

# Reprioritizing the Relationship Between HCI Research and Practice: Bubble-Up and Trickle-Down Effects

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## ABSTRACT

There has been an ongoing conversation about the role and relationship of theory and practice in the HCI community. This paper explores this relationship privileging a practice perspective through a tentative model, which describes a “bubble-up” of ideas from practice to inform research and theory development, and an accompanying “trickle-down” of theory into practice. Interviews were conducted with interaction designers, which included a description of their use of design methods in practice, and their knowledge and use of two common design methods—affinity diagramming and the concept of affordance. Based on these interviews, potential relationships between theory and practice are explored through this model. Disseminating agents already common in HCI practice are addressed as possible mechanisms for the research community to understand practice more completely. Opportunities for future research, based on the use of the tentative model in a generative way, are considered.

## Author Keywords

Interaction design; design practice; design methods; community of practice.

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## INTRODUCTION

In the field of HCI there has been an ongoing discussion about the relationship between academic and professional practice. The lack of recognition and adoption of research results among practitioners has been seen by some as a problem for academic research [10, 23, 26], while at the same time, practitioners have expressed that research is not addressing their everyday problems and therefore not offering suitable tools for their needs [23, 27]. This study focuses on how this current state of affairs impacts the practice

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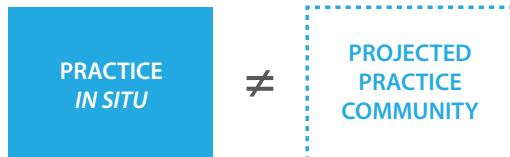
community, and how researchers have the potential to inform practice by first understanding it more fully.

In this paper we will explore two aspects of the relationship between academic research and practice. We have labeled the two as the *bubble-up* effect and the *trickle-down* effect. The bubble-up effect describes the efforts of the practice community—and ideally the academic community as well—to refine and abstract situated knowledge and practice of methods, tools, or concepts into refined theory and defined tools and methods. The trickle-down effect follows the more traditional research tradition, denoting and describing the way adaptation of research and theory is commonly seen to take place in design practice, including the opportunistic use of methods, tools, or concepts that originate in an academic community.

Even though the bubble-up and trickle-down phenomena indicate an exchange of expertise and knowledge between research and practice, it is often not a well-functioning relationship where both sides strongly benefit from the other side, or even share core values about what constitutes practical knowledge. This mismatch in the relationship between research and practice is problematic for several reasons: it means that researchers in many cases spend time and energy devoted to research aimed at supporting practice that is largely ignored by practitioners; at the same time, professional practice is often shaped by institutional and traditional norms and values that have the potential for improvement through research and practitioner partnerships. This mismatch can be understood as a general devaluing of the “other side,” that is, researchers view practice as uninformed while practitioners view research as not being in touch with the reality of real world design.

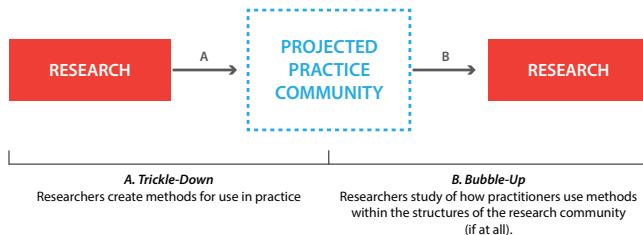
[27] argues that there is a need in HCI research to focus more on existing practice, understood on its own terms. In that study, the relationship of the designer to their tools in the act of designing was found to be significantly more complex than previously assumed. This intentional focus on practice revealed that conceptions of practice in academia—which are then codified in theory and pedagogy—are frequently not grounded in any study of how designers practice “in the wild.” The practice community that researchers project does not necessarily represent the way HCI practice is actually conducted (Figure 1). This is not a new phenomenon; Rogers [23] reports on several earlier

studies that show the same pattern where research results are not adopted by practice in the way intended by researchers. We see the mismatch, shown in Figure 1, as a serious problem for the HCI research community.



**Figure 1. Practice *in situ* and projected practice.**

There is even less research to be found in HCI addressing ways practice might positively influence research, that is, what we label the bubble-up effect, although practitioners have developed a wide range of professional conferences, blogs, and other tools to meet these needs internally (Figure 2).



**Figure 2. HCI research as processes of trickle-down and bubble-up**

This paper reports on our attempts to develop a better understanding of the relationship between research and practice, in particular from the perspective of practice and from practitioners. To explore some aspects of these phenomena we developed an interview study that documented general beliefs about and use of methods by design practitioners, and their knowledge and use of two specific methods—affordances and affinity diagramming—in their design practice. This research occurred in parallel with additional exploration of how researchers as developers of design methods conceive of their use in practice.

