

Meta-levels in design research: Resolving some confusions

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Abstract

Doing design and doing research are related activities. When doing design in a (PhD) research project, a number of confusions pop up. These confusions stem from the fact that most of the basic terms, such as 'designer', 'research', and 'product', have many connotations but not a shared definition. Because design research often happens in a multi-disciplinary context, the confusions can be even larger, as each discipline brings its own connotations and associations to the discussion without making them explicit. Especially when the researchers build on design skills themselves, and conduct research-through-design, it can be difficult to distinguish where and how activities are done to create new particular solutions for users or new generalizable knowledge for discourse.

We present a visualization that has helped to clarify a number of these issues by separating out the different goals, roles, and activities in which we engage when we do design research. It takes the form of a diagram of six meta-levels, where at each level an actor works to develop both a theoretical insight as well as a practical application to be used at the next level. We discuss how the diagram helps to separate roles and persons, different levels of (academic and practical) discourse, and to clarify competing tensions within a research project, for instance when defending a design decision in a research prototype as serving the research goals at the cost of practical utility or vice versa.

Keywords

Design research; design roles; methodology; reflective practice; participatory design; meta-levels

Introduction

The relation between design and research has rapidly developed and diversified over the past decade. On the one hand, a thriving academic climate has emerged, with universities worldwide setting up design education as an academic discipline, next to a vocational practice: doing research has become a growing part of design education. On the other hand, designerly ways of doing research, e.g., prototypes, iteration, and future visions, are becoming more pronounced parts of research methods (Sanders & Stappers, 2008). We also see a new kind of design researcher become prominent: the design-trained academic doing academic research, such as PhD projects, within the domain of design.

In the second half of the 20th century, design research was mainly an activity by academics trained in other disciplines with a research tradition, with engineering, cognitive science, and computer science as prominent platforms. In the 21st century we now see a maturing of design as an academic discipline, and researchers with a design training are exploring designerly ways of doing research (e.g., Koskinen, Zimmerman, Binder, Redstrom, & Wensveen, 2011; Stolterman, 2008; Zimmerman, Forlizzi & Evenson, 2007).

However, especially for this category it can be difficult to communicate, or be sure, which of their activities should be labelled ‘design’, ‘research’, or a combination of these.

This paper is based on the authors’ experience in two decades of PhD projects by designers. Its aim is to provide a means to help clarify (and resolve) some confusions that arise in conceiving, presenting, and discussing the roles of doing design and doing research in projects that aim to develop new tools, techniques and methods of designing. We present a framework for making ‘pointable-at’ different roles, tools, disciplines that play a part in such a research project. It is intended as a tool to support the discussion, but we do not pretend it to be a worked-out theory, neither does it make claims about which parts or relations are most important. Similarly, we do not ground it in any of the different discussions mentioned above. Rather, to clarify what (some of) the questions are, and to provide a hands-on (visual) means to assist in making sense of the different perspectives that pop up in discussions.

‘Design’, ‘research’, and their relations

For the purpose of this paper, we use a possibly naïve, but widespread working definitions of ‘design’ and ‘research’: *design* as the methodical development and implementations for a particular new solution in the world; and *research* as the development of new knowledge, generalizations that are shared in (academic) discourse and that can be used by others on a range of different situations. This reflects Stokes’ (1997) tensions between ‘aimed at application’ versus ‘aimed at generalization’.

Design and research often occur in close relations. Figure 1 summarizes four different relations between ‘design’ and ‘research’. Each of these four helps to make a point, and together they help to bring out the variety of facets that play a part in the discussions about them. Some would disagree with this simplification, argue that design and research are essentially the same, or have much more complex relations at many levels. Nevertheless, the tension between application and generalization is generally recognized. In this paper, we focus on the last of these relations, in explorative research through design projects.

