10 Introduction to User Research

This part concerns how to obtain actionable knowledge about users, their activities, their needs and wants, and their contexts of use. *User research* comprises the principles and methods for obtaining, analyzing, and representing such knowledge. The data we collect as part of user research should be about actual users engaged in specific activities with specific needs and capabilities; it is about the current state of affairs, although that might not yet involve an interactive system. For instance, we might observe users as they do their work (see Figure 10.1) to learn what it is about and what concerns them.

In this sense, user research complements the part on understanding people (Part 2). In particular, the theories and principles discussed in that part aim to be *general*. They concern the psychological and social factors that pertain to most, if not all, cases of human-computer interaction. However, that understanding is necessarily limited. The current theoretical view of humans is patchy: Every project will face questions that are not covered by existing theories. Any interactive system also involves *particular* users doing particular activities in particular contexts. We need to know these particulars when we do not have a general understanding that covers them or when it is not clear which general ideas from Part 2 (on understanding people) we may apply. Therefore, the general

Figure 10.1: A researcher observing a user [1]. User research is about empirical description of the present, particularly the users, their activities, the roles of any existing interactive system, and their contexts of use, including the social, organizational, and physical context. It also concerns the users' needs and wants. These descriptions are collected to inform design.

understanding of people from Part 2 must be fleshed out with empirical insights about these particulars to inform design and decision-making. For instance, the selection of icons for an interactive system depends on general features of human visual perception (see Chapter 3). But selecting the actual icons to integrate in a system requires designers to know about the particulars of the work that people do and which representations that would match the actual work.

The chief aim of user research is to *obtain concrete, empirical knowledge about users*. This goal has been central in human-computer interaction since the beginning of the field. Its importance is captured in slogans such as "know the user" [5], "early focus on users" [4], and "start with the needs of the user" [15]. User research is where "know the user" happens. This requires that, as researchers and designers, we should be in direct contact with users, rather than relying on second-hand descriptions or assumptions about them. We cannot know the particulars of users indirectly. As mentioned in Part 1 (Introduction to HCI), this is a central tenet of being human centered. We need concrete, empirical knowledge about users to design interactive systems that match what they do and want.

A key commitment in user research is to *understand first and design later.* The idea is simple: Do not jump to solutions or try to come up with interactive systems that will solve a problem that you see. Instead, just try to determine what goes on for users. In that way, we consider user research to be rooted in the empirical sciences. The methods we use in user research are adopted from social science, psychology, and other behavioral sciences. Thus, we treat design separately (see Part 6 on Design). In that part, we will treat methods that break assumptions behind methods in the empirical sciences. For example, in co-design, we do not study users' activities and context to establish a basis for design. Instead, users are included in the design process for the purpose of breaking the barrier that separates user research and design. When using design probes, we do not aim for accurate descriptions of people, but to generate knowledge that inspires new ideas. More generally, in many design-oriented methods, the intersubjectivity of user research is challenged. Designers who immerse themselves in the world and data may not need to articulate their understandings to others. In contrast, this part approaches user research as an applied empirical science. This is a key difference between user research and design.

Unfortunately, *obtaining knowledge about users is complicated.* Many factors contribute to this complexity; understanding those factors helps avoid the pitfalls and put the care into user research that it requires. The factors include the following:

- The say-do problem. This problem comes from the frequent observation that what users say they do might differ from what they actually do. For instance, when people are asked how much they use the Internet, their self-reports have only low correlation against log file data [21]. In this case, directly asking is not a valid method.

- In pursuing their activities, users rely on knowledge that is hard to articulate [17]. Many factors that drive our behavior are *latent* in such a way that they are not accessible to conscious inspection and are hard or impossible to describe verbally. *Tacit knowledge* refers to knowledge that we are largely unaware of, but can be effortlessly brought into use in the right situation. Highly repeated motor skills, like

riding a bike or typing in a familiar password, are good examples. You cannot ask people about how they ride a bike and get the full picture.

- Users' needs may only be recognized in the future [20]. For instance, no user of batch computer systems was likely able to articulate the need for a graphical user interface. Thus, identifying what users need requires them to imagine the impact of new technology on their activities, which is very difficult.

