Making Design Rationale Matter: how design rationale has failed and how it can succeed again

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ABSTRACT
This paper argues that design rationale has become irrelevant by effectively ignoring the practical contexts for which it was first developed and from which it needs confirmation of its core assumptions. We identify the original and current rationale behind design rationale research and find that the two have diverged in ways that prohibit its validation and relevance as a design approach. To address this issue, we propose the adoption of a phronetic research agenda that supports the study of human value rationality in design. We finish by presenting the notion of a Participatory Design of Design—one example of how we might employ a phronetic research frame—towards making design rationale matter again.

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H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Human-Computer Interaction (HCI), as its name suggests, has long been concerned with human-centric design. To that end, we have developed countless methods of engaging with users and stakeholders to promote design that reflects their needs, values, and life situations. Yet, as HCI researchers design design processes, we take a different frame toward engagement with the designers that will use them—our "users." To this author's knowledge, there has not been an effort to, for example, pursue a more user-centered design of user-centered design. This becomes an issue when our "products" are not accepted in real use scenarios, as is the case with design rationale.

This paper explores the failings of design rationale and how we might make it relevant again. In the 40 years since the birth of design rationale, and in the 20 years since it has been introduced to HCI, design rationale systems have been enthusiastically argued for and developed [6, 28]. Yet, rationale-based design systems have seldom broken through to industry and into the environments that they were initially design for. The problem at the root of this situation is that design rationale researchers seem to have, ironically, neglected the design rationale for design rationale; they have become distanced from the original aims of rationale as a practical tool for democratic engagement, human value-sensitivity, and real-world deployment. In this respect, design rationale has thus far failed to live up to its reputation.

We argue that design rationale *can* matter again—that is, it can become relevant to practical design contexts, produce knowledge to support practice, expand our research frontiers, and begin to substantiate (or disprove) some of the noble theoretical claims that have been made in its support. We borrow from Bent Flyvbjerg's book, *Making Social Science Matter,* not only our title, but also a research program that we believe can support a new mode of research to complement and reinvigorate current work [12]. Participatory Design of Design, as we are calling it, is a natural extension of Flyvbjerg's phronetic research program—in which value-rational decisions are legitimate forms of knowledge—and may provide a way for rationale to return to the practical contexts for which it was originally intended.

We begin in the next sections by presenting the origins and motivating rationale behind design rationale in the form of Rittel's IBIS notation and Alexander's pattern language. We then turn to one form of design rationale within HCI, Carroll's claim, as a lens for discussing the current state of design rationale research. A comparison of the values and motivations that underpin each of these three forms of design rationale reveals that current research has made departures and introduced gaps that must be filled. We finish by putting forth a complementary phronetic research agenda and proposing a Participatory Design of Design.

DESIGN RATIONALE ORIGINS
Design rationale was born on the heels of a tumultuous rejection of the design methods movement. Beginning in the late 1950's, the movement was ushered in by a host of influential mathematicians and engineers, including John Chris Jones, Morris Asimow, Bruce Archer, Horst Rittel,

and Christopher Alexander [10]. Their approach built from Taylorism and Simonian simplifications of human activity, imposing rigorous structure onto the once craft-oriented task of design [10]. However, a number of large-scale failures in planning [20] and deadly social protests against its totalitarian result [5] would disrupt the design methods movement in the late 1960's and early 1970's. The impact was so profound that a number of those who first spearheaded the movement publicly denounced it. Whereas Rittel began to distinguish between first and second generation design methods by introducing the notion of "wicked problems" [25], Alexander changed his approach from objective mathematical symbols [1] to subjective prose [3] and urged others to forget design methods altogether [2].

Kunz's & Rittel's IBIS

Design rationale was Rittel's practical answer to the new complexity he saw in design as a result of the failures of the design methods movement [27]. Real-world design problems, he insisted, do not have a well-described set of permissible operations nor do they have an enumerable set of possible solutions. In fact, describing the problem *is* describing the solution, and so there can be no clear problem definition from the start. There is no stopping rule for wicked problems, and solutions are never "right" or "wrong," they are only "better" or "worse." Each problem is ultimately unique. Design problems, then, are intractable.