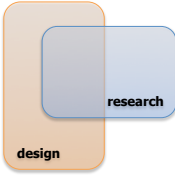
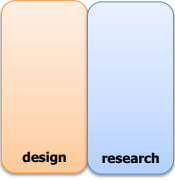
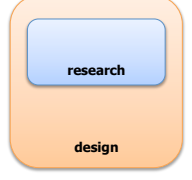
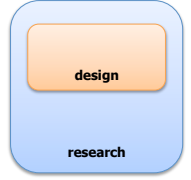
			
<p>a. design and research as overlapping entities</p>	<p>b. design and research as separate entities</p>	<p>c. research as a part of design</p>	<p>d. design as a part of research</p>
<p>Both proceed in iterative cycles of generating and evaluating ideas, both build on earlier knowledge, both have a goal of an improved condition in the future. The goals differ: application and generalization.</p>	<p>Traditionally, activities labelled as ‘design’ and ‘research’ have often been conducted by different communities of professionals, or departments in a company, each having different sets of values.</p>	<p>Formal research training has increasingly become a part of (academic) design training.</p>	<p>The creative part of doing research is receiving attention. Here, researchers who have an education grounded in design, play new parts.</p>

Figure 1: Four basic relations between design and research.

Explorative Research through Design

Design research is rapidly expanding as academic design education matures. For instance, at Delft University of Technology, design has been a discipline leading to an MSc degree since 1969, and in the last decade there has been a rapid growth of the number of PhD students (to date 200 PhD theses have been defended, and at the

moment 140 PhD candidates are active). Before 2000, PhD research was typically carried out by academics trained in non-design disciplines, but since 2000, an increasing number of these PhD candidates have an MSc or MA in a design discipline. In part this is due to research becoming a more visible element in the education and the profession. This new type of PhD candidate typically has a high motivation to create results relevant to the design profession, and brings a set of sensitivities, skills, and probably values, which are more design-directed than for candidates with a different background (Horvath, 2007; Stappers, Sleeswijk Visser, & Keller, in press).

In this paper, two PhD projects by design MScs are used to exemplify the story. In each of these, the candidate had set high goals for ‘short-term relevance for designers (and others) in the field’. Both saw their object of study not as a problem to be described, but an area to be explored and improved: explore a design phenomenon to generate new knowledge and develop a new solution going hand in hand. The authors see this as key elements in a research through design approach. Table 1 lists some characteristics of these two projects.

Table 1: Two PhD projects on tools and techniques for designing.

	Keller (2007)	Sleeswijk Visser (2009)
Thesis	For Inspiration Only	Bringing the everyday life of people into design
Phenomenon studied	Designers’ interactions with the collections of digital and visual materials that they keep for inspiration.	The use of rich information from contextual user studies in innovation practices
Knowledge goal	Understand how they use the collections in designing.	Understand how the information can be communicated and used in innovation processes of companies.
Design goal	Develop tools/techniques to support the joint use of digital and physical images to support creative tasks	Develop communication tools that stimulate empathic understanding in design teams.

Confusions inbetween disciplines

Design projects are mostly interdisciplinary, and explorative research also. Ideas develop typically inbetween different disciplinary frames of reference, and in the direct struggle with a phenomenon. As a result, most of the words we use in everyday design research discourse, are only vaguely defined, and the objects we make resemble other ones. This can lead to several confusions, some of which we describe below; we aim to resolve them in the next section.

“Is this design, or is it research?”

Central in Keller’s work was a prototype, *Cabinet*, that could be used to explore novel interactions with image collections (similar to the by now ubiquitous multitouch tables). It was used to study how designers change their way of working if new interactions became available, not to create a product that could be sold on the market in the short run. Yet practitioners and researchers on visits would regularly ask ‘when is it released’, even though it had been stressed that the prototype was a tool for research, not a product to be manufactured and sold.

“Can a designer be a user?” and vice versa

Keller was developing a tool to support designers in keeping collections of images: designers were the users of the tool which he designed as part of his research. Designers in the audience often failed to recognize themselves in the term ‘user’.

Similarly, Sleeswijk Visser was working in the area of participatory design where users collaborate with designers at activities which previously were exclusively carried out by designers. During her case studies she encountered quite some scepticism about involving users in the early stages of design. ‘Users’ would not be able to think of future solutions and can only think of the existing, so why listen to users? And what is then the role of the designer? The notion of users as ‘experts of their experiences’, or participants in co-creation challenged people’s basic division of the world.

“is designer a profession or a role?”

Several developments in the field raise questions about the status of the term ‘designer’. As noted above, in participatory (co)design, users and designers collaborate at activities that before were the sole responsibility of design professionals, such as determining requirements, coming up with ideas, and developing and evaluating concepts. Similarly, in the recent discourse on ‘service design’, these activities are often performed by other professionals whose background we would not readily categorize under ‘design’, such as engineers or MBAs.