- Social reasons further make it difficult to gain insights into users. Suchman discussed how the ways in which work gets done are often kept secret. Making work visible is fraught with difficulties [23]. For instance, making work practices visible may challenge the power between those doing the work and other members of an organization.

This is a partial list. Nevertheless, because of these factors, user research is both needed and difficult to do right. This is the reason it takes up an entire part of this book.

If user research is that difficult, why attempt to do it at all? Perhaps the most important reason is ethical: User research is a commitment to listening to your users and taking them seriously. Rooting decisions in empirical data can help avoid biases in decision-making. However, even the most rigorous user research is no guarantee that the result will not be harmful to end users. Another motivation is that user research can help build better interactive systems. Gathering insights about users that can inform decisions about whether to build an interactive system and how to build it. Properly conducted, empirical research trumps empathy and opinion. The insights help make decisions on how to have the desired impact on the future situation, possibly using interactive computer systems. User research can also challenge assumptions about products. For example, Kumar and Whitney [10] described user research to uncover patterns of daily life in a culture, including its value systems and social structures. The results of such user research can challenge the one-design-fits-all idea. Discovering drastic differences in a user population that was thought to be homogenous can help rescoping and diversifying a product offering.

The rest of this chapter explains the key parts of user research, and the rest of this part details the specific methods for doing user research.

10.1 Goals of User Research

The primary goal of user research is to obtain, analyze, and represent knowledge about actual or prospective users. We call this goal *gathering knowledge for design*. What is it then that we seek to gather knowledge about? In some cases, the user researcher will have a design brief, focus, or relatively clear idea about the scope of the interactive system under consideration or of the use-related issues that needs to be studied. In such cases, this will shape the user research. In other cases, the outcomes of user research will determine what the focus of the interactive system will be, or whether something need to be designed at all. In both situations, the following list of the types of insights to gather may be of inspiration. They may be remembered through the acronym used by Benyon [2], PACT, for people, activities, contexts, and technologies.

- People, including users' skills, personalities, socioeconomic status, abilities, beliefs, habits, motivations, needs, and wants. This only includes the experiences and attitudes of the users and their first-person views of themselves and their activities.
- Activities, including the tasks that users do and the practices in which they engage. What do users do? What do they strive to achieve and in which contexts?
- Contexts of use. This can include the physical context (e.g., weather, lighting, the built environment), the social context (e.g., social relationships and activities with others), the organizational context (e.g., roles, power structures, division of labor), the historical context (e.g., prior exposure to practices and systems), and the cultural context (e.g., cultural beliefs and norms that affect the use of the system).
- Technologies, including existing interactive systems and tools that the users engage with. This may include the perceived pros and cons and any opinions of alternative solutions. Nevertheless, it is important to remember that the point of user research is not to primarily focus on technology or to begin imagining technological solutions, but to focus on people.

A prime goal of user research is to *inform* design and practical decisions, such as whether to launch a product or if it contains biases. However, because user research is often open-ended, it may fail to speak directly to concrete decisions. More severely, we face the *is–ought problem*, that is, from descriptions of how things are, one cannot conclude how they should be. For example, let us imagine that you have collected extensive amounts of data on what your users do on mobile devices, say, when they are cooking. What can you say about their need for a new service? The difficulty is that essential characteristics of that new service may not be in that user data. Hence, even at best, user research results are never strongly prescriptive of designs. However, a significant value of user research is that it can convince stakeholders about the quality of decisions taken. Compare a designer who refers to personal experience with one who presents statistics, interview data, and a model that describes the users. Which one will be more persuasive?

However, generating insights for design is not the only goal of user research. Another prominent goal is to *involve users* in the development of interactive systems. One motivation is that the involvement in development is an argument that users have a political or moral right to be part of shaping the interactive systems they might work with in the future. This argument comes from the Scandinavian tradition of systems development and is called participatory design [7]. Another motivation for involving users is pragmatic. Research has suggested that user involvement works to create better systems that users are more committed to using [8, 6]. Part 6 will discuss techniques for involving users not only as a source for getting insights about the current situation but also as co-designers of the future situation.

