way of doing research and the outcome of that process (Bryant & Charmaz, 2010). This dissertation follows the former definition. It does not introduce a "grounded theory," classically understood as a basic social process and a conceptual framework to describe it (c.f. Charmaz, 2006). Instead, it draws upon the example of laboratory studies and the tactics of grounded theory to introduce "provocative yet provisional" (Clarke & Friese, 2010, p. 369) concepts that can help us grapple with the people, objects, and discourses of interaction design. These concepts, as I describe in Chapter 1, are inspired by the "practice turn" in social science. But they are deeply rooted in my experiences of variable, changing, *local* arrangements of times, places, words, bodies, and tools. Chapter 4 will examine those local arrangements in more detail.

CHAPTER 4

Welcome to the studio

> The politics of doing the visual are as material as matter is visual […]
> Both are engaged beyond the ocular (Rose & Tolia-Kelly, 2012, p. 3).

This chapter introduces three problems of representation and action that prompt performance. It will do so by describing the main human and non-human constituents of interaction design projects in consultancies — representations, tools, project roles such as "user" and "designer," billable hours, conference rooms, and so on. It will argue that the intra-actions of these constituents produce three interrelated objects of intense of concern to designers: scope, behavior, and assent. Project *scope* is the quantities and types of objects that the designers will make within the time allotted to the project. *Behavior* here indicates the objects of representation for interaction design: how machines and humans will think and act. Finally, as a consequence of the service relationship between design consultancy and client organization, designers work to make their actions accountable to client expectations by ensuring client *assent*, or agreement.

But in the absence of working code (a common condition in consultancies), interaction design work is organized around the production of representations to be delivered, or circulated, to others. I will argue that the ongoing work of managing the production and circulation of representations unites these dimensions and in turn produces the characteristic topographies of project work in consultancies. We will see that the work of adequately representing human and machine interactions is irreversibly entangled with the economic and political troubles of delivery in consultancies.

Interaction designers in consultancies spend much of their time making "deliverables" — documents that will be given, or "delivered," to the client. Deliverables are representations of the project; they tell stories. Studio debates often turn on what to "show," "illustrate," "communicate," or "demonstrate" with a deliverable. Put to work by programmers, visual designers, marketers, executives, the story in the deliverable will then be retold as a working system. Relation-

ships to organizational boundaries define deliverables (D. M. Brown, 2010). They are produced by one group of people and then *delivered* for use to another one.

For that reason, the status of an object as a deliverable does not depend on its form or function. A deliverable can be a paper sketch, a set of digital documents, an interactive prototype, or a fully working system. A deliverable is a deliverable because it is *intended* to cross organizational boundaries. Emailing a wireframe to an in-house visual designer does not make it a deliverable; emailing the same wireframe to a client *does*. Or, alternatively, it can be useful to reverse the terms of the definition. It is labelling an object *as a deliverable* that asserts an organizational boundary between the sender and recipient.

But delivery, as we will see in this chapter, is a complicated business. Designers generally send clients digital files for review throughout the project. These digital files can then be circulated within the client organization, sent back to the designers with comments, and archived for later reference. Yet the digital files are rarely accepted as sufficient. Oral presentations nearly always accompany this digital delivery. During the interim client meetings which typically punctuate projects, the designers talk and gesture their way through explanations of what the documents signify, acting out the behavior of digital systems and their human users. Despite the interim reviews, teams of designers will formally present finished documents to the clients who hired them. They may even travel to the client's headquarters to repeat their presentations for more senior client management. Delivery, then, is a hybrid process, requiring the co-presence of designers and clients as well as the circulation of digital files. It is not a single act but a sequence of managed encounters.

4.1 The visual culture of interaction design

A visual culture[1] defines, in an often-quoted phrase, "What it is to see, and what there is to see" (Latour, 1986, p. 10). Visual culture links, as Henderson writes, "Explicit material experience to a particular way of understanding the world" (Henderson, 1998, p. 26). Common tools and techniques for representing the world are made available (or not) in workplaces. These techniques include not just hand skills and methods, but also a lexicon of conventional schematic and pictographic symbols. Professionals learn to use these tools and techniques in formal and informal education. What they learn, Henderson argues, is often craft or "fingertip knowledge" — a nonverbal, nonvisual tacit knowledge (Polanyi, 1968) learned through doing. They also gain, she argues, a type of visual

1 As used in STS, the term is quite different from the semiotic readings common in other traditions (Julier, 2006). "Visual culture" as used here follows Rose and Tolia-Kelly's call to "rematerialise" (2012, p. 2) studies of the visual.

literacy: skill in reading and writing conventional professional symbols. We can think of the visual culture of interaction design as a particular case of what Rose and Tolia-Kelly call

> A continuing mobilisation of communicative aesthetics which refigure our encounters with space, form, time, grammars of meaning and their habitual interpretation (2012, pp. 1–2).

That is, interaction design's visual culture reflects and shapes everyday practices in the interplay between conventional technologies of visualization and trained modes of interpreting them.

Diagrams and drawings pervade studio spaces. They cover the walls of project rooms, sometimes several layers deep. People draw in paper notebooks as they talk. Paper sketches are stacked on desks next to laptops, litter floors and fill trash cans. Large computer monitors display the unmistakable signs of interaction design's "boxes and arrows" diagrams: geometric shapes, black lines, colorful arrows. One might imagine that these digital drawings vanish without a trace onto hard drives and intranets, but they too are unavoidable present. Just listen to the back-and-forth between two designers: *Where is that presentation saved? Did you send it to the clients? What's the most recent version called?* During projects, designers can spend most of the working day drawing, watching other people draw, or reviewing completed drawings. Interaction designers draw alone, in pairs, or in large groups. They do it within in teams, and with clients. Hands tap furiously across the keyboard and stroke the trackpad; eyes swing back and forth from paper to screen. Designers pile up stacks of sketches and annotated paper printouts in meetings, then combine the sketches into digital drawings afterwards.

Both the act of drawing and the resulting artifacts are central part of embodied cognition and collaboration in design work. The activity of drawing helps solve existing problems and produce new concepts (Cross, 2006; Lawson, 2005). Experimental drawing, or sketching, is a tool of practical sense-making: cognition that is "composite, physical, and concrete" (Gedenryd, 1998, p. 15). As interaction designers examine paper sketches, visual messiness or interpretive ambiguity can stimulate creative misunderstandings or re-interpretations through graphic "backtalk" (Goldschmidt, 2003; Purcell & Gero, 1998; Schön, 1983). We will see one such example in Chapter 6, in which a group of designers draw and redraw the same rough wireframe on a whiteboard as they work through the implications of reorganizing an iPhone screen. Thinking does not precede drawing; it happens through the collaboration of designer and drawing.

Later, as documentation of design proposals, diagrams help stabilize collaborative projects. Tentative concepts expressed in words or gestures — the kinds of words or gestures described in Chapter 7 can be ephemeral. Drawings allow these ephemeral concepts to persist past the meeting for integration into shareable documents (Tversky, 1999). When the project goal is to bring "stories into coherence" (Bucciarelli, 1994, p. 70), as after a contentious design meeting, rendering the multiple sketches into a single digital diagram crystallizes and formalizes a single consensus

plan for the team. In that way, the act of recombining many sketches into a single digital drawing is articulation work (Strauss, 1988), negotiating disagreement through redrawing.

As boundary objects (Henderson, 1998, extending Star & Griesemer, 1989), deliverables support collaboration among different disciplines (such as software programming, marketing, and visual design) and organizational groups (such as client and consultant companies) by facilitating multiple readings and uses. Standardized visual lexicons, such as those for wireframes or architectural blueprints, produce documents that are legible to different organizations and disciplines (Henderson, 1998; Lawson, 2005; Whyte & Lobo, 2010). In specifying systems, deliverables serve as both "transparent media" and as objects of design in their own right (Suchman, 2000a). As Schmidt and Wagner write of the "notional" field of architectural practice:

> The building does not exist prior to their work but only as a result of their work. More than that, the representational artifacts do not exist prior to their work either. […] For architects, in the absence of an objective, material field of work, the representational artifacts constitute the field of work. They serve as objectifications of the construction-in-the-making and are, as such, the immediate object of their work, they are what is looked upon, inspected, gestured at, discussed, modified, annotated, etc (2004, p. 364).

In the absence of working code, for interaction designers there is no way to work upon the prospective system but through the representations they make. Interaction designers *act through representations* to manipulate and reshape information structures and ontologies; interface composition; application behavior; users and their goals. Yet in delivery to clients and other stakeholders, representations are themselves also objects of design. Not transparent, they can turn into communication design problems in their own right. Chapter 6 traces the shifting status of one wireframe as it moves between transparent representation and object of design. For the designers I met never forgot the final end of their diagrams: delivery to clients, developers, and other stakeholders. In the absence of the working system, the files are the shared objects of debate. Designers must produce documents that are can be circulated easily among clients and developers, copied at will. And that means digital files in standardized formats.

The final deliverable, when it is not an interactive prototype or a working system, almost always takes the form of a digital files that can be easily circulated. Before delivery, these digital files are often saved in formats that both make them ineditable and hides certain groups of components, or "layers" from view. Once saved in an uneditable format, digital files are immutable — but highly mobile — inscriptions (Latour, 1999) that can guide action outside the studio. In theory, interaction designers should be able to send a single set of wireframes to clients for approval, then visual designers for styling, content managers for text and image production, and programmers for software writing (D. M. Brown, 2010).

In this way, the ability to edit and manipulate the drawing also enacts organizational and disciplinary divisions among the team, clients, and future users. We can think of the visual culture at work in representing interactions with the standard tools and deliverables as a means of *professional vision*. Professional vision — "the power to authoritatively see" (C. Goodwin, 1994, p. 626) — is not neutral, and not evenly distributed. The enactment of professional vision has consequences for what can be seen and what becomes invisible as groups coordinate action with and through deliverables.

The "standard set" of deliverables

By one count, interaction design projects result in twenty different types of deliverables, from simple stories and aphorisms to complex visual style and programming guidelines (Morville, 2009). However, three types of deliverables form "the standard deliverables"[2] from project to project[3]. To understand what it is that interaction designers do, then, we need to at least understand the structure and purpose of those three: wireframes, site maps, and flows.

Wireframes

Wireframes (Figure 4.1) illustrate the visual layout of a screen-based interface. Though "bare-bones" schematics, they communicate the functional and spatial relationship of every component of a webpage, screen, or application state (Garrett, 2002). According to Saffer (2009), they typically include:

Content: Interface design is the composition of text, images, movies, and audio into a unified visual field. The interaction designer indicates the type, general location, and relative prominence of the element.

Functional controls: Wireframes define how users can trigger, stop, or modify system functionality. For example, Figure 4.1 includes video player controls, and buttons enabling the user to "chat now" and submit a search query.

Navigation elements move users among parts of the interface or allow them to locate elements such as objects, tools, or data (A. Cooper, Reimann, & Cronin, 2007). The navigation elements specified in wireframes include hyperlinks, drop-down menus, and non mouse-based input mechanisms (such as gestures).

2 Phillip, Personal communication, July 7, 2012.

3 I do not want to over-generalize. But interviews with designers, readings of well-regarded handbooks (i.e. D. M. Brown, 2010), attendance at international industry meetings, and observations at design firms suggest that if any drawings could be said to be universal to interaction design, it is wireframes, site maps, and flows.

Annotation: Supplementary text may include suggestions for developers and visual design, business rules intended for clients, notes, and reminders for further action. Designers often add icons such as arrows to highlight certain elements of the wireframe.

Metadata: Text contextualizing the document within the project, such as its date of creation, version number, or creator's name. Wireframes are a crucial part of collaborative work across organizational boundaries:

> Almost everyone involved in the development process will use them [wireframes] at some point. People responsible for strategy, scope, and structure can refer to the wireframe to confirm that the final product will meet their expectations. People responsible for actually building the site can refer to the wireframe to answer questions about how the site should function (Garrett, 2002, p. 137).

Along with the groups listed by Garrett, we can add: researchers use the wireframes to evaluate prospective users' reactions; content developers use wireframes as guidance on what to write, photograph, or film; visual designers flesh wireframes out into realistic-looking mock-ups. It's no surprise that Saffer writes, "Next to prototypes, wireframes are usually the most important document that interaction designers produce" (2009, p. 151).

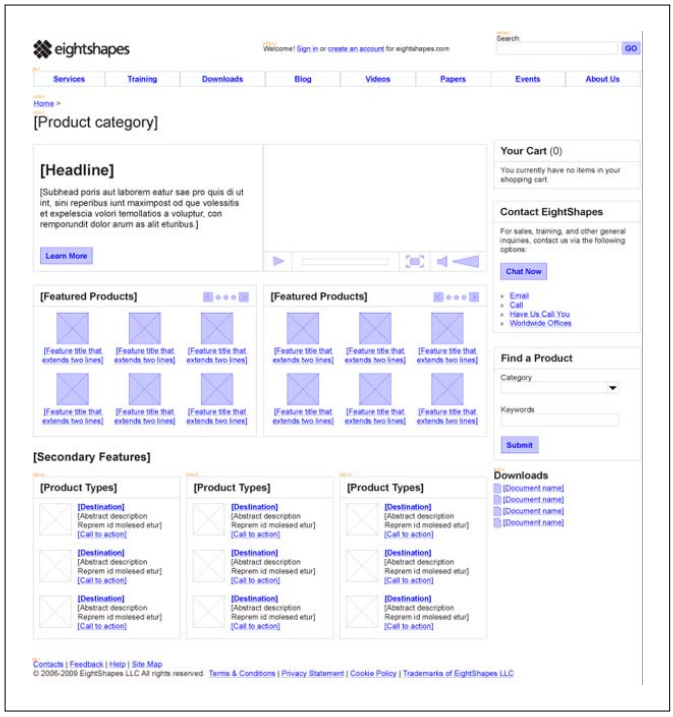


Figure 4.1 Wireframe template (EightShapes, 2010)

Site maps

Site maps[4] illustrate the distribution of digital information into different physical regions, such as pages of a website, screens of an application, or software states {Garrett, 2002, 107}. Unlike a wireframe, site maps do not visually correspond to what they model. Rather, site maps are symbolic images that help designers interpret and manipulate the computational structures and ontologies to be implemented in text-based code.

4 The name "site map," as Jesse James Garrett (interview with D. Brown, 2003) points out, actually has two uses. In website design, a "site map" is also a text list of all the site's webpages provided to help users locate desired functionality. Within the design process, the phrase "site map" commonly refers not to textual lists but to these "architecture diagrams." In this dissertation, "site map" will always refer to the former definition.

In particular, site maps visualize the *hierarchy* of regions within the site (Brown, 2010). They often follow a tree-like[5] structure (Garrett, 2002). In a tree structure, each site may have multiple top level categories linked from a home page. Each of those top-level categories will then have subcategories, as in Figure 4.2. Each of the subcategories can have multiple categories of its own, and so on. The assumption is that regions closer to the home page are more likely to be noticed by users and hence should be more central to the functioning of the system. When clients review those site maps, they are also reviewing the designers' interpretation of the relative importance of the internal groups responsible for each region of the system. The process can be contentious (Goodman, Kuniavsky, & Moed, 2012). For that reason, as designer Dan Brown (2010) points out, the work of drawing site maps simultaneously draws out the "politics of hierarchy" — both informational and organizational.

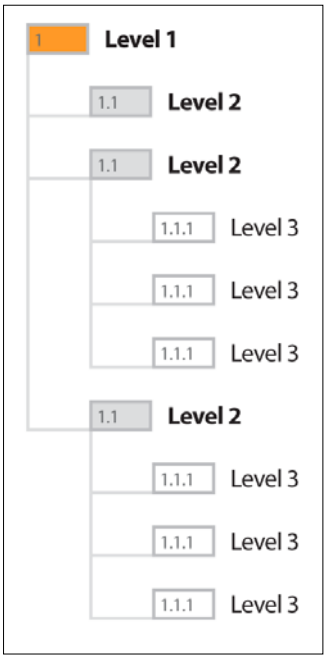


Figure 4.2 Site map template (EightShapes, 2010)

Flows

Flows (Figure 4.3) map the sequence of pages or screens necessary to achieve tasks. They document logical relations of sequence and causation between regions in the site map, much like a flow chart (D. M. Brown, 2010; Saffer, 2009). For example, the rail trip ticketing application discussed in Chapters 5 and 6, should prevent a traveler from buying a ticket before selecting an origin and destination. Task flows help designers assign functionality and controls to appropriate physical regions. Conventionally, each region is indicated by a labelled box, and sequence indicated by directional arrows. Site maps include every region in a system. Flows deliberately *exclude*. They represent only the pages, screens, or states necessary for the task at hand.

For example, the designers of MediumFirm do not have enough time on to make a flow for

5 The "tree map" structure is so named because it resembles a tree, with the home page as a root and the categories and subcategories spreading out into leaves and branches (Brookshear & Brookshear, 2002). The hierarchical "tree model" common in sitemaps emerged from the folder-driven storage technologies of website servers in the 1980s and 1990s (Garrett, 2002). Universal resource locators (URLs) mapped to specific file paths on a server. A sitemap would accurately represent the location of webpage files within folders. The rise of database-driven websites since the 1990s has meant that the locations of webpages are stored in a hierarchically "flat" database, not within nested folders. Nevertheless, the conventional tree-map structure persists.

every task in a rail ticketing application. They can only represent the tasks that would be most important for the system in its first phase of development. As I will describe in Chapter 5, designers cannot determine the most important tasks on their own. Instead, they work with clients to develop enough interactional expertise (Collins, Evans, & Gorman, 2010) to align their diagrams with the clients' priorities for the system. A finished set of flows, then, articulates designers' understandings of the purpose and function of the prospective system. They too exist as intermediary objects (Boujut & Blanco, 2003; Vinck, 2012) between stages of the design process and between disciplinary and organizational interests.

Boxes and arrows: A visual lexicon and grammar

Wireframes, site maps, and flows use the same conventional visual lexicon. They consist largely of simple shapes such as rectangles that are connected or bounded by lines. The shapes are in a single color, most often black, white, or a shade of grey. Lines are also in black or gray. Important areas are often highlighted with one or two bright colors. In Figure 4.3, for example, the well-known design consultancy EightShapes[6] highlights key areas with orange and green. Following a widespread industry convention, hyperlinks (as in Figure 4.1) are often colored blue. Early sketches often indicate the presence of text with scribbled lines (Figure 4.4) or placeholder phrases such as "link goes here." Over successive revisions, legible text often replaces horizontal lines. At first glance, all three diagrams strongly resemble architectural plans or engineering schematics: line drawings of an object viewed as if looking straight down, rendered in two dimensions, without perspective or shading.

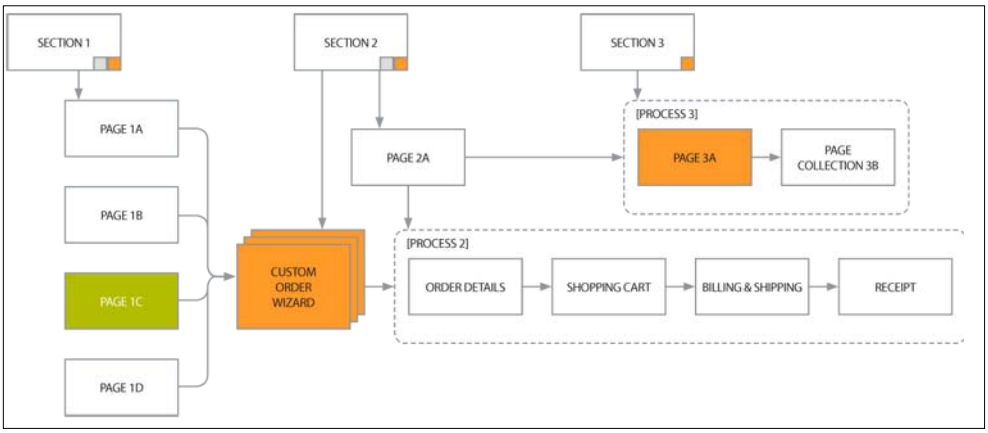


Figure 4.3 Flow diagram template (EightShapes, 2010)

6 In order to protect study participants' confidentiality, these illustrations of a transition from sketch to built website come from a case study from a well-regarded design consultancy that is already publicly available on the Internet (Curtis, 2012). The same points however, could be made in reference to the drawing practices at all the companies I visited.

Unsurprisingly, interaction designers often call this visual grammar "boxes and arrows." The boxes represent discrete entities and the arrows represent relationships between them. The entities in the boxes can be anything relevant to the project: categories of information, pages or screens, user groups and so on. The "arrows" often do not have arrowheads, just as the "boxes" can in practice be circles, diamonds, et cetera. Only site maps and flows actually use arrows as icons. Nevertheless, "boxes and arrows" is now a usual term of art for the standard three diagrams and any variations upon them.

These visual conventions do not change significantly in the movements between hand-drawn and digital tools. EightShapes' informal sketches (Figure 4.4) resemble formalized hand-drawn wireframes (Figure 4.5) which in turn don't look so different from their digital wireframes (Figure 4.1). Indeed, a conventional rule is to show clients wireframes that are (or appear to be) hand-drawn at the beginning of projects, to suggest that the design proposals are as rough and mutable as the lines (Buxton, 2007). As proposals stabilize, clients receive more refined and more precise lines. In practice, at the studios I visited, formal presentations never included hand-drawn wireframes.

This "boxes and arrows" visual lexicon and grammar has remained dominant for at least twenty years. Illustrations of contemporary wireframes in all three editions of the classic interaction design handbook *About Face* (A. Cooper et al., 2007; A. Cooper & Reimann, 2003; A. Cooper, 1995) look remarkably similar. Flows drawn in 2000 (as reproduced in Newman & Landay, 2000) resemble flows I saw in 2012. Boxes and arrows diagrams are visually and structurally consistent between projects, firms, and geographic regions. Designers trained in France, in Italy, and in Britain all draw the same types of diagrams, using the same sequence of movements. Diagrams shown at professional conferences in Brazil, Portugal, and in the United States all contain the same elements, arranged in much the same ways. Fashions in line weights and accent colors may vary, but the language of boxes-and-arrows persists.

The tools of representation

Making diagrams typically has two stages. Obviously, the first stage is drawing itself. But without written explanation, how is anyone on the team to understand the drawing or the role it should play in development? Diagrams become meaningful to projects in the second stage, when integrated into a final deliverable such as a report or a presentation (D. M. Brown, 2010). In the second stage, these final deliverables *composite* together multiple types of diagrams, annotations and explanations, as well as text describing the project, its methods, and its planned results. They document not just design decisions but the reasons behind them. Drawing in presentation software (as LittleStudio does in a magazine design project) allows designers to merge the two stages. Using layout, illustration, or business drafting software separates the two, adding an extra step.

Figure 4.4
Informal hand-drawn wireframe sketches (Curtis, 2012).

Figure 4.5
Formal hand-drawn sketches presented to client (Curtis, 2012)

Figure 4.6 Finished website (Curtis, 2012)

In producing the standard set of deliverables, interaction designers move back and forth between digital and paper-based tools, and from small pages and screens to wall-size displays. They usually begin by sketching on paper. But they soon move to the computer, translating paper sketches into more easily shareable and transportable digital documents. Those digital files are printed out on paper for group review (see Chapter 7 for more on the use of paper), often posted to whiteboards for collective examination and longer-term archiving. During reviews, designers may draw new ideas on scrap paper, personal notebooks, or Post-its, and add edits and annotations to printouts. In individual drawing sessions, designers moved fluidly between multiple forms of paper (such as Post-it note thumbnails and detailed pen sketches) and multiple digital files (such a separate site map and wireframe).

Hence interaction design drawing is both a *mixed-use* and a *differential* practice (Henderson, 1998). It is *mixed-use* in the ease with which designers slide back and forth between papers and screen for much of the project. Yet interaction design drawing is also *differential*. There are tasks for which there is an agreed-upon "right tool for the job": pens and paper for initial drawing, presentation and drawing software for preparing interim and final deliverables.

Pens and paper are omnipresent. Some designers carry around personal sketchbooks; others scavenge scrap paper as needed. Firms provide a seemingly infinite supply and variety of Post-its, the rectangular, adhesive-backed notes made by 3M, along with different widths and colors of pens and markers. Chapters 5 and 6 both describes the central role of the semi-sticky Post-it and the black Sharpie-brand permanent marker in experimentation and documentation during design projects. Occasionally, designers will used pre-printed templates for early sketching. However, typical templates (firms often design and make their own) are only a little more structured than a blank sheet of paper, with spaces earmarked perhaps for a title, name of creator and maybe a date. In contrast to a short list of standard drawing software, there appears to be no standard choice in paper drawing tools outside of the Post-it and black Sharpie.

Large display surfaces, especially whiteboards, are also an important element within an assembly of coordinative artifacts in interaction design studio (Kelley & Littman, 2001; Moggridge, 2007). Whiteboards host ever-changing collections of texts and images: marker-scrawled sketches, task lists, calendars and notes; Post-it notes surrounded by more markered annotations; pages torn out from personal notebooks; layers of taped-up printouts of digital files; magazine and newspaper clippings; even printed-out photographs of earlier, erased states of the same whiteboard. Like a growing pile of completed paperwork on a desk (Kidd, 1994), the accumulation of printouts on a whiteboard allow the knowledgeable observer to monitor progress on the deliverables. Yet as erasable drawing surfaces, whiteboards are assumed to be the home of temporary work. They can be altered and removed at will (which is why so many consultancy whiteboards are labelled "do not erase!").

The important thing about display surfaces like walls and tables for design consultancies, then, is that they are large and easily visible: they can "draw together" (Latour, 1986) heterogeneous media, personnel, and disciplines. Collective work sessions, as I describe in Chapters 5, 6, and Chapter 7 depend upon not the surface not just being visible to a group, but large enough to be practically usable by multiple people at the same time. Whiteboards should not be taken as egalitarian free-for-alls; they are often dominated by one person acting as the "scribe" (Kelley & Littman, 2001), who controls which words or images make it to the shared space. But group work often involves the division of the whiteboard into separate "owned territories" (Suchman, 1988). In this way, the placement and movement of artifacts on the whiteboard coordinates action without direct interaction among people (Schmidt & Wagner, 2004). It facilitates side-by-side or directly collaborative group work, collective examinations of finished work, longer-term archiving, and monitoring of progress.[7]

Even though interaction designers use a variety of paper and digital drawing tools for elaborating on initial sketches, the end deliverable is usually one or more standard types of schematics instantiated as a digital file. These digital files have a lifespan far beyond their paper counterparts: they will be emailed and forwarded, presented in conference rooms, archived on intranets. If the project progresses to development, they will be viewed by developers, corporate managers and marketing teams. Chapter 6 reviews the process of deliverable-making in more detail. The files produced standard software tools of interaction design have qualities in common with Latour's description of artifacts capable of mobilizing action (1986, p. 7): they are *immutable* (that is, able to withstand transport without alteration), *presentable* (that is, easily shown in a group), *readable*, and *combinable* (that is, mixable into different groups).

7 The work of air traffic controllers (Harper, Hughes, & Shapiro, 1991), hospital staff (Bardram & Bossen, 2005), and architects (Jacucci & Wagner, 2007; Schmidt & Wagner, 2004) provide similar examples of the coordinative uses of shared graphic fields.

The digital diagrams made by these favored tools are *layered but flat*. Drawing on screen is not like drawing on paper. Software tools for drawing allow designers to stack up digital objects in discrete layers, and make those objects and layers more less visible by moving them forwards and backwards in the stack with a few keystrokes. It makes these agglomerated objects easier to navigate and manipulate. However, the movements leave no visible traces on screens. They are preserved locally and temporally by the common "history" or "undo" functions common to software programs. But once they are reopened in another program by another user, that history is gone. When deliverables cross from designer to clients, the layers have often been "flattened," offering no glimpse of the processes that created them. Like scientific journal publications (Knorr-Cetina, 1981; Latour & Woolgar, 1986; Star, 1985), the diagrams that arrive at clients' inboxes show no visible signs of the hard-fought additions, deletions and regroupings that produced them. Without access to expensive programs or the original digital files, the layers themselves may not be visible or editable at all. It is not an inherent quality in the files but lack of ready access to professional software which makes them immutable.

They are *scalable and zoomable*. Interaction designers favor software that retain precise, clean lines as images are enlarged and reduced in size. That allows designers to copy them into new documents, resize them, and combine them to make new compositions. Chapter 6 argues for the significance of these functions as part of the work of scoping the project. At the same time, drawing software allows users to magnify and telescope their viewpoint, seeing more or less detail as the diagram remains the same size.

They are *combinable but modular*. Designers routinely combine images from different sources, including photographic raster images, into a single wireframe. Later, separate diagrams can be composited into written reports and slide presentations that order the same diagrams differently. Depending on the original format of the copied element, it may even remain editable in its new combination. Yet the components are not necessarily interdependent. What lies within each box in a boxes and arrow diagram can, for the purposes of coordinating work, be black-boxed. The boxes are interconnected, but *modular*. A visual designer can copy a wireframe into visual design software as the basis for mockup; a developer can import the same wireframe file into a programming environment as the basis for an interactive prototype.

Scientific image-making practices often involve the erasure of case-by-case specificities in order to produce idealized, simplified pictures of general types of objects (Daston & Galison, 2010; Lynch, 1988). Studies of design engineering (Henderson, 1998) and architecture (Yaneva, 2005) have emphasized the opposite: how productive movement between different sizes and scales results in the buildup of detail over time in models. In interaction design, it is software-enabled layering, zooming, scaling, and copying that manage the accretion of detail in building up images complexly textured with interface components, realistic content, and annotations. At the same time,

it is software-enabled flattening and deleting that enables the erasure of edit histories and editing functionality when the documents circulate outside the team.

None of the projects I observed used specialized software. Instead, designers had adapted a small group of general-purpose programs to the specific needs of interaction design and their companies. These adapted general purpose tools include:

› *Illustration and layout tools*, such as Adobe[8] Illustrator and Adobe InDesign

› *Business drafting tools*, such as Omnigraffle and Microsoft Visio

› *Presentation tools*, such as Microsoft Powerpoint or Microsoft Word

The general purpose programs adapted for interaction design share similar interfaces, drawing tools, and standard drawing components. In all, the user is presented initially with a blank page: a bounded drawing area with edges and margins. Unlike a paper page, that drawing area is almost infinitely expandable. Most programs use a book metaphor, in which a single file is organized into a sequence of "pages." One file can thus contain multiple diagrams on separate pages. All the standard programs provide similar repertoires of diagram components: primitive shapes such as boxes and circles, lines (with and without arrowheads), text, colors and basic shade gradations. They provide similar tools for composition: for automatically aligning elements in space, for functionally grouping elements together into larger arrays, or layers, that can be manipulated simultaneously, for placing elements one atop the other. They allow the storage and sharing of graphic stylesheets: typeface and font size; weights and colors of lines. They also support the storage and sharing of component libraries, such as standard website navigation elements and icons.

Firms develop their own libraries of icons, typefaces, and drawing styles over time to create a distinct representational style for each firm. These libraries simplify drawing work by storing and making available solutions to common tasks, such as illustrating iPhone back buttons, or picking a typeface for annotations. Shared libraries mean that deliverables produced by different people use the same icons and typefaces, binding together the firm as an entity. Some firms and individuals share their templates and libraries publicly, spreading new conventions for colors, icons, and lay-

8 At 25 years old, the software company Adobe is as old as the digital design field. Like Apple and Microsoft, it too draws on technological innovations birthed at Xerox PARC but never brought to market (Adobe, 2013). The company's first success, PostScript, allowed computers to render typefaces accurately and consistently onscreen and on paper, revolutionizing print and digital typography. Adobe's second success, the Portable Document Format (PDF), is now a standard file format. Flash and AIR, two platforms for digital applications, provide the underlying code for a massive number of websites. Interaction designers rely on InDesign and Illustrator, its flagship drawing programs. And visual designers use Photoshop for their comps.

outs across the profession.[9] The software tools themselves are designed to accommodate this sort of distribution; each tool provides an interface for importing and exporting visual elements.

These similar capacities are facilitated by the same underlying visual rendering technology. All the standard software programs use *vector-based* rendering — an image processing technique that stores and manipulates images as assemblies of mathematical equations.[10] That stands in contrast to the *raster-based* rendering used in programs such as Adobe Photoshop. Raster-based rendering stores images in terms of the location and color of every pixel that makes up an image. They permit pixel-by-pixel manipulations. However, raster-based images limit the legible size of a diagram. Enlarging a raster-based image often decreases the image's sharpness, as software cannot interpolate new pixels into the gaps created by moving the old ones apart. Vector images cannot make per-pixel adjustments to photographic images. They are not suited to what designers call "pixel-perfect" mockups. But their mathematical equations by default produce the precise, clean-edged lines and simple geometric shapes so associated with boxes-and-arrows diagrams. Vector rendering allows designers to enlarge and shrink diagrams almost endlessly in order to recombine individual diagrams into new deliverables. It is this layerability, scalability, and combinability of vector-based digital drawings that increases their mobility (Carlile, 2004; Henderson, 1998; Latour, 1986) within and across organizational and professional boundaries.

Making mobilizable deliverables hence requires access to the right software. When contract freelancers enter a team, they can spend days negotiating access to the requisite programs and troubleshooting installation. They also need to find and install each firm's standard document templates and libraries. In addition, they may also need to gain access to a client's digital assets: logos, images, and text. Negotiating access to protected corporate servers can require still more effort, with multiple rounds of emails to clients, project managers, and clients' technical support staff. Hours expended on technical troubleshooting means time lost from tight schedules. The determination of consultancy staff to negotiate those obstacles is a testament to the necessity of guaranteeing access to digital tools and assets.

As designers move among firms, cities, and countries, they carry old tools with them, and pick up new ones. LittleStudio's contract freelancer taught the team a new wireframing tool; I watched a contract freelancer teach himself a new layout program at MediumFirm. Generally, however, organizations have preferred tools that they supply for designers. Yet all of the tools implement the

9 The Eightshapes templates in Figure 4.1, 4.2 and 4.3 are one example of this practice. As of July 2013, they are freely available at http://www.eightshapes.com.

10 See Savage and Vogel (2008) for a more detailed explanation of the differences between the two rendering techniques.

familiar syntax of boxes and arrows. As a consequence, I saw designers achieve basic competence, if not mastery, less than three hours after starting to use a new drawing program. Competence includes not just know-how but motor reflexes. Keyboard shortcuts substitute quick button presses on the keyboard for more time-consuming mouse selection movements. In performing keyboard shortcuts, designers' hands move almost faster than the eyes can track. These shortcuts are tied to specific programs; moving from one software program to another requires retraining muscles and relearning shortcuts. Nevertheless, designers like the freelancer at MediumFirm will retrain themselves multiple times over the course of their careers as they move from organization to organization.

Representing behavior

As Lynch writes of the "externalized retina" of scientific visual cultures, standard technologies and procedures for producing and manipulating images can define

> What becomes "knowable" or "reportable" in linguistic or conceptual terms. Intelligibility is built into the visible form of materials in the way they are brought under scrutiny (1985, p. 44).

Changes in representational technologies, such as the switch from paper drawing to computer-assisted drafting (CAD), can trigger pervasive changes in seeing and making (Henderson, 1998). The visual culture of "boxes and arrows," with its ensembles of tools, standard lexicon, and low-fidelity deliverables articulates interaction design's central objects of knowledge as control of functionality, organization of digital information, and structured sequences of activity. But this visual culture poses a continuing problem for interaction designers in representing human and machine behavior with the standard diagrams.

Fidelity indicates a material resemblance to a working digital system (Lim, Stolterman, & Tenenberg, 2008). From the perspective of commercial interaction design, fidelity has two main parts. The first part is *behavior*: the extent to which the specification successfully conveys how humans act and digital systems respond. Behavior, for example, includes the representation of animated screen movement, such as components which "drop down" or "fly in." The second part of fidelity is *realism*: the extent to which the content in the schematic resembles that of the finished system. For example, in designing a travel booking application, a designer might populate digital wireframes with believable origins and destinations as he prepares them for presentations to clients. The third part of fidelity is *finish:* the extent to which the representation's visual appearance of the representation matches that of the working system, e.g., in colors and typefaces. Finish is largely the domain of visual design. Communicating digital behavior is of "first and foremost" concern to interaction designers (Bryan-Kinns, Lif, Hamilton, & Ismail, 2001, p. 92). Yet the standard boxes-and-arrows deliverables of interaction design represent behavior at low fidelity. Static drawings, even digital ones, are not "clickable." They have viewers, not users. That is, the standard diagrams

in both paper and digital formats are not interactive like software, websites, and mobile applications. Touching iconic "hyperlinks" does not load new information atop the existing page or produce a new one; transitions from one state to another are not animated; there is no kinaesthetic feedback. As Julie, a visual designer at LittleStudio, explains:

> You show somebody a blueprint of a house, and you're showing them the bones of it, and you can even show the renderings of what that might look like, but when you actually walk into a space it's an entirely different experience than looking at it in drawings. Same kind of thing applies to interactive products. Because when you look at [it] in wireframes, you're seeing the blueprint (Interview, January 1, 2010).

Or, as Arvola and Artman write, "What the diagram lacks is the transitions" (2007, p. 117).

The dilemma in this widespread use of static diagrams emerges from the concern of interaction design with digital *behavior*. Designers, clients, and developers must implement three-dimensional information architectures, visual animations, and temporal progression of machine activity in response to human input. Yet static drawings are flat, and will not *behave* on their own.

In commenting on a public proposal for interactive wireframes, designer Bryan Zmijewski (2012) complains,

> The main issue is: how do you show interactions ...and then test your assumptions with clicks. Static wireframes are not good for this — nor do they help you push a design direction forward.

In introducing the standard diagrams of wireframes, flows, and site maps, I touched on the endemic political troubles of organizational hierarchy that the contents of technical documents enact. Zmijewski's complaint refers to a second endemic political trouble in the world of boxes-and-arrows caused by low behavioral fidelity. How can one make decisions on the basis of diagrams that do not mimetically represent what is to be decided? For example, in the magazine project I discuss in Chapter 8, the client vacillates between two screen animation proposals because she cannot imagine how either will appear in working software. Her inability to make a firm decision delays software development, leading to a project crisis of time and money.

This problem of representation and decision-making is by no means unique to interaction designers. All representations under-specify (Suchman, 2000b). As representations, they are by definition non-identical to that which they signify (Hacking, 1983). They can be only temporary solutions to situated political problems of resolving "multiple competing, possibly irreconcilable, solutions" (Gerson & Star, 1986, p. 257). However, complaints about the non-interactivity of static diagrams have appeared for decades in academic studies (Arvola & Artman, 2007; Landay & Myers, 1995; Myers, Park, Nakano, Mueller, & Ko, 2008), case studies (Bryan-Kinns et al., 2001), and popular manuals (Buxton, 2007). "Fidelity," as a tangible aspect of design representation in the

absence of a working system in use, is a persistent practical problem for coordinating action inside and outside interaction design consultancies.

Calls persist for "interactive sketches" (Buxton, 2007; Landay & Myers, 1995) that would more accurately portray the tangible qualities of interactions without demanding inappropriate realism and finish. And indeed, those calls have results in prototyping tools that support both drawing and coding. They simulate interactive functionality by enabling hyperlinking between screens and some crude animated interface behaviors (Perotti, 2012). These programs separate drawing and coding functionality in their interfaces (and hence in users' work practice). Designers first create a set of wireframes, then add hyperlinked "hot spots" to connect them into clickable flow. These tools are widely available, and from online forums[11] appear to possess active and committed users.

Yet, despite that research and product development, static sketches are still the norm in the workplaces I visited. My observation and interviews provide no examples of these clickable, interactive diagrams. Conventional wisdom in the industry gives two reasons. Early team drawing sessions (such as the ones I described in Chapter 6) are held to profit from quick, rough sketches (Buxton, 2007). Making many drawings can help avoid premature fixation on any one vision for the finished system. Moreover, making interactive prototypes or increasing the realism and finish of preliminary ideas can waste time if the idea is then discarded. In presenting those ideas to clients, moreover, designers remove any visual elements that are not salient to the decisions they need clients to make at that moment (Bryan-Kinns et al., 2001). For example, visual design is usually fixed in the later stages of interaction design projects (Garrett, 2002). So representations made early in the project use the codified, monochrome "boxes and arrows" visual lexicon to direct decision-makers' attention to programmable behavior rather than visual polish.

Study participants offered other, more individual explanations, resting on the vast practical gap[12] between making static diagrams and interactive prototypes. Reasons include an inability to integrate the tools into their firms' existing procedures; that they "get by well enough" (Jess, Personal communication, August 6, 2012) with tools they already know well; a rejection of proprietary

11 A search of the popular online forum Quora in July 2013 for "wireframing tools" returns posts praising a number of such interactive sketching tools. One typical forum post comes from a product manager who claims to use the interactive prototyping program Axure "professionally - nearly daily since 2007" (Feldman, 2012).

