Learning from prototypes

From the design studio to the city

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My recently started Civic Prototyping research group aims to develop new tools and methods enabling urban residents to exploratively research and develop applications of new technologies. This allows them to improve their everyday lives by taking their own initiative in creating valuable services, products, collaborations, and shared spaces. Facilitating applied design research is an essential part of this. But what does applied design research look like in the context of a community of people who keep trying to change the world around them? And what are the challenges for the implementation of applied design research in such a context? To answer these questions, I first need to explain my understanding of what applied design research actually is.

The meaning of applied design research

'Design research both inspires imagination and informs intuition through a variety of methods with related intents: to expose patterns underlying the rich reality of people's behaviors and experiences, to explore reactions to probes and prototypes, and to shed light on the unknown through iterative hypothesis and experiment'. [1] This elegant quote by Jane Fulton Suri perfectly captures my understanding of what is applied design research.

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2. For a comprehensive definition and overview, please refer to: Pieter Jan Stappers and Elisa Giaccardi, "Research Through Design," in *The Encyclopedia of Human-Computer Interaction, 2nd edition, eds.* Mads Soegaard and Rikke Friis-Dam (Aarhus, Denmark: 2017): 1–94.

3. William W. Gaver, "What Should We Expect From Research Through Design?," in *Proceedings of the 2012 ACM Annual Conference on Human Factors in Computing Systems (May 2012): 937–946,* https://doi.org/ 10.1145/2207676.2208538.

4. Abigail C. Durrant, John Vines, Jayne Wallace, Joyce S.R. Yee, "Research Through Design: Twenty-First Century Makers and Materialities," in *Design Issues* 33, no. 3 (Summer 2017): 3–10, https://doi. org/10.1162/DESI_a_00447.

The term 'design research' in academic circles has grown to mean the study of designers, design processes, and their outcomes. Adding the prefix "applied" brings the term back to how it functions in designers' common speak. There, it simply means all kinds of activities that designers do to understand better the context they design for. To me, applied design research means exactly that: the hands-on, practical, but also often informal investigation into the design context, which is an integral part of doing design.

Internationally, the discourse on applied design research and the synonymous term *research through design* [2] has grown considerably over the last five years. Bill Gaver, among others, published an insightful set of challenges for the academic research through design community,[3] and the first Research Through Design (RTD) conference followed in 2015.[4] What made this conference exceptional was its relevance to both academics and design professionals. During the RTD conferences, several styles of applied design research were brought together, and prototypes were used as a valid form of knowledge transfer.

In 2019 we had the honor to host the RTD conference at TU Delft. We saw first-hand how the discourse on applied design research has matured in recent years. However, the diversity of research through design approaches has also given rise to a discussion about what defines 'good' research through design practice, guaranteeing the validity and generalizability of design knowledge.

Zigzagging between design research and design activities

Applied design research can be challenging for designers – simply because research and design are two activities with very different purposes. Research is focused on generating knowledge about the world in which we live. Design is aimed at producing interventions that will change this world. This friction plays out all too often in design processes. Design research focuses on learning about the design context and generating new knowledge. The focus of design is on

applying knowledge to create an intervention that (in the eyes of the designer) will improve the world.

Designing and design researching can be seen as two parallel processes that stimulate each other but have different goals. A good designer iteratively moves back and forth between those two processes, as visualized in Figure 1. In the poetic words of Donald Schön: *"the designer (...) shapes the situation in accordance with his initial appreciation of it, the situation 'talks back' and he responds to the situation's back talk."*
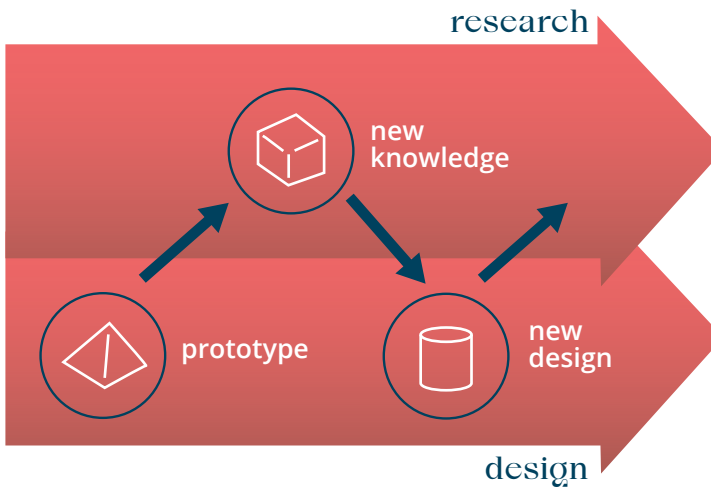

Figure 1
Designers make iterative moves between designing and researching their design context.