Another goal of user research is to *create empathy* between the user researcher (who might also be the designer) and the user. This goal turns the activity of knowing the user into "understanding what it feels like to be that person, what their situation is like from their own perspective. In short, it involves empathy" [25]. This view permeates much

work on design. Hansen [5], for instance, argued that one important function of getting to know the user is to "remind the designer that the user is a human". Rams argued that "indifference towards people and the reality in which they live is actually the one and only cardinal sin in design". Thus, direct and continued contact between user researchers and the people they seek to understand might help establish a good connection among them. However, empathy is not a substitute for empirical inquiry. As discussed in Part 6 on Design, it tends to fail us. Just like it is difficult to guess—even after years—what a significant other may want, it is difficult to emphasize with the lived world of someone else.

Finally, user research is valuable as it is, even with no product in mind. User research may lead to discoveries and contribute to *basic research findings*. Many examples of such findings were already given in Part 2 on understanding people. This is the reason why some HCI researchers have argued that not all papers that describe studies of people need to contain implications for design [3].

10.2 Who is the 'User' in 'User Research'?

This section concerns *users* or the people who use or might use an interactive computer system. There are often many more users than one can practically address in user research. Thus, a central step in all user research is to define who is a user and then to select which users to research:

- In *target audience specification*, the user groups targeted by the end product are defined.
- In *user sampling*, a sample of those users is selected for user research.

10.2.1 Target audience specification

A number of ways of thinking about users have emerged in human-computer interaction. Perhaps the most prominent is that the users that we focus on in user research—interviewing, observing, surveying—should be *representative*, that is, a group of users who varies enough to be typical of the major types of users. What is representative is largely an empirical question. User research can chart both existing and potential user base, for example via methods like customer surveys. But defining who a user is unfortunately often a political decision. Are we designing for wealthy young professionals or managers? Or are we designing while taking into account the real and diverse needs of all users? The stance of the authors is that user-centered design should strive to cater for all audiences equally, while considering their diverse needs. This means striving away from the urge to design for managers and self and instead empirically studying who will or might be a user. Figure 10.2 shows an example where three main user groups were identified as targets for an IT system developed for a hospital.

Another approach to selecting users is to focus on extreme or *extra-ordinary users* [18]. This idea originally emerged in accessibility research, where Alan Newell and colleagues

argued that we should focus on users whose abilities are outside of what we may consider ordinary. The point here is to learn from users at the extremes of ability distributions. They may be the ones posing the hardest requirements for design. Pullin and Newell [18] listed a number of products that originate in such users groups, including the tape recorder (developed for blind people) and kitchen products with big grips (for people with tremor).

Still another way is to think of users in terms of *early adopters*. The rationale here is that early adopters of technology have needs and wants that will be general for other users months or years later. One popular approach is *lead users*. A lead user may be a social media influencer, a journalist, or a member of a community of practice (e.g., Stack Overflow or Dribbble). They can influence a larger group of potential users and sway them to try the product.

Another way to think about users is to focus on the *variety of users* that we engage with in user research. The key idea here is that we want to understand users and their activities with as much nuance and complexity as possible because that nuance and complexity help in creating better designs. Identified groups should be different in terms of their needs, beliefs, contexts, purchasing power, and so on.

In addition to the direct users of interactive systems, in many cases, other people are affected by the systems, indirectly involved in their use, or benefiting from the system. For instance, they may be parents of children who use a kid's web page or coworkers of users of an accounting system. We call these people *stakeholders*. We may do research with stakeholders in all the same ways as we do with users. However, methods that focus on observing and analyzing interaction are less relevant. Further, stakeholders do not directly need to interact with a system and thus may have different views and varying knowledge of the benefits, drawbacks, and activities relevant to the system. Questions of power, interest, and relation to users are thus necessary to answer so as to involve stakeholders.

In practical projects, time should be preserved for the identification of target users. Kujala and Kauppinen offered a five-step procedure for this [9]:

1. Brainstorm a preliminary list of users.
2. Describe the main user characteristics (including market size).
3. Describe main user groups and prioritize them.
4. Select typical and representative users from the groups.