Words & Prototypes, Products & Tools

As the examples above illustrate, design discourse can be confusing. In part this is because different communities (engineering design, interaction design, service design) use similar terms with different meanings which are not made explicit, in part because our most important words are often everyday words too. For example, in experience design and service design, the term ‘product’ is used in at least three meanings. (1) Pine and Gilmore (2011) use ‘product’ to refer to ‘the endresult of a design process, which can be a commodity or a service’. (2) in the discourse about product-service combinations, product and service stand for the tangible and intangible parts of the endresult, and (3) within the context of ‘service design’, others refer to this tangible part as a ‘service element’.

It is not the goal of this paper to come up with once-and-for-all clear definitions. First, such an undertaking is premature as the field is developing rapidly. Second, it would be an enormous amount of work across the different (and emerging) communities, in each of which there is an in-depth discourse. And third, it is probably not necessary, if we find ways of avoiding the confusions of ‘small words with large meanings’. Instead, the goal of this paper is to make some of the relations explicit, so design researchers can use terminology and be able to express them better/position their research strategy/set up with other academics. And to do so in a designerly way, supported by a visual, pointable, language to provide a way to separate the different notions involved in the discourse.

User-product-designer at different levels

Over the years we developed a diagram to help clarify the issues mentioned above. Figure 2 shows some key elements: a mixer (which stands for a mass-produced industrial product), a professional designer (iconically indicated with the beret) with a pencil (representing all manner of design tools and techniques), a cook using the mixer, and a researcher with a clipboard (representing all manner of research methods and tools). Figure 3 organizes these in three meta-levels. At each level an actor (the manikin on the left) develops an object (on the right) with the aid of a tool (in his hand). Beneficiary of this development is the actor on the level below.



Figure 2: Symbols to visualize stories about PhD projects. Mixer (product), designer (with design tool), user (of the mixer), and researcher (PhD candidate).

In the cases of Table 1, the PhD candidate is represented by the researcher at the top level, design practitioners occupy the middle level, and end-users the lower level. The pencil at the top level represents the design technique of interacting with images in Keller's research; with Sleswijk Visser, it represents UX communication tools. The clipboard represents the research tools and techniques used to evaluate and generate the 'pencil'. In both cases, the pencil is a tool or technique that helps the designer at the middle level in understanding the 'cook' user at the lower level.

The connecting triangle: designer-product-user

The triangle shows how the 'guy with the pencil' and the 'cook' are connected through their relation with the mixer as a product: the former is its *designer*, the latter its *user*. For the former the mixer is a product (an end), for the latter it is a tool (a means). We label this relationship as the *designer-product-user triangle*. It forms the connection between the levels in the diagram, each of which is a 'meta-level' of designing for the level below: the cook is developing a meal, the pencil guy is developing a tool to help the cook, and the clipboard-carrying person develops a tool to help that middle level. This reasoning can be extended above and below the three levels of Figure 3 to produce Figure 5.

One lesson is that we must label the three levels in a way that is not confusing with the terms 'designer', 'product', and 'user' in the triangle. Figure 5 shows a pragmatic choice of labelling levels through their actors. This labelling is intended to enable clear, and somewhat intuitive, way to refer to the separate level, but every single term can easily be objected to when taken as a definition.

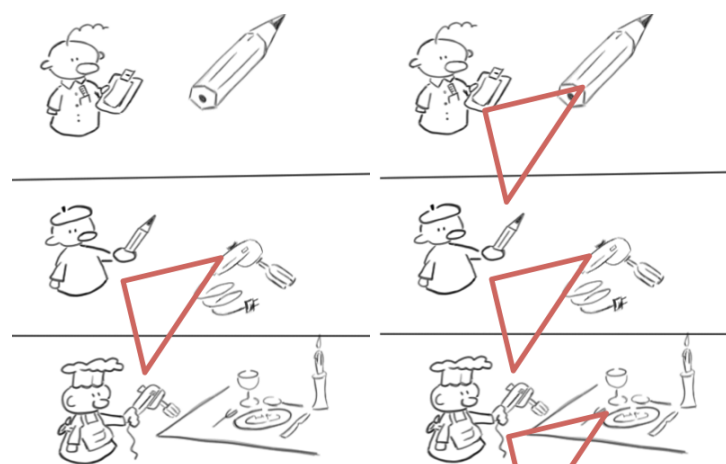


Figure 3: Roles, tools, and products organised as three meta levels, each connected to a level below and above.