We first discuss the existing relationship between academic research and practice as seen through the lens of the research tradition. We then discuss the history and context of two specific design methods, using this discussion as a framing to explore traditional conceptions of method use in practice and research traditions. Finally, we provide findings and discussion from interview participants in relation to these specific design methods, with implications for the relationship between academic research and practice.

### THE DYNAMIC RELATIONSHIP BETWEEN THEORY AND PRACTICE

The connection between theory and practice is seen by many as vital, but often tenuous due to the intersection of competing *communities of practice* [6, 11, 16]. There are different ways to understand the relationship between these communities depending on focus and purpose. We have, in

this project, worked with a tentative understanding of this relationship as the flow of information from one community of practice to another—along dimensions of *appropriation* [23] and abstraction of *in situ* detail.

Rogers [23] traced the dimension of appropriation as it relates to the relationship between theory and practice, but only in the application of existing research to practice, that is, the appropriation of theory through use and adaptation in design practice. We will focus more strongly on the implications of stimulating a flow from both sides, with equal representation and valuing of communities.

The relationship between research and practice can refer to many different potential areas of concern, such as practicalities (e.g., time, resources), competence, skills, and organization [6]. In our research we focused on the way *design methods* are understood, developed, and used in the two communities of practice. We define design methods broadly, as any intellectual or practical support that a practitioner might use to support the design process in a positive way, encompassing everything from everyday methods, techniques, and tools for idea generation and collaboration, such as the "pen and paper," whiteboard, brainstorming, dialoguing, to methods and applications for sketching and refining ideas. For convenience, we label the flow of information about design methods from practice to research as *bubble-up* and the flow of information from research to practice as *trickle-down* (Figure 2).

Based on this tentative model of the relationship between research and practice and a preliminary understanding of the two notions of bubble-up and trickle-down we developed our research design. We first introduce our approach and the two design methods we decided to focus on. We then present our interview study and our findings. To conclude, we return to our tentative model and our two concepts and how they can be further developed in a generative way to inform future research.

### OUR APPROACH

As a way to examine how practitioners view design methods, as defined in this paper, we decided to focus on two fairly well known design methods: *affinity diagramming* and *affordances*. We are well aware of the fact that these two methods are not necessarily methods in any strict sense; although affinity diagrams have been developed into more formal variations over time [2, 12] and understandings of affordances have evolved over time [13].

Our choice of these two methods were based on their difference in apparent source, with affordances coming from ecological research methodology and affinity diagrams most often seen as coming from a business and marketing context (although the true source is cultural anthropology [1]). These methods also represent a range of method types: from generative and interpretative (affinity diagramming) to descriptive and analytic (affordances).

We researched the history and background of each method, including: attention to the originating field or discipline, contributing authors or scholars, the first entrance of this method into HCI, and the current state of the method in HCI literature. We have no ambition to be comprehensive or to give a complete description of each method, since that is not the purpose of our work and we also expect most readers to be familiar with them. Instead, we provide some background information as a point of comparison from which interview data can be contrasted and viewed.

### AFFINITY DIAGRAMMING

Affinity diagramming is commonly used as a tool in business to organize and cluster ideas or concepts. It appears to have been introduced to the Western world during the movement to Total Quality Control (TQC) in Japan, and was published as one of seven key business tools [28]. Although this tool became popular in a business context, it was originally known (and is still known in some Asian contexts) as the *KJ Method*, which originates as a method for sorting ethnographic data.

The KJ Method was created by Japanese cultural anthropologist Jiro Kawakita, and was originally created as a way to analyze data obtained through ethnographic methods in the 1960s [14]. Early examples of this method appear to be solitary without significant iteration, used as a way to “let the facts speak for themselves,” grouping facts based on relationships that were perceived to join them [1]. After individual relationships were established, groupings were narrowed down to a reasonable number, generally ten or less. While the method is still used this way in some contexts, it is also used as a generative method, instigating the generation of data from stakeholders, and then evaluating relationships and connections between concepts, instead of only a way to evaluate a known data set.

Beyer & Holtzblatt (2) are some of the first to discuss this method within the HCI community, introducing major concepts and procedures for carrying out this method from the original TQC books [28; see also 18, 30]. Very little research has been carried out specifically on the use or adaptation of this method within the HCI context, aside from the creation of digital tools to support the core activities of the method [7]. However, various forms of Post-It note based diagrams seem to be common in both educational and professional settings. To what extent this use is true to the method of affinity diagrams is less known.

### AFFORDANCES

Rogers [23] provides an excellent historical overview of the notion of affordance, from its early roots in ecological methodologies within the psychology community [8, 9, 25] to the importation of the key idea of affordances into the HCI community through the work of Don Norman [20].