12 Indeed, the changes to interaction design work practices necessary to support the production of interactive diagrams are a matter of some controversy as of 2012. On one side, some designers argue that "wireframes are dead," (Smiley, 2012), and that designers should move more quickly to working prototypes. Other designers argue that "time spent is time gained" (Mall, 2011) when it comes to making "invisible deliverables" — intra-team artifacts that will never be shown to clients but that aid development.

tools and file formats that developers might reject; the optimization of interactive diagramming tools for web design, and the inappropriateness of web-specialized tools for designers specializing in mobile or appliance design. The choice to use an interactive diagramming tool seems to be a combination of organizational decisions, settled individual habits, and perhaps self-declared identity.[13] That is, *as an expert designer I do not need new tools.* Or: *I would like to try a new prototyping tool, but it would disrupt working relations with teammates who prefer Adobe products.* A full examination of why designers do not abandon these tools is beyond the scope of this chapter and this dissertation. For the purposes of this dissertation, it is enough to point out that that the diagrams and software programs I observed are typical ones, and that the deficiencies of these typical diagrams and tools are a matter of considerable concern to many professional interaction designers.

4.2 The topography of the project

> [The] texture of an organization: Is it smooth or rough? Bare or knotty? What is needed is a sense of the topography of all of the arrangements: Are they colliding, coextensive, gappy, or orthogonal? (Bowker & Star, 1999, p. 40)

We cannot understand the politics of representing interactions without describing the sociomaterial landscape, or topography, or of project work in San Francisco interaction design consultancies? One way to understand organizational topography is through the sort of people one encounters on a typical project, both inside and outside the consultancy. As we will see, professional roles are project-specific. Intra-organizational mobility makes for fluid and shifting work relationships. Another way to understand topography is to map the spaces (online and architectural) and timing of project work. Work time is managed along with work space, with hours calculated and metered out according to the demands of project contracts and the firm's bottom line. It may be tempting to dwell on the creative possibilities of airy open floors and unstructured hours spent in contemplative sketching. However is more accurate to describe the topography of interaction design consultancies as *striated* (Deleuze and Guattari, 1984). That is, despite the mobility of designers among firms and the fluidity of their trajectories consultancy time and space are differentiated into regularly ordered, firmly divided blocks.

13 Stolterman and Pierce (2012) take similar lessons about tool choice from a series of interviews with interaction designers.

The "open office": on- and off-line

Design firms are often described as "open offices" — open architecturally, and so facilitating the free and creative circulation of artifacts and conversation (Kristensen, 2004; Moggridge, 2007). And indeed, some consultancies in SoMA are converted lofts or factories, with vast open floors. Visitors in reception areas or conference rooms can watch designers at work, much like restaurant diners watching chefs cooking in an open kitchen. These consultancies also appear to be digitally open as well, with frequently updated, publicly viewable blogs and social media updates.

Many of the larger consultancies I visited shared a similar office plan: central open areas, crowded with individual desks for employees, with smaller rooms lining the periphery. The desks are generally crowded with papers and pens, computers and giant monitors, and all the other residue of longterm occupation: photos of family members, toys, coffee cups and so on. Open areas are often surprisingly quiet: headphones contain music; conversations are muted and brief; personal phone calls are taken at the periphery. The only sounds are the soft clicks of computer keys and, in some firms, agreed-upon background music.

Without walls, employees themselves must guard the open space. Visitors are politely asked to wait in reception areas without a clear view of what is on screens or desks. When I toured open plan studios, I often had to sign a non-disclosure agreement before my guide allowed me to leave the waiting area. When clients are allowed to walk freely about the studio, employees must remove confidential materials relevant to other projects from view. A sudden flurry of movement often signals visits from outsiders as employees hurriedly clear walls and tables of diagrams and text covered under non-disclosure agreements while leaving behind non-confidential material. One designer called this practice "redaction," like a censor blacking out portions of a document.

Enclosed conference and project rooms, by contrast, are the realm of unguarded visibility and talk. The project room houses all the non-digital artifacts related to the project: sketches, visual references, images and text for analysis, meeting notes, deliverables in progress, and of course stickies everywhere. Consultancy employees may spend most of their time in these small rooms (Moggridge, 2007, pp. 518–519). For temporary employees, the project room may be the only place available to work. Covering the walls of project rooms with artifacts keeps them available as resources for discussion. But the walls and door also prevent project outsiders, such as external vendors and other projects' clients, from hearing those discussions and viewing those artifacts.

The kind of space that consultancy managers give each project indicates expectations for membership and confidentiality. Not all projects receive enclosed rooms. All four projects I observed were relatively "safe" for me to observe, I was told, with tolerant clients relatively unworried about confidentiality. All of these "safe" projects were either assigned an unwalled region or

had no dedicated space at all. The consultancies I visited reserve their limited supply of walled rooms for "unsafe" projects.

In general, no one but project members enters those enclosed rooms, even when the doors were open. Unenclosed project work spaces, however, could be entered at will. Project room entrance also enacts membership. As one MediumFirm designer joked to an "outside" designer who had temporarily grabbed a seat in an unenclosed project space, "You're now on our team because you're in our space" (Jaron, Fieldnotes, May 21, 2010). Open spaces enact open participation and more open access; closed spaces limit access and participation to designated project members.

An important part of maintaining boundaries between open and closed regions of the studio is what has been called "presentational labor" (Sheane, 2012) — the emotional and aesthetic work of modulating one's bodily conduct before an audience as part of one's assertion of professional expertise. As a stage for the "presentation of the self" (Goffman, 1959) as competent designer and as loyal firm employee, the open studio results in a permanent audience. It is by now an industry cliché to mock "designer-y" eyeglasses and expensive sneakers — the visible markers of professional belonging. What designers joke less about is the ongoing work of organizational belonging — of producing a harmonious sensory and social environment in the studio.

For while disagreements are frequent, insults, public admonishments, loud voices and agitated body language are rare. After a design lead received an email she found hostile and accusatory, she was shocked. *Very unprofessional*, she told her team. *Rude.* (Jess, Fieldnotes, February 18, 2010). Her composure was only somewhat restored by an in-person apology. But the most important audience in a consultancy is the client. One of the few blunt disruptions of studio harmony I saw in an open space was the reprimand a young designer received for visibly sneering at a client.

Open plan design consultancies in particular seem to require a commitment to a clear "sonic envelope" (Rawes, 2008) around one's desk. Even when meetings turn heated, desk-bound employees bodily give off a front of inattention (Goffman, 1959), as if architectural walls do actually prevent them from seeing and hearing the debate at the table. This is especially true when there are no architectural barriers between individual desks and conference tables. In the one-room office of LittleStudio, employees at their desks stayed silent during client meetings at the table, communicating in text online as necessary. The production of studio spaces lies in bodies as well as walls.

The careful practices of non-disclosure are another type of bodily boundary work. In Chapter 3, I introduce anxieties over the definition and security of sensitive client information in the context of my own positioning as a visiting researcher. In the realm of the FrieNDA, I point out, access to closed studio spaces and sensitive business documents relies upon personal trust rather than contract. The same holds true for consultancy employees, both temporary and permanent. As they move among organizations, they must themselves guard against sharing what they have promised to keep secret, or seeing what they should not. This is often a question of bodily conduct: of not

entering certain project rooms, of limiting what one says about previous employers, of referring to certain clients and projects with code names, and so on.

Mirroring the project room, clients (and often freelancers) receive limited access to digital resources. There is usually a company intranet which stores project-specific documents and company-wide documents, such as non-disclosure agreements. It also contains password-protected regions for each project. Visitors cannot wander at will through the consultancy's servers. They get password-protected access to their project space — which contains only files that the designers have actively chosen to upload and share. In the same way, clients receive digital files cleaned of history — of evidence of reusing files and formats from previous projects, of extraneous drawing components, of previous versions. In this way, the differential circulation and storage of digital files forms part of an "ordering system" (Schmidt & Wagner, 2004) for coordinative work among consultancy employees, clients, and external developers.

The open area may be surprisingly quiet, but that does not mean employees are working alone. There is another digital space — one with no architectural correspondence. A stream of written messages continuously scrolls across computer and telephone screens: chat and email about the project, Twitter updates from professional acquaintances. The visual design might send some comps to review; clients might post requests to their project site; the project manager might ask for time reports; a spouse might text. However, since the flood of communication takes place in text, on smaller screens, it is both silent and hard to follow. The space of the small screen is a personal preserve; uninvited glances at other's screens are met with questions and polite rebuffs, as I learned while trying to observe solitary work. Those who archive work-related chats would not share them with me. The text-based personal channels, then, are another way of maintaining confidentiality by limiting what can be overheard and what will be shared with others.

The layered organization of the firm's digital extensions online largely echoes the layered spatial configuration of the studio. Many of the consultancies that I encountered maintain a vibrant public presence online. Their websites host blogs with news items, sometimes sharing project results, lecture videos from public appearances, and tutorials in professional skills. They have social media accounts for the firm, and individual designers often report, with discretion, about project work. But the public online activities, like the open studios, stands in front of an array of less easily accessible hidden online spaces. Professional non-disclosure is enforced by digital access management through password protection and private communication channels as well as bodily conduct and architectural barriers.

Studio timing

Accounts of "flow" (Csikszentmihalyi, 2009) in creative professions demonstrate that psychological sensations of immersion and timelessness can persist over hours of work. However, the number and scheduling of those hours in consultancies are tightly managed in order to keep delivery on-time and on-budget.First, we can think of project time as structured around repeated cycles of preparing for and recovering from client encounters, from the first sales presentation to the final delivery. There are three main phases of client encounters in consultancies. An initial series of *sales presentations* take place before signing any contracts[14]. These may be punctuated by an exchange of emails between representatives of the design consultancy and the client, negotiating what the firm can and will do, by when. If the consultancy is successful, this phase ends with joint agreement upon an initial contract often called a *statement of work* (SOW). The SOW lists the number and type of deliverables, the due dates for delivery, and the price of the project. The deliverables and schedule mandated by the SOW are often translated immediately into paper to-do lists and calendars posted in the project room. Integrating the project's schedule into its architectural environment makes time consistently available as a resource for coordinative discussions.

For the SOW, along with negotiations between the project manager and the client representatives, determines what is to be delivered, and when. It sets the schedule for the interim client encounters throughout the project. Sometimes these encounters are *working meetings* intended to generate many tentative design proposals for the project. Sometimes they are *presentations* that review finished work. A client encounter can also be a *document exchange*, in which clients and designers do not meet but rather exchange artifacts. These interim encounters may be tied to the scheduled delivery of promised documents, or they may be "check-ins" to report progress at regular intervals. The final phase of the client encounters is the concluding presentation(s), in which the consultancy presents the full results of its work to the client representatives. Satisfied clients may even ask a design consultancy to deliver the final presentation repeatedly to other groups in their organization, dragging out the project past its original end date.

The cyclical work of preparing for and then recovering from client encounters is tangible throughout the consultancy. Project managers prominently post calendars labelled with deliverable due dates and client encounters. Days and meetings are ticked off or rewritten on the calendar; file revision dates chronicle late nights and weekend work as more hours are necessary to meet deadlines. Team outsiders watch conference rooms fill and empty; designers bustle about tidying project rooms for the big final show; catered lunches arrive and the resulting detritus is packed

14 The role of sales encounters is, of course, not unique to interaction design. Jevnaker (2005) describes initial sales encounters in furniture design that resemble those I witnessed at studios and at the Consumer Electronics Show (CES).

away. Client meetings themselves often begin with a verbal summary of the last meeting and a review of actions since then; they end with a verbal preview of what will happen in the next days.

Second, within the project, consultancy employees meter out working time in hours. Hours are currency in the political economy of consultancy work (Ladner, 2009): counted, traded, documented and monitored. Consultancies may charge clients either by hours worked or in one lump sum. The lump sum or estimated hours are contractually guaranteed by the SOW, and increasing either requires written permission from the client.

So keeping billable hours within the estimated limits is crucial to the profit margin of the project and hence the financial health of the firm. Exceeding one's assigned billable hours means that the project is benefitting from unpaid labor, possibly to the detriment of other projects. Working less than one's assigned billable hours is frowned upon as losing money for the consultancy. Project managers assemble project teams and assign work with an estimated profit for the consultancy in mind. As Ladner writes, "The ideal business condition for an agency is one in which 100 per cent of its employees' labour time is sold to a client" (2009, p. 14).

Billed hours inexorably accumulate over repeated cycles of preparation and recovery from client encounters. Tracking, reporting, forecasting and renegotiating one's hours, then, are important skills for consultancy designers. Among similarly priced personnel, hours are often traded or redistributed to limit the total number of billable hours expended on the project. Anecdotally, it seems that controlling the expenditure of hours is difficult in practice. LittleStudio, as I discuss in Chapter 8, found themselves working more than sixty hours a week to satisfy a demanding client. Team meetings at one project at MediumFirm often ended with designers redistributing their hours as personnel moved on and off the project. The team at LargeAgency, enjoying a collaboration with a fashionable ceramics designer, in the end devote more hours to the project than the firm management wants. In the end, however, it is project managers and lead designers — not more junior practitioners — are responsible for managing the distribution and expenditure of time. Part of becoming a senior consultancy designer, then, is acquiring expertise in estimating task times and in redistributing those hours among the team as needed.

Time in design consultancies is usually metered relative to the production of deliverables. The SOW, as Jess explains to a client, establishes the "numerical parameters" of the project's scope, or exactly what the design consultancy will deliver, by when, for what price (Fieldnotes, February 10, 2010). In quantifying the terms of the project, the SOW establishes equivalencies among the consultancy's fees, hours allotted to the project, and the number of artifacts that the consultancy must produce. On that basis, the project manager and leads can calculate roughly how many hours they can give each deliverable if the consultancy is to make a profit on the project. The time calculations change along with the scope of the project. If the number of deliverables threatens to expand past what the consultancy desires or is capable of accomplishing, either the amount of time granted or

the amount of money paid must be expanded correspondingly — or else the designers may suffer from underpayment and overwork. Chapter 6 examines scoping and time management in more detail. Chapter 8 follows a crisis of scope and its resolution.

In this way, hours are a currency of design consultancy work, exchangeable for money and for deliverables. Time must be carefully doled out over the cycles of client encounters if the team is not to come up empty-handed just before the final presentation. Ladner (2009) calls these professional temporal rhythms "agency time," calling attention to the quantification, calculation, and monitoring of the passage of time in consultancies in service to the economic relationships among client, firm, and employee. Building upon Ladner's analysis, I prefer to describe the temporality of project work as "studio timing," emphasizing the ongoing labor of time management that produces the appearance of untroubled, well-scoped delivery.

Project roles

Interaction design projects in consultancies rely on a standard, well-defined set of roles. Within the consultancy, besides interaction designers there are typically also visual designers. Non-designers within the consultancy include project managers and often user researchers and developers. Visual designers define the organization and graphic style of screen-based interfaces (Garrett, 2002). They specify spatial dimensions, colors, typefaces, and often the general subject matter of images. Project managers administer design work. They set and enforce schedules and time limits, record project decisions, and communicate with clients (K. Goodwin, 2009). User researchers, when present, plan and conduct empirical investigation of the needs and activities of potential end users (Goodman et al., 2012). Developers, or "devs," are the software programmers and hardware engineers who build what the designers specify.

Within consultancies, team personnel are assembled on a per-project basis. In small consultancies, as in LittleStudio, one person may handle more than one role. Jess served as project manager, interaction designer, and user researcher. Small to midsize consultancies, such as MediumFirm, also often hire temporary contractors to make up gaps. To clients, these contractors are presented as permanent employees. During the rail ticketing project discussed in Chapters 5 and 6, the contract project manager and main interaction designer explicitly discussed how to give the clients *the [MediumFirm] experience* (Fieldnotes, March 2, 2010).

None of the consultancies I observed kept developers on staff. Instead, they subcontract development work out to specialist vendors. Unlike contractors, vendors are never presented as permanent employees. Indeed, I saw interaction design consultancies insist on distance from development vendors after technical problems emerge. When LittleStudio and LargeAgency encounter project-threatening technical problems, both firms explain the problems to the client as a result

of the vendor's non-participation in the tight coordination with the client characteristic of a well-managed consultancy. The absence of developers is one consequence of the size of the companies I visited. Consultancies with hundreds of designers, such as IDEO and Frog Design, keep engineers with a diverse array of skills on staff. Just like the very large ones, smaller consultancies may take a range of technical demands, from mobile applications to home appliances. But unlike the very large consultancies they cannot afford to permanently hire engineers competent in all these specialities. Instead, they contract development out to specialist firms as needed.

So project teams coalesce and then dissolve. But individuals may work together again and again, albeit in different roles. Jobs in Bay Area design consultancies are often "at will," meaning either the firm or the employee can end employment at any time. People move from organization to organization, and role to role. A designer may begin "in-house" at a product company, move to a consultancy, then be assigned to a project with her former employer as a client. Or she may take the reverse route: work at a number of consultancies, then move in-house and hire one or more of the consultancies who employed her. Temporary contractors continuously circulate among firms, with their precarious employability resting on their professional reputations (Neff, 2012). It is in this environment of employment mobility and role fluidity that practices of non-disclosure, studio harmony, and repeated reskilling come to be so visible in everyday studio work.

As service specialists (Goffman, 1959; Schön, 1983), interaction designers in consultancies need clients by definition to commission projects and pay fees. As one user researcher told a team at MediumFirm, "the measure of every successful project" is getting another project from the same client (Fieldnotes, May 18, 2010). They are also a source of professional status, as the lists of clients prominently featured on consultancy websites suggest. Representatives of client organizations may identify themselves as engineers, marketers, accountants, managers. LittleStudio had a client who was himself a well-known interaction designer. Yet despite the centrality of clients to project work, their access to project work at the consultancy is carefully limited. Weekly meetings are often held over the Internet or telephone; visits to the studio itself are prearranged and often scheduled down to the minute.[15] And as we saw earlier, their ability to view and manipulate documents is also often restricted.

One senior designer at a boutique consultancy told me that roughly 80% of her job involves "client management" (Fieldnotes, February 25, 2010). Client management is, essentially, articulation work (Strauss, 1988) — work necessary to coordinate efforts. One part of that is what designers call "managing expectations," or coming to an agreement with clients about the project's

15 Some organizations encourage more frequent "working sessions" with clients, in which the clients spend more time at the studio. Nevertheless, these working sessions are never impromptu.

scope. In controlling the fate of projects, clients are also responsible for making decisions about what designers should do (K. Goodwin, 2009). Another part of client management, then, is the managing of decision-making. Consultancy teams must convince clients and other stakeholders, such as developers, to commit limited resources, including time and money, to the project — but in turn, they typically offer clients substantial say in what designers do with those resources (Monteiro, 2012).

And then there are users. A "user" is an end consumer — a person who actively employs the system but is not responsible for design and manufacture (G. Cooper & Bowers, 1995). Many handbooks for commercial designers (i.e. A. Cooper et al., 2007; K. Goodwin, 2009; Saffer, 2009) mandate frequent encounters with the potential human users of new technologies, producing stories of use validated by empirical research.[16] An orthodox "user-centered project" is successful when the designers correctly transmit their intentions to the user through the medium of the interface.[17] So identifying and understanding users is central to interaction design project work.

Yet, depending on the project and consultancy, interaction design projects in consultancies draw less on formal research and more on implicit notions of human behavior (Akrich, 1995). As Ivory and Alderman write, "Despite the rise and rise of user-centred and participative design, the user is most notable for his or her physical absence from the design process" (2009, p. 132). Users — or potential users — are largely physically absent from interaction design consultancies as

16 There is a long history of thoughtful criticism of user-centered design (UCD)'s discursive sepaation of "humans" from "technology" in order to support its claim to be an obligatory passage point to a more humane world (Berg, 1998; Garrety & Badham, 2004; Suchman, 2006). As argued in Chapter 1, given the deployment of key parts of UCD as a definitional part of interaction design design thinking, it is now a more worthwhile question to ask how users and UCD are mobilized in practice.

17 This notion of a passive user who reads out the meanings created by an active design-producer has been undermined already, notably within the sociology of consumption (Miller, 1995; Shove, Pantzar, & Watson, 2012), feminist studies of science and technology (Oudshoorn, Rommes, & Stienstra, 2004) (Suchman, 2004), and critical human-computer interaction research (Gaver, Beaver, & Benford, 2003). Nevertheless, it remains a theoretical underpinning of user-centered design. The Scandinavian practices of participatory design deliberately work to undermine this division between designer and user by making those people who will be subject to new technologies a part of their design (Ehn, 1990). Note also that the very terms "participatory design" or "user-centered design" imply that one key characteristic of "users" is that they would otherwise be marginalized as organizational outsiders.

human visitors.[18] User research, when conducted, makes end-users available to designers through representations (Goodman et al., 2012). Users are materialized discursively, in verbal descriptions, photographs, and other user-representations (Hyysalo, 2006; Ross, 2011). (Chapter 10 analyzes one type of user-representation, physical roleplay, in detail.) Users themselves rarely get to view or influence these materializations. Chapter 1 describes the centrality of user-centered design to definitions of interaction design in more detail, and summarizes some common practical and ethical concerns about the absence of user representatives.

Striated spaces and times

Firms carefully manage access to project documents as they are archived and displayed on intranets and conference rooms alike. As with a restaurant's open kitchen, there is more activity taking place than is visible from the paying seats. In this way, we can describe the organizational topography of design consultancies as *striated*, or regularly ordered. That is, to borrow a distinction from Deleuze and Guattari, there are "two types of multiplicities":

> Metric and non metric; extensive and qualitative; centered and centered; arborescent and rhizomatic; numerical and flat; dimensional and directional; of masses and of packs; of magnitude and of distance; of breaks and of frequency; striated and smooth (1987, p. 484).

Imagine, Deleuze and Guattari suggest (p. 526), two quilted blankets. One is comprised of irregular pieces in no discernable pattern. The other is comprised of repeated, modular blocks. Both are continuous surfaces built of heterogeneous materials, but the former is *smooth* while the latter is *striated*.

Striated boundaries similarly define projects. In a world in which workers move fluidly among organizations and among project roles, design consultancies limit access to both architectural and online studio spaces. With walls, appointments, passwords, and file formats, they limit how project outsiders (such as clients, users, developers, and non-team employees) view and manipulate confidential project documents. Even architecturally open regions are cross-cut by private digital messages on personal computer screens. Timing practices quantify and meter hours so as to complete deliverables on time and on budget. These striated temporal and spatial boundaries, then, are

18 Suchman identifies "systemic barriers" (2006, p. 188) to more participatory design methods in commercial design, including typical timing and budgeting practices. I cannot describe in detail these systemic barriers here. However, it is important to describe the noticeable absence of human users from studio spaces as not merely a neutral result of individual choices.

not natural or permanent. They are enacted in ongoing practices, which include bodily conduct, digital tools and office architectures.

4.3 Conclusion: The tensions of delivery

The work of adequately representing human and machine interactions is irreversibly entangled with the economic and political work of delivery in consultancies. Interaction design's visual culture, as expressed in the "standard deliverables," centers on low-fidelity diagrams composed of monochrome geometric shapes. In representing the composition of interfaces, the logical sequence of transactions, and the organization of content, they articulate debates over technical and organizational hierarchy and prominence. Designers agree, however, that they do not communicate digital behavior, such as screen animations or dynamic transitions among logical states. Layered but flat, scalable and zoomable, combinable but modular, digital images are complexly detailed but often hide editing functions and the history of their making from those outside the firm. It is not just what they show but what they hide that allows deliverables, when circulated among designers, clients, and developers, to bind together different disciplines and organizations into a coherent project.

In short, the business of interaction design consultancies is bound up in the work of making and circulating deliverables and other representations. Divisions among the roles of client, user, team member, and so on are enacted over time by how project participants are permitted to see and manipulate these objects. Architectural arrangements, bodily conduct, digital security, and access to software programs limit access to project documents. Project management practices meter time in hours to meet cycles of representation making, delivery, and planning. The organizations these routines enact are strikingly temporally and spatially patterned by the tensions of *delivery*: divided into exchangeable units of time and money, and oriented to managing disclosure and access online and in architectural space. Despite the common descriptions of design work as flowing and studio spaces as open, the "organizational topography" (Bowker & Star, 1999, p. 40) of design consultancies is *striated*, or regularly ordered. This striation cannot be taken for granted; rather, it is the product of continuing effort by consultancy employees and the ordering systems (Schmidt & Wagner, 2004) they maintain.

Such characteristic striations help produce three major tensions of delivery in consultancies.

› *Defining scope* Along with computational capacities, what often shapes projects is the economics of hourly billing by designers and developers. Budgets practically limit the labor time that consultancies will commit to the project. Limited time thus shapes what developers can build and what designers can specify. As we will see in Chapter 6, "scoping the project," or

defining what concretely designers will deliver in the time allotted, requires continuing negotiation of what and how to draw.

› *Representing behavior* The standard, "low fidelity" boxes-and-arrows schematics are not digitally interactive in the same manner as working, coded prototypes. And therein lies a continuing problem for interaction designers: how to convey to clients and other project constituencies the *behavior* of humans and machines with the standard diagrams? Chapter 10 examines how physical roleplay enacts human and machine behavior.

› *Achieving assent* The consultancy is a service specialist; it can neither act on its own nor compel representatives of other organizations to obey its preferences. It enlists clients into the project by helping them make informed decisions about how systems are to behave. Yet the typical low fidelity representations do not mimetically convey behavior. Chapters 5 and 11 deal with two very different means of eliciting knowledge and enlisting cooperation from clients.

In sum, the messy business of delivery is this: how to define interactions and enlist clients while coping with limited time and insufficient representations. The central chapters of this dissertation will examine how and where episodes of performance respond to these tensions.

CHAPTER 5

Forum of alignment: The material politics of the whiteboard

When I first meet the designers of MediumFirm, they are busily preparing for a two-day client workshop that would identify, in the project lead's words, "everything that needs to be there" (Fieldnotes, March 5, 2010) in the final deliverables. Even though their initial Statement of Work (SOW) lists the number and types of documents to deliver, the team still does not know what that "everything" will contain exactly. However, one of the team's most pressing concerns is the application's feature list. "Feature" is a term of art in software development for a specific action that the program can execute — i.e., for Eurotrips, allowing travellers to buy a rail ticket, or see ticketed itineraries. Misdirected or unwieldy feature lists can result in overworked design teams and inelegant results (Saffer, 2009). Moreover, the list itemizes expected components of the final deliverable. It crystallizes agreements between designers and clients. If the deliverables do not articulate all the features, their relationship with the client may suffer, potentially getting them fired from the job. The feature list can — and should — change over the course of a project, along with designers' and clients' understanding of the final product. But for interaction design consultancies, co-managing the feature list as well as their clients' expectations is crucial to the projects' success. The workshop, then, is a crucial early step for the designers in aligning what they will do with their clients' desires for the project.

In this chapter, I will argue that the work of identifying, naming, bounding, and ordering features has a lot to tell us about: (1) the *material politics* of interaction design and (2) the importance of *showing practices* in those politics. By material politics I mean both the politics of cooperatively manipulating the material anchors (Hutchins, 2005) for often very abstract ideas, and also the political relations between designer and client teams that those objects enact. By showing practices, I mean the performance relations of display and witnessing that produce a shared conception of the features and the project. To do that, I will follow the Eurotrips project over two days as the designers lead clients through a "feature collection" workshop intended to identify and prioritize features as a first step in designing interactions.

But first, a caveat: I do not wish to give the impression that this chapter describes a standardized process of feature collection within professional interaction design. For one thing, these feature collecting activities were more formalized, orderly, and explicit than others I saw — one of the other designers at the firm calls this project's process "particularly left-brained" (Fieldnotes, February 23, 2010). For another, Post-its on whiteboards are not the only way these designers might accomplish the work of feature naming, identification, and prioritization. Some studios use spreadsheets; others prefer written lists on large pads of paper. And indeed, in building a feature roadmap, the MediumFirm designers later translate features on Post-its into rows on a spreadsheet. Hence, it would be inaccurate to imply that that there is a standardized set of procedures for feature collection, or that Post-it notes are even the universally acknowledged "right tool for the job."

Instead, the workshop at MediumFirm serves as an unusually encyclopedic and rigorous exemplar of conventional tools, tactics and concerns shared by many other interaction design projects. Its activities utilize recommended design strategy activities from professional handbooks (Amy keeps K. Goodwin, 2009 on hand for reference throughout the workshop), as well as advice from more experienced colleagues at MediumFirm. As well, Post-it notes have come to function as a part of the symbolic performance of competent professional design (Irani, Dourish, & Mazmanian, 2010). They are nearly omnipresent almost all of the design studios I visit, towering in stacks in conference rooms, covering walls, filling up trashcans, and dotting the cases of laptops. Here, I am following the rationale of Amy, the lead designer, for employing the Post-its in research analysis. For her, spreadsheets are "kind of the same thing" as Post-its, "but in a digital format." However, she tells me, pointing at a spreadsheet: "showing this to people who are new to doing personas is overwhelming. […] So doing the paper works so much better in collaborative settings" (Fieldnotes, February 23, 2010). Given that my own readers, like Alexa's collaborators, are likely to be inexperienced with her methods, I am following Alexa's advice in using the note-based process as an illustration. By the end of this chapter, I hope readers will understand the benefits she gets from "doing the paper" with her clients.

5.1 Making the features jump out

The small budget and short timeline, combined with the clients' large ambitions, complicates the designers' plans for the project. Since tourism is seasonally variable, the Eurotrips management wants a skeletal but functional application ready for the start of the tourist season three months hence, with improvements planned for later phases of development. The MediumFirm team — consisting of Amy and George, the interaction designers, Laura, the visual designer, and Ina the project manager — have promised their clients enough guidance to build a first version immediately, as well as a roadmap for future development. But logically, before the designers can

start figuring out what their clients should build first, they must figure out the entire roadmap. The novelty of the project has introduced further difficulties. In 2010, a Eurotrips press release for the new application claims, there were no other mobile railway ticket buying application existed for smartphones. The Eurotrips application will be the first of its kind. In looking for features, the team will have to identify, extend and modify those of the existing Eurotrips website.

Finding an explicit definition of *feature* in interaction design textbooks is difficult — it seems to be taken for granted as a part of professional knowledge. One definition equates features with *functions*: a feature *is* what a system *does* (Cooper, Reimann, & Cronin, 2007). Another associates features with *solutions*, as differentiated from problems or requirements (Tidwell, 2005): a feature *is* what an entity *needs*. Some designers (i.e. Mirel, 2004) argue that a "feature list" approach to interaction design is too constraining, but interviews with interaction designers suggest that the feature list is a common deliverable in both consultancies and in-house teams. As functional units and answers to problems, features are undeniably constitutive of software applications. But before they are programmed into working software code, they exist as lines of text in specification documents and graphic elements in user interface diagrams. For Eurotrips, MediumFirm will deliver both.

As part of MediumFirm's organizational commitment to user-centered design,1 the designers base the Eurotrips feature list on formal, explicit user representations (Akrich, 1995) based on interviews with North Americans who have recently traveled by train in Europe. During the first morning of the workshop, the group discusses the "user needs" that the designers have identified form those interviews, which are listed on a series of yellow Post-its on a whiteboard. Amy encourages the clients to move the yellow Post-its into small groups, which she then labels with "big user needs" in larger yellow Post-its (results shown in Figure 5.1). Then, Amy asks everyone to gather around the big conference table, where she presents four project personas — fictional characters who represent categories of potential users (Pruitt & Adlin, 2006). The personas consist of photographs, names, capsule biographies, goals of travel, and descriptions of travel-planning habits. The team, the clients, and a number of visiting designers from the company gather in smaller groups to make concept sketches. They are directed to invent, draw, and name product ideas that might help the four personas plan satisfying rail trips in Europe. Before lunch, the groups tape their sketches to a whiteboard and discuss them.

1 Made visible in statements on their firm's portfolio website, on blog posts by individual designers, and in public presentations of their work at conferences.

Activity 1: Making the features jump out

Amy and Ina's plan, as Ina says, is to look for any "potential features" which "are really jumping out"[2] from the concepts on the sketches. However, there is another source of features — visual groupings of needs and opportunities. Instead of working with the sketches directly, Laura successfully makes a counter-proposal: that they take the concept sketches, still taped to the whiteboard next to the working area, and "bucket" them into the user needs clusters. That way, the features will link the concepts and the needs. First the designers, and then the clients, start to move the yellow user needs clusters up to the top of the whiteboard, leaving most of the space below open, and start moving the sketches (on white paper) over. Each sketch is placed under the user need cluster that the mover believes it supports.

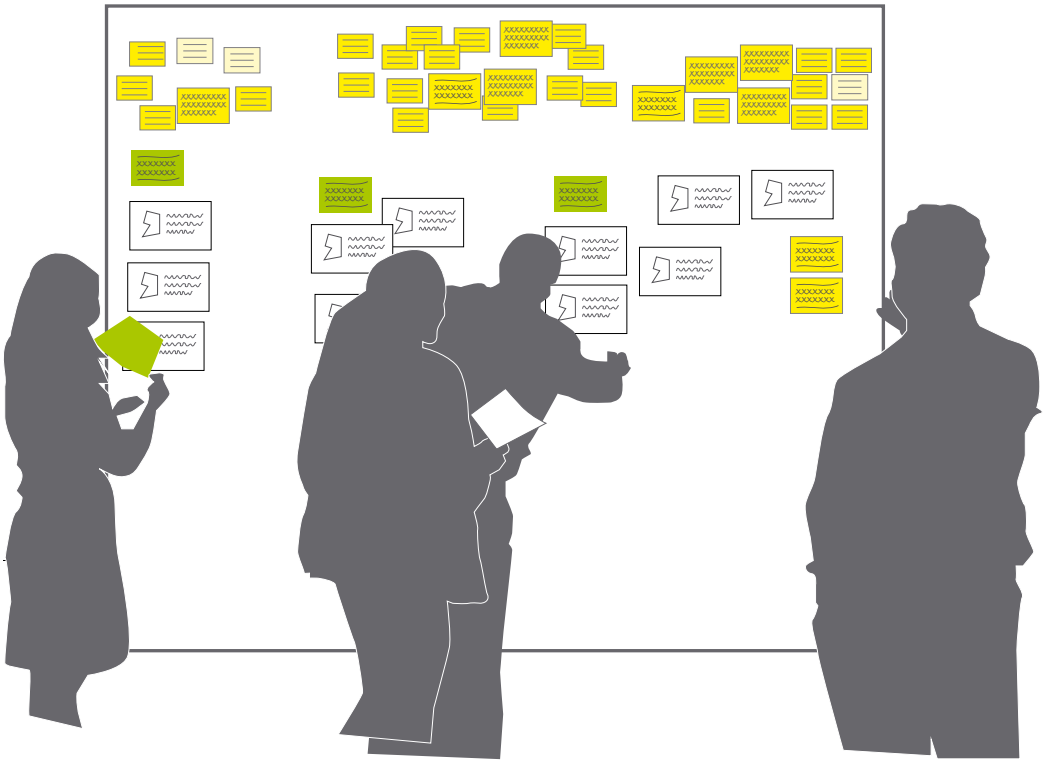


Figure 5.1. Starting to make the features jump out onto green Post-its. On the top of the whiteboard, the clusters of small yellow Post-its have been grouped into "big user needs," (indicated by the larger yellow Post-its). Two clients (center) are now bucketing the white concept sketches into the big user needs as another client (right) looks on. Amy (left), the lead designer, has started to write green feature Post-its.

2 All quotations and paraphrases in Activity 1 from fieldnotes, March 1, 2010.

Activity 2: Pulling out the features

The next day, the group starts pulling out "high-level" features from the sketches in earnest and placing them on more green Post-its. The purpose, as George says, is to ensure "we have a more specific feature to put on the roadmap."[3] Amy and Ina ask questions of the clients, and the other designers remain mostly silent. The questions mix business rules, ("So you can't change a ticket, right?"); technical logics ("What kind of data would you need to enter from your phone?"); and preferred terminology ("How would you describe that feature?"). Some of the questions are answered briefly, by a single respondent. Other times, questions provoke a discussion. Sometimes Amy and Ina copy down the clients' exact words, but other times what they write bears little resemblance to what the clients say. Occasionally, one of the clients points at or touches a Post-it note. But seemingly by common agreement (though no rules to this effect have been explicitly stated), only Amy and Ina (the most senior project personnel) write, add, and remove green feature Post-its. As Amy and Ina work with the Post-its, they simultaneously move the concept sketches so that each new Post-it is located on top of or nearby the sketches

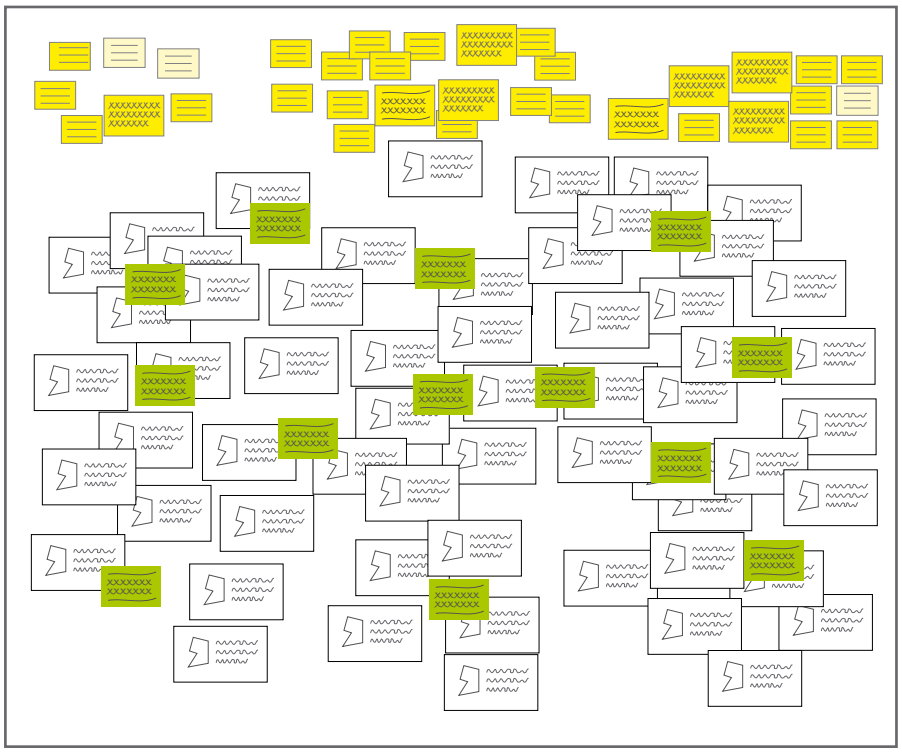


Figure 5.2. The whiteboard after the features have been pulled out.

3 All quotations and paraphrases in Activity 2, 3, and 4 from fieldnotes, March 2, 2010.

whose features it pulls out. Though they are still referenced in conversation, the yellow user need Post-it notes remain where they are, untouched. Figure *5.2* shows the result of this activity.

Pulling out the features also means differentiating one feature from another. That's not as easy as it sounds, as this exchange between two designers suggests:

> Laura: <*Holding a concept sketch*> So there's a difference between planning and collecting ideas and then once you've booked those things and they become an actual itinerary <*gestures to one of the big needs Post-its*> then it's like tracking <*pauses*> yeah. <*Looks at the concept sketch*> So this is like idea-generating before (travel).
>
> Amy: Well <*pauses*> yeah. So there's ==
>
> Laura: <*Moves to the center of the board and starts waving her hands up and down*>
>
> == Cause like some of these things are ==
>
> Amy: == What you do in the moment. (Don't) over-complicate it. If this is one feature, that's fine.

Features not only have to be made to "jump out," from the concept sketches, but they have to be named and classified (as, for example, "in the moment"). As they move pieces of paper around, both designers and clients receive instruction from Amy on how to properly do it. I.e., Laura is not to "over-complicate" matters and make extra features where only one would do.

Activity 3: Breaking out the wall

Next, the group will, says Amy, "break the wall out into more granular features" by moving the feature Post-its to a blank whiteboard. There, they will "order the feature set," says Amy, "to help us come up with more ideas" until they have "all the possible features." "It's not to dictate anything in terms of the interface," she says, meaning that this exercise remains unconnected from drawing user interface schematics. It will only produce words. Staring at the whiteboard, Amy starts writing on smaller green Post-its, about half the size of the feature Post-its. Each small green Post-it has a few words on it, such as "Supporting information" or "New purchases." These, in the words of Amy's planning document, are "meta-solutions," or descriptions of multiple features. (Though Amy herself never says those words to her clients.) Amy first lines up four of these small Post-its in a horizontal row along the empty whiteboard that once held the concept sketches, then Laura and George start silently moving large features Post-its into columns below each small meta-solution Post-it.

Figure 5.3. The broken-out wall. Large Post-its are features; small Post-its label feature categories or "meta-solutions."

As George and Laura move Post-its, Amy keeps talking to the clients. She cautions the group not to get "too obsessed" with fitting each feature to a meta-solution. The point, says Amy, is to use the categories on the meta-solution Post-it notes to ask themselves "have we thought of all the features" for each, stopping when "everything's covered." She moves large (feature) and small (meta-solution) green Post-its to the board as she goes. As Amy starts adding new meta-solution Post-its, Laura and George move more and more of the features Post-its into the new columns. The effect is of a complicated dance, executed without either of them bumping into each other as they interweave. At the end, the column possesses the same number of Post-its, and there is no evidence of the movement of hands and Post-its. George and Laura start asking the clients questions, but Amy and Ina are still the only ones adding and removing Post-it notes.

The questions ask the clients to imagine a working system. "Does it [the application] know when you get off [the train]?" "Where do recommendations come from?" As the clients talk, Amy takes Post-its off the first whiteboard and replaces them with freshly written ones. Twenty minutes later, there is almost the same number of Post-its on the board as at the beginning — but thirty have been replaced with new ones. During the process, Amy is the only one who stands at the board in front of the group; Ina steps in front of the audience only to add or remove notes, then moves back into the crowd. During the course of the exercise, Amy has moved Post-its in

and out of the column. (See Figure 5.3 for an illustration of the final result.) At the end of the exercise, piles of green features lie crumpled and discarded on the conference table, to be thrown out at the end of the day.

