Human-centered Toolkit Design

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ABSTRACT

Human-computer interaction (HCI) is a tool-intensive domain. The multitude of perspectives yields a significant diversity in terms of processes, methods, and tools. Toolkits can support practitioners in selecting and applying appropriate tools for specific tasks. However, in order to be used effectively, toolkits must be designed well. Given the heterogeneous perspectives within the HCI community, we propose to start by differentiating between methodical and technical toolkits. Further, we argue for embracing human-centered design methods (methodical toolkits) to systematically develop high-quality (technical) toolkits. Finally, we focus on challenges and opportunities by presenting examples from many years of working on methodical toolkits for design and usability engineering. Our intention is to share research experiences on methodical toolkits and juxtapose it with the technical toolkit expertise of the workshop participants. Thus, we hope to steer the discussion towards a holistic understanding that promotes toolkits as a research method for HCI and, ideally, develop a tool-chain that supports the systematic design of high-quality technical toolkits.

Author Keywords

human-computer interaction; design; human-centered design; usability engineering; toolkits.

ACM Classification Keywords

D.2.2 Design Tools and Techniques

INTRODUCTION

Human-computer interaction brings together people from various backgrounds equipped with their very own processes, methods, and tools. Frankly, this can be blessing and curse at the same time. But we embrace the opportunities which arise from multidisciplinary collaboration more than we fear the possibility of failure.

Our approach towards researching, designing and evaluating interactive systems can be described as tool-supported human-centered design (HCD). While the principles of HCD are thoroughly described by the ISO standard [3] we want to shed light upon our concept of human-centered tool-support for the design of interactive systems. Most generally speaking, one needs the right tool at the right time for the job one seeks to accomplish. Given the vast number of methods and tools [16] within our domain, toolkits can be regarded as facilitators.

What is a toolkit in general and what is it for us?
Toolkits are capable of bridging the gap between concept design and full implementation by facilitating rapid prototyping and the exploration of novel designs without in-depth technical knowledge [5,10,15]. However, to make our point, we propose a differentiation between technical and methodological toolkits.

Technical toolkits are platforms for rapid prototyping comprising hardware and software building blocks.

Methodical toolkits are collections of methods together with information on when and how to apply them.

As with many terms we are concerned with (e.g. *design*) the term toolkit leaves ample room for interpretation. Since we like to bring a new perspective to the discussion, this differentiation seems somewhat necessary. Our goal is to find ways to systematically produce high-quality toolkits. To this end, we firstly need to establish a common ground for the discussion. This, we achieve by agreeing upon what a toolkit is and what is not (or should be or should not be) and how we go about designing toolkits. Taking this thought further, we state that both are inter-connected. Technical toolkits are the tools used by the users to create a specific outcome while methodical toolkits define the overall process of methods, for which technical toolkits need to be developed. They share common goals and should not be considered in isolation: *Speeding up the process while being easy-to-use; mitigating engineering challenges; lowering the entry bar for engagement; allowing to easily experiment, build and evaluate; improving the quality of the solution; improving interdisciplinary skills; creating a common understanding about the relevance of HCD while at the same time supporting the process with tools for its implementation.*

Why are we interested in toolkits?
Löwgren [7] reasonably distinguishes between engineering design and creative design. The former applies wherever the problem is comprehensively described and the mission is to find one solution to the problem. The latter is described as a tight interplay between problem setting and problem solving where the design space is explored via many parallel ideas and concepts. With each of the authors coming from opposing ends of this spectrum, our collaboration pursues a synthesis of both approaches on a methodical level. Our prime vehicle of scientific and methodical exchange is our shared interest in toolkits. More precisely, we are interested in toolkits as a research method for HCI. Following the research through design approach, we can state that communication among the HCI research and practice community relies heavily on research artifacts [18]. Building theses artifacts requires technical tools as well as, and this is important to us, process and method knowledge - hence our distinction between technical and methodical toolkits. Ideally, toolkits are collections of tools developed or curated by experts to put (experts and) non-experts in places where they can more easily create research artifacts without having to tediously learn highly specific skills.
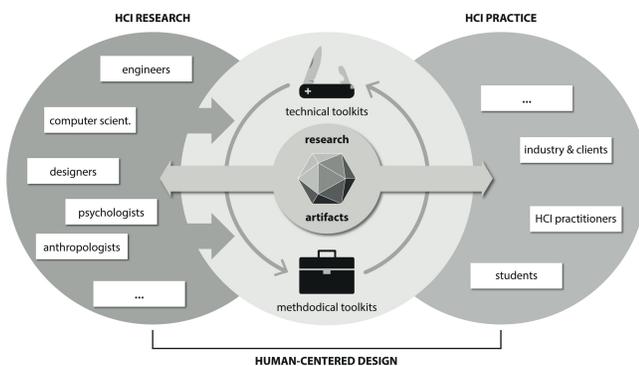