Resolving confusions

The labels help us resolve the confusions listed in the previous section. The *Cabinet* prototype worked towards a product on the tool developer level (a 'pencil'), not a marketable product (a 'mixer'). The design professional who took offense of being called a 'user' mistook the consumer level for the user-of-design-tools level.

Separating the levels also helps in separating different levels of discourse, and possibly different values. For a prototype developed during a research-through-design project, such as *Cabinet*, the values at the tool developer's level (research goals) outweighed values of practical utility (product developer's goals). All image exchange had to be done through transfer on USB-sticks, which served the research purpose of making this overt and measurable behaviour, and a conscious act, although for a commercial product an internet connection would be more practical.

Tension: research versus design

The separation of levels of discourse is reflected in a mundane way in our own personal collections of books: among these books are those on product designs, on design methods, on research methods, some on basic philosophy, and some on cooking. The diagram shows how these books (and associated journals, conferences, and communities taking part in the discussion) can be split on those levels. The book, speech balloon and thought balloon in Figures 4 and 5 represent the (academic) discourse.

Discourse is the means for sharing (explicit) knowledge, and at each level we recognize that there is a store of existing knowledge that can be applied in designing (box c in Figure 1). At each level there is also an opportunity to learn from reflective practice (Schön, 1983) or from classic research actions. At each level the practitioner learns from applying existing knowledge, and builds experience from reflecting on practice, and at each level the challenge is to share insights from practice into the shared body of knowledge. That requires making insights explicit, and generalizing it.

The diagram also can be used to clarify Stokes' (1997) contention that research itself does not have to aim exclusively at generalization or at application, but that the two can go together. And it illustrates a very real tension in design research that one goal can be satisfied at the expense of the other.

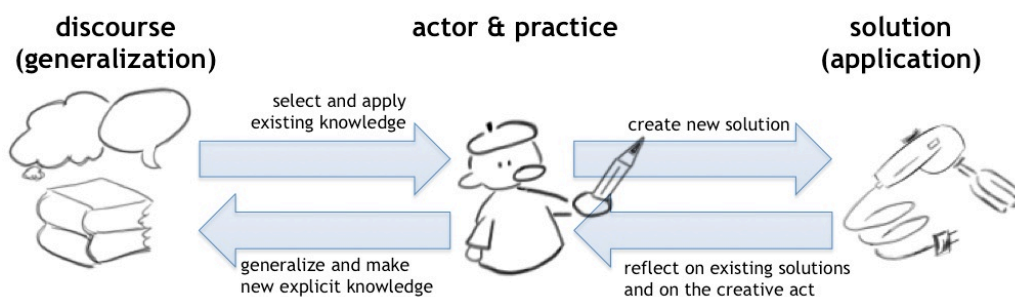


Figure 4: Research and design between generalization and application.

Levels: roles and persons

Figure 5 shows a different manikin at every level, but they all look quite alike, which was done on purpose. Sometimes the different manikins represent different persons or roles. In the cases by Sleeswijk Visser she acted as the tool developer, communicating user insights to others who used these insights for designing products for yet other people. On the other hand, in conducting the project, there is no doubt that she drew on her own

experience with the other roles. The book collection example above illustrates how we all have to deal with mixtures the different roles. The aim of the diagram is not to separate the mixture, but to assist in recognizing it. Most of us who are involved in design research will visit all of these levels and roles in some ways. In some we have our primary goals, some we use as vehicles for being able to conduct work on another level, and in some we consult others for their expertise, either through written work or in person. At each of the levels we face the problem of finding what existing knowledge is available to help us, and when we don't find it, we have to improvise.

Are these all levels?

The discussion above has mainly focused on the three core levels, with a few extensions toward developing research methodology and a vague indication that it doesn't stop there. Also in the other direction the levels can be extended. The bottom layer in Figure 5 shows that the story doesn't end with the cook using the mixer as a tool to produce a meal. Also this meal has a function of a tool in the social setting where it is consumed. It may be to let the people at the level 'life' enjoy their being together for an occasion (the label 'life' was chosen as a plain indication that there are probably more levels to follow, not as a denial of life to the levels above). And again this occasion is to celebrate connections, to strengthen ties, or to prepare for 'a business deal', and so on.

