

# Methods in the Making: A Perspective on the State of Human Research in Design

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## Introduction

This article was developed from experiences in human-centered design, both within field research and as a design researcher and educator. Several of the observations, insights, and examples offered here have been inspired, or at least clarified, by a current project being conducted by the School of Design at Carnegie Mellon University for the United States Postal Service (USPS). The USPS project entails the transformation of complex informational documents into accessible language and visualizations in a new set of documents for use by postal employees, the public, and business customers. My role in this project has been to advise the research and design team on user research and product testing, given a mandate of user-centered design.

This project is noteworthy from several perspectives relevant to this article, and design research in general. First, there is the unique aspect of application focused on the design of an informational document. Although certainly arguable as an interface, there is a perceived difference between this product and more traditional interfaces housed in three-dimensional and digital artifacts. Related to this is the recognized paucity of user-centered design and testing within communication (graphic) design,<sup>1</sup> particularly in comparison to the more established history of industrial design. Fundamental to my own background in human factors and industrial design has been the realization that although one can identify these differences, they become relatively mute in the process of research and design. That is, the issues that emerge, with respect to both content and methodology, are relatively similar in practice, and in fact should be mutually informing across disciplines and products.

The information shared here, culled from the USPS project and others, should serve to reinforce the need and *demand* for user-centered approaches in design, and offer some clarity in the methods that can best serve this cause.

## The Language of Human-Centered Design

The very phrase *user-centered design* is worth contemplating at the outset, noteworthy at least for the absence of the word “research.” User-centered design describes a *process*, one that is at once both

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<sup>1</sup> See, for example, the argument put forth by Strickler regarding suspect reliance by graphic designers on “specialist” design intuition. Zoe Strickler, “Elicitation Methods in Experimental Design Research,” *Design Issues* 15:2 (Summer, 1999): 28.

human- and design-centric. Research, in this case, is implicit, yet is addressed *within* the context of design. Design, in turn, is recognized as an activity inherently tied to human needs and concerns. For this reason, I would argue for further clarity and humanizing of the phrase by calling it *human-centered design*.

I offer in contrast the more traditional terminology of *user testing*, and its counterpart, *usability*. There is a growing body of design literature critical of the limited connotations of these terms, both in definition and practice.<sup>2</sup> On one level, user testing may be misconstrued as implying a test *of* the user, certainly something we strive to de-emphasize to participants in human factors research! In response, a more accurate descriptive term would be *product testing*.

Furthermore, if we examine the activities of research at any given time in the life of a project, the term *user testing* is, in fact, a misnomer. The phrase implies that a product (or artifact, be it a prototype, manufactured object, or document) has an informational set to be matched (tested) against user (human) interpretation. In many stages of a design project, *user research* offers a more appropriate description of the activities actually taking place. For example, when we are collecting information from people to inform our baseline knowledge of their needs, desires, or thought processes, we are engaged in user research. User research may entail interviews, conversations, business or facility tours, the examination of currently used documents or products, and work observations, as well as documentation through writing, sketching, and photography.

Sometimes, it is also relevant to distinguish between *users* and *tasks*.<sup>3</sup> Whereas user research reveals aspects of people as described above, *tasks* often are isolated for research in terms of how goals are accomplished, pathways of experience, milestones and roadblocks to achievement. Eventually, aspects of users and tasks are mapped together.

Finally, user testing and usability often too narrowly define the range of human concerns of interest to design. This too is increasingly documented in current design research literature, with clear trends identifying the need to address aspects of product desirability, pleasurable interactions, and emotional resonance, in addition to the more established elements of product design centered around what is useful and usable.<sup>4</sup>

### Project Life Cycles and Research

Past models of user testing and usability consulted users in late-stage product development, primarily for evaluating prototypes or finished products. There is a growing argument to include people in the very early stages of design, including pre-ideation phases.<sup>5</sup> In agreement with this, I advocate that, in the life of longer-term projects, a roster of stakeholders be built with agreement for participation at various stages throughout product development. This partnership results in an ongoing relationship, whereby relevant people