Rittel believed that design problems are further complicated because they exist in a social context where there is a plurality of constantly (re)constructed values that make any one problem definition or solution unable to fulfill the desires of all stakeholders. Issues of ethics and democracy arise, as well, and traditional planning has ignored them both. In design, "there are no value-free, true-false answers" and "planning is a component of politics"[27]. Furthermore, design provides ultimate "epistemic freedom: there are no logical or epistemological constraints or rules which would prescribe which of the various meaningful steps to take next" and is completely rooted in the designer's subjective worldview [26]. These concerns—democracy, human value frames, politics, and subjectivity in design—were driving forces behind his new approach to design.

Rittel's answer to design complexity was to propose argumentation as a form of design. In 1970, Rittel, in collaboration with Kunz, authored his first paper on the Issues-Based Information System (IBIS) [16]. IBIS is a formal notation for exchanging and documenting textual arguments in an ongoing design decision dialectic. It provided a hierarchical structure for documenting topics, issues, questions of fact, positions, arguments, and model problems. As an ongoing and historical reference, IBIS was supposed to "assist in generating dispute," offer "a more scrutinized style of reasoning," and to document "the state of discourse at any time" [16].

The IBIS system was an embodied illustration of Rittel's rejection of the notions that design problems can be tractably planned, carried out objectively, or handed off to the computer. With IBIS, Rittel aimed to acknowledge political decision-making while rendering the design process more transparent. He understood that optimization and pure rationality were out of reach and definitionally depended on the people involved, and so opened up the design process to a wider audience. And, with humans providing the ever-changing content, he knew that it would be "adaptable to rapidly changing language," values, and social agreements [24].

The promise of IBIS was not to provide an optimal or even rational pathway for design; instead, it sought to offer a stage for political decision-making towards a more democratic, transparent, and reflective design process. It moved away from the "scientific design" that aims to *prescribe* systematicity—it was, in fact, created in direct rejection of it—and occupied a third space between that and "design as discipline," which aims to *describe* intuitive reflection in action. The practical commitment of design rationale was reified by being, from the beginning, deployed into the field in three varied contexts and into the hands of real design planners in action [16].

Alexander's Patterns

A second outgrowth of the failed design methods movement—separate from the development of design rationale but closely related to it—was the development of Alexander's pattern language. According to Alexander, "every place is given its character by certain patterns of events that keep on happening there" [11]. Patterns, then, aim to capture the architectural and social phenomena of a place through problem descriptions, example solutions, design rationale, etc. Patterns are linked in a hierarchy—a point that was much more the focus of Alexander's work before his rejection of the design methods movement—of design solutions that constituted a language. In a Wittgensteinian sense, he saw the connection between the abstract and the grounded and communicated architectural knowledge through multiple built (as opposed to theoretical) examples.

Even though Alexander and Rittel had little respect for one another's work[1], many of their goals were shared. Both relied on people in context to provide the content of the design; patterns are descriptive, not prescriptive, and Alexander acknowledged that each context would require situated re-workings of the examples provided [11]. Rittel and Alexander also acknowledged the role of human values in design; where IBIS allowed values to be embedded into the content of each entry, patterns explicitly admit the values that their solution takes for granted. In both, the

[1] Gleaned from conversations with Steve Harrison, an architecture student at Berkeley from 1969-1977.

chief benefit was not the explicit knowledge imparted, but the role that IBIS or the pattern played in "reinvigorating public participation in, and discussion of, architectural design." Like IBIS, patterns were to provide a platform for democratic, dialectic engagement in design.

Perhaps the most salient way in which both Rittel and Alexander aligned in their vision was their dedication to the practical application of the design rationale tools they introduced. Both criticized the Simonian notion of a mechanistic, apolitical, and undemocratic design. Rittel's work was motivated by the practical failing of the first generation planning paradigm, while Alexander's was motivated by the outbreaks of violence on university campuses that revolved, in part, around lack of democratic architectural engagement [5, 20]. Both men emphasized the need to link between theory and practice, and they actually followed through with this commitment. For Rittel, this took the form of three extensive, field-based pilot studies of IBIS carried out before the first papers on the system were published. For Alexander, this took the form of "The Oregon Experiment"—a study of Alexander's democratic community planning at the University of Oregon; the approach was formally adopted by the university after 4 years of study and is still in action today [5, 33].