The notion of affordances is defined by Norman as “...the perceived or actual properties of the thing, primarily those fundamental properties that determine just how the thing

could possibly be used. [...] Affordances provide strong clues to the operation of things. [...] When affordances are taken advantage of, the user knows what to do just by looking: no picture, label, or instruction is required.” [20]

However, today, there are many different definitions and the way the concept is used differs widely [13]. The underlying concept of affordances is used both with and without its historical roots.

In recent HCI scholarship, the notion of affordances has been re-examined. According to Kaptelinin & Nardi [13], the early work of Gibson informs the concept of affordances, describing the notion of interaction between animals and the environment as a primary source for insights. They discuss the potential for mediated action as a way to recast affordances as a method for investigating “distinctly human uses of interactive technologies.” [13]. This re-examination of the concept attracted substantial interest at the session where it was presented at CHI in 2012.

According to Rogers [23] the notion of affordances is an example of a theoretical construct that has transitioned from research to practice while, in the process, losing its complexity and richness. Rogers notes that many practitioners recognize the concept and even “use” it without knowing its background or history.

### INTERVIEW STUDY

The purpose of our interview study was to find out how the two design methods we selected—affinity diagrams and affordances—are currently understood and used by practitioners. We were particularly interested to discover how much practitioners know about the background and history of these methods, and where and how they learned about it, and to what extent they use it—that is, the trickle-down effect. It is important to note that this interview approach inherently defines and values these methods from a research perspective by using labels from that tradition; issues of labeling become clear in the analysis of the interview data.

Implementation and use of a method in practice, regardless of knowledge of the history or background of a method would be sufficient to see it as an example of the trickle-down effect, rendering these aspects of the method sufficient, but not necessary. Similarly, the “core” of these methods may have also been developed and used by practitioners without knowledge of the “proper” title. This similarity between practice-originated and research-originated methods would not be discovered unless practice-centered research was carried out. We also wanted to find out if the practitioners were aware of any professional practices that have been developed and manifested in more formalized or structured ways or informed attempts to construct design methods based on practice and shared with a professional or research community—that is, the bubble-up effect.

### Data Collection

We selected 13 practitioners from 12 companies, beginning with an opportunistic sample of HCI alumni from a large

university, and then snowballing to include colleagues and other figures in their professional networks. All of the practitioners we located and subsequently interviewed worked as an interaction designer, user experience designer, or user researcher in some way. They had a range of professional experience: several practitioners had 10 or more years of experience, while the majority had worked 3-10 years.

The practitioners had a variety of educational backgrounds: of the 13 interviewees, eight had an HCI-oriented education, three had a technical or engineering background, and one had a visual design background. Five of the interviewees were female, while the remaining eight were male.

A phone or face-to-face interview was scheduled with each participant. Each interview followed a semi-structured format, and was audio recorded to facilitate further analysis. In addition, a dedicated researcher took detailed notes either during or shortly after the completion of the interview.

A subset of the interview participants (Table 1) was selected based on numerous criteria to preserve the diversity of the original sample, including years of experience, vocational background, nationality, and gender. This subset is used to facilitate a more detailed discussion of our findings.

Name (Pseudonym)	Years of Experience	Vocational Background
Cheryl	10+	Business
Abbie	20+	Computer Science
Vicki	4	HCI
Phil	2	HCI
Jagdish	3	HCI

Table 1: Subset of interview participants.

### Findings

Our interviews covered a broad set of questions aimed at understanding professional practice in the field. In this particular analysis we have focused on a small portion of the overall interview. These questions do not probe all aspects of the relationship between theory and practice, but they do provide us with some insights into the way practitioners think and reflect when it comes to design methods.

#### Where did they learn methods?

Some participants learned methods in graduate school, but in most cases dissemination of methods was through encounters with colleagues in a design context. Phil specifically noted his formal education in HCI as informing his knowledge and use of methods, while other designers who had practiced in the field without graduate work in HCI relied more on their colleagues, professional conferences, or publications for their understanding of design methods.

Due to the relative newness of the field of interaction design and the presence of many in the field who are trained primarily in other fields, a strong cross-pollination between related disciplines such as marketing, visual design, and business lead to the adaption and adoption of new methods. Cheryl experienced this phenomenon, tracing an important method for doing “guerilla research” that had been informed by her boss, who had learned this method of research from a marketing company. Cheryl has since written about related methods, further disseminating these ideas into her company and practice community.

Participants sometimes felt that they had made a method up or felt that it was common sense approach, and then found a name to apply to that idea or concept later on. Abbie discussed the “common-sense” nature of affinity diagramming as a basic way of filtering data. She had used this general method prior to learning about it in a more formal sense at an early CHI conference.

