Research through Implementing Design

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Abstract
Knowledge in Research through Design (RtD) is commonly produced by designing and testing prototypes, but the implementation phase is often overlooked. In current work, we explore the temporal aspects of RtD through long-term deployment and development of hybrid interactive installations in real-life settings such as parks and museums, where the designs need to be adapted to external stakeholders' prerequisites and values. We argue that stepping beyond prototypes, into the implementation phase, produces unique knowledge relevant to RtD. It gives opportunities for in-the-wild-studies, insights that unravel over time, provide near-futuring perspectives, and allow unique insights into stakeholders' design values. Based on a set of design examplars, we showcase what types of knowledge can be gained through RtD engaging with complete implementation processes, including post-inauguration, and we discuss challenges and opportunities of such RtD projects.

Author Keywords
Research through Design; Implementation; longitudinal studies.

The Role of Implementation in Research through Design
RtD is largely based in prototyping [31], even though design practice relates to the whole design process, and beyond, for instance through design after design [9]. A problem identified by RtD researchers, is how to prove that design implications have real life effects [26]. A literature review from 2018 on Research through Design identifies the need to focus more on implementing designs and on in the wild studies over time, rather than just briefly trying prototypes with invited test groups [12]. From a knowledge perspective, there is a difference between just sketching or speculating a design idea, and actually designing an artifact or activity [4]. One could argue that there would be a similar difference between merely creating a prototype, and to implement a design in its meant real world situation. Understanding the nature of design practice is crucial for successful interaction design research [28], and isolated prototypes might be far from everyday design practices [31]. For RtD, being part of a design project during a longer time frame, and allowing for its natural unfolding, is crucial to provide useful results [12]. The intrinsic differences between prototyping and implementing is well acknowledged in design practice [29] and implementation holds its own

Figure 1: The playground shortly after inauguration (egg in front and story hut in the background).

Figure 2: Researcher documenting the wear and tear of the playground, note the water filled cavity around the egg.

challenges [27]. In other research fields, such as health, the special properties of implementation research are clearly identified [20], this doesn't seem as clearly defined within RtD. Design evaluation methodologies could benefit from being more aware of the drawbacks of the simulated properties of a prototype, and how such studies create a present-future gap [24]. Implementation can enable long term studies, providing insights into graceful degradation [25], faded novelty effect [17] and the full life-cycle including end-of-life [21]. Within RtD features such as emergence [11] and reframing [32] have been discussed as central within the design processes, and such focuses could be expanded more beyond inauguration.

A form of insights that can be missed in the prototyping stages are design considerations related to external stakeholders, societal prerequisites and values, and in how laws, public opinions, costs and security affect the designers options [2]. Design contains political and moral values [8], and especially when designing with public stakeholders, transferring those into the design becomes crucial. While stakeholders, such as museums, might accept the design suggested for a prototype, when moving towards actual implementation, opinions can be explicated much stronger, and designs even vetoed for instance because they are not perceived as conveying meaningful values [22]. Facing such challenges, and failures, can provide a relevant knowledge contribution in relation to RtD [10, 13].

RtD can engage with how things might be in the future through futuring [23], where artefacts are designed to spark reflections, and point out preferred futures [12]. But the future is a very long time span. RtD can for instance engage with the distant future through speculative design [7]. We argue for the importance of also study near futuring, exploring implementable, but not yet implemented design solutions. The near future can be very relevant from a research perspective [5, 16, 18]. We argue for the importance in RtD to explore these near futures through implementable design solutions, together with external stakeholders. Between what we already can do, and what is too difficult to do in the current state, there is a zone of what could be done, with scaffolding. Within learning this is referred to as the proximal zone of development [6, 30], we argue that there can also be a zone of proximal design, a creative space in between how things are today and how they could be in a near future. We will now explore these concepts through three design examples from different previous and ongoing projects.

Design after Design after Design: The IoT Playground

This project focused on designing an Internet of Things enhanced playground, as part of an innovation project involving a municipality, an NGO, a tech company and RtD researchers. The project lasted between 2017-2020. Utilizing capacitive sensors for the interactivity, and outputs in the form of led and loudspeakers, two types of installations were implemented; the magical eggs, and the hut of stories. They contain different play scenarios, offering play opportunities such as the eggs turning into a chase-the-light-game, or a music instrument, and the hut containing stories about the forest animals, changing daily. The installations were built to be permanent with an expected life span of 10+ years. The playground was inaugurated in October 2020 (fig 1) and has been active since, revisited from time to time by researchers, although less often since

Figure 3: design probe from early phases of the interactive art project

Figure 4: Prototype of interactive art installation.