Carroll's & Kellogg's Claims

The thread of inquiry opened up by design rationale is one that is still thriving today, 40 years later. As early as 1988, design rationale entered into the conversations in HCI. Since then, there has been widespread development of notations (e.g. QOC [21]) and tools (e.g. gIBIS [9]) that represent a wide range of approaches to rationale structures, documentation, and access methods, management and integration strategies [17]. These diverse manifestations also come with diverse goals for its intended use; Lai and Lee document a few: reasoning, communication, reuse, critical reflection, maintenance and redesign, documentation, understanding, debugging, verification, analysis, explanation, modification, and automation [18]. Let us hone in on one of these—the claim—as a sort of case study of design rationale in HCI.

Claims were born in an effort "to reconcile the contrasting perspectives of theory-based design and hermeneutics" towards a Simonian science of design [7]. Claims are hypotheses about the psychological consequences of a crafted artifact on a user in the context of use. According to Carroll and Kellogg, these claims are exhibited as embodied yet interpreted qualities in a designed artifact; each feature empirically represents the psychological effects in a context. Claims document design rationale in informal language and are derived by predicting their effects (as hypotheses before design) and by observing them as embodied in a designed artifact *ex post facto*. As user-centered design hypotheses, they can be tested in context and then incrementally compiled and gainfully abstracted into design theories. Hence, Carroll and Kellogg suggest, they are reusable units of knowledge that are relevant across contexts.

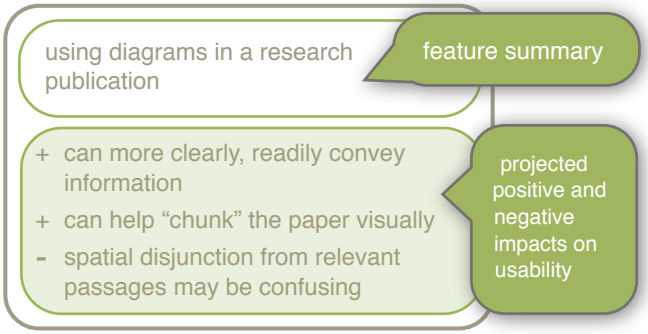

Figure 1. Example claim, including feature, pros, and cons.

Carroll's claims have never been very concerned with the motivations that drove IBIS and patterns. There was never an emphasis on democratic engagement of stakeholders. Neither was there an explicit acknowledgment of human value frameworks and how claims as design rationale might capture or support these. The motivation behind claims placed much more emphasis on achieving "both a basis in science and utility" through "a more systematic approach" to design interpretation. Through the claim-artifact coupling, it was suggested, we could contribute to design theory and effectively bridge the theory-practice gap. While Carroll and Kellogg sought to move beyond "simplistic" controlled studies and evaluations metrics like "time or error rate," there has been little engagement of claims in the wild. The result is not only that claims are not being put to use for practical design, but also that the generation of practice-based theory as envisioned is not taking place.

In the years since they were first introduced, IBIS, patterns, and claims have spread into fields (e.g. artificial intelligence), into research agendas (e.g. calling for strictly controlled empirical study only), and into application areas (e.g. design automation) that are oftentimes at ironic odds with their initial mission [6, 14]. Many studies overlook the original attention to accountability or social engagement and use reductionist measures to quantify benefits with respect to time and efficiency, aim to remove human intervention through automation, and consider the usefulness of rationale as a factor of its computability[14]. While this sort of spread and diversification of ideas is an important tenet of research, there has been an unwarranted casualty—the loss of practice-orientation—in the process of adopting design rationale and claims in HCI and beyond.

THE CURRENT STATE OF DESIGN RATIONALE

After forty years of research—twenty of those in the field of HCI—design rationale as an approach to design planning has moved into many different areas and comes in many different flavors. Yet, the overall research agenda has taken a turn away from real design contexts and towards the research lab. Much effort is put into building new design rationale systems as opposed to testing them, most tests take place in the laboratory, and those that are carried out in

the field are often informal [11, 14, 28, 32]. The result is that some of the core assumptions of the benefits of design rationale—that it is "useful" and "usable"—are yet unsubstantiated [28]. Shum and Burge both propose more empirical studies of design rationale, and Dearden and Finlay identify the lack of real-world study of patterns to be "one of the most obvious weaknesses" in the research. Perhaps another side effect of this disconnect between academia and industry is that "few design rationale systems have made it into practical use in industry" [6, 14].