Activity 4: Bang and buck prioritizing

During the final minutes of breaking out the wall, Ina draws two axes on yet another large whiteboard. She labels the vertical axis "Priority" and the horizontal axis, "Future." This will become a visual map of the timing and importance of the proposed features. Amy's notes for the workshop describe the exercise it will support as a "bang and buck prioritizing activity," but in conversation, she and Ina refer to it less colorfully as a "timeline exercise." As Ina says, "We can filter, but we want to know your priorities."

The final distribution of the Post-it notes on the board will indicate the clients' collective wishes to the team. The height of a Post-it note's placement on the Priority axis represents ease of technical implementation, while the left-right position on the Future axis indicates whether, for business

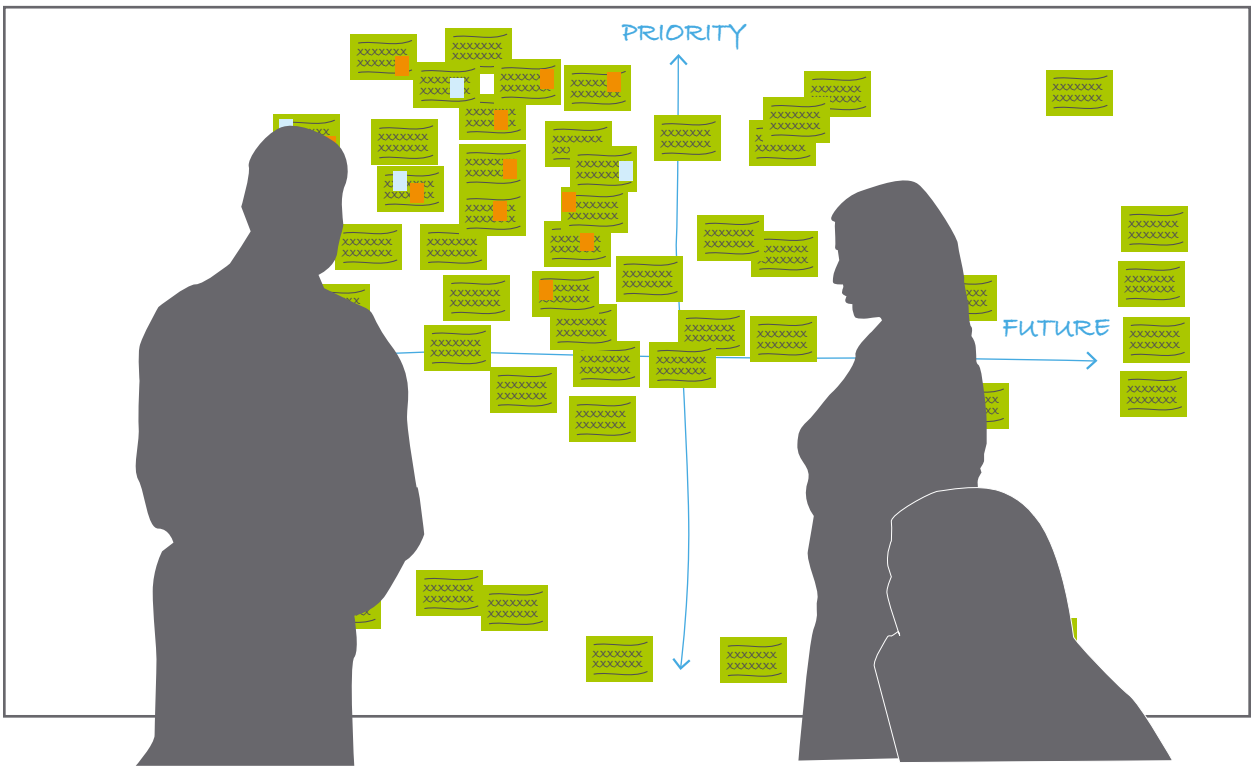


Figure 5.4 "Bang and buck" prioritization. Ina (top right), the project manager, asks a client (standing, left) about the technical feasibility of a feature as Amy (lower right) looks on.

reasons, the feature should be implemented "now" or "later." Amy prompts the clients to start moving green feature Post-its from their columns onto the empty timeline. They have an hour to place the 54 green features Post-it notes along those axes. Ina and Amy quietly discuss the axis names as they watch the clients move Post-its. Should the "now" and "future" points should be labeled "easy" and "hard"? Ina says, "We would need to know how hard [it is to do]. Because I don't know how hard it is." She continues, laughing: "The designers know how to design, but they don't know how hard it is to build in their systems."

Amy, now convinced by Ina that they need to integrate the engineers' perspective explicitly, decides to do a round of "dot voting." She divides the clients into two groups: technical experts and business experts. Amy asks the business experts to place orange stickers on the features they want built "now," and the technical experts to place blue stickers on the features they believe they are able to build "now." "In deliverables," she says, "the wireframes will reflect the results of this exercise <*points to orange and blue cluster*> and the roadmap will reflect this <*pointing at the 'future' side of the axis*> too."

As the clients scurry about sticking blue and orange stickers onto Post-its, Amy leaves the whiteboard and sits down next to me. Unasked, she whispers her rationale for this exercise. For her, there is an "optimal way of doing things" and a "realistic" way. Her "optimal" plan for the exercise would have had the clients sort the feature Post-its "by business and user priorities separately," and only then sort by technical feasibility. Instead, pressed for time by her clients' tight schedule, she is taking a "shortcut." This is, she reminds me, not the first time she has taken a shortcut on this project — last week she also compromised on the research data analysis, classifying the people the team interviewed into top-down categories first, instead of inductively building and labelling groups of Post-it notes to generate categories. *It seems,* I think, but do not say, *that every shortcut on the project is on the subject of "user needs."*

Ten minutes later, there is an overlapping cluster of blue- and orange-stickered Post-it notes on the middle-left region of the whiteboard (illustrated in Figure 5.4). Amy will photograph those notes at the end of the day, hand-copy them into a spreadsheet, and, over the next two weeks, use the spreadsheet to generate a proposed feature set for the application. They need an application working in less than three months. So right now, keeping to the schedule, they will move on.

After the workshop

Immediately after the clients leave, Amy and George photograph all the whiteboards. The Post-its are cleared off and thrown away. Their job done, they are no longer necessary. It is the digital photographs as immutable mobiles (Latour, 1988) that will continue on within the project. On Monday, Amy will transfer the words on each photographed feature Post-its into a row on a digital

spreadsheet. She will then assign each row a "business value" number based on its position on the feature prioritization grid and the stickers, if any, placed on it. Ranked by numeric business value, the rows will then form the basis for the feature roadmap. But what makes this later sequence of translations and transfers possible is the collaborative work of the clients and designers to add, group, and remove Post-its, sketches, and stickers from the whiteboards.

Material modes of practice in the feature workshop

By the end of the feature collecting exercise, the movement of Post-it notes on the whiteboards of MediumFirm have mapped out the relationships and attributes of three entities: the business, its customers, and a proposed system that will mediate the relationship between them. These attributes are largely abstract: goals, needs, motivations, priorities. Some of what interaction designers produce, such as graphic interface elements, can be accessed and manipulated as graphic representations. There is, for example, a strong iconic correspondence between the black-and-white outlines of wireframe sketches and the screens they specify. The attributes on the whiteboard are different: they are present only as sticker colors and words on small, movable pieces of paper.

The feature collection workshop involves four major activities: making features jump out, pulling features out, breaking the wall out, and prioritization. Each tactic changes the relationships between the designers, the Post-it notes, and the features. In making the features jump out, the team manipulates figure-ground relationships in order to make obvious features that might otherwise go unnoticed: the green notes stand out vividly against the white concept sketches; the orange and blue stickers foreground the more feasible and desirable features. In pulling features out, the discussion leader extracts words from pictures and from clients by asking questions. In breaking the wall out, the team takes individual features littering the board and lines them up into groups, not incidentally also breaking the links between concept sketch, feature, and user need. In prioritization, clients order the collection of Post-its by placing them on a grid and tagging them with colored slips of paper. All the activities on rely on the visual coding (C. Goodwin, 1994) of fields of discrete Post-its by designers and clients. But how are those visual fields formed? The following section describes four main material modes of practice (Knorr-Cetina, 1999) that produce the perceptual fields for the designers and clients to analyze.

Tokenizing

As Lawson writes, "The designer externalizes some features of the design situation in order to examine them in a more focused way" (Lawson, 2004, p. 46 emphasis mine). In tokenizing[4], the first step of externalization, the attributes of systems, humans, and corporations are identified as discrete components, named (Bucciarelli, 1988; Schön, 1988), and listed (Tang, 1989). Negotiations over what to list and how to name it produce agreements between designers and clients. In the workshop, these lists take shape as collections of tangible objects, such as Post-it notes, that humans can physically move about and transform.[5] I use the word "tokenizing" because these objects function in negotiation as tokens,[6] in the sense that they are meaningful in themselves, but also represent otherwise invisible objects of knowledge, such as system features or user needs. The Post-its that reach the whiteboard represent only a partial view of the tokenizing process. Partial, in that they incompletely document the conversation — not every statement made by MediumFirm's clients makes it to the whiteboard. But also partial, in that the writer of the notes rephrases what she sees or hears to fit on the note. So the notes placed on the whiteboard during MediumFirm's workshop are not views from nowhere (as described by Haraway, 1990). They[7] encapsulate specific encounters between a designer and her clients. Questions of partiality prompt us to consider: How are smaller units structured? What to include in the list, or exclude? How to name it? And, of course, who gets to decide what is put on the list, or left off?

4 The activity of tokenizing, as an activity, is rarely appears in studies of design (with the notable exception of Tang, 1989). However, certain tokenizing techniques are common throughout the industry. Instructions for listing are available in terms of brainstorming for idea generation; the photographs of workplace activity that decorate consultancy's websites often show whiteboards covered in Post-its. Textbooks and professional manuals (e.g. Cooper, Reimann, & Cronin, 2007) often recommend breaking interview transcripts into lines of text on Post-it notes or spreadsheet rows.

5 This feature workshop relies on widely used instructions from (K. Goodwin, 2009). IDEO's free Human-Centered Design Toolkit provides alternative instructions (IDEO, 2009).

6 Some tokens take the form of words on a screen or paper; others are graphic shapes such as the boxes and shaded areas of wireframes. The most traceable tokens, however, are Post-it notes.

7 Not all processes of movement from interview to Post-it are so partial; some firms more focused on user research work from complete transcriptions. Often, these companies use spreadsheets instead of Post-it notes. Nevertheless, there is still a process of decomposition involved in deciding where to break up each utterance line by line into spreadsheet rows.

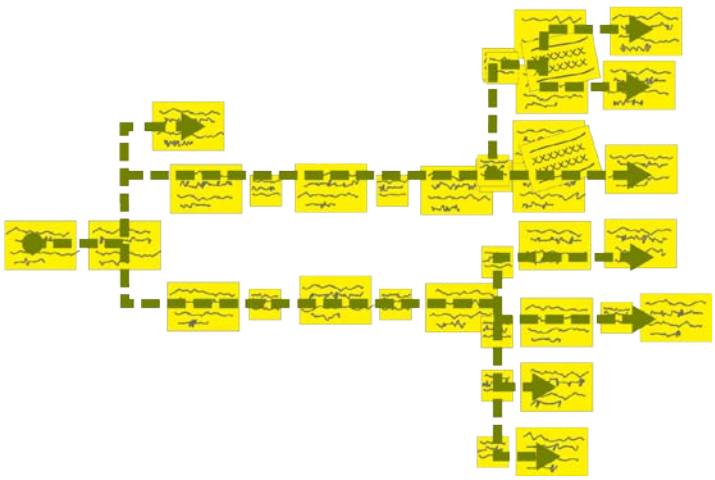


Figure 5.5 The yellow Post-it notes represent steps that users must take to buy different types of tickets. The green arrows represent how the designers at MediumFirm read the whiteboard to derive linear sequences.

Grouping

Grouping is the act of making associations between tokens by visually coding them into different categories. The items are perhaps quotations from a set of interviews, design concepts for a new product, or (as for Eurotrips) a list of potential features. Episodes of grouping prioritize project tasks for completion, sequence the screens necessary to fulfill a system's purpose, and determine the distribution of objects within a diagram, such as a wireframe. The rhythms and dynamics of placing, moving, and removing items texture activities of grouping. The Eurotrips workshop relied on three different grouping activities.

› *Clustering* In order to get the features to jump out, Amy and the group cluster Post-its and concept sketches. *Clustering* is the name professionals commonly give (e.g. "Parallel Clustering," 2010) to an activity in which tokens representing discrete concepts are physically moved closer or farther apart. The tokens can then serve as material anchors (Hutchins, 2005) for reasoning about similarity or difference. This works particularly well with Post-notes, because the notes' adhesive backing is tacky but not permanently sticky, allowing Post-its to move around a vertical surface. Clustering may be self-referential, as when the clients made clusters of related concept sketches, or it may rely on background inscriptions (as in the bang and

buck prioritization activity). These clusters are then often labelled, usually with another token (thus, in a sense, tokenizing the whole cluster). Those labels, in turn, can be clustered themselves. The canonical clustering activity involves Post-it notes (sometimes in the hundreds), but can also involve rows on a spreadsheet. The goal is to create a visually legible ordering of the whiteboard, as when Amy justifies a particularly time-intensive Post-it clustering exercise as "a good way for the client to see the needs," better than "linear notes from each person" (Fieldnotes, February 23, 2010). She even suggests markering a circle around each cluster to make the pattern more visible.

› *Tagging* Adding other objects, such as the markered circles, to specific tokens in a collection can make them more visually prominent. This activity, sometimes called "tagging," is a common exercise in interaction design workshops (Brown, 2009). In the feature prioritization exercise, Amy asks the members of the client team who are business experts to place orange stickers on the features they want completed "now," and the client team members who are technical experts to place blue stickers on the features they believe they can build "now." Afterwards, Amy explains that the deliverables produced by the consultancy will "reflect" the visual grouping of orange and blue.

› *Sequencing* Flows, one of the main types of diagrams that interaction designers deliver, represent all the steps required, in linear order, for a user to accomplish a specific task. After feature prioritizing, Amy asks the group to make a task flow for buying different types of tickets, a "use case" that the group has decided is particularly important to the application. Once again, they use Post-it notes, with each Post-it representing a step in the process.[8] Figure 5.5 shows the result this exercise, a tree-structure whose linear branches anchor the group's reasoning about each step's preconditions and results.

Accretion

As the exercises progress, paper and markers begins to cover the whiteboards.[9] In some cases, as with the labelled sketch clusters in Figure 5.2, one layer partially obscures another in order to emphasize the primacy of the top layer. In other cases, as with the stickers that mark technically feasible and managerially desirable features (Figure 5.4), the addition of a new layer highlights spe-

8 Such processes are widely used by interaction design consultancies. See IDEO's Human-Centered Design Toolkit (2009) for an example of creating an "implementation timeline."

9 It is not unusual for similar design workshops to produce "hundreds" of Post-it notes (IDEO, 2009).

cific items in an entirely visible field. In the latter case, accretion documents a decision: to focus on one feature over another. As Suchman writes of whiteboards in cognitive science research, items on the board "index an horizon of past and future activities" (1988, p. 321).

Over time, accretion turns perceptual fields, such as slides in Keynote or whiteboards, into collages and palimpsests. As collages, they combine discrete objects (like "user needs" and "business goals") while maintaining boundaries between them with differently colored Post-it notes and markered boundary lines. They are palimpsests, maintaining a record of ephemeral gestures in accreting layers[10] of objects. Accretion traces the logic of decision-making by building a stack of successive representations. It preserves what is past, and points towards next steps. In the former case, accretion often serves as evidence of effort, as when Amy periodically points to a whiteboard entirely covered with layers of colorful Post-it notes during data analysis, during a presentation of the results. The hundreds of notes on the whiteboard serve as a persuasive backdrop for her presentation of the personas making visible the days of work that might otherwise go unrecognized.

What is significant, though, is that the persuasiveness of the Post-it notes lies not in their simplification or stripping away of detail (as argued by Latour, 1986), but in the progressive addition of more inscriptions: more layers of Post-its, more differently sized labels, more stickers, more markered annotations. As evidence of local agreements, they convince as they accumulate, "conscripting" rather than inscripting (Henderson, 1998) Amy's audience into a shared vision of what should be built.

Removal

Erasure, of course, follows accretion. That is the logic of project work in interaction design consultancies. One whiteboard is erased to make way for another exercise in tokenizing and grouping; when a project is over, the project room is cleaned out. Whiteboards in particular host a perpetual swirl of erasable markers and flimsy Post-its. Cleared at end of activity; cleared at end of project: whiteboard erasures mark transitions. As a limited resource, whiteboards can hold items only so long as the items remain relevant. Inactive whiteboards do not remain untouched for long in a busy studio. As soon as the reflective conversation (Schön, 1983) articulated by the whiteboard is resolved (as in many of the whiteboard-based exercises of the client workshop), whatever was on the whiteboard is deleted. Sometimes a snapped photograph documents the whiteboard's state — but

10 As I discussed in Chapter 4, digital files are also built in layers, with annotations resting atop of screen designs atop page templates.

often, what happened on the whiteboard disappears without a trace. Routine erasure means that everything preserved on a whiteboard demands continued visibility across the entire project room.

Tokenizing, grouping, accreting and removal are, like many other design activities, ordering practices[11] (Suchman, 2004). Tokenizing decomposes the components of prospective systems into discrete items, or tokens. Grouping is the act of creating and populating named categories through the manipulation of list items, such as lines in an Excel spreadsheet or Post-it notes on a whiteboard. Clusters are produced and revised through the distribution of tokens into categories that occupy separate spatial regions in the same, clearly bounded, visual field.[12] In clustering, teams transform categories through moving tokens into clusters or lines.[13] Over time, the whiteboard accretes layers of tokens, documenting collaborative decision-making.

But not everyone has equal access to the whiteboard and the power to draw things together. Despite their financial advantage and presumed better understanding of their own business, the clients rarely touch the Post-its. At the request of Amy, clients and junior designers place stickers on Post-its and occasionally move them into clusters, but only Amy or Ina write on the Post-its, add them to the board, or remove them. As ordering practices, the placement and naming of collections of tangible[14] tokens assigns various capabilities, needs, and goals to the entities at stake: users, clients, systems, and designers.

11 Not incidentally, this vocabulary echoes that of the studies of science-in-action: "Labelling, marking, repeating, cleaning, numbering, noting, interpreting" (Law & Mol, 2001, p. 609).

12 In interaction design (though not in all forms of design), the same holds true for drawings. Designers place categories of digital information, such as "navigational menus" or "hero photographs" into graphically distinct regions on the screen, delineated through shapes and colors.

13 In drawing, designers transform wireframes, flows, and site maps by moving and resizing graphic elements, deleting and adding them, or editing the names of hyperlinks and the text of annotations. For the purpose of this analysis, it is useful to think of clustering and drawing as two ways of doing the same thing (In contrast, to, say, an analysis focusing on the core "design competencies" that should be taught in an undergraduate program of interaction design.)

14 It is common to describe work with a mouse as "digital" and all other forms of manipulation as "physical." Theoretically, "hand" craft includes the work of manipulating a mouse and "pixel-pushing" on screen (McCullough, 1998). I have argued elsewhere that the language of "virtual" and "physical" is not helpful in accounting for the experience of craft labor, such as gardening (Goodman & Rosner, 2011), in which software and hand tools are intermixed. The same is true for interaction design. The realm of the tangible does not exclude digital objects.

5.2 Creating a forum of alignment

> Ina: Any other features are really jumping out that you like? <*Client says nothing, but points an index finger to one of the concept sketches*> (Fieldnotes, March 1, 2010)

In the previous section, I followed the manipulation of textual data through listing, grouping, and accreting paper tokens. This manipulation materializes discourses of needs and opportunities as "concrete conceptual objects" (Suchman, 1988, p. 319). In this section, I want to look more closely at how that work of materialization relies upon an ecology of two tools: the whiteboard and the Post-it note. Together, whiteboards, Post-it notes, and Sharpie pens do not only represent existing features but produce new ones. They do so, I will argue, by functioning as a *forum of alignment*, which allows designers and clients to "constitute a graphic space" (Lynch, 1985) and enlist humans (such as clients) and non-humans (such as Post-it notes as concrete tokens and user needs as symbolic concepts) into supporting the feature list. Thus there are two different types of material politics taking place on the whiteboard: first, aligning of perspectives of the designers and the clients; second, selectively forming associations between human, business, and system capabilities.

Ina's question to the client demonstrates the central negotiation in making the feature list. The metaphor of "jumping out" suggests that somehow, from the combination of concept sketches and user needs Post-its, the features — and the words to label them — will make themselves visible. That they are immanent in the needs and concepts. But in practice, the process is more extractive: Ina must ask the client about her preferred features in order to make them visible. Designers like Ina have to pull out the features from clients and sketches by asking questions about business rules, technical logics, and preferred terminology, as well as having the clients move and tag Post-its. So even though the design leads are the only ones with access to the pen and pad of notes, there is not one professional vision (C. Goodwin, 1994) mobilized here as Amy writes and places Post-its, but *visions*.

The visibility of a feature cannot be taken for granted; it is accomplished by local coordination between people, Post-its, and whiteboards. One way to understand the central role of the whiteboard in assembling a feature list is as a facilitator of collaboration between representatives of different organizations and ways of seeing the world. In-house interaction designers face similar challenges in translating the perspectives of their organizational partners — engineers, managers, and marketers — into design specifications (Cooper et al., 2007; K. Goodwin, 2009; Saffer, 2009). Yet the organizational separation and temporary contractual relationships between design consultants and their clients magnify and make more visible the chasms that separate their perspectives on

the project. Nevertheless, the success of the project rests on how well representatives of different organizations, with different concerns, together define a shared object: the system and its features. Hence, Ina's words to the clients at the beginning of the feature-tagging exercise, "This is what we need you guys here for. We depend on you" (Fieldnotes, March 2, 2010).

Interaction designers often describe the work of accomplishing this shared object as "alignment" with clients.[15] Stokes and Hewitt (1976, p. 843) identify two dimensions of alignment. *Interactional* alignment, drawing on Blumer (1986), is the "process in which people orient their conduct toward one another and toward a common set of objects." *Cultural* alignment, however, is the attempt to remedy "discrepancies between what is actually taking place in a given situation and what is thought to be typical." Continuing articulation activities (Strauss, 1988), such as this feature workshop, are necessary for the maintenance of alignment in the cross-boundary project work that characterizes interaction design consultancies. And indeed, both types of alignment are at stake in the Eurotrips project and in the features workshop. When the designers ask their clients to stick little orange and blue squares on the feature Post-its, they are simultaneously trying to learn their what their clients expect of them *as design experts*, and to teach their clients about the limits of what even well-regarded experts can do given the short timeline and small budget.

On their way to alignment, what Amy and company are hoping to get from the client workshop is, in part, interactional expertise in their clients' domain. Interactional expertise is "what you get from immersing yourself in the linguistic culture pertaining to a practical domain rather than the practice itself" (H. Collins, 2004, p. 127). Interactional expertise does not require full membership in a community, or the ability to carry out key tasks. It just requires the ability to speak the language well enough to be understood. The designers don't have to build the Eurotrips application themselves, nor will they market and manage it. The feature collecting exercise will enable the designers to develop enough interactional expertise to produce a set of system specifications, including a feature roadmap, aligned with their clients' technical and business concerns — not to mention their clients' expectations for what the designers will deliver.

It is by now conventional to analyze design (Schön & Wiggins, 1992) — as well as cattle breeding (Grasseni, 2004), botany (Ellis, 2011), engineering (Suchman, 2000a), and archaeology (C. Goodwin, 1994) — as practices of skilled professional vision. In this line of thinking, what sums up a "visual culture" is how it defines both "what is is to see" and "what there is to see" (drawing on C. Goodwin, 1995; Henderson, 1991, and Latour, 1990). In accounting for the material politics of fea-

15 The designers of MediumFirm didn't explicitly use this term in my presence, but I saw it used on other projects to describe similar situations, and it is frequently used on personal resumes and promotional websites for studios. 'Alignment' with clients appears to be a common concern across design disciplines, as illustrated in Lawson (2005).

ture collecting, I am proposing a respecification (Suchman, 2006) of certain professional practices of *seeing* in interaction design as practices of *showing*, enacted in performances. The concept of showing helps us account for the practical consequences of ordering activities by emphasizing the relational and situated dimensions of vision. Designers do not just see *as* or see *that* (Schön & Wiggins, 1992), but also see *for*. Professional seeing, in the context of interaction design, results from performance-based showing. In the Eurotrips workshop, performances centered on whiteboards[16] and Post-its serve as resources for showing in four ways:

(1) They show designers how clients want to order the project, as in the feature tagging exercise.
(2) They show clients how designers want to order the project, as when Amy, George, and Laura break out the clustered wall into neat columns of features they believe are related.
(3) They show both designers and clients previously unknown aspects of the project, as when wall-size clusters of Post-its distribute the work of seeing features to the visuals.
(4) They show the boundaries between designer and client, through the limits on adding and removing tokens and bodily orientation to the whiteboard.

To understand how these activities configure (Grint & Woolgar, 1997) users, systems, clients, and designers, we need to consider the logic and politics of showing: who shows, how it showing, what is excluded from sight, how negotiations over what is shown are concluded. The feature collecting exercises depend on collective orientation to a single field. The whiteboards in use during these exercises are wall-sized, large enough to create a shared field of vision and action. Multiple people can draw and move Post-its on a whiteboard at once; what they write and place can be seen across the room. People orient to whiteboards through gaze, body position, and talk — or to the person standing in front of one, holding the pen and Post-it note pad (see Figure 5.1).

The whiteboard's edges form a stage for action. Placing and removing Post-its from that stage indicates their entrance to and departure from the scope of the discussion, if not the project. Amy, in turn, functions as a performer on the stage set of the whiteboards. Standing in front of the whiteboard, she directs the movement of her audience's gaze from one spot to the next and the progression of people and Post-its from one whiteboard to another. The spatial organization of different forms of Post-its on the whiteboard shows people how they are divided into groups, and serves as a resource for establishing who may touch it. Whiteboard work stabilizes who is in the firm and who is out, what clients are and what they can do; who the designers are and what they

16 While this analysis focuses on the role of the whiteboard, it also applies to other wall-size venues for the movement of tokens. In design sessions, for example, designers often use large projections onto walls or screens to make visible their manipulations of wireframe elements. This use of projections, however, is limited in comparison with the omnipresence of whiteboards, walls, and small paper tokens.

can do (Table 5.1). As Amy half-jokingly tells her clients as they move Post-its from one board to another: "I'm worried you guys are doing too much organization and reorganization" (Fieldnotes, March 1, 2010). At the same time, moving Post-its is a mode of communication between designers and clients, as when Ina tells the clients at the beginning of a feature-tagging exercise, "This is what we need you guys here for" (Fieldnotes, March 2, 2010). The concern for who should move the Post-its, and how often, articulates a disciplinary and organizational boundary between the managers of Post-its (the designers) and their audience (clients).

The literature of skilled professional {Goodwin, 1994} vision has examined the visual coding of perceptual fields that seems to already exist — whether cattle (Grasseni, 2004) or clods of dirt (C. Goodwin, 1994). Here, what has to be made visible and tangible in design strategy exercises such as feature collecting are largely invisible concepts: user needs, business goals, system features. In turning to Post-it notes, interaction designers make a physical practice out of immaterial concepts in order to build a consensus view of the project with clients. The needs, capabilities, and priorities exist only as "visual traces" (Latour, 1986, p. 10). Whether the features jump out or are forcibly pulled out, they must be turned into tokens, or "concrete ideas" (Suchman, 1988). Only then can the feature collection exercises distribute reasoning about prospective users and systems between people, whiteboard, and Post-its. They must first create objects in order to show themselves what they know. I will argue that in these acts of showing, the whiteboard functions not as a demonstrative *theater of proof* (Latour, 1988; Simakova, 2010) or *theater of use* (Smith, 2009) but as a generative *forum of alignment.*

The importance of Post-it notes and whiteboard to pulling out the features recalls Galison's notion of the "trading zone." The trading zone, for Galison, is a "partly symbolic and partly spatial" (1997, p. 784) site that facilitates coordination and exchange between different groups and cultures. In a trading zone, different groups can maintain entirely different goals and means for the collaboration through the use of a "contact language," or a creole, which both can speak but belongs wholly to neither. In MediumFirm, the different cultures are those of the designers and their clients; the symbolic and spatial site of exchange is the whiteboard. The Post-it notes work as

Users/customers	Business/clients	Systems/concepts
Goals Needs Behavior Motivations	Goals Needs Priorities Capabilities	Features Use cases Flows

Table 5.1. Three main groups and their attributes as figured in Post-its on the whiteboard over the course of the workshop

a kind of a very limited contact language[17] — a pidgin — that uses objects to facilitate local alignments between the designers and their clients during the workshop and over the project. However, MediumFirm's effortful acquisition of interactional expertise suggests some differences between the whiteboard and a true Galisonian trading zone.[18] In a trading zone, the exchange partners need only use an interlanguage — a language that belongs to neither — to communicate. In this case, the designers' need to please their clients produces asymmetrical acquisition of expertise: the designers are eager to learn their clients' language, but do not require their clients to draw, speak or otherwise communicate as designers would. Moreover, in a true trading zone, each group would be able participate successfully while maintaining its own perspective on the question at hand. For the designers of MediumFirm, the whole point of the whiteboard exercises is to acquaint them with their client's business and their expectations for the project.

Instead, we should think of the whiteboard as a cousin of the trading zone: a *forum of alignment*. I have already discussed the idea of alignment — but why forum? As sites of organized performance, the architecture of physical forums separates people into actors and audiences (Schechner, 2013) — or people who write and place the Post-it notes, and people who look on. Yet classically, forum activities also include audience participation — just as the clients have some limited access to the whiteboard. Moreover, the contact language of Post-it notes relies on whiteboard-facilitated relationships of spatial scale, bodily engagement, and gaze orientation. The whiteboard, as Suchman writes of board work in cognitive science, "structures mutual orientation to a shared interactional space" (Suchman, 1988, p. 319). That is to say, the whiteboard facilitates practices of relational showing. Everyone in the room orients to the whiteboard, but not everyone can affect it in the same way.

The Post-it (or any adhesive-backed piece of paper) is a movable token, the whiteboard a large, flat region. Sticky enough to cling to a vertical surface, yet easily moved; available cheaply and in bulk; sized and shaped to the human hand: Post-it notes are not easily replaced as tools of collaborative work in conference rooms.[19] Along with the wall-sized whiteboard, Post-it notes enable a curious blend of ephemerality and permanence. Whiteboard scrawls are easily erased — or kept for weeks; Post-it notes can be thrown away — or removed for permanent safekeeping. Post-it notes

17 Galison's notion of contact languages includes "structured symbolic systems that would not normally be included within the domain of 'natural' language" (1997, p. 835).

18 This comparison is inspired by Collins et al.'s analysis of trading zones and interactional expertise (2010).

19 See Irani et al.'s account (2010) of the lengths to which a small Indian design firm goes to secure office supplies that the designers of MediumFirm take for granted.

— and the four modalities of practice they afford — are central to collecting features. The combination of token and flat wall allows groups of people to negotiate and map associations between entities, played out in the embodied manipulation of differently colored and shaped flat tokens. With different features, needs, and priorities normalized (Lynch, 1985) into identically sized and shaped tokens, the resulting "optical consistency" resembles Latour's description of single-point perspective in drawing: "All the elements made so homogeneous in space that it is now possible to reshuffle them like a pack of cards" (Latour, 1986, p. 6).

Optical consistency enables the distributed cognition (Hutchins & Klausen, 1998) of feature-showing to take place between whiteboard, Post-its, and people. The first time Amy asks the clients to cluster the Post-its, she frames it as a way to generate new conclusions, saying: "Then we'll see the visual of what those clusters look like" (Fieldnotes, March 1, 2010). As the workshop participants make a few larger groups out of many smaller Post-its, they get an ordered perceptual field — i.e., a visual (see Figure 5.2 and Figure 5.4 for examples of visuals). The results are delegated to the whiteboard and Post-its: neither the designers nor the clients know what will be shown before they get "the visual." The group needs to see the placement and wording of those big needs and meta-solutions in order to come to a conclusion and progress to the next step in the workshop. Later, in the feature prioritization exercise, it is the placing of individual orange and blue stickers that makes the visual — a discrete cluster of colored blobs indicating the clients' collective desire to see a small number of features implemented as soon as possible. This is "thinking with eyes and hands" (Henderson, 1991; citing Latour, 1990), in which "people and things are mobilized in performances" (Nickelsen & Binder, 2008, p. 6). Post-it notes are just one actor in these "persuasive performances" (Suchman, 2000b), as designers and clients come to define the situation through acts of showing.

In the case of interaction design, "optical consistency" makes user goals, systems features and business needs available for "heterogeneous engineering" (Law, 1987), enabling new associations between them.[20] Post-it notes come in only a few sizes and colors, and the heterogeneous engineering taking place at whiteboards turns on that restricted visual vocabulary. These material acts of heterogeneous engineering — tokenizing, grouping, accretion, and removal — allow features to "jump out" as the combination of user needs and system concepts, and make them see-able as thick clusters of Post-it notes. The goal is not, as Latour points out, "realism," or a direct corre-

20 The optical consistency that so visually dominates the walls of design studios is also present, at a smaller scale, on computer monitors. As George tries to work through the "essentials" of the project, he makes a flowchart-style diagram to "take the user goals and balance them with the business goals" (Fieldnotes, March 5, 2010). As I have remarked before, boxes and arrows are the grammar of interaction design. The same equivalencies of size and shape that produce associations on the whiteboard can also work to "balance" different goals on the monitor through the shuffling of digital cards.

spondence to an objectively existing external world. Instead, the result of grouping, accretion, and removal on a whiteboard is best described that of internal consistency[21] — the determination of "everything that needs to be there."

Whiteboards articulate multiple perspectives. As suggested by variations in handwriting, syntax, and grouping, both designers and clients participate in this collaborative process of moving Post-its. The routine work of grooming whiteboards — of tidying straggling clusters of Post-its, of moving notes between boards, of cleaning off used boards — requires substantial attention and effort. It is, however, effort explicitly assigned to the designers, not the clients. Instead, clients are only allowed to move and tag existing Post-its. Amy (and sometimes Ina) is the one who asks questions, writes the notes, adds them to the board, and removes them. She is, quite literally, the obligatory passage point (Callon, 1986) for entry of features onto the board, and hence into the project. Control over Post-it writing, placing, and removal shapes decisions about what features the designers are supposed to include and exclude, or even what counts as a feature in the first place. Amy does not, however, have total control. The Eurotrips clients influence what goes on the whiteboard through talk, using their contractual power over the course of the project to affirm or argue with the designers' actions. Nevertheless, this collaboration is orchestrated[22] by Amy.

So whiteboards also enact a politics of materials: how the flows of Post-it notes onto, across, and off whiteboards articulate relations between designers and clients. When the designers and clients sit around the conference table and talk, the clients take the initiative: they raise questions, take issue with statements, push for different priorities (such as the importance of having an iPhone application rather than a mobile web site). When Amy stands alone in front of the projector, or in front of the whiteboard, she goes unchallenged. In speaking for the user research during the presentation, and then speaking for the Post-its clusters during the workshop, she enrolls (Callon, 1986) both personas and Post-its in her plans for the project. Thus the forum of alignment relies upon the materiality of the whiteboard as a kind of stage, in which tokens, once visibly grouped and accreted, act as both props and actors.

A "network" seems too clean and orderly a metaphor for this accretion of layers of sticky notes and marker scrawl. Instead, Ingold's language of "entanglement" (Ingold, 2008) more closely evokes the material texturing of studio work in drawing together clients, designers, user needs, business priorities, and technical capabilities. Preserved in photographs and private notes, it is this

21 I will take up this notion of the internal consistency of objects again in the next chapter, as a bodily affect produced by designers' embodied performances.

22 Chapter 8 contains a longer description of the skills necessary for such orchestration of client encounters.

entanglement that forms the "all" that the designers are trying to cover. The ordering of humans and non-humans figured in these activities does political work: who shows, how things are shown, what is hidden from sight, how negotiations over what is shown are concluded. Orienting the people in the room to the whiteboard and managing the Post-its are part of "the practical politics of classifying and standardizing" (Bowker & Star, 1999, p. 44) at work in specifying a ticket-buying application. In this way, a forum of alignment, like a trading zone, is both spatial and symbolic.

5.3 Conclusion

> A classification is a spatial, temporal, or spatio-temporal segmentation of the world. A 'classification system' is a set of boxes (metaphorical or literal) into which things can be put to then do some kind of work — bureaucratic or knowledge production (Bowker & Star, 1999, p. 10).

I have just described the whiteboard/Post-it note ecology as a *forum of alignment*. The boxes of the Post-it notes and the whiteboard allows representatives from different social worlds to enact a shared view of the system and its features, while forming new associations between user needs, system concepts, and business priorities. What underwrites this theatrical metaphor, I argue, is the concept of *showing*. In order to successfully *see* the features that they will sculpt into system specifications, designers must successfully *show*. It is this showing that assigns identities and capacities not just to user, system, and business, but to client and designer as well.

Post-it notes on a whiteboard are, literally, boxes that classify people and systems: the attributes of one, the features of another, and the "distribution of competencies" (Akrich, 1992, p. 207) between them. Users and systems are the most obvious actors co-constructed (Grint & Woolgar, 1997; Oudshoorn & Pinch, 2003) from this movement of boxes on whiteboards. Yet while the standardized shapes and colors of Post-its create an optical consistency between user needs, business goals, and feature ideas, interacting with them produces inconsistencies, or differences, between people. Who is standing in front of the whiteboard or projected image? Who is holding the Post-its? Who is speaking? The configuration of bodies, talk, and gesture around large displays enacts group boundaries and identities. The articulation work (Star & Strauss, 1999) of managing Post-it writing, addition, and removal has consequences. While they may refer to taken-for-granted facts about humans, markets, digital systems, et cetera, design specifications are not intended to accurately reference an external, pre-existing reality. They are prospective, indicating what could or should exist.

The attempt to include *everything that needs to be there* makes the MediumFirm team not just responsible to their own internal agreements about the nature of the actors at stake in the project, but also to agreements they have made with their clients. The design team orchestrates the exercises of the client workshop, but the clients are paying for the project. They are invited — repeat-

edly — to make suggestions, question or affirm decisions, and move Post-its. As a result, the whiteboard is not the sole "owned territory" of designers. It is instead the effect of a series of agreements negotiated between the designers and their clients, about what should be seen. It is also the result of authority delegated (Latour, 2005) to the tools they use — the half-stickiness of the Post-it notes, the erasability of the whiteboard, the visibility of the big black markers.

Interaction design does not just depend on making "everything" — needs, goals, behaviors, and features visible in a shared field. It also depends on negotiation between designers and clients about what the "everything" "needs to be." The negotiations may result in decisions by the clients, in mutual agreements made explicitly between clients and designers, or in collaborative alignments enacted by placing tokens and linking them together. So it is not surprising that designers put so much effort into *showing* — that is, displaying objects so that they can be appropriately seen, and so that the meeting participants can witness each other move them. These decisions and agreements, made through the politics of tokenizing, grouping, accretion, and removal of tokens, distribute competencies between designers, client-businesses, users, and systems. They put the classifications embodied in the Post-it note boxes to work. In effect, in order to get the agreements necessary to make them "do work," the classifications generated by interaction designers are not only *seen*, but *shown* in a forum of alignment.

CHAPTER 6

"You can draw way too much with a pencil": The knotwork of scoping

This chapter returns to the designers of MediumFirm as they make specifications for the Eurotrips mobile rail travel application. Even with a feature list in hand, the designers of MediumFirm have many decisions left: which features from the list to specify, how to implement them, and how to communicate the implementation details to developers. That is, the team must define the scope of the project together with their clients.

"To scope" is to define the extent of work. For interaction designers "scope" comprises two related domains (Cooper, Reimann, & Cronin, 2007). The first is that of product functionality. Which features to implement, out of all those possible? Incremental "feature creep" can make applications unwieldy to develop and hard to use (Saffer, 2009). Too little functionality may make a tool practically useless. The second domain is that of project goals. How much of the product's functionality will the current venture specify? Designers with limited time often leave much about the product open for negotiation as it is being built, rather than specifying all the relevant features before development begins. And at what level of detail will the specifications articulate the functionality that it does specify?

Resolution, as the "level of detail or sophistication of what is manifested" (Lim, Stolterman, & Tenenberg, 2008),[1] has more than one meaning. Resolution can indicate: fidelity to the material qualities of the proposed product; the professional appearance or "polish" of the specifications; and the amount of explanatory annotation provided. "High-resolution" wireframes likely include not just every graphic interface component present in the working application, but also

1 This taxonomy of scope draws on Lim, Stolterman, & Tenenberg's "anatomy" of interaction design prototypes (2008). This analysis treats "materials," "scope," and "resolution" as separate dimensions of prototypes. That flat ordering does not match how the designers I met used them in negotiating project scope. So, I have complicated Lim et al's flat hierarchy slightly, so that resolution is a subdomain of scope rather than a separate category of concern altogether.

text annotations, organizing symbols like arrows, appealing colors, official logos, and the like. Specifying too few product features at too low a resolution can decrease what designers call the "actionability" of deliverables (D. M. Brown, 2010). Such documents may offer too little guidance on critical technical decisions, and fail to address the concerns of influential project constituencies (Goodwin, 2009). Specifying too many features at too high a resolution may contribute to feature creep. Moreover, audiences may find the resulting specifications overwhelming, unnecessary, or irrelevant (Danzico, 2003).