#### What is their conception of research and theory in their practice of design?

While most of the practitioners we interviewed seemed aware of the research and academic community, they did not attempt to forge a connection between their community of practice and the academic community or professional academic community (e.g., ACM/CHI). Cheryl discussed her impression that CHI was generally populated by graduate students, and that she believed in “spreading the wealth” by sending her employees to a broad range of more practitioner-focused conferences, looking to her employees to discover which events were most valuable. This shift to practitioner-focused events was a general trend from our interviewees, with a more direct emphasis on justifying the expenditure to attend these conferences through real and tangible gains in applicable methods.

Abbie reflected on the role of professional conferences, especially CHI, noting that there was too much “big language” and not enough “beer and steak” interaction with peers. This shift to the theoretical and away from the practical was a main reason she has shifted to other venues over time, as she describes herself as an “applied person.” Most interviewees seemed aware of theory, and how it might inform patterns of research or testing, but as practitioners, they mentioned the constraints of client budgets, and how the budgeting process often came in direct conflict with the “proper” application of theory or research-driven approaches to design or user research.

Cheryl discussed the frequent conflict between the need for research, and the lack of willingness from clients to pay for this research. As a result, her company has drifted from more traditional research methods to high-value, low-cost methods of user research, like guerilla research.

#### How do they utilize methods in their design process?

According to almost all of our participants, designers want methods that are *easy to explain* to their clients and *easy to*

*visualize*, for the purpose of assisting them in communicating their design ideas. Ease of explanation and ease of visualization often seem to go hand-in-hand, suggesting that methods can be a powerful tool not only during the design process, but also to facilitate communication about design.

Jagdish noted the use participatory design methods to quickly engage clients and designers around core issues, including them in key design decisions within the interface. In conjunction with engagement or communication, level of detail was a concern that Phil surfaced, as he related that the “state of finality” influenced the designers and clients he worked with, and thus preferred mediums and tools that didn’t focus on details (e.g. Photoshop, Illustrator).

The practitioners seem to be highly opportunistic in their selection and use of methods, often selecting methods based on context, time and tools available, and designer knowledge. Phil used methods in a highly opportunistic way, selecting methods primarily based on the proximity of the individual: using a document or Microsoft PowerPoint for people who were unavailable, while preferring to use wireframes with markers for someone in the same office. In contrast, Abbie and Jagdish seemed to focus more tightly on one set of methods—mental models for Abbie and usability testing and iteration for Jagdish—that they applied opportunistically, varying by fidelity and approach given the specific design context.

Designers also adapt methods as needed for a given design situation, often seemingly unconsciously, to meet the constraints or requirements of the specific design problem being addressed. Vicki discussed her use of “scrappy” design methods, noting that many “textbook” methods required more time than she had to do “the right way,” so adapting methods was often the only way to carry out a given method in practice. She further described the importance of implicitly understanding your audience, and using appropriate terms and methods to communicate with that audience. In particular, she described the differences between sharing information with other designers versus working with people from marketing or their human factors lab, highlighting the importance of speaking a consistent language with the people you are communicating with, “translating” terminology where appropriate between disciplines.

#### *What do they know about the original intent or historical context of the method?*

Frequently, the interviewees seemed to lack a clear historical knowledge or context of creation concerning a specific method, while still successfully using the “core” of the method in a productive way. In several cases, they were satisfied with this approach, labeling the method as “common sense” or not applicable to their specific area of practice. Specifically, Abbie noted that she had employed the concepts behind affinity diagramming—sorting and clustering—in her design practice for years, and thought of this method as “common sense.”

For other participants, conceptual knowledge of the ideas *behind* a method was most important, not knowledge of specific “traditional” methods or processes known by a certain name. The company Cheryl works for adapted affinity diagramming based on experiences of some of their designers, using more defined division of labor between designers (including moderation) and “throw[ing] the post-it note over their shoulder” after each idea is complete. This type of adaptation, either corporately or in a specific design situation, was quite common across all of our participants.

Most importantly, the interviewees seemed to be focused on *when* to use design methods rather than basing their use on the origin or historically informed use of a method. Phil related an instance of a semantic differential, which was originally referred to as an affinity diagram in our interview, but was then retracted. Later in the conversation, Phil demonstrated a robust hybrid method that he and a colleague had developed, which included many ideas from affinity diagramming. It is clear that knowledge of the origin of a given method, or even prescribed steps to accomplish that method, is not a barrier to using the conceptual idea behind a method in a specific design context.

	Yes	No	N/A
<b>Affinity Diagramming</b>			
<b>Concept</b>	10	2	1
<b>Historical Context</b>	0	12	1
<b>Affordances</b>			
<b>Concept</b>	10	1	2
<b>Historical Context</b>	3	8	2

Table 2: Participant knowledge of methods

In Table 2, the participants’ knowledge of two selected methods is detailed. N/A refers to participants who were not explicitly asked, or did not explicitly answer, the question. While most participants were comfortable interacting with the general concept behind each method, confirmed by a discussion of core ideas from the methods in their design practice, their knowledge of the historical background or context of the method was more limited. Even in the case of affordances, where the participants knew some historical context surrounding affordances, their knowledge was limited to Don Norman’s work that introduced the concept to the field of HCI [20], with no knowledge of the method’s genesis in the work of Gibson and ecological approaches within the field of psychology [8, 9].