Managing one's own design iterations is a difficult skill. I have coached numerous design students who were hopelessly stuck in their design research. They would not dare to come up with any design ideas until their research felt truly complete. This is what design coaches often call *'analysis-paralysis'*. Paradoxically, the more the students researched, the less complete their research felt. At the same time, other students had design ideas in the first moments of their design process and rejected the need for doing design research altogether. They were fixated on their first ideas, and immediately wanted to invest a lot of time and energy in their detailed development. Driven by the loss aversion, they would then do everything they could to protect their 'design darling' from any research or criticism that might prove it flawed.

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5.   Emil Flach's team-mates were Marieke Noordermeer, Yu Wang and Ward Groutars in the first stage of the project, and Sarah Kraan, Maira Ribelles and Ziwei Li in the second, coached by Roy Bendor and Marise Schot. This story uses the perspective of one person to emphasize the individual character of learning during design.

6.   Roy Bendor, Aadjan van der Helm and Tomasz Jaskiewicz, eds., *A Spectrum of Possibilities: A Catalog of Tools for Urban Citizenship in the Not-So-Far Future* (Delft University of Technology, 2018).

My best design students were able to continuously move between their design research and design activities. They kept adapting their ideas, building many prototypes, and gathering feedback on these prototypes from others, making their design research and design development progress work hand-in-hand and support each other.

An example

Let me give you an example to better explain the complexity of applied design research in practice. Emil Flach was a fourth-year Industrial Design Engineering student at the TU Delft when he was commissioned to design a speculative 'instrument of citizenship for Rotterdam 2060'. The assign-ment was part of the Interactive Technology Design course. At the beginning of the project, Emil and his team [5] were told that they were expected to come up with an application of interactive technology that would help future city dwellers to be more informed, more active and influential in shaping their future city.

Over the next nine weeks, Emil and his team would come up with several ideas about what the future of Rotterdam could hold and invent interactive products that would fit into that future. One of these products was an interactive device that looked like an umbrella and could help create personal space in a busy city (Figure 2). Each of such prototypes helped Emil and his team imagine the future city in more detail and grasp the complexity of future urban problems.

They did so by investigating the city and citizens of today and extrapolating the observed trends into the future. These investigations led them to a future vision of an overcrowded and competitive society. The team converged on a design for a device that would help people to prove themselves as valuable to their community, while at the same time raising many ethical questions about the balance between a per-son's obligations as a citizen versus personal freedom.

Next, the teams were rearranged. Emil joined his new teammates, and this new cooperation brought up another aspect of overcrowded society, namely dealing with immi-grants who settle in the city. The process ultimately led to a

provocative concept of a device that links migrant families to current city dwellers as hosts (Figure 3).

The users of the device still had several choices, but in the end, citizens were always forced to take care of newcomers to their society. The prototype led to much discussion about the validity of the different attitudes that citizens may have toward migrants. It confronted the seemingly noble idea of 'adopting' a migrant family with a forced, automated, and dehumanized way to implement it. It challenged people to question their own values and beliefs about migration.

During the design process, Emil's team's prototypes were shared with other students through work-in-progress exhibitions organized as part of the course.[6] During the project, students regularly exchanged insights and

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know-how, helping each other express and understand the complexity of the current and future challenges facing Rotterdam and its inhabitants.

The 'smart migrant dispenser' was later exhibited with other prototypes during the Dutch Design Week in 2018, where it reached thousands of visitors. Emil observed the reactions of people to the prototype while he supervised the exhibition. Many visitors were puzzled. Some laughed, others shrugged their shoulders. Some of them got angry with Emil because they were offended by the taboos that the prototype crossed, or because they misunderstood its thought-provoking purpose.

In his recent reflection on this project, Emil noted that for him personally the key lessons learned during the project were the technical skills he developed while building his prototypes and the ability to explore a design space iteratively. He also regretted that he could not articulate his team's nuanced views on migration when confronted by visitors during the Dutch Design Week exhibition. It was a skill that other team members focused on. Each of the more than a hundred other students who followed the Interactive Technology Design course that year went through a different, very personal learning process. However, they all had the same challenge in mind, improving the future of Rotterdam.
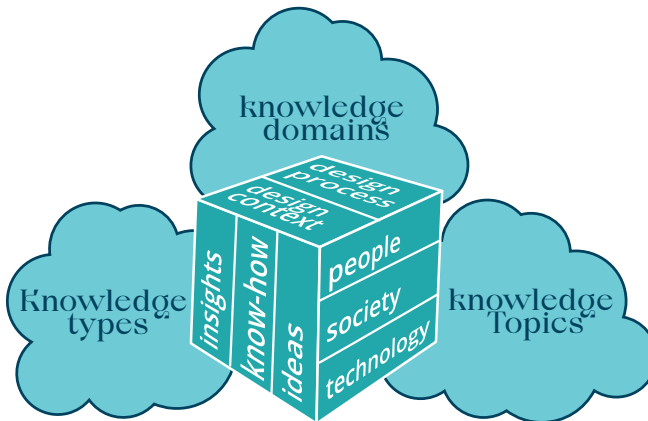
The knowledge of designers

When following the story of Emil's applied design research, you may notice that there is not a single topic or type of knowledge that he has obtained when working on his project. Many of his learnings were tacit and manifested themselves rather in his design actions than in what he said or wrote. Many of his observations, impressions and thoughts probably got lost in between his iterations, while in various ways they still influence Emil's abilities as a designer and design researcher.

