

From Recipes to Meals... and Dietary Regimes: Method Mixes as Key Emerging Topic in Human-Centred Design

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ABSTRACT

Many argue that a decade-long crisis is crippling methods research in human-centred design (HCD). A recent paper critiques the widespread methods-as-recipe approach and suggests studying methods as part of HCD work; like in cooking, nobody cooks recipes, but they are used to bridge ingredients and meals. This paper extends that metaphor to dietary regimes that govern what meals are pursued. This focus shift expands the scope of relevant issues for methods research, thus creating a demand for open-ended and detailed case studies. Here we conducted a meta-review of five longstanding case studies that highlighted a key topic deserving attention: practitioners' method mixes should be taken seriously. Single-method use by a project, professional, or company happens rarely (in this data, never). Considering method mixes affects discussions of method validity and reliability. Even more importantly, it opens for consideration how method use in real-life HCD work differs from recipe development and validation.

Author Keywords

Human-centred design; user involvement; methods; routines; context; method mixes; strategy.

ACM Classification Keywords

H.5.3. Information interfaces and presentation (e.g., HCI): Group and Organization Interfaces.

INTRODUCTION

Few IT software projects succeed [34] and methods research on human-centred design (HCD) is in a decade-long crisis [7, 10, 38]. Key challenges include the ignoring of the messy reality of design practitioners and the subtle transformation of method comparison into a comparison of

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evaluation settings. Recent research has proposed that methods should be metaphorically understood as ingredients and meals, rather than straightforward recipes that can be applied independent of context and skills [38].

In this paper we are concerned with the current status of methods research in HCD and aim to develop it forward. Based on several detailed, well-structured and longstanding case studies, we conduct a meta-review of the method mixes in use in five organisations.

We extend the food metaphor from one project to concern multiple projects; that is, from a recipe for a particular meal to a diet for multiple meals. The analysis describes typical diets, such as method mixes in use by several organisations and projects and professionals within them, to support the research agenda of bringing back the empirical reality of HCD into its academic study [24, 38].

In the following, we outline the background of this scientific debate, proceed with details of five case studies and analyses, and turn to the observed method mixing and 'dietary regimes' in the cases. Finally some particularities of the method diets are noted and directions for future methods research are suggested.

BACKGROUND

Standish Group has researched the success and failure among IT projects for two decades and, based on data from approximately 90,000 cases, reports a low success rate of 39% (in 2012). A staggering 50% of features are hardly or never used, which indicates that resources are wasted on solving the wrong problems. Small projects have a 70% chance of success, whereas big projects (i.e., over 1 million) hardly have any chance at all. More interestingly, the amount of failed projects remains persistently high, at around 30% across the years, even as the amount of challenged projects seems to be slowly declining – offering some hope of future IT project success, again particularly in smaller projects [34].

When studying the underlying success factors, the Standish Group came to the conclusion that it is not the technical factors that are the problem. The top two critical factors were executive management support and user involvement,

while tools and infrastructure were at the bottom. Factors such as skilled resources, clear business objectives, process and project management were ranked in the middle. This ranking indicates that it is the relations between the development team and other stakeholders that are most critical.

Previous research on user involvement has indicated two challenges on a strategic level. First, there is a widespread ad hoc adoption of user involvement methods. Organisations underuse both their expertise and research results. Second, the methods research in this research field is in crisis and it has been so for more than a decade [7, 26, 27, 38]. This has resulted in biased methods resources and research that fails to help practitioners [5, 37].

Mainstream research on usability evaluation methods is a paradigmatic example of the method crisis. During the 1990s, a number of studies compared the effectiveness of the most-used usability evaluation methods: user testing, cognitive walkthrough, heuristic evaluation, guidelines, and expert review [4, 15, 20, 29, 30]. However, when Gray and Salzman examined the experiment setup in five major methods studies, they found small problems that added up and skewed the results significantly [7]. The results, published under the provoking title ‘Damaged Merchandise?’, contributed to a healthy debate in the field regarding research design and measurements of usability [31].

A second seminal study by Molich et al. [28] compared the performance of different usability evaluation labs by sending the same program for testing to four labs. When the researchers compared the resulting reports, they found very little overlap between the usability problems reported by the different teams. This made it evident that, while usability evaluation can provide sufficient information to support development, the results are difficult to reproduce and subject to evaluator effect [14]. In total, nine comparative usability evaluations (CUE) were made on websites, web apps and Windows programs. These studies raised debate on the established guidance on how many test participants are needed and the return on investment of different usability methods [e.g., 26, 27].

The basic agenda of usability and user experience remains sensible: Focus on use and users, measure design outcomes against goals, and iterate. Practitioners can make it work, given a sensible business case, suitable resources, access to users, and a skilled team of developers and evaluators. However, the methods research also fails practitioners since it often ignores the messy reality of usability and user experience practice. Woolrych et al. [38] argue that method comparisons often turn into a comparison of evaluation settings and that method mixing is ignored.