Despite this seeming lack of “complete” knowledge of a method, including its origin, theoretical foundation, and specifics around its use, it became clear that designers were able to derive and use the *core* of these methods quite effectively, regardless of the perceived academic rigor of their processes. When not being constrained by the structures

and detailed implementation of the original method, these designers also seemed to be more willing to adapt and appropriate these methods in practice.

## DISCUSSION

In our discussion we will focus on the relation between research and practice that emerged from our interviews, primarily the notions of *appropriation*, *abduction*, and *disseminating agents*. We will then return to our tentative model and reflect on how our findings can be interpreted in the light of the model and the concepts of *bubble-up* and *trickle-down*. We will also add the notion of *cycle-around* and discuss the concept of *design judgment*.

Through our analysis of the interviewee responses in relation to our tentative model presented here (Figure 3), appropriation and abduction were identified as core activities in both directions. Concepts discussed in the text are linked to the model where relevant.

We found that *appropriation* of research and theory (A) is frequent, especially in the application and context-of-use for specific methods by practitioners, resulting in abduction of research methods vis-à-vis real world contexts, while not necessarily in the form expected by those who develop new methods and tools. The appropriation is in many cases radical. Sometimes only core aspects of a method are preserved and translated into actual practice.

Appropriation is found in the intentional or unintentional reshaping of existing methods by individual practitioners. We found this appropriation to be an essential part of using methods, not necessarily a misuse of the original method. This alters the original meaning of what it means that a method is “used” in practice. When methods are radically appropriated in an abductive sense, even though they are originally highly formalized, they are still “used” and sometimes emerge as an even richer method *in situ*.

We also found that the lack of communication between researchers and practitioners, in the eyes of the interviewees, leads to inaccurate and incomplete *abstractions of practice* (Figure 1). This perceived lack of understanding of design practice among researchers seems to be the core reason why the practitioners do not show any serious interest in investigating new methods developed in academia.

### Disseminating Agents

Even though appropriation of academic results does not seem to be common among practitioners, it does happen. Based on the interviews we conducted, a number of *disseminating agents* were identified that commonly bring design methods into practice. While research and theory are often assumed to be connected—at least peripherally—to practice, none of the practitioners we interviewed relied on any traditional academic sources for information regarding new methods or perspectives on tool use.

Disseminating agents seemed instead to be linked to industry norms of employment, especially regarding which pools of people work in a given segment of the industry, with practitioners informing their own community in an educational sense (as shown with E in Figure 3). For example, in more traditional graphic design or marketing fields (even if they are UX centered), prevailing norms of those industries tend to dominate. In newer, UX-focused teams, another balance of people and sources of information dominates.

Regardless of industry segment, primary disseminating agents were people (e.g., coworkers and colleagues from professional groups and associations) and Internet discovery through blogs, news articles, Twitter, and trade publications available online. Of particular interest is the role of coworkers in shaping or redefining a person’s feelings and knowledge about methods. Some of our interviewees learned methods from specific coworkers, or in the context of on-the-job training, while others learned methods more