Figure 1 Tool-supported HCD

What is our contribution to the workshop topic?
We propose tool-supported HCD for the design of technical toolkits because ultimately, toolkits are interactive systems. Interactive systems must be designed with the user in focus. Therefore, toolkit designers should rely on established practices. In this regard, HCD appears to be the most suitable procedure to yield high-quality toolkits. Our intention is to share research experiences on methodical toolkits and juxtapose it with the technical toolkit expertise of the workshop participants. Thus, we hope to steer the discussion towards a holistic understanding that promotes toolkits as a research method for HCI. How this could unfold in practice is illustrated in Figure 1.

Why is our contribution relevant?
If we understand research artifacts as the primary entity of idea exchange in HCI, we can conclude that the ability to create such artifacts should not be exclusive to highly specialized experts. Having said this, the significance of toolkits as facilitators becomes apparent. However, effective facilitation requires solid toolkit design. We claim that the latter is most effectively achieved by applying appropriate human-centered methods to the development of technical toolkits as well as to the creation of any research artifact. Thus, actors of the HCI community may directly benefit from the work of colleagues with different backgrounds and skills by easily and correctly applying (or tailoring) their methods and tools. Toolkit design must consider the entire process of context of use, requirements, design and evaluation to produce high quality toolkits. In other words, there is a distinct need for thoroughly designed tool-chains which address the entire process. Following this proposal, we would enable the community to systematically and collaboratively produce high-quality research artifacts, which then serve to communicate ideas, attitudes and solutions to the practice community. Taking this thought even further, we could ultimately use these thoroughly designed toolkits, methodically and technically, in a participatory manner to actively create awareness for the HCI approach and support the establishment of HCD in e.g. organizational settings.

CHALLENGES AND OPPORTUNITIES

Challenge 1: Toolkits as a Research Method for HCI
Having engaged in toolkit design and evaluation ourselves we can state that building a path towards tool-supported research first and foremost assumes to overcome the lack of common language in terms of methods and tools among the HCI community. Often we find ourselves talking about the same activity or outcome but calling it by different names. This is certainly owed to historical disciplinary perspectives [13]. It is one of the reasons why we proposed the distinction between technical and methodical toolkits in the first place. By doing so we add complexity but we also clarify our standpoint. HCD offers a framework to systematically understand such different perspectives and should therefore be applied to toolkit design. It provides an opportunity to foster collaboration through understanding. Establishing such a common ground may result in great opportunities to push the envelope of the field. By emphasizing the interplay of process and artifacts can elevate our communication in terms of transparency, traceability and reproducibility with the goal of motivating and attracting e.g. students, business partners, and many more to adopt the human-centered mindset.

Challenge 2: Designing and Building Toolkits
Generally speaking, to design something of quality requires a clear and robust notion of the needs you want to satisfy and whom you are designing for. A standardized process for this is HCD ('engineering design' [7]). At the same time, HCD provides leeway for exploring design spaces in a more creative manner ('creative design' [7]). In a nutshell, it is a framework that offers guidance for design and development activities. However, it comes to live only through the people who apply it. This is also the reason why although standardized it is often applied incorrectly due to a

lack of knowledge or resources [13, 14]. Thoroughly designed toolkits could be a remedy. Hence, the challenge would be to find a way to systematically design high quality technical and methodical toolkits, which achieve the aforementioned goals. The opportunity in the context of this workshop could be to identify a tool-chain that may facilitate toolkit design.

Challenge 3: Methods for Evaluating Toolkits

Current attempts to evaluate toolkits comprise efforts to compare different toolkits with one another [17]. We would rather argue for a usability testing approach. Following this idea, when evaluating toolkits, we must focus on three aspects: *Quality of outcome for the toolkit's purpose (intended users, their tasks and intended outcome); but also, quality of outcome for the process, which may include more stakeholders (receiver of the outcome) than just the intended user; Chain of information. Input & output. To support the whole process of transformation of information in a holistic tool-driven approach.* During the workshop we want to discuss strategies to ensure and implement the testing perspective in toolkit design.

SUCCESSFUL TOOLKITS

In order to further elaborate on our proposed categorization, we present a number of toolkits for each category, technical, methodical and hybrid, that in our own experience worked well with clients and students alike.