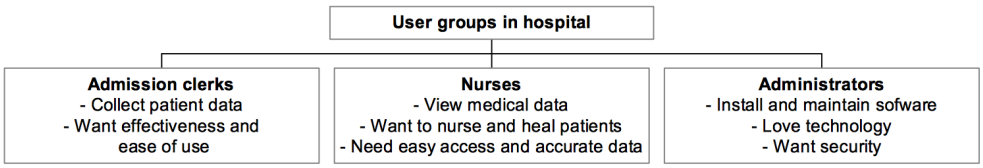

Figure 10.2: User groups identified for the development of an IT system for hospitals [9].

5. Gather information from the users and redesign the user group descriptions according to the new information gathered.

10.2.2 Sampling

After the target group has been specified, user research can be carried out. To this end, particular participants should be chosen. Below are five considerations for selecting which users to include:

1. Representativeness: Is this user group representing the target groups?
2. Statistical power: Will this sample size be large enough to draw reliable conclusions about it?
3. Access and availability: Are these users available for study?
4. Cost-efficiency: Is this user group providing information for design that warrants the cost of studying them?
5. Costs for users in participation: Does being part of the user research present any cost or danger to the participants?

These considerations may lead to different choices with respect to whom and how many users to include. The individual chapters that follow this introduction contain more detailed advice.

10.3 User Research Methods

Research methods in user research are the means for obtaining empirical evidence about users, including research-based instruments, techniques, and procedures for collecting, analyzing, and reporting insights. As in any empirical study, the goal in user research is to obtain accurate knowledge about the topic under study. What makes user research different, however, is the pursuit of actionable knowledge. The outcomes should be useful in conceptualizing, designing, and making decisions. Moreover, actual use of research methods may differ from the way they are described in science. In other words, user research is a practice. Practitioners share tricks of the trade, develop personal insights, and develop communities of practice and organizational procedures (see Part 6 on Design Practice).

A host of research methods exist that help do user research. In this part, we cover a number of qualitative and quantitative methods used extensively in both universities and companies for user research. As an overview, Table 10.1 shows some prominent ones. They are divided according to four dimensions:

- Qualitative vs. quantitative focus: For example, survey data is mostly numerical and analyzed statistically, while field observations are qualitative.

Research method	Explanation
Open-ended interview	Ask users questions about their attitudes, experiences, and activities.
Contextual inquiry	Observe and speak to users as they do they work.
Observation	Observe users while trying to avoid affecting them.
Ethnography	Explore the viewpoint of the user through observations, interviews, and participation.
Surveys	Collect a large sample of structured self-report data.
Diaries	Have users keep a diary about their use of interactive systems.
Log file analysis	Automatically track what users actually do with interactive systems.
Analysis of archival data	Analyze the documents and posts that users produce in or with interactive systems.

Table 10.1: Overview of popular user research methods learned in this part.

- Obtrusiveness: How much the research is allowed to affect—and thereby potentially disrupt—the situations that are being observed. For example, in contextual inquiry, the researcher takes a semi-active role by asking questions and demonstrations from participants.
- First- versus third-person view: Is the goal to offer a description of how users' see situations or rather describe them from a third-person perspective?
- Open-endedness: How much does the method rely on predefined measures or constructs (e.g., survey)?

10.3.1 Research Strategy

Research strategy concerns how to select one or more research methods for gathering insights about users. The selection of research methods depends on what the user researchers think is important to obtain insights about. On the one hand, the anticipated outcomes obtained with a particular method should be useful to the problem at hand. On the other hand, the resources needed for the method are also important to consider. However, the choice of method is not just about cost-efficiency.

McGrath introduced three general principles for thinking about research strategy [12]. The first principle states that *research methods bound what we can empirically learn.* According to McGrath, "all methods have inherent flaws, though each has certain potential advantages". From this principle follows that there is no correct method; the selection on methods needs to follow from careful consideration of the goals of the user research. Only

that can determine which method to use. Thus, the user researcher should never state that interviews are better, or that field studies are superior. Only that each has certain limitations and certain strengths.