To remedy the method crisis in HCD, several initiatives have been launched. For instance, EU COST actions Mause (294) and Twintide (IC0904) were launched in 2005 and 2009 to harmonise research and practice on design and evaluation methodologies for computing artefacts [24].

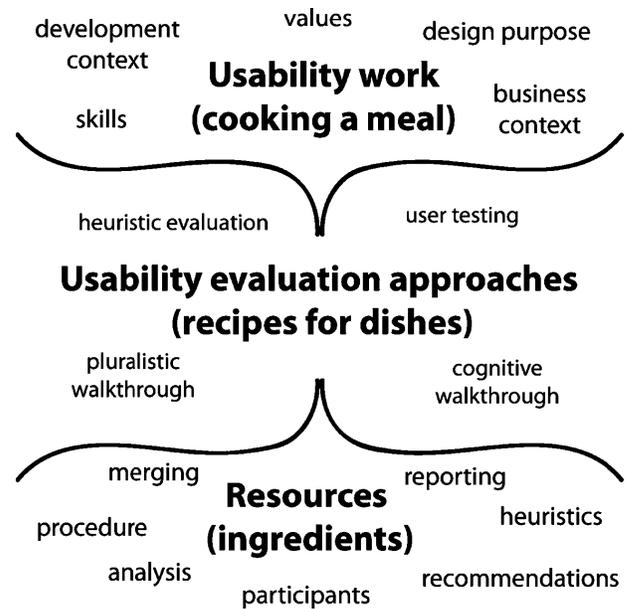


Figure 1. From Methods to Resources [37].

Woolrych et al. [38] sketch out a double-sided research agenda. On the one hand, methods research needs to dig deeper in to the variety of resources for design and evaluation (Figure 1). Based on prior research, they created a brief list of 15 factors concerning process details, such as report formats, data analysis procedures, and heuristic sets. Methods research needs to explore how these resources are adapted and configured by practitioners. On the other hand, methods research needs to focus on context and situations that shape how the above resources are combined. In particular, Woolrych et al. note the importance of the practitioners’ experience, design purpose and vision, and client needs and expectations, as well as problem prioritization criteria. They suggest that, rather than frowning at ‘the best evaluator effects are worthy of imitation’ [38:261].

The above research agenda would incorporate four steps: detailed and well-structured case studies, meta-reviews of these case studies, the construction of models based on credible generalisations, and fourth, if possible, positive objective knowledge, which so far has remained elusive in methods research in HCD.

METHOD MIXES AND DIETARY REGIMES

An important part of the agenda set by Woolrych et al. is to pay attention to the empirical fact that method recipes seldom, if ever, face the empirical realities alone and in isolation [38]. Practitioners combine and mix methods to get the job done and this is an important facet to note – validating a given method recipe is just part of the game. Hence, even if the usability merchandise was undamaged with respect to the recipes that were used, then the research focus should incorporate how different methods work together, complement and cross-validate each other. In Woolrych et al. terms, we should look at the set of recipes,

ingredients, and overall goals that are used to cook a given meal.

Based on our 15-year research program of real-life company deployment of user research methods, we could not agree more. We are yet to encounter a project or a project phase where a single method, as in a recipe, was alone used to deliver the knowledge on users and lead to design decisions. Practitioners are, by default, using multiple methods in combination, both in parallel and in sequence to achieve the project goals.

We further wish to draw attention to a facet of real-life HCD method use that we believe is essential in bringing (outside) reality back into (too academically introverted) HCD methods research. This is that the methods or method mixes are not planned, evaluated and chosen based on their inherent merits and validity *only*. In modern real-life ICT development method choices are based on a cumulation of insight about users and method deployment competence in the company [9, 13, 18, 21]. Companies do not appear to dumbly repeat the same enquiries and tests if they already possess roughly the needed information from previous projects. Further, enquiries on users and the methods that are used to study them are targeted to issues of strategic business relevance and to users that are deemed to have particular strategic relevance with regard to *business goals*—not, for instance, how representative these users are statistically of the whole of user base or with regards to other academic virtues of method deployment (sample size, generalizability, etc.).

Attention needs to be paid to why particular studies and particular methods are used in organisations; why the practitioners end up using them, and what they use them for—that is, what do they infer from them. To continue with Woolrych et al.’s metaphor of ingredients, recipes and meals, we extend the methods research envelope to point out how development organisations end up preparing particular kinds of HCD meals; in other words, that they have ‘dietary regimes’ by which practitioners and organisations get their jobs done in real-life settings. In discussing this level of method deployment, we extend Woolrych et al.’s [38] concept of ‘usability work’ to ‘human-centred design work’ to point to how practitioners use HCD methods as part of their going concerns.

In this paper we seek to establish 1) *that* method mixes are the prevailing reality, regardless of which layer of HCD we examine in real-life settings; be it at the company, project, release or single professional; 2) *that* how these method mixes come into being is not based on careful consideration each moment, but are influenced by knowledge generated by prior investigations, use of informal methods, and background skills of practitioners; in other words, the ‘meals’ are part of a specific ‘dietary regime’. In doing so, we link these empirical data to the extensive case study reports that are already published on *how* this happened in detail in each case, as we cannot imagine a way to condense 35 research

articles and four books into a ten-page description. The thrust of these linkages is that HCD method research may benefit from also examining the routinised, resource-based and strategic aspects of this work, even as it calls for new disciplinary resources into human–computer interaction (HCI). We shall now move to outline our research approach and then present two social media cases in greater depth, followed by shorter illustrations from three other cases.