Scope as an organizational concern emerges from interactions among three major resources required for interaction design projects[2]: digital storage, computer processing power, and labor hours. The technical limitations of computers and display devices in the 1980s led to rigid constraints on the amount of functionality and the complexity of graphic interface design that programmers could implement. Software designers and developers laboriously compressed functionality into brief lines of code and trimmed extraneous features and interface elements. The situation is now reversed. Processing power, data storage, and sophisticated display devices have grown inexpensive. Software feature lists can balloon without penalty, and expand the number of interface elements to design and implement.

In Bay Area interaction design, time is now actively managed as a limited resource (T. Brown, 2009). Consultancies charge clients by the hour; their finances depend on efficiently managing employees' schedules. Expert software developers, particularly for 'hot' new platforms such as the iPhone, are expensive to hire and often in short supply — so designers often try to minimize developer time. Moreover, the comparative ease of developing new websites and applications has shortened the design and development schedules expected by the final owners of these products and services. MediumFirm's client, for example, hopes to go from signing a contract with MediumFirm to a working iPhone application in under four months. External pressure, such as that exerted by investors on start-ups, can also sharpen demands for a speedy delivery of specifications.

Scoping a project and product means deciding what each member of a team needs to do, given their accountability to project constituencies and limited resources of time, money, and personnel. As an everyday concern, scoping entangles questions of effective representation — how will designers communicate the attributes of the proposed system to stakeholders such as managers, developers, and clients — with the effective performance of their duties. While the contract between a consultancy and a client may set initial terms for the project's schedule and deliverables, those terms often contain unexpected ambiguities, prove unrealistic to execute, or require renegotia-

2 See Chapter 1 for more on the resources required for interaction designers, as well as the typical limitations on those resources.

tion as the client's situation changes[3]. Appropriate project scope, then, is a situational problem for which there are no generic solutions. It is a problem both of planning ahead, based on the contract between client and design firm, and of responding to unfolding concerns.

This chapter will investigate scoping with an account of one such situational problem and the means by which a group of designers tackled it. Both the feature workshop discussed in Chapter 5 and the initial SOW will guide the efforts of the designers. But neither the scope of the project nor that of the mobile ticket-buying application itself is defined when the designers start making the specifications. Stabilizing the scope of the project and product requires rounds of drawing, talking, and presenting results to clients. This chapter examines this iterative process by following the evolution of one central element of the application, the itinerary screen. Labelled as a "big need" during the workshop described in Chapter 5, an "itinerary" is an unquestioned project requirement. Yet, as its appearance and functionality undergo substantial revisions, the team's plans to further elaborate upon it prompt client dissent.

This chapter also revisits the questions of politics, performance, and representation introduced in the previous chapter. But where the last chapter examined the whiteboard as a place of showing practices, this chapter will trace scoping as a process of figuring out what to draw and how to draw it in order to tell a convincing story of the project. By following an object-in-the-making, the chapter introduces and defines two scoping techniques: changing the field of vision and action through zooming and re-articulating objects by rendering them differently. These descriptive terms address transformative engagements with tools rather than on discrete objects or human judgments.

Tracing debates over what to draw — and not draw — will help us revisit the notion of showing practices, introduced in the previous chapter, as client audiences are figured into the composition of deliverables. At the end of MediumFirm's labors, we will come to see scoping as an interactional performance — a continuing process that orders not only projects and products, but also the professionals who make them. Hence, this chapter argues, accounting for scoping means attending not just to the role of individual artifacts but to the tangible connections among them. It introduces the metaphor of textile knotwork to describe how interstitial, transformational actions make and sustain connections which can eventually scope the responsibilities of project, product, and professionals.

3 See Chapter 8 for an account of one such renegotiation.

6.1 Scoping at MediumFirm

From the beginning, the MediumFirm sales and design team know that the Eurotrips project requires careful scoping. The clients want an impressive "flagship" iPhone application, but cannot build a complicated application in time for the upcoming tourist season. MediumFirm is to generate an ideal list of features, then divide them into a phased "roadmap" for development over the next two years. With the roadmap as a guide, the team will produce a small number of wireframed screens (they are not sure how many) to guide immediate development, with some of the wireframes (they are not sure how many) further rendered as colorful, realistic-looking "mockups" of the visual appearance of a working screen. The Statement of Work (SOW) makes it clear that MediumFirm will not deliver complete specifications as conventionally defined. However, the team still wants to deliver *useful and actionable* documents (Fieldnotes, March 12, 2010). That is, the documents should present immediately applicable directions for achieving Eurotrips' goals. To do that, MediumFirm must figure out which features to specify, in how many wireframes, and at what level of resolution — while keeping in mind their clients' goals.

The designers see the project as largely routine, complicated only by staffing arrangements. Eurotrips already has a website to serve as a reference, and everyone on the MediumFirm team has designed multiple iPhone applications before. Moreover, MediumFirm already has standard templates for the deliverables and libraries of standard icons. However, three of the five members of the team are temporary contractors. Hence each of the team members has different expectations for project management. George, the contract interaction designer, and Amy, the interaction design lead, differ in particular: George usually starts by sketching individual screens, while Amy prefers to start by mapping the whole application. Chelsea, one of the two permanent employees, joins MediumFirm a week into the project. Amy, the other permanent employee, will be largely absent for the latter half of the project. Only George, of the five teammembers, is on the project and in the studio full-time. Part-time and often off-site, the others require frequent catch-up conversations on activities they have missed. These clarifying conversations are another reason we return to MediumFirm. Their continuing efforts to explain their actions to each other will help us trace in more detail how scoping works.

An introduction to scoping moves

Neither the Eurotrips project's governing SOW or the initial workshop with clients can tell the MediumFirm team authoritatively exactly what their deliverables must contain. To figure out what the specifications will include — and exclude — they perform a series of transformational, material moves. This section introduces a conceptual vocabulary for these moves. In one type of move, rendering, designers translate a representation into another format. Rendering tools influence how

designers draw, and hence what they can see in the resulting artifact. In another, zooming, designers enlarge or shrink a field of view. Zooming manages what elements can be seen, and hence, drawn. Throughout the process, tools such as software, Post-it notes, pencils, and whiteboards alter what George and his teammates see and draw. As we will see, figuring out how to alter what one can see and draw by selecting different tools is part of interaction design expertise. The tool makes the move along with the designer, and vice versa.

Rendering

Much of an interaction designer's time is spent re-representing: iteratively instantiating a single object or concept in different formats and media. Examples of re-representing activities include: using text descriptions to inform sketches; sketching variations of the same page or screen; copying paper drawings into digital files; instantiating a single digital object, such as a webpage, in the three standard deliverables (wireframe, sitemap and flow). This common activity has no formal name in interaction design. Given interaction design's appropriation of the word "wireframe" from computer-assisted drawing (CAD), here I use a related CAD term, "rendering," to describe this common activity. Computational rendering adds color, texture, and shading to skeletal line-drawings. Though a rendered CAD file may look strikingly different from the wireframe, the software and its makers treat the rendering as a version of the wireframe, rather than a totally new object (Houdart, 2008). As George renders the itinerary screen as content map, paper sketches, Post-its, and both onscreen and printed-out schematics, he and others treat them as alternate versions of the same thing.

Two aspects of rendering are particularly salient to what we will see happening at MediumFirm. The first is *transformation*. Rendering, like a theatrical rendition of a song or speech, changes the meaning of the object enacted. Rendering rarely produces an exact copy: its goal is to add, subtract, rearrange or restyle elements. Transformation occurs most obviously in translations from one medium and format to another. A line of text on a Post-it bears resemblance to the wireframes it guides, though both are understood to instantiate the same feature. But even copying a paper sketch into a digital file without changing its composition of elements is transformative. On the one hand, changes to the new digital file can be more easily reversed. On the other hand, such a digital file can now be compressed into a fixed image — an immutable mobile (Latour, 1999) that is less alterable and more easily emailed. In this transformation, the tools used affect what can be drawn — and not drawn. Drawing a wireframe with a thick black marker produces different results than drawing with a thin, erasable pencil. So part of the work of rendering is choosing an appropriate tool from those available in the studio.

The second is *reference*. A reference, for the purposes of this chapter, is a material, directional link[4] among objects. It is an umbrella term that incorporates behaviors previously treated as disparate. Sometimes iconic resemblance establishes a link, as when digital wireframes combine graphic elements from preliminary pencil sketches. We can draw some vocabulary to describe interaction design practices from previous studies of architecture and graphic design. Sometimes project-specific phrases (i.e., "nodes and links") serve as conversational resources for design talk (Fleming, 1998; Matthews & Heinemann, 2012), figuring multiple renderings as instantiations of the same concept. Sometimes referencing emerges from searches for analogous examples (Murphy, Ivarsson, & Lymer, 2012) (i.e., other tourist-oriented applications for the iPhone) or informational material (i.e. iPhone interface standards). Sometimes they involve opportunistic re-use (Ball & Ormerod, 2000), as when a final deliverable employs a file and digital assets created for a previous project. And sometimes they are linked together only by the sequential flow of talk and gestures, as when designers open calendars to check how much time they have left before the next client presentation. Repeated rendering of the same object produces a web of references.

This analysis will introduce vocabulary I have invented in order to describe four common means by which transformational moves produce this web: chains of reference which build to a single end-point; leaps, in which an element of a long-dormant rendering is integrated back into the current state of the project; and returns, in which a new rendering is reintegrated into a previous one. References, then, are often deliberately established in order to serve as citational evidence in client presentations. As we will see, part of what references do is help solidify and defend a necessarily tentative set of evolving proposals from attack by clients.

Zooming

Talk of "zooming in" and "zooming out" comes up frequently in studios. It refers to two related scoping moves. In optical "zooming," designers enlarge or shrink what lies within a field of view. In conceptual "zooming," designers enlarge or shrink the bounds of a topic or matter of concern. In both, zooming in enhances details at the expense of a panoramic perspective. Zooming out

4 Goldschmidt (2005; 1995) introduced and popularized the method of "linkography" to compare different processes of design and evaluate their productivity. Judgments of links rely on expert evaluations of similarity of content between the first state and the second. Figure 6.1 inadvertently echoes the diagrams featured in Goldschmidt (2005). However, my rather broad definition of "reference" here is broader than the linkographic limits of content similarity. My diagrams and other attempts to trace references among design artifacts echo those of the linkographers, but, being more inspired by Latour's study of "circulating references" in the work of soil scientists (1999), have somewhat different means and very different ends.

enlarges a zone of visibility, but blurs details. Like making larger and smaller scale models in architecture (Yaneva, 2005), zooming in and out is a matter of iterative partial seeing. It works by framing and focusing the human eye upon a single perceptual field. Move your point of view far enough away, and the details of the wireframe visually appear to collapse into box filled with tiny, illegible lines. However, you can map the box's relationship to other boxes. Zoom in again, and the box seems to unpack itself into legible lines and text. However, you can no longer examine its relationship to the rest of the map.

Zooming entwines sensory perception and movement. At MediumFirm and elsewhere, I often saw designers cyclically enlarge and shrink their monitor views. It was as if they were on a bungee cord, plummeting physically into the drawing, then suddenly snapping back out. Some tasks, such compositing individual screens into flows, require a relatively zoomed-out perspective. Other tasks, such as editing lines of tiny text, call for zoomed-in magnification. In much the same way, designers move their bodies during discussions at the whiteboard to alter what they can see and edit. They zoom close to inspect a small region on the whiteboard, then quickly step backward to consider the region's place in the larger perceptual field.

Metaphors of elevation and perspective suffuse everyday design talk as well. In one conversation at MediumFirm, I heard, in quick succession, recommendations to take a *high-level* view of the system; *dive down* into a screen; then *jump back up* to the map (Fieldnotes, March 9, 2010). The sensory experience of software zooming underwrites the linguistic metaphor (Lakoff & Johnson, 2003). After shrinking a document from 400% magnification to 25% in under a second, one can easily see a wireframe as zoomed-in site map (or flow), and a flow (or site map) as a collection of zoomed-out wireframes.

Zooming, then, is a transformation not of the object, but of the viewer's stance towards it. Like composing a photograph, zooming in and out frames and reframes a visual field. The notion of "framing," of course, has a rich history in studies of design. In Schön's oft-cited definition, "Problem setting is the process in which, interactively, we name the things to which we will attend and frame the context in which we will attend to them" (1983, p. 40). The work of framing is often studied as a matter of language (e.g. Dorst & Dijkhuis, 1995). In the conventional view, designers frame projects by deploying metaphors, value statements, and narratives rather than pens and software. But, as we'll see from the negotiations over scoping at MediumFirm, moves of optical zooming helps discursively frame and focus "the problem" (however defined by the team) by directly manipulating human perception. Optical and conceptual zooming are entwined.

The story of a wireframe

To investigate how rendering and zooming scope the Eurotrips project, we will return to the studio, where the designers have two weeks to draw up specifications and a roadmap.

Making a map of the system

George starts work on the deliverables by drawing rows of small "thumbnail" wireframes on paper with a ballpoint pen. He starts each wireframe by swiftly sketching standard iPhone interface elements such as the screen boundaries and top/bottom navigation bars. I saw similar patterns of drawing wireframes in each studio I visited, with each platform's standard elements drawn first, and in largely the same order. This repeated sequence of hand movements reminds us that what is being redrawn is not always a digital artifact. The sequence instantiates an informal professional standard: the elements that comprise a generic iPhone wireframe. One of the sketches, a text-based list of departures and arrivals, is labelled as an itinerary.

But George soon abandons his wireframes to start a content map — a boxes-and-arrows flowchart-style diagram that visually groups resources such as content and controls (Figure 6.1-A). The content map is a digital rendering of the Post-it notes from the feature workshop. What was a horizontally arrayed cluster of large and small yellow Post-its on the whiteboard labelled "Your Itinerary" is now a neatly aligned vertical column onscreen, with text labels expanded and new boxes added. With the content map, says George, "I've been again trying to kind of do a little zooming out and trying to get to the right level of detail". [5] But, he continues, "That's kind of the trick. What level of detail I'm starting [with]."

And so George keeps shifting from wireframes to content map. Neither wireframes nor content map are helping George figure out what functionality to draw and how to distribute that functionality into separate screens. George and Amy agree: it is "hard to wrap your brain around" the relationship of content map boxes to potential screens. The wireframes show "a little too much": each sketch shows interface details but does not indicate functional relationships among screens. Both content map and wireframes leave important scoping questions unanswered: How many screens will the application require? And of those screens, which ones should the designers draw for their clients? To decide how to organize the feature list into screens, and which screens to draw, they need what Amy calls a "map of the system" — a single diagram showing both the contents of individual screens and the connections among the screens. This map is to be an intermediary

5 All quotations in this section from fieldnotes, March 5, 2010.

object (Boujut & Blanco, 2003) that will be used to build first the deliverables and then the working application itself.

Amy has a plan for mapping the system. She proposes an "uber-sketch": rough wireframes of the "key screens" linked together by arrows into flows. Together, the key screens and the flows are to help George and Amy verify that they are directing their limited time towards specifying only the most necessary features. George is to first render the detailed pen wireframes onto iPhone-sized Post-it notes, one wireframe per Post-it, with a chunky Sharpie marker (Figure 6.2-B). These are Alexa's preferred tools for wireframing mobile applications. She says:

> I would recommend drawing iPhone interfaces with a big Sharpie on one of these <*points to a large Post-it note pad*> and you can only draw like the things you can draw <*laughing*> with that big Sharpieeee <*pauses*> Yeah, you can draw way too much with a pencil.

Together, the markers and Post-its force designers to include fewer elements in less visual detail. That is, using fat Sharpie markers on small pages lowers the potential resolution of each sketch. And it prompts decision-making: Which are the most important elements to make visible? Which can be safely excluded from the Post-it? To answer those questions, George and Amy check the feature list from the workshop, now rendered as a spreadsheet on Alexa's laptop. They glance at the yellow feature Post-its.

After George finishes rendering a batch of Post-its, he and Amy add, group, and remove notes on the whiteboard (Figure 6.3). As in the feature workshop (Chapter 5), they scribble text annotations, add smaller Post-its as labels, and connect Post-its with arrows until they are satisfied with the number of screens and logic of the connections. The Post-it labelled "My Itinerary" (Figure 6.1-B) is almost identical to the ballpoint version, but it is now a stand-alone Post-it that can be placed, moved and redrawn without disturbing other screens. Scribbled question marks around it remind George that he must specify its internal components soon. Rendering each wireframe on a single Post-it turns each note into a token of a single screen.

At the end of the session, George and Amy count the number of notes on the whiteboard. They are relieved: their count roughly matches what the sales team promised MediumFirm would deliver. The final project deliverable, says Amy, will resemble what is now on the whiteboard, but rendered at a higher resolution, with "more polish and more detail." Now, George and Amy hope, the rest of the project will consist of resolving product details — such as what, exactly, the itinerary screen does. In that way, manipulating Post-it notes on the whiteboard helps scope both what the product will do and what the designers will accomplish over the course of the project. Yet the uber-sketch is not complete. It remains a work-in-progress, with its composition — Post-it notes, wireframe elements, hyperlinks, tasks for designers — subject to hourly changes.

The making of the uber-sketch illustrates how rendering and zooming facilitate scoping. George and Amy are having trouble resolving the "essential requirements" of each screen in isolation from an overall perspective on the system. George's pencilled wireframes optically zoom too far into each screen. They show the details of interface elements but not the screen's relationships to others. His flowchart and site map zoom too far out. They give him a panoramic view of feature categories, but do not tell him how to distribute features into screens.

Alexa's response is to render both wireframes and content map in a single diagram: an "in between" uber-sketch that uses the physical scale of the Post-it notes and whiteboard to make elements of both diagrams legible at the same time. The whiteboard, as in the feature workshop in Chapter 5, allows the designers to work with individual Post-its and also treat the whole board as a single composition. Unlike the feature workshop, they are not *pulling out* individual Post-it notes from a less-important background. Instead, they are *building up a portrait* of the entire application from individual notes. By granting them a previously unseeable perspective on what they need to do, the whiteboard is again serving as a temporary forum of alignment. In this case, the alignment is in the form of a working agreement between George as a temporary contractor and Amy as the permanent employee supervising him.

Getting to a hashed-out wireframe

The uber-sketch has not closed debate over the itinerary screen. The next phase of the project — between the creation of the uber-sketch and the first client presentation — sees four more renderings of the itinerary screen.

First, George transforms the itinerary Post-it note into a digital wireframe. It is a multistep process that I see him repeat again and again for each screen. The first step is drawing many thumbnail wireframes on a big piece of paper. While copying the zones of functionality on each Post-it note, George also draws some elements taken from a much earlier "concept sketch" made by another MediumFirm designer. We can think of this integrative move as a referential leap forward. George is transplanting graphic elements from a long-dormant earlier exercise into his current work.

Then George moves to the computer. His drawing software comes loaded with MediumFirm-specific libraries of pre-made iPhone icons and components. And his onscreen document size is pre-set to the dimensions of an iPhone screen. Pulling objects from the library, he adds the standard iPhone navigation elements, such as a bottom navigation bar, to the blank page. Then he manually draws application-specific interface components, taking elements from multiple thumbnail sketches, moving them, sometimes deleting them. The resulting composition bears a kind of family resemblance to the paper sketches without being precisely identical to any of them.

As George draws with his mouse, he zooms in and out repeatedly. This optical zooming (Figure 6.1-C, -D) follows a pattern common to every designer I watched draw. He magnifies what is onscreen to edit and align elements precisely, then pulls back out to inspect the overall layout. Occasionally, he sketches more elements on paper, then adjusts his onscreen drawing. This *cyclical* movement of rendering and referencing was common to many studios. While InDesign allows the user to undo mistakes almost endlessly, its single-page view still shows one state of the drawing at a time. In contrast, the paper sketches keep multiple tentative experiments in view simultaneously.

When George is satisfied, he prints the digital wireframe out and tapes the paper to the whiteboard above the original Post-it (Figure 6.2-B and Figure 6.3-E). Amy next adds scribbled annotations to his printouts. George does more editing, then tapes the new printouts atop the old. Every few hours, Amy returns to review his work and add more edits. The pile-up of printouts is a kind of *reversal* or *return* of reference, in which the addition of a new rendering (the printouts) changes the composition and significance of the older rendering (the whiteboard). In this way, the whiteboard serves as a persistently visible map not only of the project's screens and evolving scope, but of George's progress through the task that Amy has assigned him.

Next, a routine review[6] of George's printout during a group transforms the itinerary screen's essential requirements. During the meeting, one team member after another sketches a visually similar image on a whiteboard (Figure 6.2-A). The image, which resembles an accordion-folded paper (Figure 6.1), articulates a new organizational principle for the itinerary. The previous renderings display only departure and arrival information. Chelsea proposes a different model. Tourists treat rail vacations, she argues, like a network: a series of "nodes," or cities, connected by train trips, or "links." To help people plan more effectively by including the complete journey, the itinerary should represent nodes as well as links. Or, as Amy describes it, your itinerary *shouldn't just be a bunch of train trips. It should be where you're going, with the train trips in between*[7].

"The accordion," as everyone on the team calls the sketch, is a visual metaphor for tourists' spatiotemporal experience of rail-based tourism. It sandwiches train trip information between the names of destinations. Each place name is a link to more information about it. Folding together links to place information, trip information, and ticket booking, the accordion-itinerary now forms the "backbone" of the entire application as users' "main experience." Everyone is excited about the accordion metaphor, which answers a "key question" from Amy: how to include "destination-focused" photographs and text along with the content and controls for ticket buying

6 For more on team reviews, see Chapter 7.

7 All quotations in this section from fieldnotes, March 9, 2010.

and viewing. However, the metaphorical rendering only vaguely visually resembles George's current wireframe. The two images are linked only by the shared label of "nodes and links." But given the limited hours left to the project before the client presentation, how much time should George spend on rendering and refining the itinerary screen?

George wants to "tell the story of the system" and is worried that spending too much time on the accordion will prevent the team from drawing the itinerary screen within the "big picture" of the application. Standing in front of the uber-sketch (Figure 6.2), George says:

> On one hand, this is <*pauses*> it's really critical that we sort this out <*taps the itinerary screen printout with his pen*> <*pauses*> the only thing that I'm concerned about is um is y'know um is basically looking at this <*steps in close to the printout*> at the expense of looking at the system and the framework <*moves away from the whiteboard*> together.

In moving towards and away from the whiteboard (Figure 6.2-C), George is mimicking his earlier optical zooming onscreen: magnifying his view of a particular region, then stepping back to expand what he can see. Physical zooming enacts an argument about which screens to draw. It is a new use for the whiteboard composition, which first helped George and Amy see the system, then made George's work visible to the team. Now it serves as a stage for George's argument about how to scope his work.

Chelsea, however, thinks that since MediumFirm cannot deliver full specifications, the team must get the client *excited* about what they can deliver. To do that, she is proposing scoping their work to screens that are likely to be more "compelling" and "playful." As George talks, Chelsea tapes a large calendar next to the whiteboard (Figure 6.2-E), extending the composition. Labelling one day on the calendar as "itinerary screen," she says that there are only enough hours to do the itinerary screen as well as an alternative "landing screen" for users without trips booked. But two screens provide "just one very small window on the system," says George. They aren't enough to show clients.

Chelsea responds that clients should see only documents that are "complete and thought-through." Given low-resolution, zoomed-out, "high-level" renderings, they will "start throwing darts and picking stuff apart." Her concerns demonstrate how visual resolution serves as a tool of rhetoric. "Hashed-out" — i.e., specifically detailed — drawings help patched-together compositions like George's wireframes survive client examination without being "picked apart" by a hostile audience. Walking over to stare at the calendar (Figure 6.2-D), George finally agrees. The calendar is another persistent and visible rendering of the itinerary screen — one figured in employee-hours rather than interface components and hyperlinks.

Concerned about client reactions, George eventually presents not one but two versions of the itinerary screen to the clients. Following his usual cyclical movement between rough paper thumbnails and detailed digital drawings, he produces a digital "playful" version to demonstrate the accordion. But his presentation also includes the previous "stripped down" concept, whose composi-

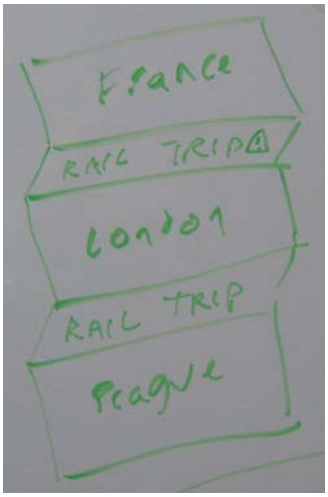


Figure 6.1 One of the accordion sketches

tion is closer to the Post-it notes and concept sketches already shown to the clients in the feature workshop. George abandons the utilitarian wireframe when the clients approve the playful version. Like the content map, it becomes a dead end, and never referenced again. The rest of the project expands, so to speak, the accordion.

In the run-up to the client meeting, George adds ever more components to the itinerary screen wireframe. Some components are interface elements, such as believable trip information and realistic-looking iPhone icons. Others are client questions and concerns, indexed by annotations on wireframe printouts and on the site map. The result is the "building up" of a specific object, as Henderson (1991, p. 455) writes, rather than "dissection or disassembly." Studies of scientific image-making often describe the abstraction of specific cases into general types (Daston & Galison, 2010; Latour, 1990; Lynch, 1985), with "ever simplified inscriptions" as the basis for ever "harder facts" (Latour, 1986).

In the case of the itinerary screen, what makes a hard fact for the project is a decision from the clients. This decision does not demand selection, simplification and generalizability. Instead, it is the accretion of project-specific detail through cycles, returns, and leaps of rendering and zooming that solidifies a tentative proposal into a playful itinerary screen. Throughout all these movements, though, there is a central chain of references (Figure 6.3, marked in red) — that link text on Post-it notes in the workshop to the digital wireframe shown to the clients.

Negotiating project scope

Layers of Post-it notes, text descriptions, pencil drawings, and whiteboard sketches come to cover computer screens, tables, and walls. Yet in calculating project scope, these proliferating renderings of the itinerary screen still count as *a single object*: one screen out of the twenty they have promised to deliver. So where is this single object located?

The itinerary screen is in all of those places and media. In hashing it out, George's attention never rests in one place for long. He moves among the computer monitor, the whiteboard, the calendar, and all his scattered paper sketches. He huddles with Chelsea, Amy, or Laura once or twice a day. The itinerary screen acts in the project through all of those renderings. His software rendering lets him draw and erase repeatedly, until the time comes to make a PDF as an immutable mobile (Latour, 1999) for client review. Chelsea's itinerary screen box on the calendar (Figure 6.2-E) schedules his limited hours. The whiteboard and site map show him the big picture of the

itinerary screen, reminding him to draw out the connections between the itinerary screens and its neighbors. And the piles and layers of paper sketches — growing until the very last minute of the project — helps him keep multiple tentative experiments in view simultaneously.

The designers want to render the "hooks": the screens that are "the most compelling and interesting, that define the experience" (Fieldnotes, March 16, 2010). Amy in particular is advocating for a *more beautiful* itinerary screen, with *more character*: "This is the place where the metaphor of like trips connected by destinations has the chance to really sing," she tells Laura and George (Fieldnotes, March 18, 2010). The team is still working out how to indicate the distinction between nodes/destinations and trips/links graphically.

The problem, however, is that the clients want the designers to specify exactly how to book and pay for tickets instead of spending their time hashing out the itinerary screen. Tickets are, after all, what Eurotrips sells. To the designers, specifying the ticket buying sequence runs contrary to why MediumFirm hired Eurotrips in the first place. To George, Eurotrips didn't hire MediumFirm

> to sort of figure y'know to take their (.) their (.) their ticketing experience mobile. The interesting thing <*pauses*> They hired us to think about mobile strategy and big picture (Fieldnotes, March 16, 2010).

In George's words, MediumFirm is not "getting paid the big bucks to figure out the ticket booking flow." That task involves merely "translation" of the existing web-based process to the iPhone — a routine task that should not pose much trouble for "any capable designer," such as those in-house at Eurotrips. The crux of Chelsea's opposition to specifying the utilitarian screens is also a lack of difficulty. "Don't draw it," she says of a login screen, "Because you know you can" (Fieldnotes, March 18, 2010). Hashing out the "interesting" itinerary screen and destination suggestions, the designers believe, are vital to mobile strategy and require expertise that Eurotrips' in-house designers do not possess. Yet the designers agree with their clients: ticket booking is part of the backbone, and it was affirmed as part of project scope during earlier meetings with clients. They cannot avoid specifying it altogether.

Scoping the drawing process, then, is in part an affiliative practice (Suchman, 2005). It requires reflective debate over how to make the kind of specifications that MediumFirm associates with "mobile strategy," and hence with the sort of company MediumFirm wants to be. Chelsea finally decides that George will draw some screens in the ticket booking flow, but fewer and in lower resolution than the clients might prefer. This reworking of project scope will allow the team to deliver "a complete piece of work" — i.e., a limited set of deliverables that will vividly "define the experience" — without entailing a high-resolution "complete picture of the system" (Fieldnotes, March 18, 2010). In doing so, George and Chelsea are not just deciding what wireframes to draw and to draw them. They are also showing *themselves* and MediumFirm as makers and seers of the

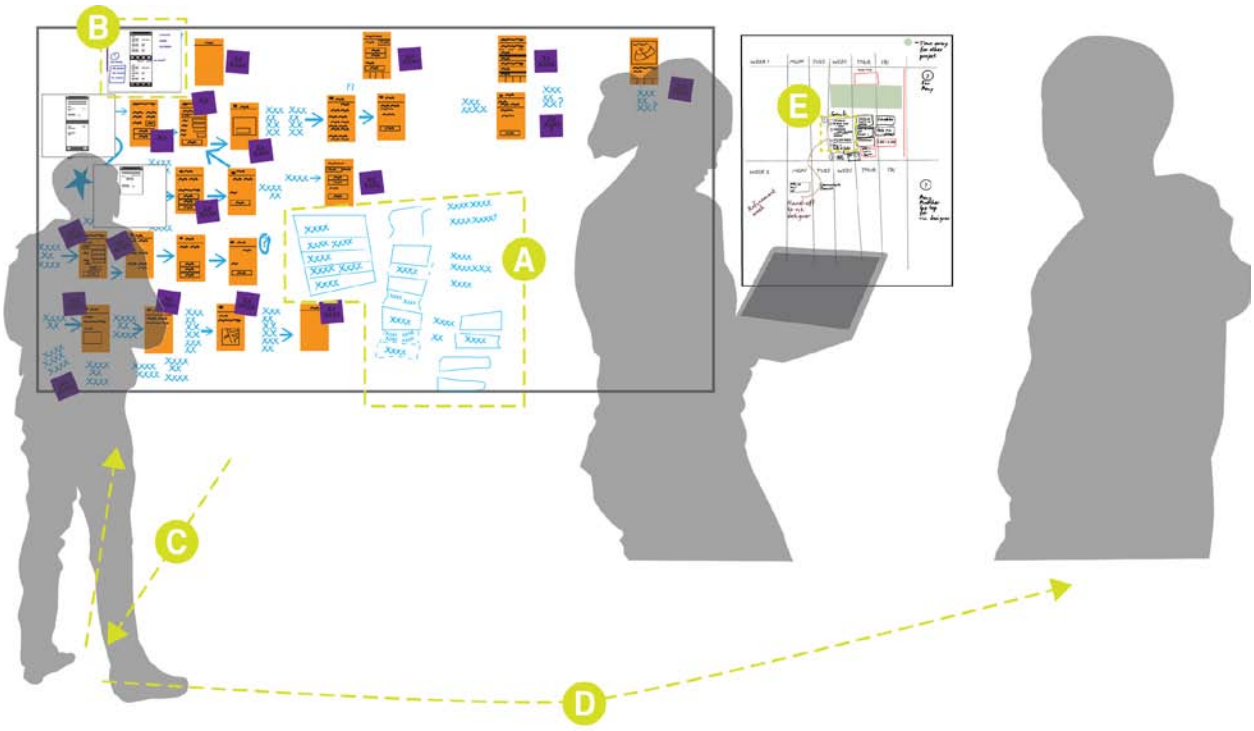


Figure 6.2 George stands in front of the finished uber-sketch. Box (A) encloses three of the "accordion" sketches. Box (B) encloses an itinerary wireframe printout taped on top of a Post-it sketch. Arrow (C) indicates George's zoom into and out of the whiteboard. Arrow (D) indicates his progression to stand in front of the calendar (E) with Chelsea. Illustration composited from multiple photos.

zoomed-out "big picture" to an anticipated audience of clients and developers. This is what George is doing as he moves among whiteboard, site map, and the piles and layers of paper sketches: instantiating what is "interesting" to project constituencies through where, how, and how long he directs his attention to any one tool and document.

Delivering the compiled set

The final deliverables encapsulate the story that the designers want to tell. They are:

› A sitemap, including indications of which screens the designers did not draw

› A "wireflow" that resembles the uber-sketch

› Annotated wireframes, one screen per page

› Visual mockups created by Laura

› A roadmap created by Amy

Some of these deliverables, such as the sitemap, were made in the course of scoping. But the wireflow must be drawn. As Amy promised, the wireflow resembles the uber-sketch, digitally cleaned-up and pasted into a company digital template. Working from the calendar and from the template, Chelsea sketches adjustments to a pre-existing wireflow template and *returns* it to the calendar (see Figure 6.3-G and -H), elaborating on the web of references displayed on the wall. The adjustments are labelled with both the limited number of hours left, and a warning for George not to go "too far for the conversation" — that is, spend time drawing anything the designers don't need to show or that might mislead the clients.

Working from Chelsea's paper sketch, George copies and pastes wireframes into a copy of the MediumFirm example file and starts to arrange the wireframes into rough approximations of the uber-sketch flows. The wireflow has two goals: both "demonstrating all the flows" and to "show anything that you don't want to take care of." Amy worries that the clients still expect impractically high levels of resolution in the utility regions as well as the hooks. Like a few consultancy designers I met, she uses a deliberately artificial "client voice" (exaggerated pitch shifts indicated with arrows) to mimic an anticipated client reaction:

> They might be like ↑well why isn't the information consistent↓ for all that. And you're just trying to say that this is the overall logic.[8]

The wireflow, then, must keep the clients from complaining about what the designers did not draw, as well as what they have drawn. As terms like "conversation," "show," and "demonstrating," suggest, the wireflow and other deliverables are being assembled with performance in mind. Chelsea's notes and Alexa's "client voice" both serve the same purpose: to help George figure not just the system and the firm but of *the client as well* into the deliverables.

What George gives to the clients and Laura is a file that Laura calls "the compiled set": a multipage document in Portable Document Format (PDF). PDF documents are easy to email and readable with a free program. But without access to George's drawing software, many annotations and other components of the complex drawings are invisible and unaccessible. Intended to support a performance of work and expertise, the flat PDF file transmitted to the clients appears authoritative. Like a scientific publication (Knorr-Cetina, 1981; Latour & Woolgar, 1986), it hides from view the abandoned conjectures, messy erasures, layered accumulations, and web of references that produced it. The clients will never see the crowded whiteboard, the hand-drawn calendar, the messy table. Nor will they ever see the libraries of standard digital components from which George assembles his working wireframes. Laura, who visits the studio regularly, is aware of what the PDFs

8 Chapter 7 describes roleplay practices in more detail.

hide. To the clients, however, most of the renderings that comprise the project remain unseen, unknown, and uneditable. They see a polished demonstration and a smooth presentation[9], rather than the stumbling series of experiments.

Postcript: A second project for MediumFirm

The "compiled set" is not the end of the rendering process for the itinerary screen. Developers will take the PDFs and render them as code. The renderings emailed to the clients are just a temporarily frozen moment within a continuing, fluid process[10]. For the booking sequence proves difficult to extrapolate. George and Chelsea were incorrect: Eurotrips' engineers could not extrapolate the ticket purchasing functionality from the website and the few screens MediumFirm delivered. So Eurotrips hires MediumFirm again. The next project is scoped more tightly – framed and focused solely on the utility screens. MediumFirm will design a booking sequence — now renamed the "booking engine" as a reference both to its centrality within the iPhone application and its newly realized complexity and *compellingness* as an object of skilled design.

Scoping in practice

To summarize what this account of scoping has told us about the moves that produce it:

Scoping moves rely on tools as intermediaries. Many classic accounts of design cognition (Goldschmidt, 1991; i.e., Schön & Wiggins, 1992). emphasize a direct, unmediated connection between graphic marks and the human brain. Rendering and zooming, however, shift out effort to intermediary tools — the software that enlarges and magnifies what is onscreen, the fat Sharpie or thin pencil, the small, semi-sticky Post-its. Solving the problem of what to draw or not draw is, as we saw with the uber-sketch, a matter of choosing the right intermediary as a partner in drawing, seeing, and thinking. It depends on close and expert relations with tools. Later, digital copying allows George to place all the individual screens he drew into the wireflow without hours of painstaking re-drawing[11]. Rendering tools also affect sight. MediumFirm's preferred software can only display

9 This distinction between demonstration and experiment draws on Collins' analysis of displays of science (1988).

10 The metaphors of freezing and thawing throughout this chapter are inspired by Whyte et al.'s account of engineering design representations (2007), as well as Law and Mol's description of gradually changing "fluid objects" (2001).

11 Though depending on the software settings, this digital copying may necessitate extra work. Designers often have to manually adjust font size and line weight in shrunk or enlarged components in order to create a pleasing and legible graphic composition. Software speeds the process but does not automate it.

screens individually. To see compare multiple screens simultaneously or view them in context of the entire system, George must turn to the whiteboard.

Scoping moves facilitate performances. In the previous chapter, I argued that showing practices help produce alignment among designers and clients. Rendering and zooming are also showing practices. Most obviously, expert use of tools makes visible aspects of the design situation that people cannot see unaided — as when Chelsea scrawls an "itinerary screen" box on the calendar to show George the gap between his limited hours and his ambitions.

This example highlights how rendering and zooming anticipate and enact future tensions of showing and witnessing. Interaction designers are well aware that often what they make is not a working system but a communicative artifact — an intermediary object (Boujut & Blanco, 2003) that must, as Amy says to George about the compiled set, convincingly *demonstrate* to project constituencies what the working system is to do. Compositing the wireflow and the sitemap from individual screens shows the clients the project's scope: the components that MediumFirm need not draw in detail because Eurotrips' designers can infer them.

These communicative artifacts, however, cannot persuade on their own. George, Amy and Chelsea all verbally anticipate and rehearse encounters with designers and clients (see Chapter 8) in figuring out what and how to draw. In prompting decisions about what to show and not show, rendering and zooming activities articulate boundaries — boundaries between the team and its external collaborators, and between anticipated performers and audiences.

Scoping moves are fluid but irregular. Descriptions of transformational moves often employ metaphors of continuous motion, such as "a cascade of intermediaries" (Callon, 1986) or "a flow of transformations" (Latour & Yaneva, 2008). Sequences of rendering and zooming similarly produce circulating references and shifting foci, but the transitions that scope the Eurotrips application are not smooth, constant, or unidirectional. Zooming produces sudden, dizzying perceptual jumps and climbs; artifact formats (such as the content map) are abruptly abandoned, only to reappear in another form (such as the site map) once the project situation has changed (see Figure 6.1). Rendering and zooming continuously transform design objects, but as often as not through cycles, leaps, and returns rather than steady forward motion.

Scoping moves forge and break associations among artifacts. References link one instantiation to previous and subsequent ones. Those connections make MediumFirm's plans for the itinerary screen more compelling by (1) invoking previous agreements and approved diagrams as allies and (2) productively constrain MediumFirm's efforts to specifying elements that they think are interesting and difficult. As Post-it notes, digital documents, printouts, sketches, calendars, and firm billing statements proliferate, no one artifact can hold together all of the itinerary screen's constituent elements. The fate of the itinerary screen depends on making, maintaining, or breaking connections among its evolving instantiations — and on how those connections are made visible

(or invisible) outside the team. Rendering and zooming moves make meaning in the interstices. They enact project relations in how, precisely, they exclude, delete, and abandon as well as how they accommodate and connect.

Scoping moves enact accountability relations. Decisions about scope enact accountability relations within the project and profession. The artifacts that the designers will deliver turns on what they hope their clients will find, as the project manager says, *useful and actionable* (Fieldnotes, March 12, 2010). Seeking their clients' approval to proceed, MediumFirm needs *compelling* diagrams. They need the artifacts for what Chelsea calls "the conversation" — a demonstrational performance for clients that is to persuasively associate specific attributes of the new system with specific design-implementation-support-use constituencies. Multiplying renderings, accreting detail, creating webs of reference, then framing and focusing visual attention through zooming are all ways to improve the likelihood of what Kotamraju (2011) calls "a good show." Rendering and zooming, then, solve rhetorical as well as technical and aesthetic problems. They help assemble a visually complete and coherent story of the project and the product in a way that satisfies designers and clients.[12]

6.2 Knotwork as metaphor

A finished artifact such as a site map can temporarily fix in place decisions about the scope of the project and product, but it is through intersticial moves such as zooming and rendering that those decisions are made. As we see throughout the Eurotrips project, managing the extent of work is a continuing problem of planning, accountability, and representation. None of the initial contracts or conversations fully define what the team is to make and how they are to make it; the team and the clients must renegotiate the terms of their work repeatedly in order to keep the project on budget and on schedule. Indeed, the scope of the Eurotrips application and of MediumFirm's immediate work only gradually emerges from rounds of transformational moves that forge associations among the artifacts instantiating the itinerary screen. It is these moves that incrementally knot together the project's scope — an ever-changing, story of the project and its constituents oriented towards a convincing performance.