We haven't found it useful to carve the diagram in stone, or to try to formalize it with very specific definitions; rather, it serves as a way to make different concerns and concepts pointable-at, to support the consideration of separations, relations, or identities, but not to prescribe them.

What's in a level?

Besides the actor, the means and result at this level (designer, tool, and product), we included explicitly situation or environment in which this work occurs, the other tools used (labelled 'co-tools' in the diagram), and the discourse, which also stands for the community and its values (which is primarily social, but we didn't want to draw more manikins in the diagram). These ingredients helped most in our own discussions.

At every level there is a research-design (generalisation-application) tension in activities between as shown in Figure 4. Every PhD candidate and academic researcher faces these on a regular basis. Designers, with a heart for applicable results even more so.

What connects activities in the levels?

Besides the product/tool, the diagram also helps to explain two important paradigms that emerged in design research thinking in the past decades.

Schön (1983) introduced the term 'reflective practice' as the mode of knowledge generation that comes with experience. He described how practitioners, through reflecting on a level of action, build generalizations, overarching and underpinning understanding to support that level. In design education students are trained to be not just users of design techniques, but to modify their tools for the needs of new situations: they can act on the level of the tool developer to make their 'new pencils'.

Similarly, the generative techniques developed by Sanders (e.g., Sanders & Stappers, 2012) are used in a participatory process in which everyday people ('consumer level') become aware of their patterns of use and their underlying needs, values, and motivations, so that they can collaborate with designers on the 'product developer' level.

These levels of reflection and participation happen across the whole diagram: consumers participating in the development of new products, designers participating in new tools developed with (rather than for) them. We also see 'tool developers' actively engaged in furthering our understanding of the research methods that help to generate and evaluate