Toolkit 1: Technical Toolkits

We present examples from our domain, which is predominantly concerned with software design and usability engineering. We focus on interface prototyping software that supports code-less prototyping of GUIs acknowledging recent developments towards a human-centered approach. These tools are quite often also used by non-experts (design or HCD). We chose two popular examples, *Axure* [2] and *Adobe XD* [1] to make our point. These products are relevant because both go beyond pixel design. *Adobe XD* and *Axure* have increasingly adopted a process approach, i.e they integrated features that support testing and collaboration as part of a coherent workflow. Both products do not only address the designer but whole teams. They inherently uphold usability and user experience practices. This can be considered a success in terms of human-centred tool design. However, they do not yet represent an entire tool-chain in the sense that we propose beforehand.

Toolkit 2: Methodical Toolkits

We present one example of a hands-on methodical toolkit which enhanced our educational work with students but did also contribute to designing our very own toolkit presented in the *Toolkit 3* part. *Sprint* [6] is a hands-on guide to the focused and effective application of the human-centered design approach in practice. It lays out how the *Google Ventures* team conducts design sprints as a consulting service for start-ups that struggle with developing their product. Essentially a design sprint is a five-day workshop,

a variation of commonly known design thinking workshops. Each day is dedicated to accomplishing another goal in the development process. Each step encompasses different methods which have to be performed in order to move to the next phase. Sprints are literally compressed versions of the HCD process. What makes it so interesting is that it delivers quick and tangible results. Participants spend a given amount of time working intensively on a specific task. At the end of this focused period of time they can see or experience the artifacts they created, a pile of sticky notes, paper prototypes, etc. This quality conveys a feeling of efficiency and satisfaction for everyone involved and fulfils all requirements of a valuable experience. In absence of scientific evaluation, we can only tell from our experience that the sprint format works. Methods such as *Crazy Eights* bear great potential for motivating people who are usually reluctant to pick up pen and paper. The combination of story-telling and detailed tutorials makes it easy to apply and tailor design sprints.

Toolkit 3: UX Method Toolkit

The *UX Method Toolkit* is the result of Henrik's master thesis [9]. For the most part it is a methodical toolkit which employs digital and analogue means to support HCD projects. It comprises 16 HCD methods. As a whole they constitute an entire HCD process. Most methods are suitable to be conducted during UX workshops with users unfamiliar with the methodology. The methods are represented as physical trading cards, digital method pages, and a database entry. All representations are interlinked. These artifacts are shipped in a sturdy briefcase emphasizing the physical presence and contributing to the overall user experience. The Toolkit provides multiple tools to navigate the collection and theoretically the domain itself. First, a visual selection tool – the method map – assigns the methods to phases. Second, QR codes link analogue and digital content. Third, an interactive infographic visualizes appropriate method sequences. These tools facilitate the application of the methods by providing video tutorials, print-able templates, and method-related metrics. This toolkit seeks to combine methodical and technical elements. It is an examination of the interplay of different toolkits within HCI. It is relevant in terms of *lessons learned*: *It is hard to systematically evaluate toolkits with users; talking about methods can be difficult due to a lack of common language; one cannot draw a clear border between disciplines; one has to get the why and how-to across as efficiently as possible.*

ABOUT THE AUTHORS

Henrik Mucha currently works as a research associate at the Institute Industrial IT (inIT) in Lemgo, Germany where he is part of the HCI Lab. Henrik holds degrees in Industrial Design (Dipl.-Des., University Duisburg-Essen) and Usability Engineering (M.Sc., Rhine-Waal University of Applied Sciences). His current work is concerned with human-machine interactions in industrial contexts [8]. His interest in toolkits is e.g. expressed by his master thesis *UX*

Method Toolkit: User Experience Methods for Human-centered Design Workshops [9]. Generally, Henrik's research and starting doctoral thesis revolve around the question of how design methodology and concepts such as UX can be applied to the design of industrial human-machine interactions. **Karsten Nebe** is full time professor for Usability Engineering and Digital Fabrication (since 2011) at the Rhine-Waal University of Applied Sciences, Faculty of Communication and Environment in Kamp-Lintfort, Germany. He was working as Usability Engineer since 2002 and did his doctoral thesis in the field of integrating usability engineering and software engineering [13]. He is head of the degree program "Usability Engineering, M.Sc." and an active member of various DIN, ISO/IEC working groups related to HCD. Since 2014 he is the director of the FabLab Kamp-Lintfort. (Expert member (besides others) in ISO/TC 159/SC 4/WG 28 (Joint between ISO/IEC JTC 1/SC 7 and ISO/TC 159/SC 4) Common Industry Formats for Usability Reports, and ISO/TC 159/SC 4/WG 6 Human-centred design processes for interactive systems).

SUGGESTIONS FOR TOPICS
- *Discussion of the proposal to 'understand' toolkits as a way to perform HCD in a tool-supported way (methodical and technical)*
- *Define the framework for chain of (future) tools*
- *Report on current developments in ISO committees with regards to toolkits*

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