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- 2 Bruce Hanington, "Innovation and Method in Design Research" in Silvia Pizzocaro, Amilton Arruda, and Dijon De Moraes, eds., *Proceedings of the Politecnico di Milano Conference, Design (plus) Research* (May, 18-20, 2000): 64–69. See also Patrick Jordan, *Designing Pleasurable Products: An Introduction to the New Human Factors* (London: Taylor & Francis, 2000).
  - 3 JoAnn T. Hackos and Janice C. Redish, *User and Task Analysis for Interface Design* (New York: John Wiley & Sons, 1998).
  - 4 This argument currently is being promoted primarily in conference forums and accompanying proceedings. For example, Martin Helander, Halimahtun Khalid, and Tham Ming Po, eds., *Proceedings of the International Conference on Affective Human Factors Design* (CAHD), Singapore, June 27–29, 2001 (Asean Academic Press), and the Third International Conference on Design and Emotion, Loughborough, England, July 13, 2002 (proceedings forthcoming).
  - 5 This view is supported by Liz Sanders of SonicRim, among others (in presentation, Carnegie Mellon University School of Design, February 12, 2001).

may be called upon to assist in both the generation and evaluation of concepts and solutions, while concurrently becoming *invested* in the project.

Particularly at the beginning of a project, when the user group and its tasks are unknown to the design team, it is critical for members to immerse themselves in the user's world to develop a functional literacy of the material with which they will be working. User research, as contrasted to user testing above, is appropriate here.

Initially, *speculative* scenarios may be used to test ideas of product engagement and use. These are hypothetical scenarios of use determined by the design research team, to pilot-test possible issues in interpretation or navigation, while simultaneously providing a check of research protocol. Once detail is collected through user research, *actual* scenarios may evolve for more specific product testing.

During early development, prototype reviews may be conducted with users or experts to probe for confirmation of design directions established from earlier research. This should not be misconstrued as user testing. In transforming the USPS manuals, for example, document reviews were used with a second prototype as probing confirmation of appropriate content, topics, and sequence of information. The prototype had enough fidelity to present it to users, yet it was premature to test specific content. Reviews were conducted both with business customers, and "experts" within the USPS. A typical protocol for this research would involve members of the design team asking questions on common information needs and scenarios of use, presenting the document and its general structure, and then asking for feedback on the prototype based on typical experiences of the user. The table of contents is put under particular scrutiny for logic of information flow, and the index is examined and supplemented by users for the comprehensive inclusion of key terms. While these sessions are conducted with design team members in person, in some cases, we may leave the document prototype with users for longer periods of time and conduct follow-up sessions for feedback.

At later stages of prototype development, more traditional product testing provides critical information. In the USPS project, document testing is carried out to evaluate successful elements and trouble spots in document content and navigation. These tests are slightly more formal than earlier phases of research, and involve the users going through the document using actual scenarios, thinking out loud to pinpoint decision-making issues, annotating the document with color-coded dots and written comments, and answering probing questions. These sessions typically are videotaped to provide a transcript of the session and to identify key observations of behavior. For convenience, we may conduct these tests in our own facilities; however, it is valuable to collect feedback in the actual

work setting, under real circumstances of use, wherever possible. For complex and lengthy documents, it will be necessary to conduct some tests of individual components or sections of the document only, and to conduct other tests where we again leave the prototype with users for extended periods of time, with follow-up sessions to elaborate on feedback.

The process used in the USPS project is thus described in terms of human-centered design, and includes the following elements of research, some of them iterative:

- User Research—early, baseline collection of information
- Speculative Scenarios—preliminary scenarios of use built from baseline information
- Pilot Testing—in-house testing of content, and research protocol
- Product (Document) Reviews—expert and user reviews of document
- Product (Document) Testing—testing of prototypes with users and experts.

Research in the early phases of a design project often is referred to as generative, formative, or discovery research, and generally is contrasted to evaluative research, typically positioned as an end-stage component of research. User participation in generative research can provide critical information in understanding users, and their needs and desires, but also can be invaluable in developing ideas for product features and forms. There often is a false distinction made between methods reserved for generative research, and those for evaluative research. While purposes may be different, there can be significant crossover in the application of methods and, in fact, multiple iterations of form (concept) generation and evaluation should be cyclical and mutually informing.

### **Method and Purpose**

It is clear that there is a vast inventory of research methods from which to choose. The key challenge lies in making an appropriate, purposive connection to *goals* in the selection of methods used at any given time in the design and research process.