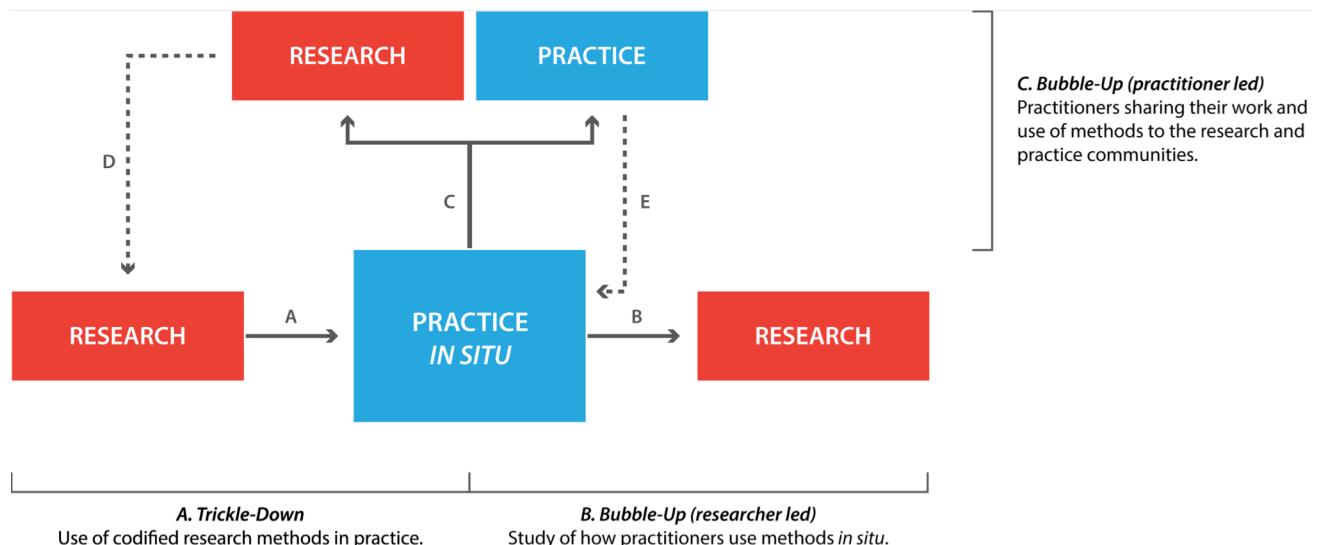


Figure 3. Ideal cycle-around between the research and practice communities.

informally through private study, or (rarely) through explicit education in an institution of higher learning.

### Trickle-down (A)

There is a substantive disconnect between how design methods are understood in academia—inclusive of higher education and research centers—and how methods are applied in practice. There are several potential reasons for this. For instance, the disconnect could be due to the primary discursive modes of communication in academia (e.g., journals, conferences, colloquia), and the lack of substantive overlap with practicing designers, who often communicate with more immediacy through personal networks, design teams, social media, blogs, and trade publications. The disconnect could also relate to the lack of a cohesive design culture within interaction design, or relationship to a larger professional organization, as in architecture (AIA), visual design (AIGA), and other design fields. While there are some professional associations in interaction design (e.g., IxDA, UXPA), there is no cohesive framing of professional practice, and as such, competence-building has splintered among professional conferences, organizations, and more informal methods of learning.

The “trickle-down” effect denotes an often-felt “lost in translation” feeling among academics as they view design practitioners working in the field [10, 11, 23]. While theory and other forms of externalized knowledge is the primary output of the working academic, the working designer produces designs for a client or market. Design methods (including tools, activities, and theories, among others) from academic sources are co-opted by designers in a highly pragmatic sense where the generative work of the designer takes precedence over order or guidance imposed by any one academic method.

These academic methods in use are thereby seen by academics who have an interest or stake in the methods as being altered or appropriated—often in a negative sense as a loss of fidelity or core—when compared to their original intent and (theoretical) richness and depth, maybe as part of larger intellectual or theoretical approaches. This is especially true in cases where a small concept or term is taken, devoid of context, from a larger theory or base of academic practice, and dismantled in its pragmatic use in an individual designer’s practice. For example, the notion of *affordances* are often seen as singled out from the original context of an ecological approach to research, and applied as a separate and distinct concept, often without the benefit of its historical and academic grounding, in an HCI context (see [23]). It may be possible to locate stages of “trickle-down,” in the sense that a practitioner over time completely incorporates research or theory into their practice without being aware of its roots—a continua of trickles that become a stream of common practice.

This “trickle-down” is a natural outcome of the academic tradition being oriented hegemonically as the center of dissemination (as opposed to the practitioner or designer), and

occurs organically as students are educated and theory is applied in practice or disseminated through a variety of forms over time. However, this traditional model does not allow for a rich exchange of information between the academic and practice communities; this centrality of research creates a conversation only in terms that the research community understands and values. In order to explore the potential for communication in the language of the practitioner—communicative norms that are useful and generative in practice—we must explore the reality of design practice and the concept of design judgment in a more specific way.

### Design Judgment

The agency of the designer in selecting appropriate methods (or pieces of methods) and combining them in a way that is appropriate to the design process and design problem at hand can be seen as the core of design judgment. While this process is not well understood, it is known that a master designer is highly synthetic, drawing opportunistically from a variety of sources to undertake and inform their practice [5, 17, 19, 24]. The study of tacit knowledge in this framing has been carried out over many decades, traced through the early work of Polanyi [21], Vickers [29], Schön [24], and more recently by Cross [5] and Nelson & Stolterman [19].

If the concept of design judgment is brought into the model of exchange between the research and practice communities, it becomes clear that there is a need for a balance in our understanding. The practice of research has been scrutinized and is fairly well researched and understood. In recent decades there has been recognition of science as a practice that has to be understood as partly distinct from and as richer than the ideal image of the scientific process. Research practice has been described as situated, social, and takes place in a reality of constraints and practicalities [15]. We propose that professional practice of design should be studied and examined in a similar way, with the intent to create understanding of the full richness and complexity of practice *in situ*. This is the approach that is advocated by Donald Schön in his seminal work on design [24] and also later by [26] and [10]. The notion of design judgment can be seen as a core concept that would help us to develop and deeply explore the nature of design practice in this way.