In recent years, I have been researching ways to structure, capture, and share practical design knowledge such as Emil's. In a series of studies, my colleagues and I have

analyzed the design research documentation of large groups of students. Our analysis revealed three ways to differentiate the different types of design knowledge the students documented, as illustrated in Figure 4.

First, that knowledge was either related to the domain of the design context or the design process. Second, we encountered three different types of knowledge descriptions. There were declarative statements, commonly called 'insights', that described what designers considered to be true. There were also procedural descriptions, which we called 'know-how'. They represented a process needed to be followed to achieve a specific result. There were also speculative state-

ments, which we called 'assumptions', 'design hypotheses' or simply 'ideas'. They described what designers expected a specific intervention to achieve. Third, the topic of the acquired knowledge differed. Some students focused on individual people, others on society at large, or on technology, while in many cases, a combination of topics was addressed.

This systematization of design knowledge has further helped us to better support applied design research by creating a 'reflection card' tool for structured reflection during the design process. Such a reflection card is a simple digital form organized based on the identified design knowledge categories. Each student designer had to fill in a reflection

Figure 4
The three sides of design knowledge detail what designers learn.

7. The statement that 'everyone is a designer' was popularized by IDEO's Tim Brown together with the concept of "design thinking," [8] but it has long existed in the design discourse. For example, Herbert Simon wrote in *The Sciences of the Artificial:* [9] *Everyone designs who devises courses of action aimed at changing existing situations into preferred ones.* And Victor Papanek wrote in *Design for the Real World:* [10] *All men are designers. All that we do, almost all the time, is design, for design is basic to all human activity.* This does not negate the importance of design expertise. In *Design, When Everybody Designs: An Introduction to Design for Social Innovation,* [11] Ezio Manzini clarifies the difference between "diffuse design" performed by non-experts with their intuitive design capacity, and "expert design" which requires trained professionals.

8. Tim Brown, *Change by Design. How Design Thinking Transforms Organizations and Inspires Innovation* (New York: Harper Collins-Publishers, 2009).

9. Herbert Simon, *The Sciences of the Artificial,* Third Edition (Cambridge, MA: MIT Press, 1996).

10. Victor Papanek, *Design for the Real World. Human Ecology and Social Change* (St Albans: Paladin, 1974).

11. Ezio Manzini, *Design, When Everybody Designs: An Introduction to Design for Social Innovation* (Cambridge, MA: MIT Press, 2015).

card for each design or prototype iteration created. In some cases, this meant 20 cards per student. The cards forced student designers to briefly reflect on their design process and its outcomes and articulate the most recently acquired knowledge.

Based on our analysis, we determined that the use of reflection cards involved a sequence of six different activities:

1. Changing the mindset from design-oriented to research-oriented
2. Articulating knowledge
3. Generalizing knowledge
4. Sharing knowledge with others
5. Validating knowledge
6. Applying knowledge to the design

In each of these activities, designers encountered different kinds of challenges. They often were tempted to describe what they did rather than what they had learned. Recording very project-specific notes was also much easier than making more generally applicable statements. However, the effort to articulate and generalize their insights, know-how and ideas proved to be a valuable means of communicating with others. The student designers who were better able to articulate their knowledge gathered more valuable feedback from peers and coaches and could better communicate their project to the outside world.

The articulation of knowledge during the design process also enabled serendipitous connections among students from different teams, sparking collaboration opportunities. Rather than discussing the designs, the student designers began to exchange insights, know-how and ideas more often, turning the design studio into a design research community.

Towards 'civic prototyping'

The challenges faced by the students in our design studio are also at play in cities. In many ways, a grassroots civic initiative, a civic hackathon, or a maker community in many ways resemble an exploratory design studio. The rapid construction of prototypes, articulating and sharing of the accumulated knowledge, communicating and working in

multidisciplinary groups are all challenges that such communities face. People in those communities who innovatively try to improve their city are in fact also designers,[7] with unique expertise, insights, and skills. The question remains though, can they all also be design researchers? The articulating and sharing of practical knowledge remains a challenge for both professional and non-professional design researchers. Structured reflection can help, and we can certainly continue developing our tools, methods, and techniques to better support different creative communities.

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Dr. Tomasz Jaskiewicz was appointed as a professor at the Creating010 research centre in March 2021, where he leads the Civic Prototyping research theme. Within this theme, he researches new applications and methods, tools, and processes to involve city dwellers in the digital innovation of their social and physical environment. Tomasz has a background in architecture and urban planning and has practical work experience in developing experimental architectural projects, interactive installations, and digital design tools. In 2013, he obtained his PhD from the Faculty of Architecture at the Delft University of Technology. From 2014, he worked as an assistant professor at the Faculty of Industrial Design, where he currently holds a design fellow position.

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