Consider the array of methods offered in Table 1.

**Table 1**

A Nomenclature of Research Methods for Human-Centered Design

Traditional	Adapted	Innovative
Market research	Observational research	Creative/Participatory
Focus groups	Participant observation	Design workshops
Surveys	Still, video documentation	Collage
Questionnaires	Ethnographic methods	Card sorting
Interviews	Video ethnography	Cognitive mapping
Unobtrusive measures	Beeper studies	Velcro modeling
Archival methods	Experiential sampling	Visual diaries
Trace measures	Cultural inventory	Camera studies
Experiments	Artifact analysis	Document annotations
	HCI	
	Thinkaloud protocol	
	Heuristic evaluation	
	Cognitive walkthrough	

**Interpretation and analysis tends toward:**

←	→
Counts	Content analysis
Statistics	Categories
Spreadsheets	Patterns, Themes
Graphing	Affinities, Clusters
Verbal + numerical information	Visual + verbal information

**Traditional Methods**

There are many traditional research methods that serve their purpose well, with little need to reinvent them for each intended use. Surveys, interviews, questionnaires, and focus groups—the traditional purview of market research—provide an efficient means to reach large numbers of people. If structured effectively, data collected, particularly from surveys and questionnaires, may be easily compiled, analyzed, and visualized. However, the methods are open to criticism, particularly for their reliance on what people *say* to be true, often subject to the influence of self-report bias or the natural tendency to make oneself appear “good.”<sup>6</sup> Focus groups must be well facilitated to avoid bias introduced through peer pressure unwittingly exerted by other participants or, in some cases, by the researchers themselves. These methods tend to be better at confirming known entities, yet are less critical in determining as-yet-undiscovered information.

Archival and “trace” measures similarly rely on interpretations of existing artifacts, yet still are valuable for their original purpose of unobtrusiveness, intended to reduce researcher bias and the reactivity of research participants. Archival research may range from library records to historical files to documented process work; traces are those measures made evident through accretion or erosion.<sup>7</sup> For example, a document that has been sectioned, re-

6 “As Agnew and Pyke (1982) put it, ‘On a questionnaire, we only have to move the pencil a few inches to shift our scores from being a bigot to being a humanitarian...,’” in Colin Robson, *Real World Research: A Resource for Social Scientists and Practitioner-Researchers*, 2nd ed. (Oxford: Blackwell, 2002), 310.

7 The landmark source on unobtrusive measures remains the classic by Eugene Webb, Donald T. Campbell, et. al., *Unobtrusive Measures: Nonreactive Research in the Social Sciences* (revised edition by Corwin Press, Sage Classics 1999; original publication by Rand McNally, 1966).

sequenced, and flagged in key places by the user offers substantial information to the designer during research.

The experiment as a research strategy rarely is used by designers, yet several intentions behind it serve to provide lessons of good practice for all research. For instance, the experiment draws attention to tradeoffs made between control and realism, and argues for rigor in research protocol. Lab research and protocols developed to isolate variables for manipulation and measurement provide the assurance of control, yet what field research lacks in control it may gain in realism, which is an advantage over many laboratory studies. Within my own teaching and consulting, the experiment is studied as a foundational tool for critical insights in both planning and evaluating research, assessing when and why control over variables is necessary and appropriate, and determining a suitable balance between rigor and relevance.

### *Adapted Methods*

It makes sense that we would borrow established methods from disciplines engaged in human research, since design is fundamentally a human-centered activity. However, research professions often have purposes and goals that differ from those of design. For this reason, methods borrowed often must be adapted to better suit the needs of design.<sup>8</sup>

Observation methods have previously been borrowed from psychology by the human factors community and subsequently used by design, thereby giving them a laboratory model of scientific application. The growing consensus that the use of designed artifacts occurs in natural settings of work, home, and play has convinced many that human behavior therefore should be studied in context. This has forged an increasingly greater connection with the philosophy and methods of anthropology and ethnography, fields acknowledged for their sensitivity to the study of human communities, while maintaining an awareness of the dangers of subjectivity, researcher bias, and influence.