The second principle from McGrath [12] states that research strategy is about *trading off conflicting criteria*. The criteria are as follows (in no particular order):

Realism concerns how similar the situation being studied is to the situations that the researcher wants to gather insights about. Studies that look at user-initiated behavior in its naturally occurring surroundings, such as field studies, are high in realism.

Precision concerns with how much accuracy and detail one obtains about the users' behavior and attitudes, and how much control there is over variables and circumstances of no interest. User studies that track every detail of people's hand movements with motion-tracking equipment, for instance, are high in precision.

Generalizability concerns how well the findings generalize to other people or situations. Studies that are able to get input from a lot of users, such as surveys, are often high in generalizability.

Each of these criteria works against any of the other, and in general, it is impossible to maximize all of them. For instance, let us say that we seek to maximize realism and change the situation being studied as little as possible. This has the consequence that any feature of the context, even those we are not interested in, influences our study. It also means that we obtain evidence just about one situation and face challenges when we try to generalize to others. Those principles can also be used to think about the previous discussion on how to select users. Part of that discussion was about whether one should see insights about users in general (maximizing generalizability) or about particular users (maximizing realism).

The third principle of research strategy follows from the inherent limitations of methods; we will call this *triangulation*. McGrath [12] explained the idea as follows: "If you only use one method, there is no way to separate out the part that is the 'true' measure of the concept in question from the part that reflects mainly the method itself. If you use multiple methods, carefully picked to have different strengths and weaknesses, the methods can add strength to one another by offsetting each other's weaknesses". The ordinary language meaning of triangulation is to establish the location of something by taking bearings to it from two or more positions. In research, triangulation means the combination of multiple research methods to study the same phenomenon. The rationale is that if all research methods are limited in different ways (as argued above), then their combination should be able to mitigate some of those limitations. Thus, triangulation is a characteristic of the user research process, rather than of a single method.

How to do triangulation in practice? The following checklist helps understand the requirements for triangulation [14, p.400]:

- The chosen approaches to the study must be able to address the same underlying question.

- For each approach, inherent biases should be analyzed and made explicit.
- The mechanisms that produce bias should be understood and acknowledged.
- Critical shortcomings or biases should be compensated somehow, for example, by adding a method that compensates for them.
- Results from two methods are compared and assessed to understand how the methods differ.

In triangulation, several things might happen. The different methods may result in the same overall results, corroborating the findings and offering converging evidence. The methods may also offer complementary findings, highlighting different phenomena or relations. Finally, the findings from each method may of course contradict each other.

10.3.2 Typical Process

An overview of user research is given in Figure 10.3. This process differs depending on specific methods; those variants will be explained in the rest of this chapter.

10.4 Methodological Quality

The research methods just discussed have different strengths and weaknesses. For instance, we may characterize those in terms of their realism, generalizability, or precision. In addition, the research methods may be used more or less well. We call the criteria by which that is judged *methodological quality.* Next, we will discuss the four dimensions of methodological quality.

Validity: Validity concerns whether the conclusions drawn from a study is warranted. *Threats to validity* are anything that could go wrong and that threatens the validity of the conclusions drawn. One classic taxonomy of validity covers four types [22].

- Internal validity: Whether a variable under the control of the researcher (e.g., user groups, tasks) has an effect on observations.
- Construct validity: If a measurement supposed to measure something (e.g., user experience) actually measures it.
- Statistical conclusion validity: If the conclusions drawn based on data are statistically reliable.
- External validity: Do the conclusions hold for other participants and settings?

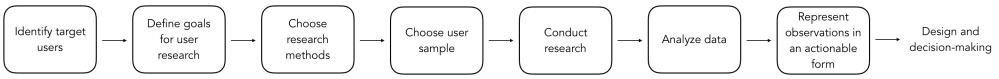

Figure 10.3: Overview of phases in user research.

Reliability: The reliability of user research, and empirical research more broadly, concerns that user research gives consistent results. That is, we would like our methods or measures to give the same result, for instance, if they are applied immediately again to the same person. McDonald et al. [11] offered guidelines for how to assess and use reliability in HCI research.