Through analysis of the interview data in this study, the types of methods used by a given designer, and how they came to select those specific methods, was an important window into their personal design judgment. Specific elements of this decision process in defining a holistic design approach is not well understood, but is vital to understanding the role of ready-at-hand and constructed methods in the act of designing. In particular, if researchers want to influence practice, then more work is needed to understand how designers select methods, opportunistically apply them to a specific design situation, and adapt or refine methods over time to suit the needs of specific design contexts, or as part of their own personal design identity.

**Bubble-Up (see B and C in Figure 3)**

As we noted above, within design practice, design methods are generally selected and used by designers in an opportunistic, *ready-at-hand* way. Although historical or academic grounding of these methods may be employed to a limited degree, the primary criterion for use is the method's value in supporting of designing an ultimate particular [19]—a unique artifact being created at a specific point in time by a specific designer. No one method is seen as capable of completely informing the design of this artifact, and the intuition and judgment of the designer is utilized as the primary form of reasoning and tool selection [4, 5, 24].

The “bubble-up” effect includes the sense from a designer/practitioner point of view that no one tool or method is *sufficient* to meet the designer's needs in any one design scenario. In a push toward the synthetic dimension, the designer opportunistically selects multiple methods (or pieces of methods) that apply in a given design situation. In doing so, the intention of the design method is often altered in an abductive way, while simultaneously, the *ad hoc* method (often constructed from many pieces of existing methods) used by the designer constitutes a rich, situated design method that is appropriated expressly for the design of a particular artifact or for use in a specific design context.

**Led by Practitioners (see C in Figure 3)**

As design practice is sustained over time, the richness of the use of design methods in a synthetic way moves the locus of knowledge generation (in regard to methods) from an academic setting to a situated design context, which has the *potential* to bubble-up implementation details in an inductive or abductive sense back to the academic community. In our study we did find some evidence that practitioners are engaged in this synthetic oriented activity; that is, they engage with constructing more general or abstract versions of their *ad hoc* methods. In some cases they had spent some time and energy in codifying or “formalizing” their *ad hoc* method in an attempt to spread it to colleagues and to the professional community. Based on our findings we believe that it is possible to find examples of how design practice have informed not only the professional community but the academic community, bubbling-up the richness and detail of practice into a theoretical understanding of methods use.

**Led by Researchers (see B in Figure 3)**

Beyond the existing dissemination of design ideas within the practice community, it is also possible for researchers to reprioritize the study of how practitioners use methods *in situ*. This form of research relies on two crucial factors: 1) the interest of the academic community in engaging rich design practice as a form of knowledge generation or inquiry, valuing knowledge about practice on its own terms; and 2) the recognition that designers use a wide complement of ready-at-hand methods to construct their design practice and experience. This form of research may lead to the generation of design methods that can be adapted and used more readily in practice, due to more intimate knowledge of the practice community [22].

**Cycle-around**

Assuming this loop comprised of the opportunistic use of methods, and the academic interest to understand and study design practice, a cycle of theory-creation and situated use of theory may be developed over time. Based on our model and our interviews, we are convinced that it is possible for cyclical movement and re-discovery from both sides of the model to happen (see D and E in Figure 3), but it is quite a challenge to value both sides of discovery equally, and for both sides to respect the everyday reality and discourse of each other. Cycle-around would represent an ideal case of tightly coupled research and practice, with each community of practice informing the work and practice of the other and perhaps more important, valuing the work and knowledge of the other within the values and language socialized in that community of practice.

This cyclical movement and discovery challenges the conception that theory and practice should be naturally disconnected, and the presumption that theory or knowledge generation should begin in certain places or activities. Instead it assumes that ideas start in a variety of ways with multiple points of entry and inspiration, as well as points of deterioration and upscaling. There are always pieces of reality in use by the opposing community of practice from either direction, not just abduction and appropriation, but lack of engagement forces these pieces of reality to be interpreted in ways that are incorrect or inappropriate.

An opposite phenomenon may also exist, whereby an idea or method coalesces or is distilled over time, as it works through a cycle of research and practice, where over time, only the core idea remains. This phenomenon represents with relative accuracy the current core of affordances in the HCI community: while it has changed and been refined over time, there is general agreement between the research and practice communities as to what constitutes an affordance, allowing mutual communication and exploration.

**IMPLICATIONS FOR FUTURE RESEARCH**

We are convinced that this exploratory study has helped to produce a set of future research questions that have the potential to lead to further results in this framing.

It is possible to ask specific questions in relation to our model and the specific concepts we have defined, using the model in a generative way to isolate and explore opportunities for further research in the contexts of academia and practice, as well as in the liminal spaces between these contexts. We will briefly discuss a few preliminary directions that we see as potentially interesting research studies that can be built around our results and preliminary model.