The underrepresentation of field studies and industry use of design rationale is not only damaging to a rigorous check of theory [28], but it also marks a divergence from some of the core values and motivations of design rationale as it was originally conceived. For one, design rationale initially had a very grounded, practical agenda. As it was born of a reaction to incidents like the Kent State shootings, design rationale sought political intervention in promotion of transparent, democratic design. Both Rittle's IBIS and Alexander's patterns were used in real-world situations and, in the case of the Oregon Experiment, had real and lasting impact. And, Carroll's claims were intended to bridge theory and practice by creating a stream of field-drawn knowledge into academia for theory building. Yet the current research agendas in design rationale do not have the same political agendas or field deployments to support them, and they consequently cannot feed into theory development.

For another, design rationale research was initially concerned with relocating design from the elite practitioners to the vast pools of stakeholders via a more democratic process. Current rationale research fails not only because it is not being used in the wild, but also because the design of design rationale systems themselves are created by academicians. Finally, current rationale research puts emphasis on machine and process as opposed to people. While rationale was initially concerned with the open society, the politics of real design, and the dualistic shortcomings and strengths of man over machine, current research is concerned with designing new rationale systems without reconciliation between designer and user.

The movement of design rationale away from its original agendas is not a problem in itself, however the underrepresentation of the former *is*. It signifies a neglect of certain research questions that might provide new intellectual avenues. The research is currently neglecting the practical, situated, qualitative, nature of design and how this will interact with design rationale systems. Furthermore, design rationale has always ignored the questions of human interpretation and meaning-making (although it always acknowledged human values as important tenets of design). This gap has been noted by others that call for the movement of design rationale study to practical settings, advocate the use of ethnography, and to encourage the inclusion of values in our estimation [6, 11, 28].

Some work is already beginning to press on these issues by taking rationale into the field for extended trials, focusing on human interaction over design rationale artifacts, and even locating design rationale in the wild [13, 22, 34]. These efforts are still vastly outnumbered and are not currently sufficient to support either scientific or practical arguments for design rationale as effective process [28]. What we need is a more unified effort to make design rationale matter again to the people that it is presumably built for: practitioners in the field. We need to understand where and how and why they are designers. We need to know how they use or do not use rationale already and how they use or do not use the systems that we provide for them or even co-create with them. Most importantly, we need to understand how these design representations and the processes that emerge around them tie into underlying human themes and sociality. As of now, these questions are off limits to us if we continue to think and frame our research without regard to people in practical contexts.

MAKING DESIGN RATIONALE MATTER

The commitment that design rationale research has made to the theoretical study of design rationale has, in many ways, made it irrelevant outside the research community. We have seen how design rationale research mostly ignores real working contexts and the important questions that arise within them—questions about how people act and make meaning in social contexts. As a result, the theory-practice gap that claims, for example, set out to bridge is still a compelling and problematic issue. We have theoretically identified a way forward for a science of design, but have completely detached it from its foundational dependency—knowledge from the field, the substance of the claim. What's more, lost in the pursuit of user-centered end-products, design rationale research ironically ignores its users: designers. We have, perhaps, fallen back into the bad habit of designing for ourselves and our own value systems, leaving designers, designerly contexts, and alternative ways of knowing out of our estimation.

How can we make design rationale fulfill its core, but seemingly forgotten, agenda? Alternatively, how can we make design rationale matter again? For us, a significant part of the answer lies in a construction proposed by Flyvbjerg and Aristotle before him, the notion of *phronesis*.

Phronesis is Flyvberg's answer to the Science Wars—the series of back and forth debates regarding valid ways of knowing in the social sciences—that have been taking place since the early 1990's. A clash between the positivist and constructivist camps, the Science Wars are a macrocosm of the debates that characterized the shift away from the design methods movement (e.g. Simon [29] vs, Suchman [30]). *Phronesis* offers "a way out of the Wars" through raising "prudence or practical wisdom" to the level of other accepted forms of knowing—*episteme* and *techne*. Apart from "analytical, scientific knowledge" (*episteme*) and "technical knowledge or know-how" (*techne*), phronesis "involves judgments and decisions made in the

manner of a virtuoso social and political actor." *Phronesis* connotes "value rationality" and concerns "analysis of values." In sum, "*phronesis* is that activity by which instrumental rationality is balanced by value rationality." While Fyvbjerg's proposition is not the first of its kind (see [31] for a more complete history), it serves as a temporally relevant and particularly compelling ambassador.