12 This thinking draws on Klaus Krippendorf's argument for a "semantic turn" in understanding design. As Krippendorf writes, "To be realizable, artifacts must afford several simultaneously plausible narratives" (2005, p. 232). It also echoes Bucciarelli's definition of engineering design as "bringing stories into coherence" (Bucciarelli, 1994, p. 84).

This analysis of scoping work in the Eurotrips project responds to two dominant accounts of design planning and action[13]: the technical rationality of design science (Cross, 2007) and the practice-oriented concept of reflection-in-action (Schön, 1983). We can illustrate the differences between these two accounts fruitfully in terms of Suchman's metaphors of European and Micronesian ocean navigation. The former "is derived from universal principles of navigation and is essentially independent of the exigencies of his particular situation" (2006, p. 25). In the latter, "nowhere is a preconceived plan in evidence. The basis for navigation seems to be, instead, local interactions with the environment" (Suchman, 2006, p. 184).

The messy course changes and renegotiations of the Eurotrips project do not resemble an idealized, universal model[14] of design process. They seem to exemplify the local, material negotiations of reflection-in-action, "A process of seeing, making design moves, and seeing again":

> Working in some graphic or plastic medium, such as drawing, the designer sees what is 'there' in a representation of a site or object, draws in relation to it, and sees what has been drawn, thereby informing further designing (Schön & Rein, 1995, p. 85).

Sketching the accordion is one such canonical case of reflection-in-action. Chelsea sees the nodes and links within the printout, draws a rough accordion sketch nearby, and then the entire team takes up her revised model.

However, the notion of reflection-in-action cannot fully account for the entwining of tool, movement, and decision-making we see in the Eurotrips project. "Reflection" presupposes a separation of seeing subject and visible, stable object. Hence, it separates human designers from the tools they use and the artifacts they produce. Moreover, Schön's reflection-in-action takes place during a pause in drawing, in stillness rather than movement. While granting an important place to bodily movements, it reinforces the primacy of distanced vision as the key to "informing," or planning, design.

The importance of accumulating reference and detail in scoping the Eurotrips project turns our attention to an alternative concept, textility (Ingold, 2010, 2011) that places movement, rather than stillness, at the center of skilled action. Ingold's arguments for the "textility of making" suggest an alternative metaphor — that of knotting and binding fibers rather than navigating an ocean — for the relationship of incremental, irregular moves to the smoothly polished "story of

13 Ingold makes a similar rhetorical move in negatively comparing the Renaissance ideal of architecture as a geometrically perfected blueprint to the "patchwork quilt" practices that erected medieval cathedrals (Ingold, 2010).

14 Dubberly (2008) has collected more than 100 such models, from "measure twice, cut once" to multiphase arrangements of boxes, arrows, and text labels.

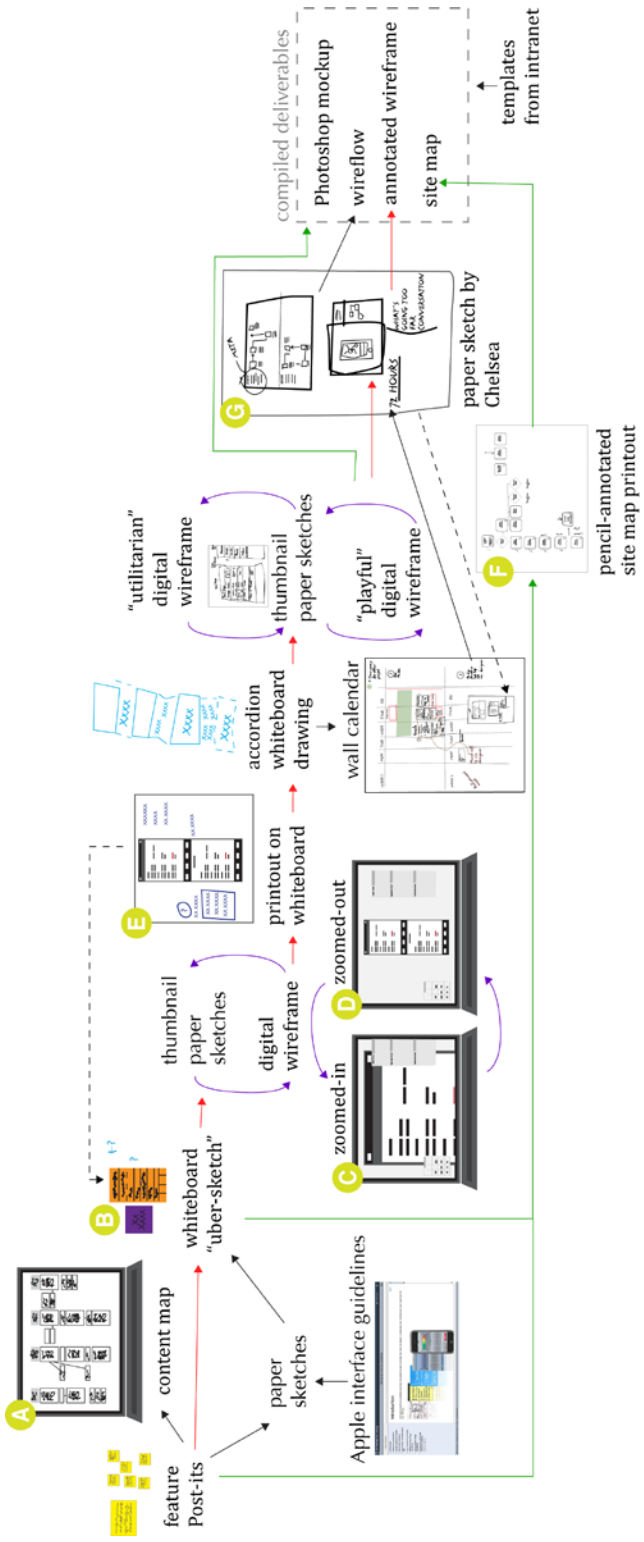


Figure 6.3 The artifacts that produce the itinerary screen and its deliverables. Major chain of references in red; cyclical rendering and zooming movements in purple; leaps in green; reverses or returns to an older artifact in dashed line.

the system" that the designers will perform for their clients. The concept of textility foregrounds processes of making rather than final products, attending to the ongoing and generative movements of transformation and change.

Texility begins not with abstract contemplation but "tactile and sensuous knowledge of line and surface" (Ingold, 2010, p. 2)[15]. It attends to the "itinerant, improvisatory and rhythmic qualities of making" (2010, p. 9) rather than following a pre-given plan. Hence, unlike Schön's reflective thinker, the role of the designer or maker is "not so much imposing form on matter as bringing together diverse materials and combining or redirecting their flow in the anticipation of what might emerge" (2010, p. 4). Elsewhere, Ingold, following Lefebvre (1992), describes the resulting registration of activity in the world as "meshwork," a "tissue of lines" like "woven fabric, the tracery of lace, the plexus of the nervous system or the web of the spider" (Ingold, 2010, p. 12). It is these textural metaphors of lines and webs that inform the argument of this section: characterizing the relationship of stabilized scope to the moves that make it up as *knotwork*.

More specifically, I use the crafting of freeform knotted textiles craft as a metaphor[16] for the role of planning and storytelling in the ongoing fabrication of scope. Knotted freeform textiles are built up gradually from improvisational activities of knitting, twining, binding, casting, plaiting, and so on (Lunin, 1990). Though planned in advance to some extent, such pieces are not as predetermined as woven fabric or conventional knitted goods. Their forms are not structured by a loom or the deliberate attempt to reproduce a pre-given pattern. Instead, their final composition depends on moment-by-moment decisions as their creators react to the state of the piece and their goals for it (e.g. a gallery-bound hanging versus a warm and durable sweater). As freeform textile-maker Prudence Mapstone writes of her shawls, blankets, and sweaters,

> There really are no rules. There is no set right or wrong way of doing things, although perhaps a certain method could prove to be more suitable than another for a particular situation (2002, p. 8).

Consider as an example the work of fiber artist Josh Faught. As a composition, *Untitled* (Figure 6.5) takes its form from incremental knitting, crocheting, and sewing moves. Contrasts in patterns and colors indicate where blocks knitted separately were stitched together. Bulbous

15 We will see another example of textility in Chapter 7, which discusses the techniques of somaesthetics, or bodily evaluation, deployed by designers in review meetings.

16 I am also inspired by Haraway's use of the cat's cradle as a metaphorical way to refigure studies of science and technology (1994). Haraway, however, is using string figures like the cat's cradle as a metaphor for how individual scholars might entangle and transform different discursive and theoretical traditions. However, Haraway's string figures — impermanently drawn, strung-together discourses — do differ from my use of fiber arts as a metaphor for the sociomateriality of interaction design scoping.

Figure 6.5
Josh Faught
Untitled *(2009)*
Hemp, sequins, pin,
and garden trellis
48 x 50 x 2 inches
Courtesy of the artist and
Lisa Cooley, New York

crocheted blossoms are the result of concentrated attention to small regions. Elsewhere, long tendrils of yarn trail off. Some trails of yarn have been looped back and knotted in, physically linking different regions. The resulting textile does not resemble a conventionally well-crafted sweater or fisherman's net. It is seamed, irregular, variegated in texture and color, even lumpy. Indeed, the piece's overall visual effect relies on an artfully and deliberately "unkempt" agglomeration of heterogeneous materials and textures (Underwood, 2009). Like one of Mapstone's shawls or coats, Faught's piece has been deliberately crafted in expectation of a specific function and audience; in this case, exhibition in an art gallery.

The uniform graphic appearance of the compiled set — or of many artifacts shown to clients — obscures the heterogeneity and handmade nature of the project scope. In this project at MediumFirm[17], the clients do not see the many instantiations of each screen in boxes, arrows, talk, and

17 The commitment to showing "results" to clients rather than "hand-drawn stuff" is common within interaction design (Hennigs, 2013). However, other interaction designers advocate showing clients hand-drawn sketches (Curtis, 2012; Rohde, 2011). MediumFirm's compiled set illustrates a practice that is very common — but should not be taken as a universal standard. Instead, we should consider the sharing of hand-drawn sketches along a spectrum of disclosure/secrecy in sharing interior team processes with clients.

text, the histories of digital erasing and undoing, the calendar and the debates that it preserves. Nor can the clients recover the visual signature of any one designer from the unified output of the team. Digital line-making tools notoriously erase the unique drawing styles, or "hands" (McCullough, 1998), of their users. Libraries of standard elements ensure that diagrams drawn by different people employ identically styled components. George, Amy, Chelsea, and Laura do not sign their work; templates branded with MediumFirm's logo and colors cast their efforts as a product of MediumFirm as a single entity. I am using Faught's deliberately irregular freeform knotwork as a concrete, visual metaphor for the irregular, incremental, messy and handmade qualities of the process of scoping *as enacted by the designers in processional activities*. The tangible materials of such thread-based fiber work help us appreciate the textility of the team's continuing responses to George's initial problem: "the right level of detail to start with."

Freeform compositions grow into irregular agglomerations, forming lumpily three-dimensional webs. Similarly, the resolution of the final set of deliverables is not uniform. Some regions of the application are rendered in more detail, fidelity, and polish than others. This non-uniform distribution of attention is facilitated by practices — digital and paper-based — of zooming. It is also facilitated by the non-uniform leaps and returns of references, which we can compare to stitching and reweaving. We could think as well of low-resolution areas as trailing threads left available for reworking — as when a new team of MediumFirm designers expands the lower-resolution instantiations of the booking flow into a more complicated and higher resolution "booking engine." These agglomerations are often made of heterogenous materials. In the case of the MediumFirm project, those materials include various types of handmade images, words and phrases provided by clients, examples of similar iPhone applications, interface conventions, et cetera.

Varying means of reference bind these materials together — from repeated words and phrases, to gestures, to digital copying and pasting from one document to another. In the Eurotrips project, as in all the other projects I observed, the location and extent of scope growth and limitation repeatedly surprises the designers. The system and its story are mutually constructed in action. But this process of co-construction is ongoing. It is picked up by the next project at MediumFirm in their new struggle with the booking engine, and then by iPhone programmers, then by tourists, and so on.

For in the act of drawing, there is no Eurotrips iPhone application in use to represent — just an unfolding and changing conception of what such an application, in the future, might include. George does not possess a pre-given "canvas" within which he can place the twenty screens like embroidery stitches on a cloth. He has no pre-existing territory against which he can judge the representational accuracy of his content map. Instead, George and Amy knit together earlier whiteboard composition, spreadsheet entries, iPhone documentation, and studio talk into a swatch of fabric — the uber-sketch. They can only build upon, unpick, and alter the uber-sketch *once they*

have knotted it together themselves. Making that fabric requires setting forth upon an unpredictable path of sequential transformational moves with the Post-it notes, Sharpies, whiteboard, and markers. It is these moves that twine together a "more and more visible, more present, more material, real" (Yaneva, 2005, p. 887) object from otherwise disjunct layers of sketches and files.

In this way, taking up another dimension of textility, we can see the linear moves of rendering and zooming as *processional* rather than *successional* (Ingold, 2011, p. 53). That is, one transformational move does not exist discretely from the next, "like beads on a string." Rather, "every step is a development of the one before and a preparation for the one following," like the variable strokes of a skilled carpenter sawing a log. Each step builds upon the previous and contributes to the next.

Consider George's cyclical movement between the content map and wireframes: he moves back and forth repeatedly between two different renderings of the same object. Alexa's uber-sketch proposal ends his back-and-forthing while building upon it. In retrospect, it is easy to divide the Eurotrips project into Ingold's suggested processional phases, such as "getting ready" (negotiating a contract); "setting out" (assembling a prioritized list of features); "carrying on" (the activities described in this chapter); and "finishing off" (delivering the compiled set). But no such clear distinction is available to the designers as they work. Amy, for example, believes that the uber-sketch has largely resolved the scope of project and product — even though three major revisions to the itinerary screen and the organization of the project are yet to come. The notion of the processional, then, reminds us to question the previous section's neat division of scoping activities into four phases.

Refiguring scoping as thread-binding is another way to revisit the places of reflection and action in Schön's influential summation. Swan and Taylor contrast the processional processes of interaction design practice with reflection-in-action. "We might think of the processional act," they write:

> As embedded in Schön's "global experiments" of process; they are the steps and deviations — the different strokes of the saw — that are eventually subsumed into reflection-in-action. The processional, then, refers not to standing-back and reflecting, but the being-in and doing (2010, p. 66).

My hope, then, is my new vocabulary of "rendering" and "zooming" helps us understand more precisely the tangible forms that "being-in" and "doing" take in everyday practice. The choice of fat Sharpie or thin pencil, 400% magnification or 25%, produce the ever unfolding "global experiment" that is project and product scope — just as the needle or crochet hook makes the shawl along with the crafter. "Reflection" rejects technical rationality and universal plans — but can suggest a division[18] of seeing and judging as cognitive acts from tool-intermediated acting and

18 Schön altered his definition of the term "reflection-in-action" over time. An early formulation (1983) includes in "reflection" the bodily, tacit knowledge enacted in catching a baseball or making a surgical incision. Later accounts (Schön & Rein, 1995; Schön & Wiggins, 1992) explicitly divide "seeing" from "moving."

doing as physical acts. Physical engagement with the heterogeneous materials of interaction design practice — the pixels, element libraries, pens, whiteboards, and so on — constitute scoping rather than being a necessary but separable prelude to it.

In my account of the negotiations of scoping at MediumFirm, I have emphasized how scoping takes place within processional moves of rendering and zooming as well as in post-move reflection. Instead of a clearly bounded ocean to navigate (with or without map), the designers of MediumFirm begin with an underspecified written contract and a firm end date. They depend upon processional, tool-intermediated, incremental moves to build up and solidify a scope, a compiled set, and, they hope, a story of the proposed application and their own professional work that will convince their anticipated audience.

6.3 Conclusion

> What a transformation, what a movement, what a deformation,
> what an invention, what a discovery! (Latour, 1999, p. 51)

Making and circulating of artifacts, from a line of text to an implementable schematic, scopes the Eurotrips application and MediumFirm's contributions to it. I first identified two characteristic transformational moves of interaction design scoping. Rendering an object into a different medium alters what can be drawn in order to affect what can be seen. Zooming, whether optical or conceptual, alters what can be seen to affect what can be drawn. Then I followed MediumFirm designers as they struggled to scope their work. Scope, we discovered, emerges from situated interactions. It is exclusive as well as inclusive, and enacts accountability relations in negotiating how to tell the story of the product and project. As such, scope is also a matter of material rhetoric — of *telling the story* of the system and its constituencies in a way that is sufficiently complete and compelling to induce clients, the visual designer, and potentially the future developers into turning the deliverables into working code.

Activities of rendering and zooming enact MediumFirm's distinctions between themselves and in-house designers: between invention of new screens and translations from the website, between big-picture mobile strategy and detailed booking sequences. They entangle organizational tensions between designers and clients, the management of time and money, and the material possibilities of pixels and pens. Like bridge engineering, scoping entwines "sense-making, persuasion and accountability" (Suchman, 2000, p. 315). It is the knotwork of negotiating how to show and tell stories, enacted in processional, transformational moves, that binds together the project, the product, and the professionals themselves.

CHAPTER 7

"How it feels like": Enacting professional feeling in walkthroughs

It's a quiet afternoon at LittleStudio. Jess, one of its founders, is working on a navigation indicator. She has just finished adding a row of little grey boxes to the tops of otherwise identical wireframes on individual presentation slides. On each slide, the rectangles are in slightly different positions. When she clicks through the pages in sequence, the rectangles appear to move from left to right, as in a flipbook animation. As Jess stares at the moving rectangles, I speak up:

EG: You're just going to click through and seeeee <*voice trails off*>

Jess: How it feels like.

EG: Do you know what it's supposed to feel like?

Jess: No. <*Laughs*> Well, yeah. Intuitively, I do. Can I articulate it to you? Um, yeah. I think it's supposed to feel natural and it's not supposed to feel device-like. It's supposed to feel like reading. Uhhhhh. Let's see. What else can I say about that? <*pauses 2 sec*> Uh. Just not device like. Like reading. Uhhhhh. It's supposed to feel like it's like ummmmm <*pauses*> y'know a system? There's individual designs, but I'm trying to find a, uh, metaphor that works. You know, that makes more sense for the size, or how the system indicators will look together. So it's just a, uh, trial, to see what will fit. So I'm making multiple screens [i.e., presentation slides] so I can see how it works.

(Fieldnotes, January 19, 2010)

Throughout the project, interaction designers frequently review, or *walk through*, what they have just made. Walkthroughs,[1] as they are called, can be impromptu and solitary, like Jess's, or scheduled group meetings. This chapter takes on a particularly common object of walkthroughs: system representations. In these walkthroughs, designers like Jess often act out the system-in-use by physically manipulating graphic representations and other symbolic objects. They enact not just the behavior of interfaces and technological platforms, but also the behavior of the human users that is to trigger machine responses. These performances respond to a central problem: like Jess's wireframes, low-fidelity intermediate system representations do not represent many of the concerns of interaction design. Most importantly for interaction designers, the low-fidelity representations do not *behave like* a working system. As I described in Chapter 4, they do not interact. Flat, static drawings cannot load new data, provide sensory feedback, or otherwise respond dynamically in space and time to human input. In order to judge their consequences for the prospective system, then, a human steps in to supplement their lacks.

In this chapter, I examine how these enactive practices supplement static graphic representations in walkthroughs. Jess's solitary flipbook animation will serve as the basis for a preliminary introduction to both enactive practices and the role of feelings in professional interaction design. Next, I will extend and elaborate this discussion with a second, more complicated example of collaborative walkthroughs during a website redesign at LargeAgency. It only takes Jess a few minutes to flick through her collection of drawings and make a decision. It will take us considerably longer to untangle the dimensions of her work.

7.1 A simple example: Making a navigation system

> An experiment is a story, to be sure — and studiable as such — but a story tied to a situation in which new actants undergo terrible trials plotted by an ingenious stage manager; and then the stage manager, in turn, undergoes terrible trials at the hands of his colleagues, who test what sort of ties there are between the first story and the second situation (Latour, 1999, p. 124).

1 Walkthroughs emerged as an evaluation technique in the 1980s in electronics engineering. Engineering review standards mandated team "software walkthroughs" (Institute of Electrical and Electronics Engineers, 1998) to catch logical and functional errors. HCI researchers took the existing technique and gave it a user-centered twist (Jeffries, Miller, Wharton, & Uyeda, 1991). This traditional HCI "cognitive walkthrough" requires one or more members of the team to judge the system on behalf of the prospective user (Lewis & Wharton, 1997). The walkthroughs that today take place at interaction design consultancies are the looser, more "improvisational" (Arvola & Artman, 2007) descendants of the formal cognitive walkthrough technique. Despite their frequency, interaction design walkthroughs are addressed only infrequently in professional handbooks (K. Goodwin, 2009 has the sole treatment I have found) and academic work (see Arvola & Artman, 2007 for a rare treatment).

A walkthrough like Jess's evaluates the experiential qualities of the proposed digital system in use. Playing out scenarios of use allows designers to see where representations fail to support a sequence of actions — where needed functionality is missing; navigation unhelpful; page layout confusing; or, things simply *feel wrong*. Activities in interaction design walkthroughs typically follow a similar pattern.

First: the person or people who made the documents spatially places them for review. Jess orders her flipbook sequentially. Later, we will see how the LargeAgency designers put long columns of paper pages into grids. In terms of system representations, one can walk through documents that illustrate a site map, a flow of screens in an activity, a few important screens, or the interface activity on a single screen. The format and formality of the representation can also vary: one can walk through a hand-drawn sketch on a Post-it note, paper printouts of digital files, or a projected presentation from PowerPoint.

Next: often, there is a brief prelude, in which the speaker explains the documents' significance to the project and any other relevant details (for example, whether they are a work-in-progress or finished). For example, Jess explains her slides as "a trial, to see what will fit." Perhaps the speaker alerts the audience to specifically troublesome regions.

Then: the same person (or people) begins to move through the arranged documents. Walkthroughs of sequential pages, like Jess's, often do resemble reading a book. But often, the speaker skips from page to page in a grid, following not the spatial arrangement of the regions but the narrative logic of a story of use: e.g. *First I click this link, which takes me to this page down at the bottom.* Verbal narration interweaves with the movement of fingers, word, and attention from one physical location in the set of documents to another.

Then: the audience responds. Responses may take the form of spoken words, drawings, or gestures. The audience members offer praise or criticism of the likelihood of the scenario, use the same representations to play out a different story, or physically alter the documents.

Identification of failures prompts the discussion, invention, and adoption of alternatives through on the spot sketching (see Chapter 6 for a discussion of drawing) or demands for more independent problem solving. Representations may be changed, abandoned, merged, or kept as-is. Paper documents especially are prone to intense physical engagement — onlookers may cover a document with annotations, use it as scrap paper for a new drawing, fold it, tear it, and tape it back together. Walkthroughs can also create new representations, whether from the merging of existing representations or the generation of a new object *sui generis*. Walkthroughs mark and label objects (Lynch, 1985), naming (Schön, 1983; Tang & Leifer, 1988), and highlighting (C. Goodwin, 1994) them. In this case, Jess decides that the movement of the rectangles is indeed "natural."

Last: At the end of the walkthrough, the group reviews what has been decided, and assigns responsibility for making changes to the documents. Jess preserves the slides for presentation to the client.

Figure 7.1 Jess explaining her trial representations. Dashed green line indicates the slides she is clicking through.

Walkthroughs such as Jess's evaluate and shape the prospective system's structural, functional, aesthetic and ethical qualities (Löwgren & Stolterman, 2004). Walkthroughs articulate the system's organizational principles: What categories of data does it present and manipulate? What do those categories include and exclude? How are they related? Walkthroughs configure system functionality: what it will do — and not do. Walkthroughs evaluate kinesthetic interface elements, including graphic composition, and temporal rhythms, as well as haptic and audio sensations (Arvola, 2006). And walkthroughs always, even if only implicitly, articulate decision-making as a moral ordering of design practice (Fleming, 1998): Who has the right to judge the representations? To which project constituencies are they accountable? Who ought to be making decisions about the system?

Walkthroughs such as Jess's also often function as generative experiments (Collins, 1988).[2] The exploration of the document provokes group or solitary debate about the possibilities and problems implied for the system and its users.[3] The walkthrough's outcome is contingent on the moment-to-moment interactions of participants. Indeed, walkthroughs often surprise participants. In acting out behavior of humans and digital systems, they also include the possibility of misbehavior. Misbehaving representations crack open (or, as designers often say, "break"), exposing fissures in flows, poor aesthetics, missing interface components, or unrightful demands upon project actors. This misbehavior resembles a set of equations and diagrams on a blackboard (Ochs, Gonzales, & Jacoby, 1996) whose logic can suddenly collapse during professional interrogation. That is the point of experiments — that they do not always succeed. So one of the most important characteristics of the enactments discussed in this chapter is that their outcomes are unknown.

Now that we know more about walkthroughs, we can return to Jess's rectangles. "Feeling like" is an everyday phrase, used habitually in every project I observed to propose future action or justify earlier decisions. This simple expression will serve as our entry point into the role of feelings in design decision-making, and the *enactive practices* that produce them. To paraphrase Löwgren and Stolterman's influential take on interaction design practice (2004), a *feeling* in design is an educated intuition. Hence professional intuition requires training, just as years of underlie skillful musical improvisation. As Jess's explanation indicates, it is this well-trained intuition that underwrites the making of credible professional judgment from improvisational enactments.

2 By now, of course, the notion that design progresses through experimentation is very familiar. In Schön's well-known terms (Schön, 1983, p. 79), the process is that of a reflective conversation, in which the situation actively "talks back" to the designer through processes of seeing carried out in representational experiments. In Schön and Wiggins' influential summation:"We shall describe architectural designing as a kind of experimentation that consists in reflective 'conversation' with the materials of a design situation. A designer sees, moves and sees again" (Schön & Wiggins, 1992, p. 135). Hence designers begin by making multiple tentative representations. Over time, they reduce the number of options in order to gradually stabilize the final form {Protzen and Harris}. This point has been made in studies of architectural practice (Lawson, 2004; Yaneva, 2005), graphic design (Fleming, 1998), computer science (Tang & Leifer, 1988), and interaction design (Löwgren & Stolterman, 2004). This chapter examines what takes place in the oscillation between generating representations and "experimenting" with them as modes of practice.

3 I owe this comparison in the context of design work to Simakova and Neyland's study of high-tech product marketing (2008). Their point is that product launches resemble demonstrations rather than experiments. Here, I am following the opposite path and looking at product development activities that seem more experimental. Walkthroughs are also a standard activity in client presentations to clients. In those cases, they resemble demonstrations, as designers offer rehearsed explanations of finished documents.

Jess, in her own words, is going on a "feeling" produced by her simulated magazine experience. That feeling can be described in words, but Jess has some difficulty doing so: her goal is a bodily response, not necessarily a verbal explanation. Hence Jess cannot logically predict which of her many interface ideas will give her the desired feeling. She cannot deduce it from theories or heuristics of design. Instead, she makes an experimental version — a series of presentation slides that she can click through quickly to simulate a working system. It is a trial attempt, as she says, to see "what will fit" in her vision for the system. In watching how the rectangles move as she clicks the mouse, Jess is *playing the role* of both a future reader and the role of the tablet. Together, Jess and her slides enact a drama of use (Smith, 2009), materializing the system's interactional qualities (Löwgren, 2008) so that Jess can decide whether or not she wants to show the grey rectangles to her client, and perhaps include them in the final specifications that the programmers will implement.

In this drama of use, roleplay and storytelling as *enactive practices* merges designer and user, and designer and system. In judging the naturalness of this navigation indicator, Jess speaks for herself as an expert designer, and for the future reader who is not present in the studio. In making decisions about the rectangles, she takes herself to be not just a qualified enactor of the scenario, but also a credible observer of her own responses to it. Roleplay turns Jess into a hybrid figure, a designer-user-computer who makes the indicator, animates, experiences it, and judges it.

The symbolic resources that Jess brings forth to judge the comparative worth of material things — what we could call *values* — are themselves redefined and refigured as Jess walks through her flipbook. One such value here is *naturalness*. As the founder of a company whose website promises "solutions from people's POV," Jess here is defining "natural" as what *the tablet's* prospective users will find easy to use. It is a central tenet of user-centered design that what one type of person finds easy to use, another may find difficult (Goodman, Kuniavsky, & Moed, 2012). Hence value-talk in walkthroughs often refers not to universal metrics but rather local and temporary arrangements of potential systems and potential users (Arvola, 2006; Buchanan, 2001; Fallman, 2003).

Yet Jess has not invented the oppositional concepts of "natural" and "device-like" on the spot. Quite the contrary! "Natural" in particular is a common term of praise in design education and professional work. Jess's invocation of this long-standing conceptual opposition instantiates practice-bound imaginaries (Hyysalo, 2006) of humans and devices common to the interaction designers I met. "How it feels like," then, figures *professional value discourses* into the walkthrough. Her understanding of "natural" and "device-like," and the activities she performs to *feel like* they are present, are shaped by previous professional experiences — her graduate studies in interaction design; past on-the-job apprenticeships; her continuing attendance at professional conferences and jurying of design contests; her conversations with coworkers and clients about the project.

Jess's improvisational performance allows her to evaluate sketches of a navigation element before presenting them to teammates, clients, developers, or users. This example is, however, rela-

tively simple, with a single designer working alone on a single interface element. How do groups of designers make decisions about more complex concerns? This section will elaborate on the role of embodied performance in the evaluation of design proposals — using a more complicated example from a larger company.

7.2 The Homeward Ceramics walkthroughs

> Meeting 2 has just begun. Audra, the project's main interaction designer, is lining up two printouts (A and B) in front of Phillip, the supervising visual designer. They show the same elements: a menu of navigation items at the top of the website with an open dropdown the width of the page showing a secondary navigation menu. A's dropdown lists general categories, while B's dropdown lists individual product line and partner collection. Audra explains that she and René, the supervising interaction designer, tried out a single wireframe that combined categories and individual items. But it failed. "We felt it was actually confusing," she says. "Because some of these categories start feeling the same." Now neither option, says René, is "working."
>
> There is silence for nearly ten seconds as Phillip and Alex, another visual designer, look at the printouts. Then Phillip speaks.
>
> Phillip: I think this <*pushes A away from him*> is too subjective, and I think this <*pulls B closer to him*> is too much.
>
> Alex: This to me <*touching B with his finger*> looks more complicated than ==
>
> Phillip: == This <*tapping B with his pen*> looks complex ==
>
> Alex: == than what we had originally.
>
> (Fieldnotes, February 8, 2011)

For LargeAgency, the Homeward Ceramics project is relatively small and uncomplicated. They are redesign the existing website for a small company, Homeward Ceramics, which makes luxury ceramic tile and housewares. The designers may add a few new features.[4] However, the project's more important goal is to reorganize the information on the site and refresh its visual style. As Audra, the project's lead interaction designer, tells me, "We're overhauling it, but we're not introducing a lot of new content or crazy bells and whistles" (Fieldnotes, February 3, 2011). It is a

4 See Chapter 5 for more on making features and feature sets.

six-week project with a small team of two interaction designers, two visual designers, and a project manager. None of the team are full-time, and the participation of the senior visual designer and interaction designer is limited to supervisory and client presentation duties. LargeAgency will deliver complete specifications for the website, including wireframes, a sitemap, and a visual style-guide. A separate development vendor will transform those specifications into a working website. The project has no firm deadline, but the designers know they must manage their time carefully to keep the small project from impeding their more complex and more profitable projects.

Initial client interviews reveal multiple, potentially competing goals. Homeward Ceramics wants to encourage shoppers to buy products from its partners while still increasing sales of its signature ceramics. However, the team knows that the company management does not want to appear *spammy* — that is, too aggressively commercial. Another non-spammy sales approach is an iPad-compatible website, so that salespeople in the company's brick-and-mortar stores can display out-of-stock goods and perhaps even make sales transactions. Hence two potentially conflicting business and technical goals: to increase sales in a non-spammy way, with one website for two very different technical platforms.

Following a brief "discovery phase" intended to acquaint the designers with the clients, their business, and their customers, the designers immediately start sketching interfaces. This chapter picks up the story of the project approximately half-way through a ten-day second phase dedicated to "user experience exploration." Audra and Alex, the more junior visual designer, spend the first days of exploration in "ideation," or sketch, sessions. Drawing freehand, on paper, they produce numerous proposals for "interaction models," (how users find their way about the site), high-level information architecture and "hero flows" (sequences mapping critical tasks). Then Audra and René, the more senior interaction designer, condense the sketches into three separate plans, or "directions," for the site reorganization.[5] The next three meetings refine those initial directions and prepare the designers for their first client presentation.

For LargeAgency, this is an atypically "unstructured" process (Fieldnotes, February 3, 2011). But then, the supervising visual and interaction designers do not believe that the Homeward Ceramics website needs much rigor.

When I asked LargeAgency's project manager how I could best observe interaction design in the project, she immediately suggested that I attend these walkthroughs. What I saw resembled other meetings I attended elsewhere. They featured a familiar assortment of disciplines (visual design, interaction design, project management), and tools (paper printouts, Post-it notes, a conference table). They ran largely on schedule, with no acrimonious controversies or technical struggles. The

5 For the rest of this example we'll call them D1, D2, and D3, as the designers do.

team treated the project itself as a routine job, requiring only part-time attention from the team members. E-commerce websites are a familiar interaction design genre, with numerous examples and even published "interaction design pattern libraries"[6] and templates available for reference. In this case, any engineering work would be technically limited: the website would run on an existing e-commerce platform,[7] so the team could only customize the appearance and functionality of a generic tool. However, LargeAgency's portfolio website features Homeward Ceramics's redesigned website. So we can take the project as indicative of what a well-regarded interaction design company believes is high-quality work.

The examples in this chapter are drawn from the second of three walkthrough meetings that take place before the team's first client presentation. Audra arrives first at the conference table, carrying a large stack of digitally drawn wireframe printouts. Each page has a big title on top (i.e., "D1 Navigation"), with the wireframe itself on the right side of the page and typed comments on the left. Some of the wireframes have giant red dots on them, which indicate drawings that are new since the last meeting or that are missing expected content. As the others gather around the table, Audra methodically lays out the separate pages describing the three main concept groups (D1, D2, and D3) in three single-file columns. The wireframes are not hand-drawn sketches, but they are definitely not *finished*. For the designers, they are still "work in progress" to refine over the next week before presenting a first client presentation.

The object of this meeting is to decide how to divide the website architecture and navigation among different categories or "buckets." Navigation is a central concern of interaction design, so René and Audra are understandably worried that it is "not working" at the moment. As we saw in the exchange above, the visual designers immediately condemn the proposals as well, as "too subjective" and "too much." But though the problems seem clear, the solution is not obvious.

In response, Phillip proposes a walkthrough:

> Let's just start going piece by piece <*bounces his hand up and down across the page*>, right. To get a better understanding of what is important to go into each of these buckets.[8]

And so the walkthrough begins.

6 For example, see van Welie's e-commerce site pattern (2008).

7 That platform, Magento, is itself is a very popular, whose website (http://www.magentocommerce.com) claimed more than 110,000 installations worldwide as of 2013. Homeward Ceramics had hired a firm specializing in Magento customization. So this was to be a largely routine programming project as well.

8 All quotations and paraphrases in this section from fieldnotes, February 8, 2011.

The team at LargeAgency has already agreed that their specifications must satisfy five main project actors: the prospective users, the e-commerce platform and its developers, the ceramics company (as clients and as a manufacturing concern), and the designers themselves. In this *user experience* phase, the team returns again and again to questions of responsibility, functionality, labor and authority.

> Phillip: If they are repeat buyers, a repeat customer, they've already gone through Discover, they already know what they want. But if they're new to the site, if they've just been served a link, don't you THINK that they'll be drawn to the Discover area. Not by just the navigation but by the other content modules <*taps wireframe with his pen*> that we're serving up on the main page. *Are we putting too much responsibility on the navigation?*

Phillip's question (emphasis mine) crystallizes two critical questions that the LargeAgency designers feel they must answer before the next client presentation. Which elements of the website and the studio should be responsible for accomplishing the website's goal of getting shoppers to buy more products? Is the job of the content modules (i.e., the visual designers) or the navigation (i.e., the interaction designers)? And who on the project possesses the authority to assign those responsibilities?

During the meeting, the topic of talk skitters from direction to direction and page to page, sometimes walking vertically up and down the columns, sometimes comparing diagrams horizontally across them. What drives the movement around the table is an evolving list of problems: i.e. the "mix and match" problem (helping shoppers purchase items from different ceramics collections); the "related items" problem (inducing shoppers to buy non-ceramics items); the "scary nav" problem (making it easy to find a specific item without intimidating shoppers with long lists). Audra and René bring some of those problems to the meeting; others, such as the "scary nav" emerge unpredictably from roleplay.

Walkthroughs usually, though not invariably, produce clear, tangible outcomes that alter the representations and the project. The meeting at LargeAgency is no different. Looping back and forth between the problems in each direction and how to resolve them, the group leaves a trail of annotations, sketches, and moved papers as they go. By the end of the meeting, the table has been transformed. D1 is still in an orderly column, its essential structure unchanged. But the D2 and D3 paper columns have collapsed into each other. Audra is to take the existing screen layout of D2 and make a new direction that layers D1's screen interaction model atop the information architecture of D3, which the team has decided is "more personal" and "more human." As Alex says, "The site now is still about shopping, but it's more compelling shopping." The physical reconfiguration of the papers articulates the directions' conceptual reconfiguration by multiple rounds of storytelling.

The table indexes the decisions taken to reshape the project. The placement of pages *for* the designers (as described in Clark, 2003) fixes in place the conceptual reorganization of the directions; annotations and new hand-drawn sketches itemize specific deletions and additions to be taken on each wireframe. Invisible but still present is a rehearsed legacy of talk and gesture: the condemnation and naming of the "scary nav"; the corresponding praiseworthy identification of the "hero image" that will take responsibility helping shoppers discover and buy new products. The table and its wireframes thus serve as a material anchor for the website as conceptual blend (Hutchins, 2005). Drawing and spatial arrangement fix in place more ephemeral performances of the system and its users that would otherwise persist only as designers physically repeat them.

The walkthrough at LargeAgency also crystallizes habits of accountability within the project: persistent ways of telling a convincing story of the system. Audra introduces iconic gestures (McNeill, 2008) that René later repeats;[9] the "hero image" and the "scary nav" emerge from the wireframes as objects with names and specific spatial boundaries; descriptions of the documents (as, say, a "work in progress" rather than finished work) are rehearsed for future client presentation. Most noticeably, walkthroughs enlist shared, value-laden aesthetic discourses, such as those of "clarity," or "complexity" into alliances with the objects as they are performed. As specific regions of the schematics accrete descriptive labels, gestures, and annotations, they help constitute a "narrative infrastructure" (Deuten & Rip, 2000) for the project that guides and constrains "tellability" (Simakova, 2013) within future team and client walkthroughs.

7.3 Enactive practices in walkthroughs

The walkthroughs at LargeAgency connect hypothesized use to specific regions in system representations through the enactive practices of roleplay and emplaced narrative. By "enactive practices," I mean the combination of talk, gesture, images and physical setting to tell a story about past action, hypothesize likely future action, or invent conscious fictions.[10] In Arvola and Artman's

9 This phenomenon of the repeated iconic "expanding area" gesture resembles the role of gesturing in representing and investigating molecules in biology (Becvar, Hollan, & Hutchins, 2005), though not with such clarity and intellectual import.

10 The concept of enactive practices unites a number of practices highlighted in other studies of "acting to know" (Kuutti, Iacucci, & Iacucci, 2002) in digital design activities. These include: exaggerated vocal intonation (Arvola & Artman, 2007) and gesture (Athavankar, 1999; Hummels, 2000; Robertson, 1996; Tang & Leifer, 1988; Tuikka & Kuutti, 2000), as well as improvisational use of existing environments and and common tools as settings and props (Iacucci & Kuutti, 2002; Simsarian, 2003; Wulff, Evenson, & Rheinfrank, 1990).

apt wordplay (2007), enactive practices in walkthroughs makes users and systems *behave* through combining talk, gesture, and media.

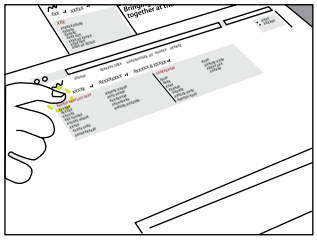
Enactive practices depend upon a number of related activities that together "animate" interface representations and bring them the material dynamism they otherwise cannot supply: "envisionment, embodiment, acting, enacting, and reflection" (Wulff, Evenson, & Rheinfrank, 1990, p. 244). That is, designers perform fictional narratives, responding moment-by-moment to the reactions of a physically present or imagined audience. This section explores two dimensions of enactive practice that emerge in walkthroughs: (1) the human and non-human characters that designers articulate in performances, and (2) how designers use bodies, artifacts, and spatial arrangements to tell stories about them.