discourse environment actor tool co-tools product

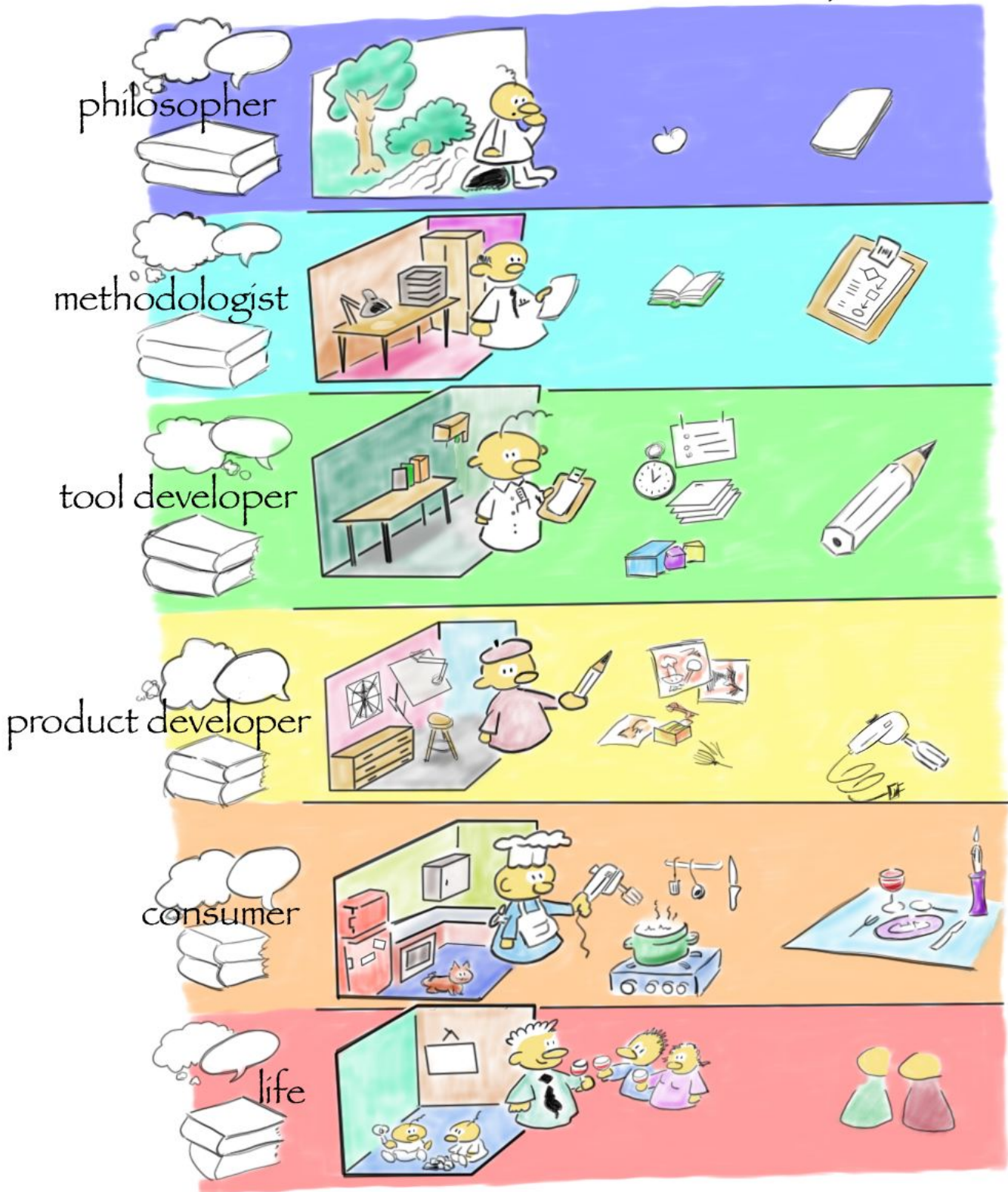


Figure 5: Six meta levels of design and research.

new proposed tools, i.e., the methodological framing of ‘research through design’ among other research methods. It can be a matter of budget at which level the actor can invest sufficient time to take active part in the discourse.

Another interesting phenomenon is cross-talk between the levels. Individuals may take elements from one level and use them at another. This can be a level mismatch as in some examples discussed above, but it can play in other ways as well. In devising a new theory, tool, or household product, the creative person makes associative use of many experiences and pieces of knowledge he or she possesses. Some of these may come from the other levels of activity. This isn’t good or bad in itself, but it may pay off to be cautious about it. In our own education, we have observed that students who employed reflective means of doing research (such as users keeping diaries and workbooks during a contextual study) also often employed elements from these research methods (diaries, workbooks, ambiguous elements) as parts of their design for a consumer product. Or earlier, programmers coming up with products with which consumers had to program functions. This can be good (a powerful element that the designer knows well is used), indifferent (a viable solution, but there might be many others is the solution space is sufficiently large) or bad (a bias about what the user might want or need). It pays to be aware.

What’s the same in all levels?

The different levels help to split out certain things, but it also becomes apparent that some things are the same at all levels. All the activities are conducted by humans, and therefore subject to our human abilities and limitations. At all levels we can attend to the functional behaviour of the person, his or her experiences, and social interactions. In the past three decades we have seen an expansion of attention on the product design and research level along these lines. At each level there is creativity and expertise.

This pervasive quality became apparent when we were looking for icons to depict the ‘product’ at the right of each level. Time and again the idea arose that a computer (or if you want, a smartphone) would be a good representation, but neither computer nor coffee are constrained to a single level.

In that respect it is surprising how some people don’t see what is the same across levels. Product designers (and researchers) often pay great attention to the usability factors for products made for consumers: text should be legible, not too many words on a line or items in a list. Then, when they present their work to colleagues, it seems like these rules don’t hold for presenting scientific results. But these principles hold at all levels, and there actually is a great deal to be won by paying attention to the usability values of, e.g., scientific instruments and theories. The diagram is one attempt to bring some usability value to the scientific discourse.

Limitations and value of the levels

Over the five years in which we’ve worked with the model, it has helped to avoid a number of cross-level confusions (an earlier version, was presented in Stappers & Hoffman, 2009). But the model is too general to be called a theory. Just as a design sketch it is a means for ordering thoughts, supporting a discussion, for planning, maybe not so much for consolidation. Several PhD students in our school have used it to separate roles, goals, and expectations. But it also appeared that the words used to describe the level sometimes led a life of their own. We recommend that researchers make their own version of the diagram, with labels and ingredients chosen to fit the discussion at hand. The diagram supports an explorative practice of mapping by visualisation and labelling, not striving for strict definitions of terms. Figure 6 shows two such variations, each depicting a number of roles and considerations that the main actor had to make, and sometimes the other people involved in this. In each case the PhD researcher had an

MSc degree design, experience in designing products for consumers, and had to explore not only a new tool, but also the appropriate mix of research actions needed to develop such a tool. It takes too far to go into detail here, but the dissertations are published and available online.