One of the opportunities presented by *phronesis* is the legitimization of practical, experience-based value knowledge—the common sense resource to which expert actors appeal as they design the future and reflect upon the past. With regard to the current situation, Flyvbjerg notes: "regrettably, the pervasiveness of the rational paradigm to the near exclusion of others is a problem for the vast majority of... practical fields such as engineering, policy analysis, management, planning, and organization" [12]. As we have seen from our analysis of HCI design history, design practice is among these.

A second implication of *phronesis* is the legitimization of qualitative scientific inquiry into the activities and values of practical experts in action. As Flyvbjerg defines the scientific agenda, "the principal objective for social science with a phronetic approach is to carry out analyses and interpretations of the status of values and interests in society aimed at social commentary and social action, i.e. *praxis*." This entails interpretation of interpretation (as scientists are themselves phronetic actors), or ethnographically-informed study. Flyvbjerg calls for fieldwork in the form of in-depth case studies, which involve observation, interviews, participant-observer positioning, contextual embeddedness, etc. Methods do not stop at the particular case level, and can also include studies with "large samples in breadth" as opposed to depth—that is, questionnaires and surveys.

The research program suggested by *phronesis* aligns with the original call for design rationale. As Rittel and Alexander began their investigation into design rationales, they took great measures to start from practical experiences and to work toward practical ends. Phronesis likewise is concerned with observing activity on the ground and "contributing to social and political praxis." In accordance with design rationale's initial focus on politics and values, phronesis concerns the "reflexive analysis and discussion of values and interests." And, just Alexander believed that practical activity requires the ability to shift between abstract patterns and particular instantiations, "prudence is concerned with particulars as well as universals." Furthermore, *phronesis* speaks to the original goals of design rationale by valuing interpretation, intuition, the complexity and ground-level details of value rationality, and the deeply situated and atheoretical nature of social phenomena. The adoption of a phronetic research agenda for design rationale would mark a return to some of the core values of the initial vision.

It is widely regarded that design cannot be adequately explained with a theory of knowledge alone (e.g. *episteme*). Rittel acknowledged this fact: "science is concerned with factual knowledge (what-is); design is concerned with instrumental knowledge (how what-is relates to what-ought-to-be), how actions can meet goals" [24]. Instrumental knowledge is that referred to by *techne*. *Phronesis* creates a third category of knowledge, value knowledge, that works in and among the instrumental. We must seek to study both as we explore design rationale in the wild.

What do we stand to gain from *phronesis* as applied to design rationale research? There are at least four foreseeable opportunities:

- Most immediately, we will begin to *substantiate (or disprove) some of the outstanding claims* that have been made in support of design rationale. Questions as basic as "will a designer, given the choice, actually use this design rationale system?" and "what value rationality is the designer using?" can be addressed.
- It will open up a *practical feedback loop into design rationale re-design*. The knowledge that we take from the field can be folded into new iterations of design rationale systems. This may lead to suggestions of how to overcome some of the most basic practical impediments to successful rationale (e.g. motivational issues).
- Gathered field data can provide a *body of ethnographic and case study knowledge* to support both novice or unprivileged researchers and practitioners that take interest in expanding their design understanding.
- It will significantly *expand our research frontiers* by opening up new lines of inquiry and generating new ideation sources. Simply being able to ask new questions and answer old ones from a new observation angle can deeply impact the future of design rationale.

In these ways and perhaps more, a *phronetic* agenda can help make design rationale matter again.

Finally, Flyvbjerg's call to adopt a phronetic research program in the social sciences is not an appeal to root out all other modes of knowing and coming to know. He does not propose that we diametrically oppose *episteme* with either *techne* or *phronesis*. On the contrary,

> "...what we could call the 'rational fallacy' does not lie in the rationalists' emphasis on analysis and rationality as important phenomena. These *are* important. Rather, the fallacy consists in... allowing these to dominate our view of human activity: so much so that other equally important modes of human understanding and behavior are made invisible.... In order to transcend the insufficient rational perspective [we must explicitly integrate properties such as] context, judgment, practice, trial and error, experience, common sense, intuition and bodily sensation [into our research program]."