"…and this is the Discovery"

Here, Audra is explaining her plans to solve a pressing technical problem: the lack of a rollover on the iPad. A rollover is an active screen region that, when passed over (but not clicked) with a mouse, reveals a previously hidden visual element. Rollovers are a conventional way to hide supplemental information until needed, as when passing the cursor over a menu item reveals a sublist of secondary items (A. Cooper, Reimann, & Cronin, 2007). LargeAgency believes that sales will increase if shoppers see attractive photographs while moving swiftly among different categories of products. This is the kind of navigational task that would normally call for a rollover. However, the iPad's touchscreen does not allow rollover inputs, making this conventional solution incompatible with the client's request for a multiplatform website.

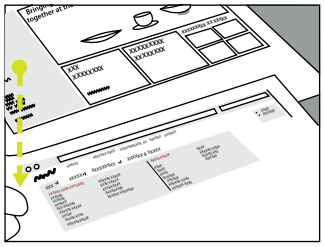
Audra's plan removes the rollovers altogether from the navigation menu. But Phillip, the senior visual designer, is having trouble understanding how the unconventional arrangement of interface elements will work in practice. Audra's static drawings do not show the menu in the process of dropping down, only at its end state. There are no visible, permanent lines among the pieces of paper to indicate information architecture; only the spatial arrangement of papers on the table indicates hierarchy and sequence. Moreover, as with Jess's rectangles, Audra's schematics do not explicitly indicate a human user's motives, decisions and responses.

So Audra acts out how she thinks the navigation will work. Figure 7.2 walks through Audra's explanation along with her.



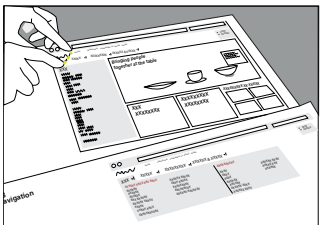
So you get THAT when you hit that arrow button <*touching a black triangle on the first sheet of paper within the shaded box*> and <*pauses*>

(A) "THAT" (the shaded box) is a secondary navigation region. It appears onscreen when a user clicks "that arrow button" (the black triangle) just as Audra is touching it. The gesture, and the other simulations of mouse actions we will see in this sequence, are pantomimic (Barten, 1979). That is, they simulate actions taken upon an object without representing the object itself.



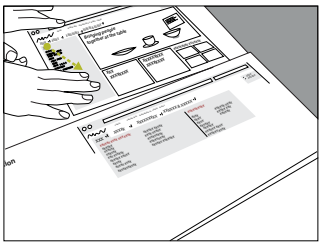
If you click Eat <*taps at a line of text next to the triangle, moving aside the first sheet to reveal more of the wireframe on the paper beneath*>

(B) Clicking "Eat" (the line of text next to the triangle) loads another page. As Audra taps the line of text with her finger, she moves aside the first sheet of paper to reveal another wireframe underneath. In doing so, she is pantomiming what the web browser would do in loading the linked webpage.



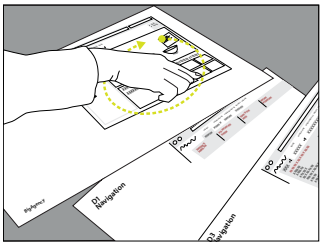
just imagine a dotted line here <*pincers her fingers on the navigation menu on the second page*>

(C) Audra hasn't yet drawn in the "dotted line" that she would use to indicate that Eat is selected on this new wireframe, so she uses an iconic pincer gesture to help her audience "imagine" the non-existent line.



you just land on this page <*spreads her hands across the second page*>

(D) Audra reminds her audience that clicking the Eat link shows the user a new page, and deictically indicates the page with her spread hands.



and this is the Discovery <*circles a finger around the central region on the second page*>.

(E) The designers' name for text and images that might guide the user to unfamiliar products is "Discovery." Audra is now using her finger deictically to mark such content.

Figure 7.2 Audra walks Phillip through the navigation from the site's home page to the "Discovery" section on the Landing page of the Eat section. Green lines highlight region referenced in pointing gestures; arrows indicate overall direction and distance of gesture.

Heterogeneous roleplay

The designers of LargeAgency, like many others, frequently use roleplay (Anderson, 2011; Robertson, 1996; Tang & Leifer, 1988). In design roleplay, "An individual acts out the behaviour of someone else or animates the behaviour of an object" (Robertson, 1997, p. 213).[11] By now it is common to define design practices as "heterogeneous engineering" (Bødker, 2009; Nickelsen & Binder, 2008; Suchman, 2000). In the previous chapter, I described how Post-it notes and a whiteboard draw together abstract concepts, types of humans, and machine functionality. Here, roleplaying similarly "draws things together" (Latour, 1990) as co-experienced performance. Audra's improvisational dance of talk, images, printouts, and gestures illustrates the *heterogeneity* of roles being played. In under ten seconds, she takes on the identities of six different project entities, four human and two machine:

(1) *An indefinite user* As she talks and taps her fingers, Audra is invoking the actions and perceptions of "you," an indefinite but very present prospective user who is not Audra herself (A, B).

(2) *The web browser* The web browser is responsible for replacing one visual region with another after the activation of a hyperlink. In moving from the first sheet of paper to the second (B), Audra is enactively simulating how the browser would load a new file.

(3) *Designer*: Finally, Audra plays her own official role, that of a designer in LargeAgency. She departs from the diegetic narration to gesturally mark a non-existent dotted line (C) and to indicate where she has placed a type of content intended to support Homeward Ceramics's business goals.

(4) *Implied machines and humans* Moreover, Audra's story also has two unmentioned but implicated actors (Clarke & Montini, 1993): the iPads and the iPad users whom she is trying to accommodate with the rollover-free navigation menu.

"I"-talk

Audra's explanation distinguishes herself as designer (implicit in her command to "just imagine") from the "you" of the performed user. But roleplaying users can also mean blurring the difference between the two. Here is Phillip trying out a new sketch for the navigation menu:

> I'm just looking at the way I would like to shop if I were to come to this <*touches a box that he just drew. It has a horizontal divider on top, text in the divider, and two columns of text below*>.

11 Like Robertson, I take "roleplaying" as a relatively loose and general term. Elsewhere in the HCI literature (Seland, 2006; Schleicher, Jones, & Kachur, 2010; Simsarian, 2003), "roleplaying" denotes more structured (though still largely improvisational) theatrical activities.

> I would want one of these <*touches the navigation menu on D1*> to just be all of Homeward Ceramics's top level lines. And then I would may want to see Arts and Design <*writes a few words next to his box sketch*>, or whatever.

This kind of "I-talk" (as opposed to Audra's "you-talk") was omnipresent in all the consultancies I visited, and nowhere more so than in this unstructured project at LargeAgency. It is a part of what has been called the "I-methodology" (Oudshoorn, Rommes, & Stienstra, 2004): the "reliance on personal experience, whereby the designer replaces his professional hat by that of the layman" (Akrich, 1995, p. x).

Here, Phillip's I-story asserts that his reactions match those of likely shoppers. Its credibility rests on his audience's appreciation for Phillip's personal and professional biography[12] both as a design expert and the kind of person who himself might shop at the Homeward Ceramics website. If technical data, as Vinck writes, "Is a gift carrying with it something of the person offering it" (2012, p. 105), then Phillip's I-story here literally is drawing together his technical proposals and his place within LargeAgency. And indeed, Phillip's I-story ends the argument — but not as Phillip might have hoped. As Phillip sketches, René points out that Phillip's sketch may look novel, but it replicates "exactly" the information architecture of the website they were hired to replace. The ensuing debate over how users *unlike* Phillip might navigate the website prompts Phillip's question about technical functionality and effort: "Are we putting too much responsibility on the navigation?" I-talk can serve not just as a way to end debate, but as a way to concretize a vague proposal enough to put it to trial.

Presentation and use scenarios

Audra's explanation plays out familiar roles from one type of professional scenario: that of *use*. How, she asks, will Homeward Ceramics shoppers discover unfamiliar products? But it's important to note that there is another type of scenario that the LargeAgency walkthroughs enact: that of *presentation*. This second scenario genre explores how representatives of producer-groups, i.e., clients and developers, might respond to the deliverables. Here is an example from a later meeting at LargeAgency, when Phillip starts to roleplay the upcoming client presentation:

Phillip:	Look. We're going to go in there anyway and preface it that, like, hey, we ==
Melissa:	== [The copywriter]'s going to have a fit anyway.
René:	Why?

12 Nickelsen and Binder (2008) examine the importance of biography in engineering design.

Phillip: Why is he going to have a fit?

Audra: It's just <*pauses*> it's kinda contrary to the stuff he's doing.

(Fieldnotes, March 9, 2011)

Presentational roleplay surfaces another way for the system-in-design to fail: it can be rejected by clients. As Melissa's interjection indicates, these two scenarios feature different characters, plots, and logic. The website-centered story turns on the behavior of indefinite, implicated, and designer-identified users, along with the website and its underlying technology platforms. The document-centered story turns on the behavior of specific, named clients, designers, and developers, along with the documents themselves. In the website-centered story, the designers alone debate the capacities and preferences of the characters. In the document-centered story, Melissa the project manager can interrupt a senior designer as an authority on the probable reactions of the copywriter. Which team members can speak in walkthroughs — and on behalf of which entities — configures (Grint & Woolgar, 1997) client and team as well as user relations. In moving between presentation and use stories, the same documents can play a double role (Suchman, 2000): as "transparent," if partial, stand-ins for the website-in-use, and as provocative objects of concern in their own right that must be artfully presented to avoid angering specific clients.

Emplaced narrative

> We should start thinking about bodies as parts of places (Pink, 2011, p. 347).

As "body-work" (Myers, 2008), enactive practices such as roleplay inevitably *add something* to the drawings. They materialize within the walkthrough objects that would be otherwise be absent, including (but not limited to):

- The material attributes of the system and its supporting infrastructures
- The expectations, aspirations, and preferences of humans such as users and clients
- The abilities, actions, and knowledge of systems and humans

These enactive practices interpellate, or call forth, "narrative spaces" (Haviland, 2000) from the interactions of talk, gesture, and placed props. Such narrative spaces emplace (Howes, 2005) the system-in-use into both designers' bodies and the studio space itself.

Consider Audra's explanation as "situated interaction" (C. Goodwin, 2000) emplaced within the space of the studio. The pages *as placed* are ready to support Audra's story of the interaction between user, navigation menu, and web browser. Anticipating the location of her audience, she has placed the papers *for Phillip* (Clark, 2003) as material anchors (Hutchins, 2005) of the project's

three navigation directions, and the likely sequence in which users will encounter regions within them. At the presumed head of each column is the "home page" for the site, which is the first part of the Homeward Ceramics website that a user would see. At the bottom is the wireframe for a "product page" from which the user can purchase the item. Indeed, it is no accident that the columns of rectangular pages on the table resemble a conventional site map writ large. Audra's argument for her rollover solution assumes that her audience can read the table as a site map and judge from her actions *upon the table* the implications of her plan for users' movement around the website's buckets.

Sometimes, however, the documents resist the story that a designer wants to tell. The following exchange takes place as Alex tries to make sense of D1's proposed information architecture:

Alex:	Does it break this website here if I click All Products <*touches a line of text in the navigation menu area*> in Cook and Dine, you're just not on Cook and Dine anymore?
René:	Yes. <*touches the same spot*> Cause you're nowhere.
Alex:	I mean, you're still OBVIOUSLY in shop.
René:	But you're not. Because there is no Shop.
Audra:	There is no Shop.
Alex:	I mean, the whole site is a shop.
René:	You're not in any section.

For Alex, "shop" (lowercase) describes a physical region of the website that facilitates buying items, versus the non-transactional "discovery" regions. For René and Audra, "Shop" (capitalized) labels a specific branch of pages in D1's information architecture. There is no such section in D1. Moreover, the designers now realize that sequence of actions that Alex describes will "break" the site's logic: "Cook and Dine" lies within the "All Products" category, and not vice versa. For both Alex and René, this categorical difference is emplaced, making sense in terms of the narrated space of Alex's story. For René, Alex's clicks drop him into digital limbo: their logical structure for the site did not take account of such an action. Alex, then, will be "nowhere" after clicking All Products. For Alex, the click keeps him inside the sphere of commerciality and shopping that should characterize the "whole site." Alex's enacted click shows the team unexpected fissures in the logic of the site and ambiguities in the designers' terminology that were not see-able in the diagram alone.

In part, walkthroughs produce enactive knowledge (Bruner, 1990): understanding generated through sensorimotor exploration. The movement of hands and eyes up and down the columns

of papers enacts vertical movement through implied conceptual hierarchies. The dance of fingers over the lines of text, or buckets, in the menu makes tangible the breadth of each hierarchical level. Or, as with Alex's discovery, uncovers unexpected logical holes into which users could tumble. Sequences of enactively pantomimed "clicks," like Audra's, make the temporal rhythms of the user interaction model tangible as taps on the table. Representational gestures (Kita, 2000) act out the dynamic movements of dropdowns and other transitions on the two-dimensional screen. This is how the walkthrough interpellates the system-in-use into the studio space, the stacks of paper, and the bodies of designers. When designers walk their hands and bodies around the table, they are also physically *walking through a future system*.

Walkthroughs employ similar material modes of ordering to those we saw in Chapters 5 and 6. Designers add new components, group them, accrete them, remove them. Yet where an ordered whiteboard *shows* the project to designers and clients as a see-able visual field, team walkthroughs like LargeAgency's *draw out* the project as linear paths in space and time. These "interpretive journeys" (Ochs et al., 1996) can introduce new elements, as in Phillip's I-story. They can associate graphic elements that are otherwise unconnected, such as the text link in Audra's dropdown and the new page it loads. Gestures in the air delimit and emphasize some regions, such the Discovery, while minimizing, deleting, or ignoring others. In combining physical movement and storytelling, emplaced narrative is a line-making practice (Ingold, 2007). They are, according to one designer I interviewed, an "art of reduction" (B. Cerveny, Interview, March 21, 2012): carving out only a few trails from the many possibilities latent in the static diagrams.

Affective aesthetics

René and Audra do not discard their first plan because it is visually unappealing or technically difficult to implement. Rather, it is "confusing." Their second plans appear to have similar problems: "subjective," "complicated," and "complex." But while Phillip, Alex, Audra and René all agree that the navigation menus are not working, they have no standardized metric or ready-to-hand measurement tool that will enable them to come up with better alternatives. That is why René and Audra have called this meeting, and why Phillip almost immediately calls for a walkthrough.

Both negative terms draws on widely held, longstanding professional value discourses. The Bay Area designers that I met frequently used the same words in the same ways: "clarity" is almost always a positive attribute; "confusing" is almost always a negative one. The opposition of clarity and confusion occurs not just in studios, but textbooks (i.e. Rogers, Sharp, & Preece, 2011), conference talks, pedagogical evaluation, et cetera. As a verbal rather than visual design activity, this kind of "talking design" (Tomes, Oates, & Armstrong, 1998) mobilizes and makes Audra's ephemeral, sensate response to her wireframes accountable to the rest of the team

by allying it with a durable and widespread aesthetic professional preference for "clarity" over "confusion." Yet, like the taste of an opera buff (Hennion, 2007) or a wine critic (Teil, 2012), the shared symbolic resources mobilized in collaborative decision-making undergo constant refiguring in studio tools, practices, and histories. For René and Audra, the walkthrough functions as an apparatus (Barad, 2003) of judgment — reshaping not just their wireframes, but the specific criteria by which the designers judge them.

In doing so, they are asserting what Phillipsen et al. (2004) have called an aesthetics of *use* rather than an aesthetics of visual *appearance*. In an aesthetics of use, judgments are relevant only to temporary arrangements and local agreements. What sort of person is finding this navigational menu confusing right now? Under what circumstances does it confuse? Through walking and rewalking through the documents, designers experience and assess the system's interactional qualities as *professional* stand-ins. On the one hand, they try to experience confusion or naturalness *as the prospective user would*. On the other hand, they name those sensations in *a shared, disciplinary language*. This walkthrough at LargeAgency is, after all, taking place in what the designers call the "user experience exploration phase." This somaesthetic (Shusterman, 1999) practice is one way to translate interpretive journeys into accountable stories: *feeling for* as a basis for *speaking for* otherwise absent users.

As Fleming points out about graphic designers' informal "performance" of documents in critique sessions, enactive practices in walkthroughs

> Give the constructed object the stability needed to survive the interaction at hand and the fluidity appropriate to this kind of social event (1998, p. 57).

Roleplayed narrative concretizes speculation beyond what the graphic representations can do on their own (Tuikka & Kuutti, 2000). Even expert designers cannot apprehend all the implications of system representations at first glance. Their possibilities and pitfalls must be discovered through improvisational path-making using talk, gestures, images, and papers. These paths rely on the symbolic placing-for (Clark, 2003) of documents on display surfaces. But the narrative focal point, as we saw in Audra's explanation, is the "mediating body" (Suchman, 2000) of the roleplayer as the producer, display, and interpreter of these qualities of the system-in-use. Nevertheless, as Jess's solitary walkthrough suggests, those affective sensations can still "mediate future possibilities" (Keane, 2003, p. 418), even if they are never used to invoke and respecify professional value discourses.

7.4 Professional feeling

> There are things where, instinctively, you know it's the right thing to do. You're not necessarily able to articulate it. (René, Interview, May 15, 2011)

The material results of walkthroughs resemble Charles Goodwin's influential account of professional ordering practices as a form of *trained sight* (1994). Professional vision incorporates specific techniques for apprehending the world, structuring one's understanding of an event, and making that understanding graspable and shapeable. As Goodwin writes,

> The ability to see a meaningful event is not a transparent, psychological process, but is instead a socially situated activity accomplished through the deployment of a range of historically constituted discursive practices (1994, p. 607).

Professional vision, crucially, is collective. Situated and contingent practices of professional vision create the "objects of knowledge" of the field: "the theories, artifacts, and bodies of expertise that are its special and distinctive domain of competence" (p. 606), as well as the specific events and materials at hand.

Like Goodwin's archaeologists, interaction designers employ conventional *codes* such as "the hero image"; they *highlight* some regions of the graphic representations at the expense of other regions; they render lines drawn by roleplayed narrative into *graphic representations* delivered to the developers and client. However, unlike Goodwin's archaeologists, the important features of LittleStudio and LargeAgency's users and systems as objects of knowledge are neither as ontologically stable nor as accessible to sight as the color of a clump of dirt. In Chapter 5, I argued that respecifying practices of *seeing* as practices of *showing* might help us better account for the practical consequences of ordering activities at the whiteboard. Here, the interweaving of emplaced affect and judgements in walkthroughs suggest another respecification of design practice: from professional *seeing* to professional *feeling*.

To begin, we will revisit Goodwin's original world of professional vision. It is comprised of pre-existing, autonomous perceptual fields, such as a clump of dirt or a stream of video. The observer, as a thinking subject, is ontologically distinct from these stable fields. The most important features of these fields are visually perceivable, such as color or the movement of a leg. Though the identification of important features is a situated and contingent accomplishment, it requires pre-defined coding schemes, such as aggression/cooperation in policing or standardized color metrics in archaeology. These coding schemes have durable, shared definitions within each profession, often fixed in specialized tools of measurement. So senior professionals, such as professors or expert witnesses, can authoritatively instruct apprentices, such as students and jury members, what there is to see and how to see it. Teaching professional vision instantiates professional authority in the teacher. Once distilled into graphic representations (themselves situated and contingent accomplishments), these visual objects of knowledge can circulate within the field as accompaniments to talk and writing.

The objects of knowledge for LittleStudio and LargeAgency work differently. The system-in-use and its users do not exist autonomously; the designers' enactive practices can only temporarily and partially materialize them in the studio. Furthermore, these practices often materialize a hybrid designer-system-user, at once observer, observed, and measurement tool. Instead of separation, there is intimate identification. Moreover, the qualities which designers invoke to justify their decisions are affective as well as visual. Jess and the designers of LargeAgency do not only *see as* or *see that* (Schön, 1983) in walkthroughs; they also *feel as* and *feel for.* The designers *feel as if* they are physically traversing three-dimensional regions in an information architecture. And in examining the "user experience" of such movements, the designers cultivate affective, somaesthetic value judgments as a means to *feel for* prospective users[13] credibly.

Any graphic representations that result from walkthroughs can still circulate, but they do not authoritatively represent the system-in-use alone. They must be re-enacted at each point of decision. It is in surviving repeated walkthroughs as agonistic situations (Latour, 1986) — not in the application of pre-defined coding schemes — that arrangements of system elements and human feelings persist within the project and within studio practice. Enactive practices remain necessary if users and systems are to retain their worth within the representational economy (Keane, 2003) of professional interaction design.

Recall Audra's complaint at the beginning of the meeting at LargeAgency: "We felt it [the wireframe] was actually confusing, because some of these categories start feeling the same." Like Audra, this chapter has invoked three concepts of "feeling" present in studies of interaction design. The first is the somatic experience of the system *as if* it is in use — the sort of tactile and affective qualities that designers often call "look and feel" (Tuikka & Kuutti, 2000). The feel of an interface, as Jess points out, cannot be abstractly imagined. In this way, some of its categories started "feeling" similar to Audra and René as they reviewed the wireframe before this meeting. Judging these qualities requires an aesthetic of use: "not inherent in the artefact itself but rather a result of the human appropriation of the artefact" (Petersen et al., 2004, p. 271).

The second framing of "feeling," less common in scholarly literature than in studio talk, is the affective *feeling for* future users that many designers call "empathy" (Kelley & Littman, 2001; Michlewski, 2008). It is this goal of *feeling for* the future user that underwrites the LargeAgency

13 Professional manuals, manifestoes, and presentations often label this experiential service as "empathy" (i.e., Beckman & Barry, 2007; Kelley & Littman, 2001; and Moggridge, 2007). However, "empathy" has emotional and laudatory connotations that I am trying to avoid. "Feeling for" is a less value-laden phrase that also references the "shifting in" (Akrich, Latour, & Akrich, 1992) of haptic and affective work to designers from usability data and other explicit user representations.

designers' rejection of their wireframes as "confusing." The designers suspect that, like them, *users* will have trouble perceiving differences among the categories.

The third definition of "feeling" is a trustworthy, well-trained intuition (Löwgren & Stolterman, 2004, p. 58). In studio conversations, such announcements of trained intuition are often signaled by the verb *to feel that,* as when Audra says, "We *felt* [that] it [the wireframe] was actually confusing" (italics mine). This third definition of feeling suggests a Bourdieuvian "feel for the game," or "practical mastery" that

> Gives the game a subjective sense — a meaning and a raison d'être, but also a direction, an orientation, and impending outcome, for those who take part (Bourdieu, 1992, p. 66)

This "right feeling," as Löwgren and Stolterman call it, is what allows the designers of LittleStudio and LargeAgency to make decisions about what to draw and how to present it to clients in the absence of definitive proof.

The work of making decisions in walkthroughs demonstrates how these three definitions can form parts of a single phenomenon: *professional feeling.* That is, the interaction designers I met rely on trained intuitions to make decisions and to *feel that*, in the absence of working systems and physically present user representatives. These intuitions are initially produced by heterogeneous roleplay that allows the designers, however distantly, to *feel as if* they are using the system. This simulated use induces a *feeling for* future users by designers as stand-ins. By invoking shared aesthetic discourses (such as "confusing" or "delightful") in narrative, these sensations and emotions can be made accountable not just to other participants in the walkthrough but also outside the studio to clients and other external audiences. In this way, both professional feeling and the decisions it underwrites rely not only on wireframes and site maps but on the performances that animate them.

7.5 Conclusion

In narrating the project, walkthroughs zigzag across the table (or through a set of slides), stringing together otherwise unconnected physical regions in the schematics. These enactive practices in walkthroughs are emplaced first in distributing cognition (Hutchins & Klausen, 1998) among "body-mind-environment" (Howes, 2005, p. 7): the designers' talk and gestures, the display table, screen, or wall, and the sheets of paper (or slides) as material anchors of digital structure. Second, they produce the system-in-use as a navigatable "narrated space" (Haviland, 2000): textured, three-dimensional, changeable, unexpectedly fissured. The system-in-use (and its users) that emerges is a multiple, fractional object (Law, 2002), constituted in the moment-by-moment interplay of graphic representations and roleplayed narrative.

The linear twists and turns of this narrated interpretive journey (Ochs et al., 1996) call forth trained intuitions — that is, *feelings* — from human co-experiencers as stand-ins for both the system and its constituencies. For like an unbuilt building (Ewenstein & Whyte, 2009), the Large-Agency website-in-use and the LittleStudio navigation menu are epistemic objects: "continually unready-to-hand, unavailable and problematic" (Knorr-Cetina, 1999, p. 10). Refracted through graphic representations, gestures, and talk, stories and speculations, they are a "pattern of absences and presences" (Law & Singleton, 2005, p. 343) mapped out in debate and speculation.

The designers' emplaced engagement with their schematics must negotiate among multiple, tentative, *notional* (Schmidt, 2011) representations, none of which fully describe the finished object-in-use. To do so, designers use talk and gesture materialize spatial and temporal dynamism that system representations otherwise lack. They also act out the behavior of human users, drawn from formalized use cases, improvised stories, or theories (formal and informal) human behavior. It is in this heterogeneous roleplay and emplaced narrative that designers come to *feel* their representations as well as see them, and make those feelings accountable to their audiences.

Hence, in resolving those debates and solidifying speculation, walkthroughs are an *exclusionary practice*, in which "the 'components' of phenomena become determinate" and "particular embodied concepts become meaningful" (Barad, 2003, p. 815). They name and bound regions; attribute features and capacities to project components and constituencies; string together stories from otherwise disconnected elements. Even if only temporary, these local agreements about the nature of the project and its actors incrementally alter its "narrative infrastructure" (Deuten & Rip, 2000), shaping the manner and form of future storytelling. Successful walkthroughs reconcile the disparate desires and competencies of users, designers, clients, vendors, and systems into a "tellable story" (Simakova, 2013) — or, as Jess says, "what will fit." Trained, collectively constituted enactive practices make otherwise absent haptic and affective dimensions of the system-in-use and its constituencies just present enough to be judged in context of the rest of the project — but not so permanently fixed that they cannot be changed by the next round of storytelling. They craft "temporary, local closure" (Gerson & Star, 1986, p. 263) of debates about what clients are like, what users are like, what the system is like, what the designers are like.

By acting out stories of use and presentation, designers produce the objects of their design through trained *professional feeling* — haptic and affective ways of materializing and judging the objects of design. *Professional feeling*, enabled by these enactive practices, is one way that designers provide "due process" (Gerson & Star, 1986) to the static graphic representations and human experience they must judge in the absence of working systems and representative users. In order to "see what will fit" into her existing plans, as Jess tells me, she must first *feel how it's like*. The expertise of interaction designers lies not just in fabricating compelling visual representations but in crafting accountable feelings.

CHAPTER 8

Performing the project in client encounters

"We are going," Jess says ominously into her mobile phone, "to have a frank discussion."

It is thirty minutes before a major client presentation is scheduled to start. All the principals of LittleStudio have gathered to prepare for it. Julie, a visual design principal, is agitated. Her voice is louder than usual and she's waving her hands in the air. Jess says, flatly, that the meeting is "not going to be positive." Dave, one of the interaction design principals, suggests that he attend the meeting as "the bad cop." It is in this nervous environment that Jess telephones the client. The client was planning to bring a journalist to the meeting as part of a publicity campaign. But, as Jess tells her, "I'm not sure if that's a conversation either of us wants to have with a reporter here" (Fieldnotes, February 10, 2010).

8.1 Introduction

Organizational, disciplinary, and physical separation of designers and clients is a hurdle for collaboration between clients and designers. The clients who have paid for the project are not present in the studio to influence day-to-day design activity. The designers who have put so much effort into the project are not present in the client organization to influence decision-making about the project there. Interim client encounters throughout the course of a project are a way for clients and designers to influence each others' work. In consultancies, initial sales presentations conducted by representatives of the design firm[1] set the terms for the project. They introduce the clients to the firm and establish what the project is to accomplish. Interim client encounters, such as presenta-

1 These presentations are not always conducted by the designers who will do the work. Larger consultancies may have one team sell the project and another do it. This practice routinely results in later misalignments. Initial promises may be so vague as to provoke competing interpretations, or prove impractical. Whether conducted by sales teams or design teams, however, the initial presentations rarely can exactly specify the results of the project. In practice, the initial terms are renegotiated as the project progresses.

tions, document transmission, and workshops, are ways for clients to approve or reject documents, share information about their business, offer advice, make demands, answer questions. At the end of a project, designers use final presentations to give the best possible impression of their work and answer any questions before the engagement ends and they can no longer affect what their clients do with the deliverables.

As LargeAgency designer René told me, "Part of my job is to make people feel better about spending half a million dollars on a process that isn't predictable" (Interview, May 15, 2011). So we can usefully think of encounters between the design team and its client as leverage points for both clients and designers. They allow clients to influence what the designers do when the clients are not present, and give designers the chance to influence what clients do with the deliverables once the documents leave the studio.

A client encounter is, fundamentally, a meeting between two groups of people with different interests in the situation and knowledge about it. The designers do the day-to-day work, but they are ultimately accountable to the clients who pay their fees. Consultancy designers, as agents acting on behalf of their clients, cannot wholly act on their own (Eisenhardt, 1989).[2] Their authority over the project is limited; consulting designers across multiple disciplines often feel themselves contractually and professionally obligated to defer to their clients' desires (Grocott, 2003; Lawson, 2004). Yet clients can also find consulting anxiety-inducing: they have entrusted the success of their business to potentially untrustworthy[3] outsiders. Client encounters, as René's words suggest, helps reassure clients that their trust (and money) is not misplaced. As such, client encounters are a form of "face-work" (Goffman & Best, 2005).[4] They are intended to help mitigate any anticipated or actual disparities between the expectations that clients' and designers' have for the project and what is actually being delivered.

In accounts from professional practitioners (such as Grocott, 2003; and Loch, 2003), a single client encounter may fulfill multiple purposes. First, client encounters are *informational*: they edu-

2 This principal-agent relationship is of course not limited to consultancy designers. It also applies wherever interaction designers ply their trade in service to non-designers such as business managers, engineers, or marketers. But disparities in domain knowledge and potential conflicts in interest are particularly visible and pronounced in consultancy work because the splits are both organizational and disciplinary.

3 This anxiety motivates agency theory: what forms of governance will protect clients from the misconduct or incompetence of consultants working as their agents? See Eisenhardt (1989) for a thorough review of of agency theory's concerns.

4 This line of argument is well-developed by Clark (1998) and those who build on his work in organizational studies, such as Jones (2003).

cate designers and clients about each others' beliefs, preferences and constraints. Second, client encounters are *explanatory*. They provide an opportunity for designers to explain otherwise mysterious or unknown professional activities to clients — an activity sometimes called "selling your design." Explanatory moves also demonstrate progress towards agreed-upon goals by presenting tangible evidence of effort. Hence "selling the design" also means selling the designer. To gain support for their work, designers, like other service specialists (Goffman, 1959; Sheane, 2012), must persuade clients of the technical and aesthetic expertise not just of their firm and but of themselves as individuals. Third, encounters are *advisory*, giving clients the chance to direct designers' next steps. Clients may need to formally approve or reject designers' proposals, or give more open-ended and informal feedback.

The projects I witnessed in my research all followed the conventional client presentation model, in which presentations anchor "a series of formally approved decisions at each stage of the project" (Grocott, 2003, p. 90). In that model, the SOW, design brief, or contract specifies the number of client presentations, what they will decide, and the revisions that clients may request between them. As designer Kim Goodwin writes,

> A presentation provides a forum for questions and discussion, which are necessary for a group to agree on difficult choices (2009, p. 366).

For many interaction designers a client encounter is thus ideally less a means of "one-way communication" than a conversational tool for producing alignment. In Chapter 5, I outlined two dimensions of alignment (drawn from Stokes & Hewitt, 1976): interactional and cultural. Interactional alignment occurs when people mutually orient their behavior to each other and to a shared set of objects. Cultural alignment, however, is a remedial activity, occurring when a gap opens between participants' expectations and what is actually happening. Alignment in client encounters takes on both dimensions. First, client encounters are to produce a shared understanding of what the clients expect from the project and what the designers are actually doing (Boag, 2012; Lawson, 2004) — i.e., cultural alignment. Second, client encounters require decision-makers to make "difficult choices" (or binding agreements about what both clients and designers will do in the future) — i.e., interactional alignment. As LargeAgency's René told me, sustaining both types of alignment in client encounters means that, "Most of the time the client needs to make a decision" (Interview, May 15, 2011).

Given the importance of client encounters to interaction design, this chapter will examine the skills they require from designers. Clients, partners, or managers who are non-designers may have difficulties in interpreting boxes-and-arrows diagrams and in understanding their role in translating those diagrams into a working system. Unsurprisingly, "communication" and "presentation"

are recognized interaction design competencies. University programs teach presentation skills;[5] job descriptions for senior and junior positions alike demand them;[6] resumes routinely highlight "communication" and "presentation" in lists of qualifications.

The specifics of "communicating" and "presenting" vary in practice among organizations and professional roles. Nevertheless, my interviews and reading suggest an industry-wide consensus: presentation skills and communication skills are essentially similar, and they are *descriptive in nature*. A good interaction designer must have, in the words of a job posting at LargeAgency, "The ability to successfully articulate design concepts to your team and client" — also colloquially called "selling your ideas." As designer Kim Goodwin advises, "Like it or not, anyone but the most junior designer needs to be an effective presenter" (2009, p. 374). What I will argue in this chapter, though, is that this popular definition of presentation skills does not account for some essential types of alignment work that designers perform in client encounters.

In this chapter, I introduce an expanded definition of client encounter skills as not just description of objects but *performance of the project*. "Client encounter skills," this chapter argues, sums up a wide variety of solutions to the practical problems that interaction designers regularly encounter in completing projects to their and their clients' satisfaction. They involve much more than the presentation skills so regularly listed on job postings. Designers must not only produce a shared understanding of the project, but use that understanding as foundation for binding decisions about what clients and designers will do next.

In order to broaden our definition of what designers must do in client encounters, we will look at a case of breakdown, in which client encounter derail rather than further the smooth progress of a project. We will follow three increasingly troubled client encounters at LittleStudio for the iMAGine project. In the first encounter, Meeting I, the designers must make an important client presentation under unfavorable circumstances. The second encounter occurs as the designers read and heatedly discuss a follow-up email from their client that seems to break their earlier agreements. The third encounter, Meeting II, is a face-to-face change request meeting to resolve the problems created by the email. Beyond creating a shared understanding of the project, the design-

5 Programs teaching presentation skills for interaction design in North America include New York's School of Visual Arts, the Massachusetts College of Art and Design, Art Center College of Design, Simon Fraser University. This list is not comprehensive, of course. I include it simply to demonstrate the geographic breadth of "presentation skills" as an object of professional concern.

6 In September 2012, for example, half of the 1068 job positions advertised on the Interaction Design Association's website explicitly demanded presentation skills.

ers of LittleStudio find that successful decision-making in the iMAGine project requires a second competency that I call *negotiating agency*.

In negotiating agency before and during client encounters, designers create the circumstances under which meeting participants can make binding, stable decisions about the project and its products. The phrase *performing the project* highlights the theatricality of the client encounter, which designers must *stage* and then *orchestrate*. *Staging* refers to planning: to making a space for the encounter, deciding whom to invite, and figuring out what to say and how to say it. Staging assembles and mobilizes the resources necessary in client encounters to produce the accountability of clients to designers and designers to clients. *Orchestrating* borrows from the vocabulary of instrumental music to recast verbal presentation skills as full-body performance skills. Orchestrating a client encounter is a form of embodied, multimodal storytelling. Designers must coordinate the movement of symbolic and material resources as they present different dimensions of the project. Within the client encounter, the role of the deliverables resembles that of a musical score. They guide situated, embodied performance but do not determine it. It is in staging and orchestrating the client encounter, then, that designers close existing organizational, disciplinary and physical gaps between themselves and their client — or, as in iMAGine, find that they have widened them.

8.2 LittleStudio and the iMAGine project

I have chosen to discuss these particular client encounters at LittleStudio because they violate, and hence expose, some widely held expectations among the designers I met. Meeting I and the email exemplify everyday interaction design work in consultancies. Ubiquitous and widely circulated, the slideshow is the "lingua franca of business" (Morville, 2009) — so much so that many consultancy interaction designers ruefully refer to what they make not as "software" but "slideware." Emailed requests and questions from clients after presentations are also usual, and often provoke debate. The prevalence of client war stories suggest that contentious relationships are a relatively common disappointment. As we will see, however, the LittleStudio designers themselves found the speed and extent of the client troubles in the iMAGine project shocking and unusual. Their attempts to understand and repair what went wrong help make visible the mundane tools, activities, and skills of client encounters that are otherwise taken for granted. The meetings also illustrate what is at stake in skillful performances during client encounters, and the meetings' importance to the delivery of a working prototype.

It is important to note that this chapter's analysis is limited to designers' activities and interpretations of *interim* client encounters in particular. Final presentations would likely feature more smoothly practiced performances. But if we are interested in the relationship of performance skills to the shaping of a final deliverable, then we must follow the messy negotiations in the middle of

the project rather than the polished demonstration at its end. By the time final presentations take place, those negotiations typically have been resolved, and the debates that shaped them invisible in the final documents.[7] However, interviewing clients during or after the project was forbidden[8] or strongly discouraged by almost every consultancy I visited. LittleStudio and Nordpub were unusually generous in letting me observe even their most heated debates. But there were still limits to my access, especially after the project was over. As a result, there are many important events, such as conversations between the client and her co-workers, that I have reconstructed from later reports. As well, some of what I report here is based on stories: stories that the client told the designers in meetings, and stories that the designers told me later.

LittleStudio had agreed to deliver a working interactive prototype of a magazine reader application for a tablet. Their immediate client, a vice president of an R&D group within a large European publishing company that we will call Nordpub, commissioned a prototype application, codenamed "iMAGine,"[9] to gain support from Nordpub's upper management for the group's plan to translating paper magazines into digital profit-centers. The client plans to present the prototype application at an annual meeting of high-level Nordpub executives. By the time LittleStudio joins the project, it is already well under way. Months earlier, the Nordpub R&D group hired another design consultancy to do a preliminary set of specifications for iMAGine. The first consultancy has produced a brief concept video that represents the proposed magazine application with simple animated wireframes. At the recommendation of the first consultancy, the Nordpub R&D group then hires LittleStudio to build a working interactive prototype of the application that will run on a tablet computer.

The new iMAGine prototype application must satisfy multiple groups inside and outside of Nordpub. First, there are three major groups internal to the publishing company. The vice president

7 Gieryn (2002) provides a striking account from architecture of how debates over the design of become visible in the process of making blueprints — then are forgotten by even the participants who lived through them once the buildings are in use.

8 And indeed, designers tried to minimize my visibility to clients after my initial contact with them. At the request of the team leaders in every project I observed, I made myself inconspicuous by remaining silent and sitting in a corner of a room or outside the project space in an open office. Videorecording was only rarely permitted, and sometimes audio recording was forbidden as well. As a result, I suspect that clients often forgot my presence. After the client left, the designers (but not the client) had the opportunity to register any objections. I have tried to respect this difference in awareness and continuing consent in how I report the activities and words of all client research participants, particularly at moments of controversy.

9 A pseudonym.

of the R&D group hired LittleStudio herself. As the representative of the R&D group, she has final control over LittleStudio's design decisions. However, the future of the R&D group's agenda rests on a second constituency: the Nordpub executives who will be at the annual meeting. They too must approve the prototype. The last internal group at Nordpub are the magazine editors themselves. The editors will, after all, will have to use the prototype if it is approved, and the R&D group believes that the prototype's success depends on winning editorial support.

There are also three external constituencies. The programmers are responsible for building the prototype on time and under budget; they must also approve the designers' plans. Then there are the application's potential future users. If all goes well, thousands of people might read their favorite publications on the iMAGine app. Market success will depend on satisfying them as well. And, finally, there are the designers. They hope that the iMAGine prototype will win them more projects from Nordpub, solidify their relationship with the referring consultancy, and showcase their abilities to other potential clients.

At the beginning of the project, both designers and client agree that the SOW authoritatively specifies what will be produced and how production decisions will be made. LittleStudio is to use the existing, approved wireframes from the video to produce four deliverables:

- A lexicon of tablet input gestures (such as swipes and taps) to access functionality
- Wireframes specifying article and magazine interface layouts
- Visual design for twenty screens
- A working prototype of the application running on a tablet computer

The SOW determines that the designers and their client, the Nordpub R&D vice-president, will make decisions about these deliverables together in meetings. Only the clients' decisions constitute formal approval. LittleStudio does not employ programmers itself, but instead has hired an outside programming company that, under LittleStudio's supervision, will turn the wireframes and mockups into working code. But before the programmers can start, the client herself must formally approve the LittleStudio designers' specifications.