Methods borrowed may be appropriate for our needs in design, yet it is equally important to recognize that we have adapted them for our own purposes. For example, ethnographic methods in anthropology may demand months or even years on behalf of the researcher, who will spend time in a community with varying levels of participation during their observations. Adapted methods commonly used in design include so-called “beeper studies,” or *Experiential Sampling Methods* (ESM), whereby people are paged at various times of the day to record their behavior, product use, and/or feelings, and *video ethnography*, where continuous video monitoring is edited, or collected in samples initiated by user movement or timers. These adapted methods serve to condense the extraordinary time devoted by formal ethnographers into more manageable and ultimately more relevant samples of information for the design

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8 An excellent reference for sources of adapted research methods and others is contained in a special issue of *Visible Language* 36:2 (2002): “An Annotated Design Research Bibliography: By and For the Design Community.” See pp. 161–168 for relevant discussion and sources of adapted methods.

researcher. Likewise, while cultural inventories or artifact analyses may not be as in-depth as those carried out by anthropologists when examining other cultures, a modest version of the methods may serve design purposes extremely well.<sup>9</sup>

While often scientific in approach, methods from human computer interaction similarly may be useful to design research. Depending on the particular needs, these methods may introduce a degree of rigor appropriate for some studies. Typically centered around issues within interface design, “thinkaloud” protocol has participants think out loud as they navigate problems or use products, to help the researcher identify key decision points, both positively and negatively encountered. Heuristic evaluation provides an expert evaluation of a product or interface against an established set of principles or guidelines. In “cognitive walkthroughs,” an analyst assesses the opportunities for appropriate actions that might be taken by users in task sequences.<sup>10</sup>

### *Innovative Methods*

Designers are fundamentally involved in creative, visual activity, and the research methods they use should provide corresponding opportunities. Fortunately, there are a number of design methods now established and continuing to emerge that represent credible ways of collecting user information through creative means. The benefits of working visually in research may be self-evident to designers, who respond intuitively to the language and find a more natural transition to design decisions from visual information. Additionally, when participants are invited to assist in research by engaging in a creative activity, the response is likely to be more favorable than when faced with a request to fill out a survey or take part in an interview. Creative methods are particularly appropriate during generative research, often referred to as *projective* because of their success in uncovering needs and desires that may be unknown even to the user, and that are difficult to articulate when probed for using traditional methods.<sup>11</sup>

Innovative methods typically are identified by their participatory nature, creative engagement and outcome, and their relatively specific application to design research. Examples include design workshops and other creative sessions in which participants (users) are invited to engage in the generation or manipulation of visual artifacts to communicate their thoughts or ideas. Completed as group or individual activities, emerging artifacts might include collages detailing preferences and feelings, cognitive maps or other diagrams indicating sequences of activities, actions, or thoughts, or models configured to represent desired product features and forms. Diaries may be formed using photographs and text generated by users over periods of days or weeks to provide insights into experiences and feelings. Existing visuals and documents may be annotated using colored Post-its®, highlighter pens, and handwritten notes.

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9 A good range of anthropology-based methods for design is presented in a special issue of *Innovation* (Summer 1996): “Anthropology: A Research Resource.” See also Tony Salvador, Genevieve Bell, and Ken Anderson, “Design Ethnography,” *Design Management Journal* (Fall 1995): 35–41.

10 Several references are available for more in-depth discussion of HCI methods: Jakob Nielsen, “Heuristic Evaluation,” in *Usability Inspection Methods*, Jakob Nielsen and Robert L. Mack, eds. (New York: John Wiley & Sons, 1994), 25-62; Clayton Lewis and Cathleen Whatnot, “Cognitive Walkthroughs,” in *Handbook of Human-Computer Interaction*, 2nd revised edition, M. Hollander, T.K. Lender, P. Parch, eds. (Elsevier: North-Holland, 1997), 717–732.

11 Uday Dandavate, Elizabeth B.-N. Sanders, and Susan Stuart, “Emotions Matter: User Empathy in the Product Development Process,” *Proceedings of the Human Factors and Ergonomics Society 40th Annual Meeting* (1996): 417. See also [www.sonicrim.com](http://www.sonicrim.com) for reinforcement of this argument.