That is, "we should develop a non-dualistic and pluralistic 'both -and.'" And, the application of *phronesis* to the research of design rationale should be no different. The research we currently do with regard to rationale has its

own value. It can posit and answer questions that *phronesis* cannot address. And, the reverse is true: "where natural science is weak... social science is strong."

PARTICIPATORY DESIGN OF DESIGN

Phronetic research opens the door for consideration beyond simply what designers do and how they do it; it provides a probe for *why* designers do what they do and why *they* consider it to be valuable. For the area of design rationale, this not only allows us to address the questions that are currently unconsidered by design rationale researchers, but it also creates a space for a Participatory Design of Design. That is, it will allow for the actual designers and their values and judgments in designing to be figured into the design rationale notations and technologies we produce. Active participation between researcher and designer in the creation of design rationale systems would tether the research down to the elicited wants, needs, and, most importantly, values of the designers for which we design.

As we move from traditional participatory design to the design of design itself, there are a number of challenges that carry over. We call out three: the black box, reconciling frames, and the double projection.

The black box

Phronetic activity takes place within the designer's black box [15]. Value rationality about the past and future design activity do have external components—a reflective design journal, the visible choice to draw a sketch, self-reports, etc.—that are accessible to the researcher via ethnographically-informed study. But, tapping into the iceberg below the waterline will require alternative ways of participatory exploration that will hinge on activity and the medium for communication. Some methods already seek to "get inside the heads of" users, for example the think aloud protocol [19]. Various elicitation methods may be less interruptive and provide a basis for common ground [8]. But, in light of the value-centric nature of the inquiry, new methods may be necessary complements.

Reconciling frames

As this paper has taken pains to point out, the worldviews from which we think and act are profoundly impactful. Not only do they shape our values, but they also color the interpretations we make about those of others. Especially in search of phronetic insight into designer activity, we must be sensitive to these differences and seek to create a space where researcher and designer can meet in a "middle" or a "third space" [23]. In this "hybrid" space, both participants become engaged in a mutual learning activity that allows the old assumptions of each to become open to question, challenge, reinterpretation, and renegotiation. Muller identifies various participatory practices that may encourage the occupation of a Third space, including workshops, story-telling, game-playing, and co-creation of prototypes.

The double projection

In phronetic study, the issue of the double hermeneutic arises. That is, the researcher must interpret a subject's interpretation of phenomena. This is also the case in participatory design of design, but there is another 'double,' as well. In participatory design of design, there is the double projection; the researcher must project usability onto a process that itself must project usability. In other words, the design process being co-developed must be user-centered (usable to the designer) while also providing for user-centrality (usable to the canonical end-user). To complicate matters, "user-centrality" could be substituted for "usage-centrality," or "value-centrality," etc. The underlying assumption about which design paradigm is appropriate is one that will also have to be reconciled in the third space. And, how are conflicts of worldview to be ethically handled when, say, a participatory design process yields a totalitarian one? As with action research, "practitioners... need to share a mutually acceptable ethical framework" [4].

The prospect for a Participatory Design of Design is an exciting one. It could lend the design of design more democratic accessibility and open up space for research-practice reciprocity. It could provide a compelling, exploratory medium for bringing design rationale into the field and bringing practical evidence into the rationale design loop. Ultimately, it could be an in-road to making design rationale matter. As we have briefly noted here, it will certainly come with new challenges (and opportunities), of which there are no doubt may yet to be identified and addressed. We hope Participatory Design of Design becomes an area of research interest not only for the sake of revitalizing design rationale, but also for the broader effort (e.g. Participatory Design of Participatory Design) of designing design in HCI.

CONCLUSION

In 1970, Horst Rittel and Christopher Alexander set out to open up design discussions, embrace human politics and values, and make space for both rationale and intuition in grounded as opposed to theoretical design. Similarly, in 1989, John Carroll and Wendy Kellogg proposed to bridge theory and practice, to lay down the foundations for a science of design that dipped one finger in academia and the other in industry. At present, design rationale has failed to make good on its promise to bridge academic and practical pursuits. It builds and then neglects to test, it lives in labs instead of design firms, and it avoids questions of human situations and values. In this sense, design rationale is making itself irrelevant. We think the resolution can be partly drawn from the acceptance of a complementary phronetic research agenda and exploration of a Participatory Design of Design.

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