We pick up the story of iMAGine in the latter half of the two-month project. In the first half, the team completed brief interviews with the sort of magazine readers they thought would like the prototype. They also conducted a participatory design workshop with the magazine editors who would publish articles with the application. By the time I start observing the project, LittleStudio has already plunged into making wireframes and sample mockups. Following a conventional work division between interaction design, visual design, and software development, (Garrett, 2002), the programmers will start coding navigation elements and gestural input before the visual design is fin-

ished. After the visual design are approved, the programmers will layer individual visual elements, such as photographs, color schemes, and typefaces "on top" of wireframed elements, like a skin.

Meeting I

By Meeting I, the designers are already encountering some unexpected difficulties. The wireframes in the original concept video establish a basic article template and navigation mechanism. The client wants LittleStudio to use this template for nine sample articles that will represent important categories of magazine content, such as long-form features and infographics. But getting sample articles from the magazine editors is taking more time than expected. And the designers are finding that the original template will not easily accommodate varying proportions of text and images. So they have already spent more time than planned altering the article template for each article. The delays are beginning to encroach on scheduled development time.

The designers hope Meeting I will result in approval for the new navigation interfaces and article templates so that the programmers can get to work. However, Meeting I occurs under unusually unfavorable conditions. The designers have made an animated slideshow to simulate crucial tablet interactions. A few days before the presentation, they learn that their client will be on vacation with no access to a computer. She only has a smartphone which cannot display their animations. So

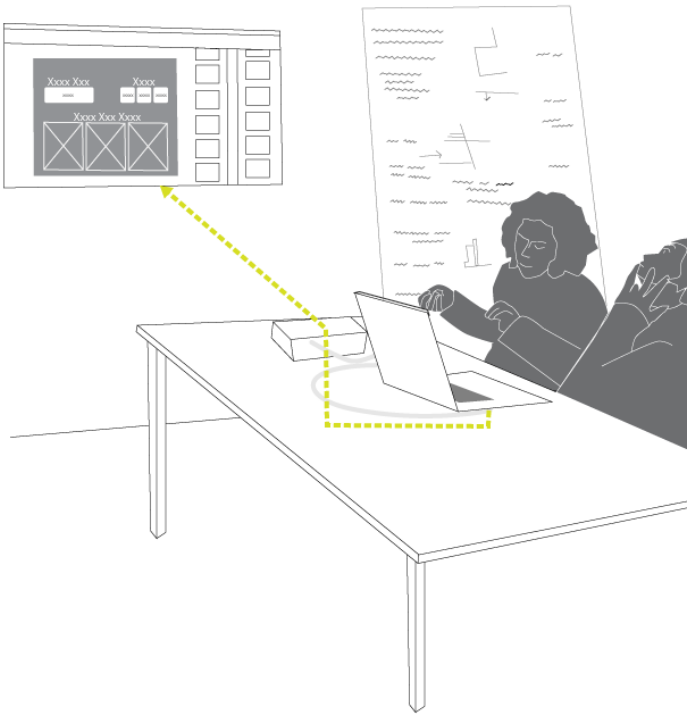


Figure 8.1 First client encounter. Jess (left) and Julie (right)are seated in front of Julie's laptop. Jess is talking into her iPhone (hidden by laptop) to the client. Notes from another "secret project" are on a portable board leaning against the wall behind them. The green arrow indicates the movement of the projected image from Julie's laptop, to the projector, to the wall.

the designers quickly translate their animated slides into the static, or "still," PDFs that her phone can open. The removal of the animations puts the burden of representation onto the designers. Over the telephone, without recourse to hand gestures or other props, they can only use words to describe what the animations would have shown. Even worse, the mobile phones have poor sound quality. They struggle to hear their client and are not sure if she can hear them.

There are two sets of documents for the client to review. The first part of the presentation concerns Julie's work: three directions for the "look and feel" of each component of the prototype's interaction model. Jess directs the second part, wireframes representing the prototype's *interaction model.* The interaction model includes: navigation within and among articles and magazine sections; indicators of article length and placement within the publication; and interface controls for "the advanced features," such as copying and pasting text, sharing an article with others, and subscribing to a magazine. Compared to Julie, Jess talks less about "look and feel" and more about "what you can do": how to switch between "browsing and reading" modes of use; the visual organization of the magazine's table of contents as a navigation element; how to mark, save, and share content at the article level and within articles; the subscription elements. The designers do most of the talking; the client speaks rarely.

Though she sharply disagrees with the initial visual design proposal, the client requests only minor interaction design changes and selects one of the "look and feel" concepts for further development. Jess requests that any further revision requests be delivered within two days to meet the programming schedule. The client agrees, and the meeting ends with cordial farewells. The next day, Jess announces that the interaction design is in "overall fine" shape, despite the unwelcome rejection of the visual designer's first direction. The presentation has overcome unfavorable circumstances to facilitate productive decision-making, and the team can confidently hand over wireframes to the developers.

The email

Yet the project turns contentious after this seemingly successful client encounter. What happened?

A week after Meeting I, the team receives a surprising and unwelcome email from their client, the R&D vice-president. After returning to the office, the client has shown LittleStudio's recent work to some magazine editors and to her co-workers in the R&D group. Based on their responses, she has assembled a long list of new demands. The requests reverse not only agreements made in Meeting I, but those made with the editors in workshops. "The scope," Julie tells me after receiving the email, "is totally been blown by this latest round of changes" (Instant message, February 9, 2010). Moreover, the email arrives more than a week after Jess's deadline for comments. The

programmers have already started work. The requests undo what the programmers have already done, as well as a week of visual design revisions.

From the perspective of the surprised and angry designers, the email breaks the rules laid down in the SOW. The email is not just a breach of expectations but a breach of contract. Fulfilling the client's requests will endanger their ability to meet the deadline, not to mention their firm's financial stability. The team has decided to "eat" the costs of the unbudgeted design and development hours already committed. That will cost LittleStudio money. But they cannot eat two more weeks of design time. As well, there are only so many hours in a day that they can physically work, and they recently started an exciting and lucrative project for another client. What can they do? One option is to put the project "on hold" — that is, refuse to work. They can also "fire" the client — that is, terminate the project. They are unwilling to do the latter, as the project is a prestigious one for their young firm and promises more work in the future. So the designers put the project on hold. They will commit no more hours until after a change request meeting.

Meeting II

In interaction design consultancies, change request meetings such as Meeting II occur infrequently. They take place only when clients' demands exceed what the designers are prepared to do. As Julie says, "I don't want to do another version and have them say, 'No, that's not right.' We just need to decide."[10] The goal of Meeting II, then, is to repair both interactional and cultural alignment: to build a shared understanding of the project, the designers' abilities, and the client's responsibilities. LittleStudio's immediate dilemma, however, is how to satisfy their client while minimizing their extra work.

Meeting II has two main phases. In the first phase, Julie and Jess minutely compare the text in the email to each slide in the slideshow. Using some of the same sorts of activities as in Meeting I, they verbally indicate the problematic objects on the slides, situate them in context of earlier project decisions, explain their concerns with the email, propose alternate responses, and estimate the required time and money those responses will take. Because the diagrams lack any graphic representation of the changes' financial and temporal "pricetags," Julie and Jess have to materialize the costs in talk and gesture. The two women link verbal time/money estimates to specific projected objects by deictically pointing with the mouse and occasionally their hands (see Figure 8.2 for an example of such gestural "pricetag" marking). Occasionally, they point to magazine pages taped to the wall behind them to demonstrate how they have translated paper formats into digital. The

10 All quotations in this section from fieldnotes, February 10, 2010.

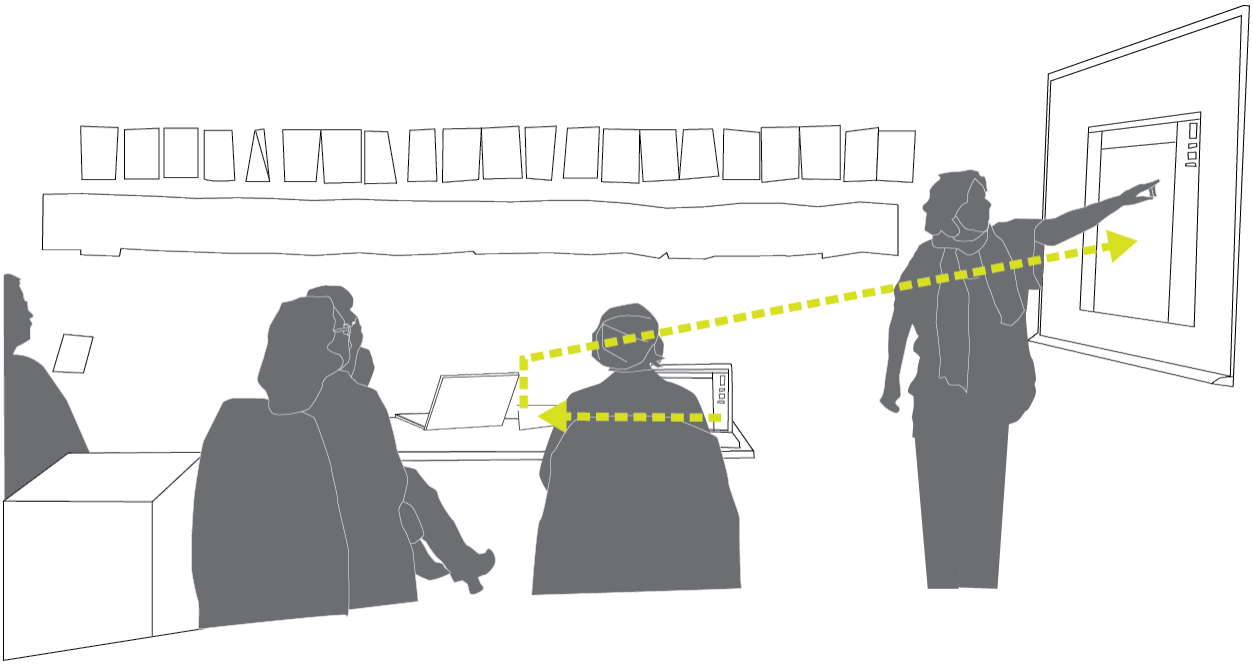


Figure 8.2 Meeting II. Jess (far right) is standing as Julie (right), seated, drives the presentation laptop. The project manager (front) and client (back) are seated in the center of the conference table. Dave, not formally on the project but acting as the "bad cop" in the meeting, watches from a separate desk at the far left. The green arrow indicates the movement of the projected image from Julie's laptop, to the projector, to the wall.

seated client watches as the designers move about the room. Describing the rationale for each request, she insists that the designers follow the editors' wishes. After explaining their disagreements, the LittleStudio designers most frequently accept the client's requests. "It's your product," Julie tells the client. Most slides are dismissed quickly in this way. By the end of the first phase, the designers and client have decided what the designers will do to most of the slides.

Some slides, however, are not so clear. Without the Nordpub editors present, the meeting participants must guess at how ambiguous or broad requests affect individual slides. Consider the long struggle over the visual "white space" on many slides. The designers assert that plentiful white space provides the appealing visual "rhythm that we're looking for." The client, speaking for the editors, argues that the amount of white space on the slides makes them look like an insubstantial advertising "brochure." To end debate, Julie volunteers to remove the white space. However, deciding to remove the white space creates more aesthetic and political problems. The meeting participants cannot figure out how to remove the white space without violating visual and interac-

tion design principles that the entire group "as a team, both Nordpub and LittleStudio" had agreed earlier would govern their decisions.

The designers' appeals to what users might do or want in deciding how to alter the prototype are unsuccessful. The client insists that the prototype must instantiate both the editors' specific "comments" and their more general "view" of the project. But the editors are not physically present, so the client offers as their proxy a rough, hand-drawn sketch of a magazine page that one of the editors has digitized for her. But the rough sketch, much like the originally approved article template, does not provide specific instructions for all the article formats. The designers and the client must infer from sketch which specific changes to each slide are most likely to please the editors, and then ascertain whether those proposed changes imply unfeasible amounts of work for the designers and developers.

The second phase is a review of the entire project. By the end of the meeting, both designers and client realize that they have been acting from very different understandings of who was to make decisions, and how. For Jess and Julie, the SOW is the ultimate authority over decision-making. To them, the SOW decrees that the client, as an executive of R&D, must "decide things" in meetings. It limits the work the client can ask for, and when she can ask for it. The client, however, denies the SOW's final authority as a contract altogether. To her, the email simply reiterates agreements about the number and type of articles made on "the first day of this project." These informal agreements precede, and thus overrule, the words of the SOW. Furthermore, she says, the designers are responsible for the project's current troubles. They failed to adequately explain her role (emphasis mine):

> The schedule is absolutely no problem is just the matter of understanding what's the decision, what needs additional information, and then what is the effect. And also what are the consequences of changing when you are at a certain stage. *Like this is decided and not to be changed.*

And there the designers must agree. "In all fairness," replies Jess, "that's true." She too acknowledges that it was LittleStudio's responsibility to manage the process of translating proposals into code more actively. Nevertheless, all at LittleStudio are relieved. The meeting's decisions have satisfied their client while keeping the designers and developers on schedule.

Negotiating agency in client encounters

The three encounters between LittleStudio and Nordpub map a fall into misalignment and a process of recovery. Meeting I, though seemingly a successful presentation of LittleStudio's proposals, fails to keep the expectations of the designers and their client for decision-making aligned. In Chapter 5, I describe how Post-its on a whiteboard serve as a temporary *forum of alignment* during a client encounter. Two dimensions of MediumFirm's client workshop are particularly important to understanding the origins of LittleStudio's misalignments. First, the whiteboard and Post-its

make important — but otherwise invisible — actors in the project, such as business goals and user needs, persistently visible and manipulatable. The slideshows in Meeting I and II make some important actors in the project, such as the white space, visible and tangible. However, Meeting I fails to make two other important project actors visible: time and money.

Second, the Post-it notes and whiteboard in LittleStudio allow representatives of the project's constituencies to make statements about the relationships between project actors — and witness other representatives doing the same. Making the decisions in client encounters binding requires a representative audience of participant-witnesses[11]. The composition of Meeting I and II's audience proves to be a second problem. Based on the SOW, the designers believe that the client is prepared to make binding decisions on behalf of the Nordpub editors. So the editors are not invited to either meeting. Unbeknownst to all at LittleStudio, the client does not accept the SOW's authority. Because the presentation does not explain the consequences of reversing her decisions, the client is all too ready to reverse those decisions later at the magazine editors' behest. In Meeting II, then, the designers and client must deploy multiple resources, such as the sketch, the paper magazine pages, and quotations of the editors' comments, to legitimate decisions necessarily taken in the editors' physical absence.

The cause of iMAGine project's misalignments is not how the designer described the prospective prototype but how they *negotiated agency* within the project. An agent here, as in agency theory means "an entity acting on behalf of another" (Eisenhardt, 1989).[12] In such a relationship, the agent "needs relevant knowledge and skills to interpret how the principal would act" (Fincham, 2003, p. 73). Whether as a consultancy engaged by a client, or an in-house team reporting to a manager, interaction designers typically work as agents. As professional experts in design, designer-agents must also manage asymmetric relations of knowledge, control and accountability (Sharma, 1997). Professional designers know more about interaction design than those who hire them, but they know less about their client's own business and industry. So they need permission from their principals to act.

The designers of LittleStudio mistakenly treat their client as an ultimate decision-maker. In practice, however, the client is acting as not as an untrammelled principal but as a dependent agent — first of the editors, and second of the Nordpub executives funding her group's research agenda.

11 I draw this term from discussions of the role of audiences in experimental science (Collins, 1988; Latour, 1988; Pinch, 1993; Shapin & Schaffer, 2011; Shapin, 1988)and in novel technologies (Coopmans, 2011; Hilgartner, 2000; Simakova, 2013), particularly Smith's summary of the history of demonstration (2009).

12 Sharma (1997) and Fincham (2003) offer more critical perspectives on agency theory's traditional identification with the anxieties of principals.

As the designers of LittleStudio discover, negotiations of agency are necessary for project alignment. The problems of iMAGine echo Gieryn's description of architecture:

> The design process is simultaneously the representation of an artifact in graphic, verbal, or numerical form, and the enrollment or enlistment of those allies necessary to move the artifact toward a material form (2002, p. 42).

"Presentation skills" are representational skills: the description of design concepts that is necessary to create a shared understanding among the designers and clients about what the project will accomplish. We can see presentational skills at work in the skillful combination of talk and gesture that the designers use to explain new features on the phone or put pricetags to their work.

But what about enrolling allies? The term *negotiating agency* is a useful shorthand for what designers do to enroll project constituencies during client encounters. "Agency" echoes the vocabulary and concerns of organizational theory, while the gerund "negotiating" emphasizes the changing dynamics of accountability, authority and control which characterize professional interaction design work. For the designers of LittleStudio, negotiating agency has two dimensions. First it involves using practical presentation skills to make otherwise invisible actors, such as time and money, tangible and visible in the encounter. Second, it means making an audience[13] whose decisions can be binding after the encounter ends. The next section expands the existing notion of professional practices in client encounters beyond representational "presentation skills" by accounting for enrollment as well. I call this more expansive notion of competency "performing the project."

8.3 Performing the project in client encounters

But what sort of specific competencies does performing the project entail? Studies of science and technology often propose *staging*. One form of staging involves "control of the setting" (Goffman, 1959). In Goffmanian staging, bodily conduct and spatial arrangements to hide "secrets" that might otherwise discredit a group's official face. Within science studies, staging has referred less to the production of *setting* than to the production of *ways of seeing* (Hilgartner, 2000; Latour, 1999;

13 The phrasing and conception of this point is indebted to Akrich et al.'s characterization of Thomas Edison's Menlo Park workshop:

> In negotiating the project, in transforming it so that it is convincing to the inside of Menlo Park, they collectively prepare their success on the outside of Menlo Park. Because if the spokespersons, the multitude of intermediaries are well chosen, the microcosm which constitutes the laboratory represents in all its richness and complexity the macrocosm which gives shape to American society, such that the acceptable solutions for the former are the same as for the latter (2002, p. 220).

Smith, 2009). Effective scientific staging hides preparatory, backstage laboratory work (Star & Strauss, 1999), "bringing certain aspects of the experiment to the foreground and backgrounding others outside of the spotlights' glow" (Latour, 1999, p. 135). It helps scientists, technologists and policy-makers "enact compelling dramas" (Hilgartner, 2000, p. 42) that cement their authority.

Staging, then, is the management of bodily conduct, physical setting, and technologies of observation that make a performance convincing by shaping what audiences can and cannot see. As a metaphor, staging sensitizes us to the tools and practices of see-ability. But it can blur some useful distinctions from theater practice. For theater professional stage managers, a theatrical performance has three elements: the script, the staging, and the actual performance (Bond, 1998). Taken as a professional responsibility rather than an evocative metaphor, theatrical stage management draws our attention to a set of mundane practices: the choreography of on- and off-stage human movements as well as the making and management of props, costumes, sets and lighting. As written instructions from the playwright, the script can prompt multiple renderings in performance. Yet the moment-to-moment flow of coordinated on-stage and off-stage activity in each performance of the script is unrepeatable. Staging lies between them, transforming a script into a singular performance. This analysis takes up the distinction between staging and performance in examining how designers[14] perform the project in client encounters.

Performing the project comes in two phases. In *staging*, the designers assemble the resources — the documents, display tools, physical environments, meeting attendees, gestures and words — they believe they will need. *Orchestrating* is situational storytelling. In orchestrating their encounters, designers are trying to elicit professional vision (C. Goodwin, 1994) from an audience who likely does not share their expertise (see Chapter 5 for a longer discussion of this task). In the orchestration of a client encounter, the deliverable resembles a musical score or a play script rather than a scientific diagram intended for publication. Like a symphony score, the deliverable on its own is insufficient for both representation of the music and enrollment of the players into a cooperating ensemble. It requires an expert human performer to describe design concepts adequately and show the likely consequences of decisions.

Staging

Client encounters may not be fully scripted, but that does not mean they are not carefully staged. We can think of this staging as the mobilizing of resources for creative improvisation: "how

14 While the focus of this chapter and dissertation is on interaction design, performance is also a noted feature of the related professional activities of user research (Kotamraju, 2011).

workspaces, technologies, and other resources can be carefully arranged to afford what must necessarily be a somewhat extemporaneous composition" (Whalen, Whalen, & Henderson, 2002, p. 241). This section describes some common *staging practices* that construct a front stage, set it for a competent improvisational performance, and configure a specific audience.

Rehearsing talk

Staging the encounter begins long before the clients arrive, as designers plan what they will do and say. They hypothesize how clients will respond to various ideas, speculate on interpersonal relationships within the client team, and strategize tactful ways to deliver difficult news on the rehearsal of presentations in team meetings). One of the most important resources that they assemble is rehearsed talk, such as pre-arranged responses to anticipated questions and temporary roles such as "the bad cop." Rehearsals can begin as soon as the clients leave the room. Jess starts anticipating the next client encounter only a few minutes after Meeting I's phone call ended:

> Just remind her of the purpose of why you did what you did. Why you chose the content you chose this time. Like, WHICH of her directions you were listening to, and which of her directions you weren't going to do now (Fieldnotes, January 24, 2010).

Rehearsals continue during the two weeks separating the meetings. Often these rehearsals coincide with planned meetings (see Chapter 6 and 7, but they are often ad-hoc. Larger or distributed project teams, as with MediumFirm's loosely connected freelancers, may schedule meetings specifically to coordinate presentations. Encounters may be improvised, but that the improvisation rests on careful planning.

Setting the stages

Producing front and backstages for clients takes constant work. As discussed in Chapter 4, client access to the physical and digital spaces of interaction design consultancies is carefully managed. Yet with no conference rooms, managing sensory spillovers in LittleStudio between the frontstage meeting and backstage company work requires extra effort. Everyone in the studio cooperates to produce the effect of an enclosed conference room. Without any explicit announcement before the meetings, radios are silenced; conversations take place over instant messaging; gazes are averted. A conspiracy of deafness, blindness, and dumbness erects invisible walls around the table, as if the rest of the people in the studio are not witnesses to the heated discussion.

Setting the frontstage carefully helps make representational resources available as needed. Recall the features workshop in Chapter 5. As a backdrop for a presentation the team uses a wall-size whiteboard entirely covered with clusters of handwritten Post-it notes during qualita-

tive data analysis. While explaining their conclusions, the team leader periodically points to the whiteboard. The hundreds of hand-written notes, arranged into labeled groups, were visually overwhelming evidence of labor. In LittleStudio a similar display underwrites claims of effort. The rows of paper magazine pages tacked to the walls around the conference table (see Figure 8.2) are used to demonstrate the different article formats the prototype must accommodate. Yet as part of the physical setting of the encounter, both Post-its and the magazine pages can wait quietly in the background until needed.

Assembling communication and display tools

Meeting I's troublesome communication and display tools remind us that part of staging a client encounter is securing the technologies to transmit words and images. It is the job of the designers to acquire and maintain those tools — no matter where the clients are located. None of the designers I interviewed saw anything unusual in accommodating clients' travel arrangements, and took for granted the expense and time of acquiring, maintaining, and deploying a constantly changing array of communication and display tools. Staging is not one event but a continuing labor.

In practice, client encounters rely on a patchwork of individually- and firm-supplied tools, from personally owned mobile phones to the firm-provided projectors and servers. LittleStudio's attempts to compensate for the absence or insufficiency of their tools, as in Meeting I, makes their necessity all too clear. The designers and client could not hear each other clearly, and the client could not access the animations that were to communicate the design proposals. The difficulties faced by Jess and Julie in Meeting I illustrate that "being a full meeting participant" should not be taken for granted as a natural consequence of attending a meeting. Rather, designers engage design's "mundane infrastructures" (Irani, Dourish, & Mazmanian, 2010), such as reliable telephone service and PDF display functions, as active participants in the making of an audience. And, largely, designers take it as their responsibility to do that work.

Making an audience

Part of the job of designers is enrolling constituencies by ensuring the right audience (as in Deuten & Rip, 2000). The client was able to disavow earlier decisions because the editors were not part of Meeting I. Successful staging requires not just assembling tools and scripting talk, but also including some participants as witnesses (like the client), and excluding others (like the silent studio employees). Meeting participants are a resource that must be staged and mobilized. In a pinch, those participants need not be literally present. In Meeting II, for example, the editors are made present in the form of the sketch, which is used as a proxy for their preferences. As Coopmans

writes of high-tech product demonstrations, "Efforts to position the technological object so as to make it 'seeable' in certain ways are mirrored by efforts to configure an audience of witnesses" (2011, p. 157). In LittleStudio, the efforts to assemble communication and display technologies mirrors the designers' efforts to *configure an audience of witnesses* who can make binding decisions.

Orchestrating

In client encounters, designers are often performing for an audience who does not share their expertise. The designers are trying to produce a shared understanding of what the audience is seeing, what it means for the project, and what the participants will do next. "Orchestrating" describes how designers "improvisationally choreograph" (Whalen et al., 2002) these encounters as they take place. This overtly theatrical metaphor of controlled coordination foregrounds client encounters as situated political performances. Besides de-familiarizing the taken-for-granted notion of "presentation," the metaphor of orchestration calls our attention to the coordinative work of marshaling symbolic and material resources on the fly during performance before a demanding audience.

Much of what designers do in orchestrating client encounters demands the conventionally understood presentation skills of "selling" design proposals. To an observer, the client encounter can appear as a startling "display of virtuosity" (Collins, 1988), cloaking the uncertainties and arguments of backstage design work (such as those described in Chapters 6 and 7). While professional communication manuals (i.e. D.M. Brown, 2010; K. Goodwin, 2009) and job postings often demand presentation skills, they leave unstated the specific abilities practically required for merely adequate (if not virtuoso) presentation.

Like the heterogeneous roleplay of designers in team walkthroughs, describing entities and making connections between them for demonstrative presentations a matter of multimodal (Lund, 2007), improvisational storytelling. Presenters entwine graphic representations with talk and gestures. They swiftly find and display resources (such as the sketch or paper magazine pages); fluently convey, with word and different types of gestures, the system and its users; cope with malfunctioning tools; not to mention realize and repair any errors made in the process. In the making of a feature list in Chapter 5 we saw similar orchestration work.

But Chapter 5 examined a relatively smooth case of orchestration, in which clients and designers are co-present and orient themselves to the same large display. To highlight the skillfulness of practiced improvisation, I will return to Meeting I, in which the geographic separation of designers and clients made orchestration more difficult. In surmounting the difficulties of Meeting I, the designers interweave four activities typical of interim presentations at other companies and industry educational texts. They are (1) orienting attention, (2) materializing the user, (3) materializing the

system, and (4) finding allies for the objects. The following exchange from Meeting I ([numeric codes] mine), in which Jess and Julie introduce a new 'circle' input gesture, demonstrates the complexity of the interplay:

Jess: [4.1] So we're doing something a little different from the rubbing ==

Julie: == [1.1] 42 ==

Jess: == [1.2] On slide 42 <*pauses*> [4.2] that [the original design firm] did <*pauses*>because of our concern that if you rub on it more you're kind of shaking the screen. [4.3] So we're looking at doing something a little bit different <*pauses*> [2.1] kind of a circular motion <*pauses*> [4.4] because that also goes well with the petal-wheel metaphor that they used in the UI of the circular controller concept. [4.5] So we're suggesting the circle because it's something we can work on in the Flash animation to see what feels best.

Julie: [4.6] Not only what feels best but what's easiest to detect.

Jess: Exactly. Um. [2.2] Okay so when the user takes their two fingers, it's a kind of two-finger circular scroll. [3.1] The screen does a flash [2.3] to show you there's a mode change, [1.3] which is screen 44 I believe. Huh. It didn't show up. [4.7] It worked in the animation. [3.2] So basically each of [1.5] those elements that are touchable and manipulatable highlight.

Orienting the audience

Orienting the audience to the correct region of the correct slide is a precondition for the rest of the meeting. In Meeting I, the client and designers are looking at different copies of the slideshow on different devices, so Jess must remember (or be reminded) to mention the slide number. When the interface "flash" fails to appear, Jess has to help her audience infer its intended location by stating its association with the "elements that are touchable." These conversational repairs [1.1, 1.3] remind us that the production of shared attention should not be taken for granted as the basis for shared understanding.

Making absent actors present

As we saw in Chapter 7, visual instantiations of design proposals often require human intervention. To materialize otherwise invisible or absent project actors, the designers must combine

talk, gestures, and interactions with images. In Meeting II Jess and Julie combine talk and deictic gestures to attach "pricetags" to each proposed change in order to introduce new allies — time and money — to counter the editors' wishes. Most noticeably, however, making project actors present takes the form of a "reconstitution of practice" (Smith, 2009),[15] in which the presenters roleplay human and machine attributes and behaviors. The theatrical skills required to do so resemble those required by walkthroughs. Jess's slides, for example, represent human action as red dots and lines that indicate where and how many fingers are touching the screen. Her wireframes do not represent the human readers' underlying motivations, or abilities. Yet, lacking visual contact with her audience, Jess can only orally narrate what users want, feel, and know [2.1–2.3].

Later, in Meeting II, she performs a similar service, by explaining how elements in the wireframes articulate preferences and expectations the editors reported in earlier workshops. Since Meeting II takes place face-to-face, however, they can use iconic, deictic, and enactive gestures (Barten, 1979; McNeill, 2008) to repair any misunderstandings. In Meeting I, Jess and Julie can only orally annotate and interpret the visual anatomy of system diagrams for the client [3.2]. They must also talk through system activities that the documents do not adequately simulate [3.1, 3.2] — such as the unexpectedly failing flash.

Finding allies

Part of making binding decisions is bringing allies to bear upon them. In this exchange, Jess and Julie begin partially on the defensive — their proposal for the gestural interface accesses necessary functionality, but it departs from the originally approved concept video [4.1, 4.3]. However, they invoke various supports for the vulnerable new proposal, such as: the hardware and its capabilities [4.2, 4.6]; the development team and their preferences [4.5]; the professional aesthetic discourse of coherence, or "going well" with previously approved elements [4.4]. Some of these allies are human, such as the developers in Meeting I or the editors in Meeting II. Others, such as the aesthetic discourse of coherence, are symbolic. Later, in Meeting II, the allies that the designers recruit include time and money. In working slide-by-slide through their document, the designers physically demonstrate the expense and pervasiveness of the email's requests by orally and gesturally attaching price tags to each interface element that must be altered.

15 Smith's notion of a "reconstitution of practice" echoes (but does not directly reference) the classic Performance Studies concept of "restored behavior" (Schechner, [1977] 2013, p. 324) — behavior that is not original to the moment but is composed, rehearsed or repeated.

The role of the deliverable in performing the project

Part of the job of designers is conscripting (Henderson, 1998) constituencies into the project, particularly clients, through deliverables. In iMAGine, the deliverables could not conscript those groups on their own. If deliverables were capable of operating independently, the client's re-presentation of the deliverables to her colleagues at Nordpub would not have resulted in a long list of change requests. Ironically, the specifications cannot specify on their own; humans must narrate, illustrate, explain, justify, argue, invoke, defend, *perform*.

Orchestrating a presentation, like conducting a musical piece, requires a variety of skills: expert staging of the physical setting and management of its audience, fluent speech, evocative gesturing, and controlled coordination of the computer and other technologies of display and communication. As such, the deliverable-in-orchestration functions much as a score for a symphony or a script for a play. In itself, it is incomplete; it cannot convince an audience on its own. Like a play script, the deliverable tells the story of the project while deliberately leaving much unspecified. Just as two different actors may perform *Hamlet* to very different affects, so too can different performers of the same deliverable produce very different reactions. It is no accident that interaction designers nearly always personally present deliverables to clients and developers: a document transmission is not seen as adequate if the meanings and implications of the document for the project is in question. We can now see why designers value "presentation skills" so highly.

8.4 Conclusion: Showing practices negotiate agency

> Take pride in running a good meeting. It's almost better than preparing a good document (D.M. Brown, 2010, p. 22).

In this chapter, I have examined how designers manage encounters with clients. Client encounters are participatory performances that, when effect, induce a "theatrical transformation" (Smith, 2009) in the terms of the project. This chapter traces a project crisis and its resolution over three sequential interim client encounters over two weeks. It begins with the relatively benign encounter (Meeting I): a presentation that, despite many difficulties, appears relatively successful. From the designers' perspective, demands and complaints in the client's follow-up email threaten the entire project. Finally, clients and designers resolve the crisis during a change request meeting (Meeting II).

Following LittleStudio's difficulties in negotiating agency helps us understand what is at stake in these encounters: the hours, dollars, friendships, technical decisions, and professional reputations that can be wasted or endangered by a failure of alignment. To many interaction designers, the phrase "presentation skills" conventionally refers to activities of communication and display

that help designers persuasively describe and defend their design proposals in these encounters. To cross organizational and disciplinary boundaries between the designers and their clients — to be *delivered* — deliverables require human help in the form of performance. They cannot conscript or prescribe on their own. As the story of iMAGine demonstrates, one of the most important purposes of these compelling performances is to produce stable and authoritative commitments of resources such as time and money.

Effective theatrical transformation in the iMAGine project relies not just on convincing description but the *negotiation of agency* to ensure those stable commitments. Interaction designers, whether in consultancies or in-house, typically act as agents on behalf of other groups. They need the continuing consent of these project principals to act. Client encounters, then, are one way to gain and maintain that consent. But to do so, designers must negotiate the problems of agency — of asymmetrical authority, accountability and knowledge — that characterize professional agent-principal relationships in even the most seemingly "cool, creative, and egalitarian" (Gill, 2002) workplace and industry.

As we learn from the designers of LittleStudio, keeping the project aligned depends on the artful organization of client encounters. For a client encounter to be effective, then, designers must make a representative audience, bring it into a shared understanding of the prospective system in use, and persuade it to make decisions. To that end, designers *perform the project* by staging and orchestrating client encounters. Staging includes not just the work of hiding some aspects of the firm and project from clients, but also the backstage work of assembling and maintaining tangible, material tools such as telephone lines, projectors, and stock phrases. Orchestrating is the situational, contingent work of embodied storytelling. It does not merely require linguistic fluency, but also skillful roleplay and materialization of the important entities that comprise the project and the management of associations among them. Staging and orchestrating allow representatives of different social worlds to agree upon what they are seeing, how to see it, and what to do next.

Staging and orchestrating, like the material modes of engagement with Post-it notes I described in Chapter 5, are *showing practices*. They do not just make certain actors and elements more *seeable* on the stage, but shape the composition of the audience and how audience members are able to *witness* action. With an audience of representative witnesses, as in MediumFirm's feature workshop, showing practices can engender binding agreements. With an unrepresentative audience, even the most carefully set stage and artful orchestration can produce decisions that are all too reversible and alignment that is all too temporary.

CHAPTER 9

Conclusion: Performances and delivery

Now that we have visited the interaction design consultancies of South Park, what interaction designers do starts seeming less and less like mental cogitation and more like a magician's act. Gesturing in the air leads to tiny mouse movements leads to pages of printed out schematics, then back to gesturing. Interaction designers make concrete and believable documentation of new products and services out of what at first seems insubstantial and incredible handwaving. The consultancy starts to resemble not a "center of calculation" (Latour, 1988), where distant objects are manipulated and transformed through cascades of inscriptions, or a "center of coordination," (Suchman, 1997), where humans manage the movement and trajectories of existing objects they cannot touch. Instead, we begin to see consultancy offices as centers of conjecture. Like pulling a coin from midair, designerly sleight-of-hand conjures up convincing visions of prospective users, systems, and businesses before an audience of decision-makers.

9.1 In summary

In tracing performances, I have moved the analytic focus on the visual from *seeing* practices (e.g., C. Goodwin, 1995; Rose & Tolia-Kelly, 2012; Schön, 1983) to an analysis of *showing* practices. As an embodied activity, "showing" turns not on cognitive processes but on acts of deliberate display. It directs our attention to relations among performers and witnesses, in which audiencing is as important as acting on stage. My goal is not to undermine seeing-centered analyses but rather, moving from my fieldwork in consultancies, to complicate and question the privileging of designers as primary see-ers by the design-as-cognition perspective. The move from seeing to showing helps us account more directly for the politics of interaction design and its consequences for the ordering of subjects and objects.

In the first four chapters of this dissertation, I lay out the background to this argument. Chapter 1 surveys interaction design as a profession, from its 1990s emergence in Silicon Valley consultancies and European design schools to its current status as a globally distributed, loosely bound going concern united by an agenda of user-centered design (UCD). Chapter 2 sets out this dissertation's

conceptual grounding in performance practices — that is, physical episodes of storytelling and narrative that take place before an audience of witnesses. It contrasts a practice-oriented stance to a dominant tradition in the field of design research, which treats diverse design disciplines as instances of a unitary type of human cognition. This dominant tradition, I argue, narrows methodological and theoretical attention, turning attention away from the political and material dimensions of design work. Instead, this dissertation takes up a "practice as enactment" approach. It considers how the responsibilities, capacities, and identities of the conventional constituents of design projects — designers, users, software tools, and so on — might be constituted in ongoing and repeated patterns of activity rather than pre-given. Chapter 3 roots the methods of this practice-oriented study, particularly participant observation, in the STS tradition of "laboratory studies" (Knorr Cetina, 1995) and constructivist grounded theory (Charmaz, 2006; Corbin & Strauss, 2007).

Chapter 4 describes the temporal and spatial organization of the design organizations I encountered, as well as the conventional tools, document formats, and visual lexicon they employ. It also introduces three sociomaterial tensions of representation and action as continuing themes in the dissertation: defining scope, representing behavior, and managing clients. *Defining scope*, or planning what concrete objects designers will make in the time allotted, requires continuing negotiation with clients and other project constituencies over what designers will draw and make. These continuing negotiations are complicated by the problems of r*epresenting the behavior* of human and machines with the trade's standard static, boxes-and-arrows diagrams. For consultancy teams need persuasive reasons to convince clients and other stakeholders, such as developers, to commit limited resources, including time and money, to the implementation of the teams' specifications — even as those low fidelity specifications do not fully convey the behavior of the digital systems or the humans who use them. They need, then, to *manage their clients* in order to produce and sustain alignment between what they are doing and what their clients expect them to do.

The central four chapters of this dissertation explore those themes through case studies that trace an ideal-type project cycle. Chapter 5 follows the making of a feature list for a mobile application in a client workshop. The feature list emerges through the collective creation of a forum of alignment, a visual space in which designers and clients can materialize a shared view of the project by selectively grouping together tokens representing human, business, and system capabilities. Those groups then help the designers "pull out" the features into a list. So to successfully *see* the scope of system functionality, designers must first successfully *show* the features to the clients and to themselves. Chapter 6 continues the story of the mobile application through the evolution of a single wireframe as the designers continue to debate among themselves and with their client what to draw. It describes how negotiations over storytelling, enacted in processional, transformational moves of drawing and seeing, knot together the scope of the project and the product. And, in the process, these negotiations knot together the firm itself.

Chapters 7 and Chapter 8 analyze the work of representing the behavior of digital systems and human users. Chapter 7 analyzes team walkthroughs, or reviews, of documents during a website redesign. By physically acting out stories of use and presentation, designers produce trained *professional feeling* — a haptic and affective means of materializing otherwise absent objects of design in order to assess them. The expertise of interaction designers lies not just in fabricating compelling visual representations but in crafting these legitimate feelings. Chapter 8 follows a project crisis and its resolution over three encounters between the designers of a tablet application and their clients. Keeping the project scope doable and the project constituencies in alignment depends on the artful organization of client encounters. For a client encounter to be effective, designers must *perform the project:* assemble a representative audience of witnesses, walk them through documents into a shared understanding of the prospective system in use, and persuade the audience to make decisions. To cross organizational and disciplinary boundaries between the designers and their clients — to be *delivered* into implementation — interaction design proposals require human help in the form of performance practices.

To sum up, performances in interaction design consultancies accomplish two purposes. First, they instantiate — make visible and tangibly *felt* — the human and machine behaviors that the static deliverables seem unable on their own to materialize. Heterogeneous roleplay, emplaced narratives, and transformational moves facilitate tentative experiments with system functionality, organization, and kinaesthetic interface elements. These experiments change how designers see and draw the system and its users, and induce the professional feelings which allow them to scope the project accountably. Second, performances of the project help produce and sustain alignment within teams and among designers, clients, and developers. To shape digital systems, interaction designers are often dependent on the active support or at least acquiescence of others. Forums of alignment show participants what participants know about the project and what they want to do about it. As with scientists in the early days of experimentation (Shapin & Schaffer, 2011), convincing others and oneself requires a skilled display before an appropriate audience to evoke affect, belief, and witnessed assent. Well-staged and -orchestrated performances of the project induce accountable, authoritative decision-making by witnesses that designers require to make decisions on behalf of clients and prospective users.

9.2 An ontological twist at the end

In Chapter 1, I asked: *Which entities are performed as autonomous, solid, and stable during interaction design projects*? *And which are performed as insubstantial, hypothetical, or unfolding*? User-centered interaction design, I contend, depends upon enacting stability and malleability in performances. Figuring "users" as real and autonomous can help stabilize digital systems that, for much

of the project, only exist in all-too-editable static documents. To begin, I will trace the changes in status of four major project constituents I have followed through the central chapters of this dissertation: the system, the user, the client, and the designer.