While these examples serve to illustrate the intent of innovative design methods, they are in no measure a complete list. The whole purpose of innovative methods is to allow for creativity in designing methods appropriate to the situation. For example, I had a student who was conducting a human factors design project on public restrooms on the university campus. Naturally, she was concerned about protocol when surveying people in context on such a private matter. We invented a method of “graffiti walls,” whereby she papered the walls of several restrooms with a headline asking for input on experiences and needs. These then were photo documented each day, and collected from the walls at the end of the study. Needless to say, she received a wealth of rich and useful information for her project.

### *Interpretation and Analysis*

Whether collected using traditional, adapted, or innovative methods, the interpretation and analysis of information by design researchers often will result in formats that may appear unconventional. These formats may include quantitative summaries and text reports, but will likely be complemented with visual information in the form of sketches, diagrams and maps, models, photographic records, and videotape. Prototypes such as documents that have been annotated and color-coded by users may be compiled into single documents that are visually analyzed for key problem areas and points of success. Research results commonly are presented in a team forum, in which they are discussed at length to extract fundamental meanings, and moved forward into possible design outcomes for further iterations of debate, development, and testing. Meaning typically is extracted through the search for emerging themes, patterns, or clusters of affinitive information.

The framework of methods presented here is not a comprehensive list, but an attempt to provide a convenient classification of method types. The framework hopefully provides enough structure and key examples to see where other methods might naturally be placed, as they are encountered or developed. It cannot hope to adequately represent the myriad of techniques that may permeate the life cycle of a typical research and design process, to say nothing of discrepancies in names given to similar or same methods. This flexibility, while contributing to some confusion at times, also can be a positive opportunity. Design research should be a creative activity, benefiting from many of the same characteristics as the design process. An integrated approach to design and research that includes designers as researchers will contribute to an enhanced understanding of project variables, and add value to both process and results.

### **Designers as Researchers**

Vast resources often are spent on user research and testing, while ultimately not making any evident connection to design outcomes.



These failures often can be attributed to the inherent difficulty in translating results from other research disciplines into an adequate language for application within the design process. Practitioners from other fields, including human research and management, may lack a critical aesthetic “filter.” Again, the term “user-centered design” argues for a process with implicit human concerns, yet places the activity of research within the context of design. While designers cannot typically claim the same level of expertise as professional researchers from other disciplines (e.g., human factors, social sciences, marketing, and anthropology), their active participation in the research process serves at least two key purposes.

Firstly, knowledge of design allows the interpretation of research information in context. Whether that information is a preference expressed by an individual user, or a pattern witnessed across users, these results can be balanced against the creative possibilities (and limitations) of design. The anecdotal is weighed appropriately in the context of more widespread opinions, yet the interpretation requires more sophistication than a strict adherence to favoring the highest number of responses, so often seen in quantitative analysis. For example, several users suggesting that an illuminated red button be used in an interface does not necessarily argue for its direct physical representation in a product, yet may suggest the need for a readily identifiable design element that offers appropriate feedback. The exact *manifestation* of those criteria will be a creative design decision.

Secondly, immersion in the research process and direct engagement with users forges a sense of empathy between designer and user. In direct conversations in which users have described upsetting and costly experiences owing to inadequate information, it is difficult for the designer not to feel a sense of responsibility. Similarly, when observing users who express a tangible sense of frustration when navigating an interface, the evident impact of design decisions and need for improvements are driven home. Such exercises in research tend to expand the notion of usability beyond function, and to reinforce the necessary emotional component of human-design interaction.

### **Conclusion**

Human-centered design currently is under scrutiny, both for the positive aspects it has to offer, and in the critique it faces as it emerges into a research discipline in its own right. While few would argue against the merits of consulting users in the process of responsible design, the debate about how this form of research is best conducted, in sequence and method, continues. The tendency toward integrating a scientific approach into the activities of design, only to justify the discipline to professions established in the history of science, should be waning by now. This is not to say we are not responsible for the appropriate rigors of research, but only suggests that

models of research adapted from other human-centric fields such as anthropology and ethnography, and those developed through our own innovation, correspond more adequately to the requirements of design both as a creative process and in holistic content inclusive of emotive human concerns. As the field of human-centered design matures and earns credibility on its own merits, we can look forward not only to the development of methods that satisfy the needs of research, but to an increasing array of rewarding products that emerge from responsible practice.