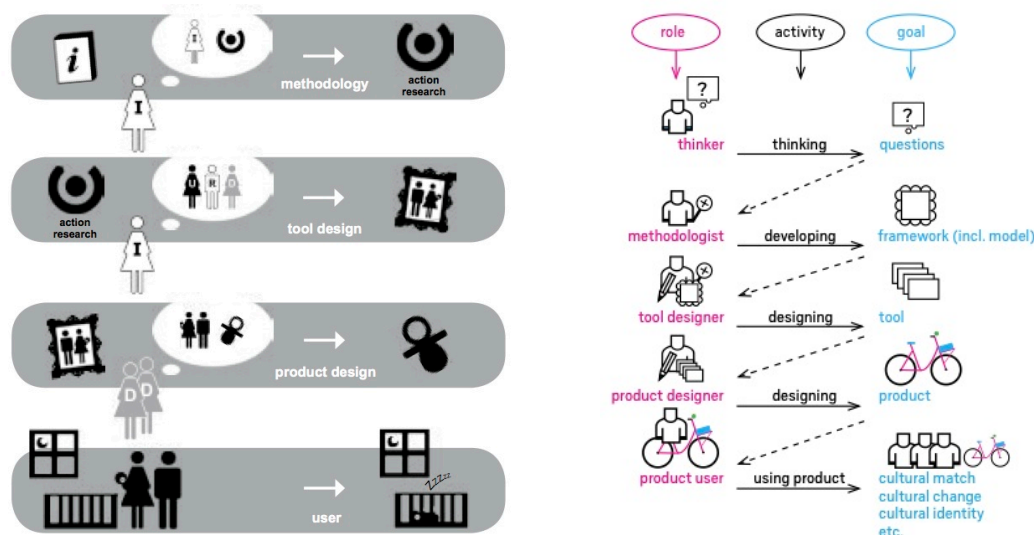


Figure 6: Variations of the diagram by PhD candidates. Left: Creating Socionas (Postma, 2012), developing a design tool for letting design teams consider the social use of products; right Crossing Cultural Chasms (van Boeijen, personal communication, October 2014), on developing exploratory tools with which designers can better understand users from very different cultural backgrounds.

Discussion and conclusion: uniting the field(s)

Design research is quickly growing field, but in many ways still trying to find its way. In part this is because the field is new, in part because several different communities (engineering design, product design, computer-human interaction, service design) have established themselves and are now beginning to overlap or sometimes merge.

In this development, much is still to be clarified. We presented a way of supporting a discussion with a pointable-at diagram that can be used to distinguish individuals, professions, roles, goals, means, results, communities, and more. All of these words are used with greatly varying precision in many places. Unifying the field(s) with exact definitions of terms that everyone would agree on does not seem a viable way at the moment: there are too many areas of discourse, and too many disciplines and interdisciplinary fields, each with their own communities, journals, and conferences. We do see hope that descriptions of concrete projects can help building a shared understanding across these boundaries, if we can find a way for participants in the discussion to achieve a common wavelength. The diagram hopefully provides an inspiration for people to support their discussions with visual means, to clarify differences and agreement of interpretation.

One prominent limitation of the diagram is that it mainly depicts singular actors. Much of design, and much of research, is an activity of teams, groups, and communities. The diagram depicts that a tool is always used in conjunction with other tools, techniques, and infrastructure, but we haven't discussed it. But just as 'other tools' can be added to the diagram (and are in Figure 5), it may be worthwhile to explore variants and visualisations for these networked activities, and how knowledge, tools, and products exist and function in the groups. Our focus on the individual designer/researcher/user has a historical

explanation in that we developed the diagram in discussing PhD research projects, which by their academic requirements have an emphasis on the individual researcher.

In the sections above we explained how the diagram can be used, and indicated some of the limitations of the diagram's usefulness. We don't pretend that this is a theory, rather feel that this is a stepping stone to help a discussion and awareness about the terms and relations we use in this dynamic interdisciplinary area we call design research.

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