Core ideas and activities possible to inspire new design methods can be found in everyday practice. These ideas and activities may be carriers of some interesting qualities based on the fact that they are “born” in the midst of practice and have survived. Core concepts or modified methods that have emerged in a practice environment could be studied

along lines of dissemination, felt effectiveness, and adaptation over time. By comparing and analyzing these concepts and methods it may also be possible to identify characteristics that are needed for methods to survive and be of use in everyday design practice. In addition to locating methods that have survived in practice, it may also be instructive to examine practices that have been disengaged from the practice community, eventually being discarded in favor of new methods. There seems to be a continual cycle of birth, use, and disuse of methods, which may provide insights into how this cycle-around has historically functioned through the lens of practice and academia.

A closer examination of everyday design practice may also reveal core activities that are currently unknown or unevaluated from an academic perspective, which could be refined and redesigned—bubbled-up—for broader use. Additionally, a comparison or analysis of design activities carried out in practice could be performed within the lens of existing theory (B, C). This comparison and analysis could serve to enrich and extend current theory, while creating a connection and alignment between theory and practice (D).

A more direct analysis of the bubble-up process as a synthetic activity may also be valuable to foreground issues of designer competence and dissemination of concepts over time. This analysis could help researchers to explore why some “core ideas” within design methods seemed to be “common sense,” according to some interviewees. For instance, the observation that the core ideas of affinity diagramming—sorting, grouping, or clustering of elements—are seen as common sense, and have been disconnected from the source method. While some core ideas may be quickly disconnected and used independently from a formalized method, eventually entering the realm of “natural” or “common sense,” other formal methods never seem to degrade beyond a certain point. Examination of this *degradation process* from a formalized method to these varying degrees may yield important insights into how methods are modified, how they enter into an everyday design vocabulary over time, and how they may eventually die.

There is an opportunity to more closely examine the existence, role, and activities of various disseminating agents. In our study we have defined these agents by their function, but it would be interesting to further study *how* they function, and what the preconditions are for different forms of agents to exist and work. Disseminating agents to be studied may include corporate and individual entities. Individual entities may include prominent designers, scholars, or authors of well-known methods. Corporate entities might encompass trade publications or digital resources, professional conferences, well-known design agencies, and professional organizations.

There are also significant pedagogical implications for this examination of practice, potentially narrowing the gap between the education of practitioners and the realities of practice. The education of practitioners frequently follows a

“studio” model of education, whereby the educational community is tightly coupled with the practice community which graduating students are expected to join [3, 24]. By evaluating the ideal system state of “cycle-around,” additional research and observation of practice could create opportunities for tighter alignment of the education and practice communities. Specifically in the area of methods use by design practitioners, study of actual use “in the wild” may significantly change the way that methods are introduced and the way their use is evaluated in the context of an overall pedagogy. Incidentally, there is a more natural alignment of this system with the research community at present, as new students disseminate research in a trickle-down motion as they enter the workforce. Thus, tactics for ensuring ongoing alignment between the education and practice communities should be considered, not necessarily privileging the research portions of the cycle.

## CONCLUSION

We believe that the framing we have offered of the academic-practitioner divide as a dynamic relationship of appropriation, abduction, and situated action opens a number of avenues for future research.

One of our most important contributions is that we have shown that the relationship between research and practice is not only a question of practice not using research, which has so far been the focus of discourse in the academic community. In contrast, from our interviews, we found that practitioners use numerous design methods in an opportunistic manner, and do not discriminate based on the source of an individual method, or even a conception of what academics may consider to be a “proper” use of a method.

Another contribution also defies the common conception that practitioners are not interested in theory or research developed design methods *per se*. We found an interest and a desire from practitioners for additional methods grounded in research, but practitioners noted that these methods have to be in resonance with their own experience of design practice and their own conceptions of how expert designers use methods [26]. However, we found in our interviews that the practitioners do not find such resonance to be common; instead methods are, in their view, not based on a sufficient understanding of the realities of practice. So, the problem with academically developed methods is not necessarily that they are too theoretical or too abstract but rather that they do not enough respect or consider the practicalities of everyday design practice [22].

This cycle highlights the value of studying design practice in more direct and careful ways, understanding when and how traditional methods and tools are used, and how this tool use is adapted based on the at-hand design problem and the judgment of the designer. Additionally, research and theory should be grounded in and informed by practice, and remain connected to known disseminating agents within design practice to have immediate and lasting benefits.

If the cycle exists as we postulate, a tighter coupling of research and practice—both in temporal and discursive contexts—is vitally important. Our interview subjects specifically requested initial results, as they were eager to hear differing perspectives on method and tool use from other designers. Connecting research and theory generation more directly to this conversation only exists to increase relevance and usefulness in design practice.

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