The system For many interaction design projects in consultancies, the system exists only as editable, negotiable words and images. The system begins as a list of proposed features (Chapter 5) jointly assembled by clients and designers. In walkthroughs (Chapter 7), designers manifest the system first as clusters of sketches, expand it into many "directions," or alternative design proposals, or condense multiple directions into a single proposal. Decision-making about what to include in these representations turns on stories of clients, users, and the constraints enforced by the schedule and budget. As the designers iteratively render and multiply representations of the system, the representations (and the orchestration of their presentation to clients) grow more polished, realistic, and detailed (Chapter 6). Yet the digital files remain editable by designers. As we see in Chapter 8, clients and designers may have multiple, sometimes conflicting readings of those files. Clients may demand changes to those files, and the decisions they instantiate, long past when the designers consider both files and decisions fixed in place.

Until expensively rendered into working code, the system remains remarkably pliable, with its stability conditional on the continuing assent of the other project constituencies. It is a series of propositions articulated in images, words, and gestures. If the project constituencies fall out of alignment, the system — and the project — can fall apart with them. Without stable assent from project constituencies, the developers may have to rewrite expensive code and the designers may not be able to move on to other projects. All in all, as I argued in Chapter 7, the system-in-design is an epistemic object: "continually unready-to-hand, unavailable and problematic" (Knorr-Cetina, 1999, p. 10).

The user As described in other studies of UCD in action (Ivory & Alderman, 2009), only a very few prospective human users entered any of the studios I visited during my visits. In Chapter 5, designers group Post-it notes around whiteboards as tokens of "user goals." In Chapter 6, the acceptance of Chelsea's accordion metaphor depends on whether the other designers agree with her description of how tourists plan rail vacations. Chapter 7 traces the materialization of users in the studio through enactive practices and their role in resolving debate. In Chapter 8, we see what happens when clients reject designers' portrayals of users' capacities and preferences: the designers turn to budget and schedule as reasons to reject clients' requests for extensive changes to the deliverables late in the project.

Yet despite the absence of human representatives of user groups in the studio, interaction design, as a self-declared "user-centered" discipline (Buchanan, 2001; Cooper, Reimann, & Cronin, 2007; K. Goodwin, 2009; Rogers, Sharp, & Preece, 2011; Saffer, 2009), demands their presence. In the absence of a working digital system or representatives of user groups, making legitimate, accountable decisions about deliverables requires producing this embodied "feeling for" users. In the nar-

rative logic enacted by team walkthroughs and client encounters, the preferences and capacities of users exist autonomously of those of designers.[1] Indeed, the repeat and new customers mentioned in Chapter 7 become *even more tangible* in the studio when their clicks and mouse movements are physically performed by Phillip, the art director, and witnessed by the team. As the deliverables grow more detailed, more polished, and more believably realistic, so too do the users-in-performance as autonomous actors, independent of the designers even as the designers roleplay them.

The client Unlike user representatives, client representatives regularly visit the studio. In Chapter 5, we follow a workshop intended to build the designers' interactional expertise (Collins, Evans, & Gorman, 2010) in the clients' business, and vice versa. In Chapters 6 and 7, we watch as teams of designers decide which composition of features will best "tell the story" of the product and project to clients, rehearse presentation tactics, and attempt to anticipate and defuse client objections. Chapter 8 examines several tactics for orchestrating and staging the negotiation of agency between client and design team during client encounters. The clients enacted during interaction design projects are, like the users, autonomous. Yet, unlike users, they are, if anything, *uncontrollably* present even when not in the studio. The clients of LittleStudio, MediumFirm, and LargeAgency have names and faces. As representatives of their own teams and organizations, they have multiple, sometimes conflicting agendas for the project. They could enter the studio *and,* as one designer at LargeAgency complains, *say anything they wanted* (Fieldnotes, February 17, 2011). For design consultancies, like consultancies in other professions, require a continuing stream of clients to thrive. Consultancies need clients not just for financial stability, but for the professional credibility prestigious clients might bestow. LittleStudio's time-consuming attempts to honor their client's changing demands underline just how far a small company might be willing to go in order to keep a prestigious client happy. But even in well-established consultancies such as LargeAgency, clients cannot be unilaterally commanded or avoided. They can only be managed.

The designer But what about the designers themselves? The typical design-as-cognition narrative posits the designer as the autonomous, central *cause* of project outcomes. In contrast, Chapter 5 and Chapter 8 emphasize the importance of the local negotiation of design agency during face-to-face client encounters. In these cases, consultancy designers are less prime movers than reactive, responsive negotiators. Clients make the project along with designers. I have also argued, by contrast, that designers *make themselves* along with their deliverables. Chapter 6 describes how

1 I am not arguing that the users enacted in the studio are identical to the users enacted elsewhere in the project, or the people who may later use the product. Rather, I am arguing that users-in-performance are locally figured as real and existing, with stable identities and characteristics that exist independently of the project.

deliverables figure the designers and the firm as "big picture" thinkers. Chapter 7 analyzes how designers turn themselves into credible stand-ins for users in order to make accountable professional decisions. Both chapters turn on a more enactive, less *a priori* definition of designerly status*:* that one's identity as an interaction designer is not the *cause of project outcomes*, but rather *an effect of successfully performing the project.*

In summary, human constituents such as designers, users, and clients tend to become more autonomous, real, and stable over the course of a successfully aligned project. Yet the system-in-design tends to stay hypothetical. That is not to say that the plans for the system remain vague. On the contrary, the detail and polish of the diagrams typically increases as the project progresses. However, the system, as materialized by deliverables, talk, gesture, and placements, is still potentially pliable. The standard diagrams are low-fidelity, liable to multiple and sometimes conflicting interpretations. Digital files permit seemingly infinite edits. A locally stabilized system is a second result of successful alignment work. We find ourselves here returning to the political questions I set out in Chapter 4: How do skilled designers enlist clients and developers in managing project and product scope? In making authoritative decisions regarding representations whose formats are widely regarded as insufficient?

Limiting expenditures of time and money with a Statement of Work (SOW) is one way to control the potential revisability and expandability of digital files. But what if the clients and designers disagree about the SOW's mandates, as in LittleStudio's dispute in Chapter 8? Then the designers and clients must find another basis on which to make decisions. To defend the too-pliable system and the scope of the project against unwelcome alterations from influential project constituencies, the designers must appeal to higher authorities — i.e., project-relevant entities *outside of the design team*. This dilemma is most evident in consultancy work, but present as well in startups and established corporations alike.

As I describe in Chapter 1, a commitment to the tenets and methods of user-centered design characterizes accounts of interaction design as a going concern. As I further describe in Chapter 3, consultancy work exemplifies and intensifies two tensions present throughout the profession: the *negotiated influence* that interaction designers have over what users finally receive. Typically neither the owners nor the engineers of the product, designers' face a corresponding responsibility to make their work *accountable across organization and disciplinary boundaries* to other project constituents, such as managers and engineers, who may not possess interaction design expertise themselves and who may have different plans for the project. Performance practices help resolve this characteristic dilemma of interaction design. It is performance practices, rather than the SOW or the principles of user-centered design, that finally underwrite the stability of system proposals. These everyday performance tactics enact a skillful ontological choreography (Thompson, 2005) which contravenes the tenets of user-centered design in order to uphold them.

"Ontological choreography" (Cussins, 1996; Thompson, 2005) describes the coordinated, staged transition of the constituents of practices among different categories of being. It is

> A deftly balanced coming together of things that are generally considered parts of different ontological orders (Thompson, 2005, p. 8)

(e.g. human and non-human, subject and object). Thompson uses the term to describe how patients undergoing fertility treatment willingly participate in objectifying practices such as radiography as a means towards greater agency over their bodies and lives. In order to make themselves into parents, women must also participate in their own remaking as tissue samples and diagnostic images. That is, fertility treatments objectify patients and their bodies *in order to help the patients enact a new form of subjectivity.* The interaction design projects we have observed also rely on skilled practices that transition project constituents between objectification and subjectification.

The ontological choreography of interaction design projects emerge from UCD's "ontonorms" (Mol, 2013): the moral orders of *ordering* articulated in carrying out UCD as Fujimura (1992) might call a "theory methods package." In demanding "humane" technology, UCD first separates human from machine. The ethics of UCD require humans (the users, the clients, the developers) to be autonomous, stable, *natural* selves, and machines to be contingent, changeable, *artificial* creations (Berg, 1998). In this way unambiguous human needs can be used to define machine attributes, and not the other way around (Stewart, Williams, & Rohracher, 2005).

As a pragmatic theory-methods package for successful technology deployment, UCD also requires a rigorous differentiation of types of humans in order to separate users from designers (Garrety & Badham, 2004). To review my discussion from Chapter 1, in studies of technological development and innovation, the figure of the *imagined user* crops up again and again. This imagined user is described as a "discursive" (Ivory & Alderman, 2009) or "semiotic" (Oudshoorn, Rommes, & Stienstra, 2004) construct — a fictional figure who exists only within the studio, as opposed to the real, embodied user representatives who exist autonomously outside the studio.

Stories of the imagined user often attribute the failure of design projects to a mismatch between this fictional representation and the real users the product encounters (see Ross, 2011 for

a trenchant criticism of this narrative).[2] In the these stories, the trouble begins when designers base their imagined user in personal experiences (Oudshoorn et al., 2004) or non-empirical sources of knowledge about users such as received stereotypes (Hyysalo, 2006; Ivory & Alderman, 2009). Cautionary tales of the imagined user also argue against treating such represented users as objects. Nicoll (2000) warns against the tendency to enlist decision-makers into UCD projects by deploying ambiguously defined users as persuasive "symbolic currency." For machines to be appropriately objectified, normative UCD requires real, empirically verified, non-imagined user subjects with coherent and stable desires, capacities, and behaviors. Stewart and Williams call this the "design fallacy":

> The presumption that the primary solution to meeting user needs is to build ever more extensive knowledge about the specific context and purposes of various users into technology design (2005, p. 4).

Like Ross, I accept the "design fallacy" criticism but prefer to investigate its origins and persistence rather than continue to attack its usefulness.

Contravening the normative narrative of UCD, interaction design performances entail back-and-forth ontological transitions for users and machines. As I describe in Chapter 7, walkthroughs blur the divisions between users, designers, and machines so that designers can "feel" their way to a right decision. UCD-oriented narratives played out in team meetings and in client encounters simultaneously turn on the discursive assertion of independent, pre-existing users with stable preferences and behaviors. What are we to make of this ontological *twistiness* — a transgression of UCD which, as successfully enacted, nonetheless achieves satisfactory outcomes for all the projects we encountered in this dissertation?

Interaction designers solidify fluid proposals by making not just detailed objects, but feeling and knowing *subjects* who can make the non-existent system accountable to judgement as

2 Ross (2011, pp. 253–254) identifies two problems with over-generalizing from these cautionary tales of the imagined user. First, such tales tend to address projects addressed to a "real, discernable, finite population" of product users — a population which can then be compared to the imagined user in the studio. Correspondingly, such tales tend to feature systems that exist in some working form, whether prototyped or fully functional, before user populations encounter them. Ross takes on a different case: the problematization (Callon, 1986) of future users as obligatory passage points for project success in the "pre-market" setting of a research laboratory. Like Ross' researchers, the interaction designers I met in SoMA often design for massive potential populations of hundreds of thousands, or even millions, of people. Yet, unlike Ross' researchers, the interaction designers make technical choices without even the prospect of controlling the future implementation of what they design. Following Ross, we can ask how it is that technologists produce such stable future users in the absence of any specifically designed product, and the uses of such future users for enrolling funders and other partners in the proposals of the laboratory.

"compelling," "intuitive," or even just "right." Which explains why the user is a slippery figure: sometimes differentiated from designer but often blurred through "I-talk," "you-talk" or roleplay. Akrich (1995) notes that "implicit" techniques of representing users, such as the substitution of the designer's experience for that of an empirically encountered user, seems more persuasive in practice. Akrich offers no explanation for this puzzling state of affairs — but here we have one. "I-methodology" is just one of the techniques I have described that materializes credible, accountable feelings in performance while still discursively affirming a user "out there."[3]

Designers objectify users (i.e., design their attributes and capacities along with the system) to grant them narrative agency in the story of the project. However, users are not objectified as "abstractions," as Nicoll (2000) would have it. Users instead are objectified as they are *incorporated* and *emplaced* into the bodies of designers and the studio environment. Hence the irony of UCD in action: the more designers theatrically *stand in* for users, the more real and autonomously users and systems act in the project.[4] The ontological choreography enacted in performance practices makes both users and systems sufficiently present and absent, inside and outside the project, autonomous and dependent, to stabilize design proposals on the way to implementation.

Picking up the metaphor of knotwork introduced in Chapter 6, I will describe this characteristic generative movement in performance practices as *ontological twists.* Pickering's name for similar activities in science is "the mangle of practice" (1995), which is a distressingly violent metaphor for collaborative practices that make subjects and objects. In analyzing fertility treatments, Thompson (2005) proposes the notion of "ontological choreography," which evokes the predictability and routine of standardized medical procedures rather than the improvisational experimentation which defines design work.

In accounting for central role of performances in interaction design, I am combining the two terms. Twisting yarn is one way of constructed knotted textiles. Unlike a mangle, it does not violently deform that which it combines. A twist is also, in dramaturgical terms, a surprising narrative event. In design projects, the final properties of the users and the system as co-configured figures often come as a surprise to participants. Moreover, the ontological work of interaction design appears, at the conclusion of this dissertation, as an ironic "plot twist" to the normative story of user-centeredness. The more the users-in-design are treated as designed objects in documents, talk, and

3 Sharrock and Anderson (1994) describe similar strategies of materializing the user to support "design reasoning" in engineering work.

4 This point inspired by Mialet's argument (2012): that Stephen Hawking as a renowned and singular intellect depends upon a network of assistive devices, medical clinicians, and research assistants that Mialet calls "Hawking, Incorporated."

gestures, more real and autonomous they become. In this way, the ontological twists of properly witnessed interaction design performances produce and bind together users, clients, and systems into stable proposals. "Users are no respecters of boundaries," write Oudshoorn and Pinch (2007, p. 557). Nor, it seems, are designers.

9.3 Contributions

This dissertation draws upon and contributes to continuing discussions in three literatures: HCI, STS, and design studies. First, as an ethnography of professional interaction design, it responds to a continuing debate in Human-Computer Interaction (HCI) (Gaver & Bowers, 2012; Goodman, Stolterman, & Wakkary, 2011; Rogers, 2004; Sutcliffe, 2000; Wolf, Rode, Sussman, & Kellogg, 2006) over how scholarly ressearch could or should influence commercial practice. As well, it builds upon a burgeoning "ontological turn" in studies of science and technology. Instead of asking how and whether representations correspond to reality, ontologically oriented approaches the means by which the identity, attributes, and existence of people and things are defined and renegotiated (Woolgar & Lezaun, 2013). And in linking the work of ontological politics to performance practices, I am also contributing to a discussion of continuing interest for scholars of design: the role of words, gestures, and images in design work.

The practice of HCI research

> One of the most significant achievements of HCI is its evolving model of the integration of science and practice. […] Currently, the model is incorporating design practices and research across a broad spectrum. In these developments, HCI provides a blueprint for a mutual relation between science and practice that is unprecedented (Carroll, 2013).

HCI researchers often describe their field as integrating the scholarly and commercial development of interaction between humans and machine computation.[5] Indeed, one of HCI's most recent achievements is the "export" of interaction design from specialized research subfield to international industrial profession — and then the "incorporating" of professional work back into scholarly research (Carroll, 2013). For Carroll, this exporting and importing of professional work is a "blueprint" — both an indisputable fact and a legible artifact that can be easily reproduced. Yet HCI researchers have debated the efficacy of the blueprint's integration of "science" and "design" for decades. There is a widespread and durable concern that HCI is not successfully exporting its research

5 Roedl and Stolterman (2013) present a useful review of such descriptions.

products to commercial practitioners through "knowledge transfer" (Green, Davies, & Gilmore, 1996; Rogers, 2004). The products of research are intended to improve technological tools for design work as well as introduce new symbolic resources, such as theories, methods and frameworks, to guide action (Höök & Löwgren, 2012; Roedl & Stolterman, 2013).[6] In this orientation to HCI, the goal of research is to instantiate theories of human behavior developed by social scientists into concrete guidelines that practitioners can follow. Yet two decades of publications[7] (and Bellotti, 1988; from Rosson, Kellogg, & Maass, 1988; to Stolterman, 2008) portray commercial designers as either relatively ignorant of scholarly HCI's theories and methods, or knowledgeable but unlikely to apply them in design work.

This dissertation responds to one prominent explanation for the problems of the "export" model. Methods, frameworks and theories grounded in the self-reported experiences of scholarly researchers or students (as described in Chapter 3) may not adequately respond to many practical concerns of commercial interaction designers (Goodman et al., 2011; Stolterman, 2008). In particular, recommendations for design action may overlook commercial constraints on time and money, the complexity of collaborative decision-making, and the practical importance that designers often place on "selling their ideas" (Roedl & Stolterman, 2013, p. 1954). By putting the observed practices of professional interaction designers at the center of this dissertation, I hope to both provide insights into how designers work that can help bridge the gap between HCI researchers' stated aims and their apparent results.

Interaction design and the "ontological turn" in STS

In Chapter 2, I situated my approach to interaction design in context of the four decades-old "practice turn" (Knorr Cetina, Schatzki, & Savigny, 2000) in social theorizing. This dissertation also participates in a follow-on "ontological turn" in STS, as articulated by Woolgar and Lezaun (2013).[8] Most obviously, as described in Chapter 2, this dissertation is motivated by what Woolgar and Lezaun call the "provocative power" and "analytical momentum" of this turn from concerns of epistemology

6 For an influential criticism of the "implications for design" approach to HCI, see Dourish (2006).

7 These theories and methods include: web design and ideas of usability (Rosson, Kellogg, & Maass, 1988); psychological theories of cognition (Green & Gilmore, 1996); behavioral approaches to human action (Mao, Vredenburg, Smith, & Carey, 2005; Rogers, 2004).

8 The introduction to a 2013 special issue on "the ontological turn" in *Social Studies of Science* (Woolgar & Lezaun, 2013) provides a long list of studies in this vein. Not listed by Woolgar and Lezaun but also clearly prominent in this turn is Bowker and Star's *Sorting Things Out: Classification and Its Consequences* (1999).

to ontology.[9] In particular, it is motivated by a critical attention to the constituting and maintaining of objects that might appear black-boxed (such as clients or features), and by what Woolgar and Lezaun call a "certain intensity of normative preoccupation and political intervention" (2013, p. 327).

Methodologically, this dissertation continues a burgeoning *empirical* study of ontologies in action, such as Thompson's study of fertility clinics (2005), Bowker and Star's case studies of classification practices (1999), and Barad's examination of particle physics (2007). Following Lynch (2013), it has tried to avoid proposing or assuming a "general theory of objects" and has instead focused on tracing and conveying the situational specificities of performance work within interaction design practice. Finally, this dissertation extends a way of accounting for relational stability and persistence that includes fluidity and change. Law and Singleton (2005) diagnose a tendency in STS to attribute the durability or reach of agendas to the immutability, obduracy, and fixity of the artifacts that instantiate them. I have taken an alternative approach exemplified by Singleton and Michael's argument for the connective role of "ambivalent" diagnostic tests (1993), Mol's "body multiple" (2002), and Law and Lien's analysis of metaphorically and literally "slippery" fish categorization work (2013). Successful user-centered interaction design projects rely not on the "clean and clear" (Singleton & Michael, 1993, p. 232) relations that populate many conventional stories of UCD. Instead, they rely on shifting, twisty relations enacted in repeated performances.

The role of representations in design studies

In linking the work of ontological politics to performance practices, I am also contributing to a discussion of continuing interest for scholars of design: the role of words, gestures, and images in design work. My claim here is that documents such as wireframes and site maps do not only represent thought but enact agendas: performed by designers, they help bring into being the systems-in-use that they specify.

One influential "depictive" approach, common in the design-as-cognition agenda, takes the words and images with which designers instantiate design proposals as passive reflections or transparent conduits of human knowledge. As Lawson writes, drawings act

> As a kind of window into the designer's mind and consequently into the designer's knowledge system and method of mental representation (2004, p. 33).

From this perspective, images in particular are "products bearing knowledge" (Henderson, 1991, p. 457) or "carriers of the first ideas, of the thoughts that emanate from the vision" (Löwgren &

9 Chapter 5's and Chapter 7's discussions of distributed and embodied cognition suggest, as Woolgar and Lezaun argue, that the separation of knowledge from action should not be overstated.

Stolterman, 2004). Along with images, gestures and words function similarly to support "depictive processes" (Athavankar, 1999). They are a way of "mapping the invisible and untouchable to concrete experiences" (Arvola & Artman, 2007, p. 108). Externalizing otherwise internal mental concepts as images makes them available to shared manipulation and argument as representational tools for collaborative sensemaking and problem-solving. They act as tongs that enable designers to grapple with ideas and organizational dynamics, whether the goal is "manipulating design knowledge embedded in drawings" (Lawson, 2004, p. 52) or "bringing stories into coherence" (Bucciarelli, 1994). Progressive stages of drawings work as "transformations between problem and solution" (Lawson, 2004, p. 59) — in which "problem" and "solution" are cognitive states in the mind of the designer, external to the drawings. Images remain, however, passive objects: "stages on which people can collaboratively dramatize their understanding" (Arvola & Artman, 2007, p. 108).

A "-scription" model treats images as texts (or script for action) to be written and read (Yaneva, 2009). More common in STS than HCI or design studies, the "-scription" model attributes the enrollment of project actors into design proposals to project representations, particularly diagrams (Henderson, 1998) and photorealistic images (Ross, 2011). In Henderson's treatment of design engineering (1998, drawing on Latour, 1986), visual representations act as "conscription devices," enrolling diverse project participants into shared action. Visual representations can do so because they are *meta-indexical*. That is, they act as a "holding ground and a negotiation space for both explicit and yet-to-be-made-explicit knowledge" (Henderson, 1998, p. 199). They translate words and mathematical equations into visually apprehensible formats while allowing for unstructured sketching; they index and hence draw out otherwise tacit knowledge from project participants; they spread and expand standard lexicons for communication. In some particularly semiotic readings of design (Akrich & Latour, 1992; Fallan, 2008; Grint & Woolgar, 1997), the designed product itself acts as a kind of script for user action, "pre-scribing" (Akrich et al., 1992) what users are to do.

Both conscription and prescription, however, assume the artifacts at stake can adequately describe or draw out knowledge of what they mean as they cross among organizational and disciplinary boundaries. That assumption underwrites Latourian arguments (1986, 1988) for the importance of the immutability and mobility of inscriptions:

> *Anything* that will accelerate the mobility of the traces that a location may obtain about another place, or anything that will allow these traces to move without transformation from one place to another, will be favored (Latour, 1986, p. 13).

Anything? Such a general rule about what relations will be "favored" does not seem to hold true for interaction design, in which the low-fidelity documents are understood to be inadequate in prescribing the actions of clients and developers alike. Interaction design deliverables, it seems,

grow more effective in prescribing action as they are transformed and rerendered in situated, unrepeatable performances.

Yaneva argues against treating representations in design as either depictive manifestations or "-scription devices."[10] Her argument about architecture, instead, is that architectural models exist to

> Gather a number of things — human and non-human actors, and their concerns, requirements and disputes — and to 'accommodate' them into objects that can be subjected to design experiments (2005, p. 872).

That is, there is no truth outside the model to be represented; there is just the model and its internal logics. The project includes plans, requirements, and the like — but those actors are articulated not just in depictive images, talk, and gestures but in the tangibly transformational moves applied to models on studio tables. This dissertation extends and complicates Yaneva's "accommodating model" argument. Though interaction designers must produce their standard documents, designers cannot achieve ontological transitions with documents alone. If diagrams are conscription devices, they induce action not only through what they contain but how they are performed. They work because they can be *played* as part of performances: played out experimentally on during team meetings and replayed in rehearsed presentations. Effortfully, skillfully, designers must make the diagrams behave before audiences in order to produce and mobilize the accountable feelings that user-centered judgments require. Instead of an immutable mobile that acts by transporting knowledge unchanged over physical distances, we see a "mutable moment": the contingent, emplaced production of locally accountable feelings of intimacy among designers, clients, users, and systems.

So how *does* one deliver design? What we have learned from tracing four steps of an ideal-type interaction design project is that interaction design projects require performances alongside images. At every step — from feature listing to making diagrams to team reviews to client presentations — there is a performance that tells the story of the project and its makers. The object that matters in interaction design projects is not solely the drawing *or* the gesture but a narrative conjunction of the two as witnessed in embodied, emplaced performances. I want to bring a central insight from STS to bear: that performing comes to matter as the appropriate audience witnesses and grants assent. But unlike accounts of science in which text and images can serve as credible "virtual witnesses" to the legitimacy of conclusions (Shapin, 1984), interaction design proposals require live performance to induce action.

10 Yaneva lists a number of "-scription" objects within STS: inscriptions (Latour & Woolgar, 1986); conscription (Henderson, 1998); prescription. To these I would add de-scription (Akrich, 1992).

9.4 Conclusion

This dissertation opened with the question, *What is the "real work" of interaction design?* I have shown that the work of interaction designers, contrary to a dominant narrative of design as individual cognition, depends very much on performance activities such as roleplaying users and systems, orchestrating performances, and assembling audiences. I have turned away from a longstanding question of design studies: *How does interaction design demonstrate a special form of human thought*? And towards a set of questions drawn from practice-oriented studies of science and technology: *What kinds of objects and subjects do interaction design practices make,* and *how do those practices produce them?*

Based on participant observation at three San Francisco interaction design consultancies and interviews with in-house and consultancy designers around the San Francisco Bay Area, this dissertation has argued that performance practices organize interaction design work. In the performance practices that characterize interaction design, humans instantiate otherwise hard-to-grasp behavior and properties of digital systems and their human users to gain the assent of an audience of witnesses. In this concluding chapter, I have summed up these moves as *ontological twists,* comprising both sometimes surprising co-configurations of users and systems, and an ironic twist on the conventional normative orders of user-centered design. With the system not yet built, the typical deliverables of interaction design are too easily changeable. Properly witnessed performance episodes help close debates on editable documents by making the non-existent system accountable to judgment by the authoritative, autonomous *subjects* the episodes instantiate.

In this way, a focus on episodes of performance turns the concerns of study from cognition, in which artifacts *represent* what individual designers are thinking, to one of practice, which sees documents, spaces, tools, and bodies as actively participating in producing and removing responsibilities, capacities, and agency. It renews a longstanding analytic focus on visual practices by shifting a conceptual emphasis from the designer-centered skills of *seeing* to the relational work of *showing.* It undermines the customary figuring of the designer as privileged see-er and knower. Following performances turns our attention, then, to questions of political representation, materiality and politics. In professional interaction design practice, the presentation of the proposal and the real work of design are not so far apart as we like to believe. It is all, as the magician might say of his show, in the *delivery.*

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APPENDIX A

Host companies

Appendix A includes a brief description of each host company's history, physical location, and positioning within the world of interaction design, as well as how I came to observe work there.

LittleStudio

LittleStudio is a "boutique" consultancy — which is to say that it has only a few employees and a specialized set of skills. LittleStudio's website at the time of this writing describes the company as "a consultancy that focuses on interaction-infused interface and device design, specializing in new technology." In practice, that means that while LittleStudio will design websites, the principals prefer non-Web based projects, including: "iPhones, iPads, touchscreens, gestural interfaces, haptics, mobile devices, consumer electronics, appliances, installations, and robots."

LittleStudio was founded in 2009 by two interaction designers, an industrial designer, and a visual designer. One year later, at the time of observation, the industrial designer had left the company, turning it into a three-person partnership. Moving in and out of the LittleStudio offices were also a full-time but temporary "contract" interaction designer, a part-time longterm contract industrial designer, a part-time office manager, and their accountant. At the time of my visit, their website advertised "boutique design studio service with big agency expertise" — which is to say that all of their principals (the founding partners) have more than ten years of professional experience, and that (unlike larger companies) at least one partner works on every project.

At any given time, LittleStudio has two to four projects. At the time of my visit, they had four, with two more project scheduled. After "accidentally double-booking" themselves, they described themselves at an organizational "breaking point," as Dave put it, (LittleStudio-2010-01-25). The visual designer, in particular, was overbooked, with three projects requiring her attention at once. LittleStudio's principals were trying to hire a project manager to help get new projects, manage communication of decision-making with clients, and coordinate the overall schedule of each partner to avoid double-booking.

Despite the company's small size, LittleStudio's interaction designers are prominent within the interaction design professional community. One founding interaction designer has written two books on interaction design. He has a master's degree from a prominent North American interaction design program, and has taught there. The other founding interaction designer chaired an interaction design conference during the study. She also teaches graduate-level interaction design at a well-regarded program in another center of interaction design, New York.

The studio itself is located in a converted factory building. While the building's granite facade appears glossily high-tech, the interior has been only haphazardly remodeled. The freight elevator remains in place, and narrow, winding hallways lead to irregularly sized offices. The studio walls are so thin that loud music frequently leaks through from the music editing business next door. The LittleStudio founders discovered the building through friends who have a web design business on the same floor. There is little socializing between the two offices during work hours, but the two businesses occasionally do each other favors, such as minding each other's pets.

The studio is one large room, with a single large window. Four identical desks for permanent employees are arranged in an L-shape around the west and north walls, with the receptionist-cum-office manager's desk nearest the door. There's also a desk in the middle of the room — that's where the short-term interaction designer sits. When the new project manager is hired, a new desk is purchased and placed in the middle of the room as well. Sound bounces distractingly off the high walls and ceiling; even quiet conversations are audible to everyone. There is no separate conference room. Private conversations take place in whispers in the walled-off kitchen area, or at normal volume in the hallway and bathrooms.

A tall, curving bookshelf hides a sink and messy storage area from the rest of the room. The shelf largely holds reference books, with names like *The Art of Human Computer Interaction*, *Built for Use*, and *Scandinavian Design*. It also displays copies of one of the founder's books and promotional materials for the university at which another teaches. The books are arranged not in alphabetic order, but in a rainbow by the colors of their covers. It also holds a few plastic and wood prototypes that the studio has made. During my two months there, no one ever took a book from the bookshelf. It appeared to be largely decorative.

Beyond the bookshelf, deeper in the room, is a large semi-circular bar. Snacks are kept in easy reach on top, but they are only served to clients. I am the only one who ever sits at the bar. Along the back wall is a small conference table that can seat about eight people, which faces a whiteboard. Facing the conference table is a red sofa. At times of stress and overwork, one or more of the designers will collapse on the sofa or in a beanbag chair next to it. Otherwise, people work at their desks.

I met Jess, one of the founders and principals, through a mutual friend. However, we did not know each other well. I had sent her an email asking whether I could observe project work at LittleStudio for my dissertation. Through a quick exchange of emails over one week in late December,

she suggested that I observe the iMAGine project and assured me that her partners and the client were agreeable. I started observation of the iMAGine project in early January.

MediumFirm

Seven partners founded MediumFirm in 2001. Today, only two of the original partners remain with the company. At the time I visited, it had 43 employees in three locations: San Francisco, Austin, and Amsterdam. Though impressive-sounding, the company's expansion was relatively recent (Austin in 2008, and Amsterdam in 2010), with nearly all the employees in San Francisco. By the time I finished writing the dissertation, the Amsterdam office was closed.

More so than the other companies I visited, MediumFirm puts public writing and speaking as part of their mission on an equal footing with design. From their website:

> Our mission is to deliver great experiences that improve people's lives, while sharing our advances in the field with our clients, partners, and peers. We measure our success by our contribution to smart, agile organizations that are responsive to their users.

Notably, they explicitly declare that they will evaluate themselves through their "contributions" to the organizations they serve — not only through the excellence of the artifacts they make. The distribution of roles within the company gives a good idea of its priorities. Of those 43 people, 14 are described as "experience designers" or "interaction designers." The next largest group are "project managers" (6), then sales and client relations (5). There are fewer people dedicated to visual design (3) at MediumFirm than to initiating and guiding client relationships.

Indeed, MediumFirm is perhaps best known for what its website calls "thought leadership" (i.e. popularization of their vocabulary and methods) rather than any specific client or project. By 2011, MediumFirm's president and CEO both fit Kennedy's criteria for "micro-celebrity" (2011). They were in-demand speakers at industry conferences, with the president popular as the author of a classic design handbook (now in its 2nd edition) and the CEO the author of a long-running and popular blog. MediumFirm has a specialized team that organizes and publicizes multiple events a year. The average ticket price for one of these two-to-four-day conferences is more than two thousand dollars, and they regularly sell out.

At the time of this study, MediumFirm occupied a two-story converted light industrial space — painted the colors of its logo — across the street from LittleStudio. At the entry, a bookshelf (holding copies of books written by current and past MediumFirm employees) and a reception area partially block access to a large, high-ceilinged space dominating the ground floor. This open space, while not crowded, gives the impression of being filled to capacity with large desks. Each desk seems packed with computers, piles of paper, and a jumble of office supplies. Along one side of the floor are small rooms, some offices for senior personnel, and some conference rooms. In

general, doors on the first floor are left wide open — there is nothing to prevent visitors waiting in the reception are to see into nearly every corner.

The top floor follows the same spatial pattern. Unlike the bottom floor, however, the small rooms are assigned to specific projects. It's clear that these "project rooms" are intensively used. Scribbles cover whiteboards, and taped-up printouts obscure the walls. Coffee cups, purses, markers and paper notepads — as well as laptops and their power cables — litter the tabletops. Post-it notes, or "stickies" march indiscriminately over every available surface — from tables to whiteboards and walls. Many doors on the second floor are kept closed so that casual visitors cannot peer in.

Instead of one large open space, the second floor has three. The first open space functions as a meeting room, with a long table and built-in projector to accommodate groups of ten or more people. It's where MediumFirm holds company-wide meetings, or schedules meetings in which employees throughout the company spend a few hours working on one project. The second space is used for project work as well. It holds a series of tables, interspersed with flexibly placed interior "walls" created by platforms on castors. During the lifespan of a project, teams can move the walls to grow or shrink the "room" available to them. One side of each wall is a large whiteboard; the other side is a fabric surface to which papers can be pinned. When in use, these walls and tables, like those in the more permanent project rooms, are covered with the tools of the trade: laptops, drawing paper, thick black markers, notebooks, printouts, and of course the ever-present stickies. The final space, in the back of the building, is packed with desks and bookshelves. These are employees' personal desks — littered again with paper, pens, and computers.

I am personally close with a number of people at MediumFirm, including the founding partners. That relationship, as people I met there told me occasionally, makes me "family." However, though I am friendly with many employees and occasionally attend professional events there, I had never visited during business hours before beginning dissertation research. I suggested to a founding partner that I do fieldwork there. He immediately agreed, and suggested two separate projects. The next day, he introduced me to the designer leading the first project. I started observing the project in its second week. I had met one of the designers once before, but the others were strangers to me. When a second project started, four months later, he contacted me and asked me to drop by.

LargeAgency

In 2010, LargeAgency's website described the company as an "independent design & innovation consultancy" solving "business challenges through design thinking." Founded in 1999, the company had about 150 employees at the time of my visits, with well-established offices in San Francisco, New York, and London. The company's LinkedIn profile describes their clients "as owners of progressive, era defining brands," including technology companies such as Google, Microsoft,

and Nokia, retailers such as Nordstrom, and cultural institutions such as New York's Museum of Modern Art and the BBC. LargeAgency provides a slightly different set of services than LittleStudio and MediumFirm: print communications and branding as well as product experience design, research, and strategy.

LargeAgency's public client list points to the contrasts between it and the other two companies. At the time of my visits, promotional materials referred to the company as an "agency" with expertise in "branding" — two terms absent from the other two companies' self-published descriptions. Both of those terms, to many interaction designers, connote advertising industry connections. With a New York office, it hires employees from other New York-based "agencies" Razorfish and R/GA as well. It devotes more resources (as per its website) to visual design and branding. LargeAgency has won a number of awards from advertising and graphic design industry magazines such as *Communication Arts*, *How*, *Print*, and *ReBrand*. LargeAgency, then, differs from LittleStudio and MediumFirm not just in size, organizational complexity, and global reach, but in promoting expertise in marketing products as well as designing them.

LargeAgency is located on an unprepossessing block on the other side of SoMA from Little Studio and MediumFirm. It's across the street from a massage parlor and a single-room occupancy hotel. Like LittleStudio, LargeAgency's office occupies a converted factory. But where LittleStudio's lobby has new glass walls and a fancy intercom system, the lobby of LargeAgency's building is dingy and dim, with a makeshift "front desk" manned by the building's janitor-cum-security staff. On my first visit, I can hardly believe I am at the right address until the studio door opens.

Walking through, I enter what seems like an entirely different building. The receptionist's desk glows dazzlingly white against a dark grey wall. A stylishly minimal arrangement of cherry blossoms and moss softens the stark contrast. Immediately to the right is the library, walled in on three sides but left open to the morning light from windows that extend across an entire wall. The open door of the library frames a giant flat screen monitor on the wall, a sleek grey sofa, and a wall of large 1960s posters, all dominated by bright colors and modernist typography.

Most of the studio activity takes place in one open room behind the library. A grid of meter-high walls forms what looks like a large rectangle divided into several big cubicles. The walls of each cubicle are lined with about six desks. Each desk has much the same standard equipment. There's one large monitor, with a laptop next to it. A silvery gray bending desk lamp. A wire container stuffed with pencils and pens. And the stacks and stacks of paper that I have come to expect.

The grid of desks takes up most of the open space, leaving narrow corridors on all sides. The back wall has another seating area, with more uncomfortable-looking grey sofas. Like all the shared seating areas in other design firms I have visited, no one ever seems to sit there. The long sides of the space are lined with smaller rooms, each labelled with a laser-etched wooden plaque. Most of the rooms are project rooms, but there is also an archive and a server room.

Soft music plays over speakers — mostly downtempo hip hop and indie rock. Occasionally, one of the workers takes a phone call. Occasionally, one can hear a brief conversation. But mostly, the only sound is music and the tapping of computer keys.

I found myself at LargeAgency after more than a year of actively searching for a large organization — whether consultancy or product maker — who would let me observe design work. It was a frustrating year. Promising conversations fizzled as contacts failed to gain approval from their managers. Seemingly positive meetings led to unreturned emails. Follow-up emails eventually prompted apologetic rejections. Rounds of meetings over three months with two enthusiastic teams at one company resulted in an abrupt cessation of contact after a research request was "sent to Legal."

A year earlier, the founder of LittleStudio had introduced me to René, my contact at LargeAgency. At that time, he had been working in-house a large multinational company. He had tried to help me observe project work there, and the effort had failed. When he changed jobs, I contacted him again. This time, I received initial permission within a week — he had simply walked up to the CEO and asked permission. After a first meeting, another manager reviewed my consent documents. After receiving permission from the team and signing an NDA, I started observation. The entire process — from initial email to beginning observation — took three weeks.

APPENDIX B

Interview Participants

Appendix B lists individual interview participants, including those interviewed in the course of observing project work. Interviews lasted 60 to 90 minutes, with most taking place at the participant's workplace. The order of the list is alphabetized by pseudonym and real name. Asterisks indicate pseudonyms; dashed lines ("——") indicate those who requested complete anonymity. Where permitted, the participant's place of work is listed, otherwise I give a generic description. The list does not include informal conversations. The listed employment and experience data is current as of the time of interview, not the time of dissertation publication.

Name	**Employment status**	**Years of experience**	**Date of interview**
——	Design Director at a major device manufacturer	15	December 4, 2009
——	Project manager, LittleStudio	12	May 20, 2010
——	Freelance interaction designer, recently departed a multinational telecommunications software and hardware manufacturer	20	May 11, 2010
Alex*	Visual designer at LargeAgency	7	April, 2011
Amy*	Interaction designer at MediumFirm	6	June 2, 2010
Audra*	Interaction Design Lead at LargeAgency	9	March 1, 2011
Ben Cerveny	Founder and president, Bloom Inc, a data visualization startup	13	June 6, 2010
Ben Fullerton	Interaction designer, at Adaptive Path, a medium-sized consultancy	11	September, 2010
Brian Yeung	Freelance interaction designer	10	January 31, 2010
Chelsea*	Lead user experience designer, newly hired to MediumFirm after leaving a job at another consultancy in the Midwest	11	May 27, 2010

Darren David	CEO and founder of Stimulant, a boutique interaction design consultancy	15	March 4, 2010
Dave Hoffer	Director of User Experience at Open Peak, a mobile software provider	12	March 5, 2010
Dave Merrill	Co-founder and President of Sifteo, a startup game design company	8	March 3, 2010
Dave*	Principal Interaction Designer and Co-Founder, LittleStudio	15	May 24, 2010
David Cronin	Managing Director, Interaction Design, at Cooper, a large consultancy, and co-author of a well-known interaction design textbook	14	January 5, 2010
George*	Freelance interaction designer temporarily contracting at MediumFirm	12	May 20, 2010
Gretchen Anderson	Director, Interaction Design, at Lunar, a large consultancy	10	January 5, 2010
Jamin*	Interaction designer, new to MediumFirm after leaving a mobile phone manufacturer	8	May 17, 2010
Jess*	Interaction designer, principal and founder of LittleStudio	9	May 14, 2010
Julie*	Visual designer, principal and founder of LittleStudio	15	April 29, 2010; May 18, 2010
Nathan Moody	Design Director and co-founder of Stimulant, a boutique interaction design consultancy	10	March 4, 2010
Paul*	President and founder of MediumFirm	17	September 29, 2010
Phillip*	Creative Director at LargeAgency	16	April, 2011
René*	Director of Product at LargeAgency	11	May 15, 2011