Figure 5: First design sketch for permanent installation, created by the artists.

the project funding ended. The playground installations are reprogrammable though a child friendly interface, and several scenarios have been added and tweaks made. Published papers on the playground design include a publication on how values have followed from ideation into implementation [3], a paper on the malleability aspects, with data from post-inauguration [2], and a paper focused on the interactive stories of the hut [15]. The latter is a clear example of post-project reframing, where the in-the-wild usage patterns inspired the article. Examples of ongoing studies (fig 2) include a focus on graceful degradation and maintenance; such as graffiti, how homeless people have used the hut, children's play patterns over time, attempted theft of sensors, and how the playground is affected by heavy rain, freezing temperatures and lighting strikes. Ideas for follow up studies include how teenagers remember playing at the playground as small children, and to conduct interviews with the municipality representatives on opinions from them and the public during the lifespan of the playground. There is also a long term goal to follow the death of the playground installations, providing longitudinal insights from idea to demolition, stretching decades.

Value Transfer in Implementation: Public Interactive Art

In this ongoing innovation project a public real estate company, researchers, and a sustainability NGO work together to create meaningful meetings in a newly built city district. As part of the project, ideas were developed for a public outdoor interactive art installation. Design probes (fig 3) and prototypes (fig 4) were developed based on stakeholder input, and design values were mapped. For the next stage an artistic design group was contacted, to -based on the pre-work- design and deploy an artwork in the district (fig 5). As researchers we now focus on how values are transferred in this endeavor, throughout the whole process. Planned inauguration is in September 2025, to be followed by in-the-wild studies with special focus on looking beyond the novelty effect. We as researchers are also open to post-design reframing, to see what insights emerge from studying the installation during the coming years ahead.

Implementing Again and Again: Museum Quest Room

This project focus on escape room mechanics, adapting them to suit museums, though a concept Called Quest Room, which revolves around a central interactive panel, combined with a physical bulletin board, leading out to a collection of free-standing quests spread around the exhibition. A storytelling layer connects the quests in an overarching narrative.

Thus far three main iterations of Quest Rooms have been developed in our RtD projects. First a prototype exhibition was built and tested at the Swedish National Museum of Science and Technology (fig 6). Building on insights from the prototype, later a permanent exhibition was designed that has now been open to the public for 3 years (fig 7). At another museum, a castle history museum in another city, a third iteration of a quest room is being built, with planned inauguration in May 2025 (fig 8). A short paper has been published on the first iteration [1], and the third iteration has been presented in a position paper, and demoed as part of a workshop at NordiCHI [14, 19].

The first iteration utilized "passports" with rfid-chips that visitors used to interact with the physical/digital

Figure 6: Central panel for the first Quest Room iteration

Figure 7: Second iteration Quest Room. (note the phone functioning as central panel, and the chest in the back, opening when all puzzles are solved)

Figure 8: Third Iteration of a Quest Room: work in progress picture of the central panel and bulletin board.

central panel. In the second iteration an app was used as central panel. The third iteration goes back to a physical/digital panel, but tries to design away the need for the passports (fig 8). Creating new versions of designs, building on similar design implications, opens up for new insights, for instance regarding how transferable design values are into other settings, and to new stakeholders. For example, we found recurring needs to negotiate questions related to authenticity in the design. After inauguration of the third iteration we intend to do comparative studies of the two implemented Quest Rooms.

Conclusion

To conclude, with this position paper we want to present some of our experiences from being part of design research projects leading us through implementation and beyond, and to open up a discussion on different aspects of Research though Implementing Design, with its many opportunities, potential knowledge contributions, as well as its many pitfalls and challenges.

Being part of the whole implementation process for us researchers meant lots of re-evaluation, for instance changing or discarding design choices based praciticalities, and on input from the external stakeholders. Adhering to the time plans of the external stakeholders provided some challenges, but less so compared to the challenge of combining Research through Implementing Design with current research project structures, where new ideas tend to get funding, but revisiting old projects is hard to find resources for.

Reframing and emergence kept being important, also long after inauguration. Time became relevant in many unexpected ways, such as in the playground example through perspectives of how trees would grow up around and affect the installations, or for the public art installation - to what extent neighbors will grow tired of an installation sound over time. The sheer amount of robustness needed for installations to withstand time was staggering to us researchers, making many otherwise interesting design options unfeasible.

Aiming at implementation in our experience made the external stakeholders spend much more time with us researchers than in previous prototyping projects, with them being very engaged in what design choices were deemed acceptable and not, they became very active co-designers. This was not least visible in the Quest Room, where there was a huge difference in designerly freedom in relation to the museum between the first and second iteration, as the latter had to be shown to the public.

Unique contributions in the implementation phase, as shown from our examples, can include better understanding of stakeholder values, insights from in-the-wild studies, understand design choices in a real world setting, life-cycle studies, comparative studies between implementations, malleability features, graceful degradation and usage beyond the novelty effect. We argue that, especially for RtD, the possibilities of combining insights from early ideation, with studies of implementation and throughout the life-span of a design, has strong potential from a research perspective. We want to open up a discussion on challenges, possibilities and best practices for such Research though Implementing Design projects.

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