Transparency: The transparency of user research refers to the idea that researchers should make the design, data, analysis approach, and derivation of conclusions accessible and inspectable. Often transparency is associated with open scholarship and a desire to increase the replicability of research. To many, this ideal of research quality applies to all forms of research in HCI, including that drawing on social science methods [13]. However, current practice in HCI is not transparent, and many studies do not share artefacts, protocols for research methods, and so on [24]. There are several practices associated with transparency, such as sharing data, deciding on plans before seeing data; care in analysis and reporting, and maintaining a chain of evidence throughout the study.

Ethics Doing user research requires that the person doing the research carefully considers what is right and wrong in collecting, analyzing, and reporting data. Concerns about ethics also include allegiances toward the various stakeholders, most importantly the prospective users who participate in the research, the client for which the research is done, the professional standards of the field of HCI, and the responsibility toward the society at large.

10.5 Data Analysis and Representation

A distinct challenge in user research is to transform obtained results into a useful, actionable form. Thus, the analysis and representation of the outcomes of user research is important.

For analysis, validity, reliability, and transparency are key issues for analysis. For instance, the transcription of interviews impacts the reliability of the analysis. If transcription is sloppy, the resulting analysis may suffer. Similarly, the care by which we record observations of users might impact the validity of our findings; if we miss writing down certain observations, our data might be invalid. The specific techniques differ depending on the research method. They include thematic analysis, affinity diagramming, statistical analysis, and machine-learning classifiers. The rest of this part will detail the techniques.

For representation, the key issue is to synthesize the results of user research in a way that is helpful for design. A representation is helpful if it brings forward critical insights of the user research in a clear and transparent manner. It may also be helpful by having impact on the people who are making decisions about the design. In the rest of this part, we discuss different techniques for representing user research. They include the following:

- Personas: Profiles that described median users of interesting user segments.
- Scenarios: A narrative account of what happens when using a system.

- Artefact and context models: Descriptions of key objects and their contextual relationships within a situation.
- Quotes: Rich representations of users' attitudes and needs.
- Journey maps: A temporal account of encounters that users have with a system.

10.6 Does User Research Work?

But what is the evidence that user research works? This is a difficult question to answer. One answer is that user research is akin to an axiom: It is taken to be valuable as a basic commitment to do user-centered research. One can go as far as saying that *not* doing user research is unethical; it may lead to outcomes that harm the end-users in ways not predicted by designers. Good examples are cybersickness, or the nausea that many users feel when using VR glasses. Another, even more severe, is algorithmic bias: AI algorithms that discriminate based on race or gender. But there is often also direct economic benefit for engaging in user research. As mentioned in chapter X, many activities of HCI have been linked to a positive return on investment. Still another answer is to point to the many success stories of work in HCI which have departed from users. In the history of HCI, there are examples of discoveries made in user research that have helped shape a product.

However, the evidence is by no means unequivocally in favor of user research. Prior to modern user-centered design, most products were developed with no systematic empirical effort prior to launch. Many of the tools we use, or musical instruments, are the result of several, even hundreds, rounds of iteration. The HCI pioneer Donald Norman [16] argued that human-centered design can sometimes lead to incoherent systems. Such systems may strive to fulfill user requests but end up as a jungle of disentangled and confusing functionalities. *Feature creep* is the unavoidable consequence of too closely adhering to even the weakest signal in user research. Moreover, as Norman argued, users adapt. They appear willing to adapt to systems that offer value, even if such systems are not necessarily adapted well to human abilities.

To sum up, user research cannot be proven to be either necessary or sufficient for building interactive systems. However, despite the rather scant evidence, user research has proven valuable for understanding people and is essential for creating good products rather than radical innovations, as discussed by [16].

Summary

- User research helps understand users, their activities, the contexts in which they act, and the interactive systems they presently use, if any.
- The goal of user research is to get insights into users; those insights may subsequently help design an interactive system.

- All methods for user research are limited, for instance, with respect to their realism, generalizability, and precision.
- The key qualities of research methods concern validity, reliability, transparency, and ethics.

Further readings

Rosenthal and Rosnow [19] is a classic introduction to research methods. McGrath [12] is a useful overview of the quality of methods.

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