META-REVIEW OF MULTIPLE CASES

Research Approach, Methodology and Data

The cases we draw from below have all adopted the biography of technologies and practices approach [8, 11, 13, 17, 32, 33]. The approach means deploying long-term investigation into the development of technology, as well as the practices of both developers and users related to it, as well as the influences of other stakeholders insofar as they are relevant. With regard to the development project, the changes in the material make-up, visions of its future states, and the business models are charted as a changing nexus throughout its development. The organisation of the design activities, collaborative network, knowledge base, company organisation, and size are mapped and linked to the biography of the project. The evolution of use of the technology is then enquired for an extended period of time; typically from the earliest ideas through the development of several launches or product versions. Other stakeholders are investigated insofar as they play a major role, but they are not given equal attention as developers and users.

The longitudinal follow-ups have, in practice, been realised by combining different research materials, all listed in Table 1. The main data types were semi-structured interviews, documents, and field observations. In the projects discussed in this paper, interviews were utilised to reconstruct the course of the innovation project prior to our entry, as well as to make periodical updates on events and actor perspectives. In all cases, we also had access to rich documentary material, both prior and after our entry. In many cases, first-hand field observations were also used.

In the document analysis, we followed the principles of historiographic source criticism [36]. Open coding of content was used to sort interviews [6]. For instance, in the WristMon study, we used ATLAS.ti, which led to 758 entries in 132 categories. The source criticism of documents and the initial interview analyses were complemented by

Case	Years	Intvw	Docs	Observation
TeenSoMe	1999-2010	24	~2400 p.	~100 visits
WristMon	1993-2007	95	~400 p.	120 site visits
TeachWeb	2009-	56	~300 p.	-
FloorMon	2005-	16	~150 p.	10 supp. data
MeTools	2014-	8	~100 p.	2

Table 1. Types and amounts of research materials per case.

data triangulation and across-method triangulation [3]. Interview data, such as informants' accounts of the development process and document sets, such as the series of business plans, were compared and cross-validated to complement one another. The above research provides us with a fair amount of confidence on the processes of design and methods use in the cases.

In these cases, we analyse user involvement methods, which include both design and evaluation methods, but also other methods of getting user feedback or other knowledge about users. We distinguish between formal and informal methods, where formal stands for established routines for documentation and knowledge transfer. With informal user involvement methods, we refer to practices where user involvement is not formally planned, sometimes as a part of other activities and where documentation, translation and communication of user knowledge for other stakeholders would require qualitative judgment and considerable effort. In this analysis, we also include as background resources our interviewees' references to prior user involvement that made a difference in the practices discussed.

Case 1: Social Media for Teenagers

TeenSoMe is one of the oldest and most popular social media services in which children and teenagers meet, socialize and play many types of games. Between 2003 and 2010, the service expanded from 4 localized hotels and 1 million monthly users to 11 language versions with 15 million monthly users from over 150 countries. Instead of an entrance or a monthly fee, the business model is free-to-play – revenue is based on micropayments and advertising in the hotel. In the early design, traditional pre-set game formats were avoided and, instead, players are encouraged to create their own objectives alongside chatting, room decoration and meeting friends. According to the developer company, most of the teenage players log on after school; on average they spend around 45 minutes per day in the hotel or on its related discussion forums.

Our data was gathered from both developers and users through a multi-method approach with varying intensities over eight years (2003–2010). These findings have been reported in detail in a PhD thesis [18]. The data collection methods include 24 interviews with TeenSoMe stakeholders (teenage/older users, user volunteers, game developers, community managers, business, R&D), a survey (N=10 000), company-to-community communication (21 issues of fanzines, 85 weekly letters, 60 news & press releases, 33 help pages), a wide variety of user-created online data (website archives of 23 fan websites, 17 hackers websites, 3400 discussion posts, and 20 h video from online participant observation), 122 articles in the main Finnish newspaper, and meetings and data comparison with third parties (youth workers, students, researchers).

The data analysis proceeded in multiple waves over the years. A survey provided quantitative information on the use of TeenSoMe. Analysis of texts written by users on

fansites explored different TeenSoMe consumption styles, popular activities and service history. The topics of the user interviews were their participation histories, changing motivations and meanings given to membership and reference groups in TeenSoMe. Taken together, these bodies of data provide us with an excellent view of the varying forms of interchange and dialogue between the users and developers of this social media service. This case is representative beyond its target group and games to social media in general because of similarities in the software business, group communication functionality and active user communities [16, 18].

Case 1: TeenSoMe Method Mixes

Let us zoom in to the development of TeenSoMe in the fall of 2005. Release 8 had just been launched, which introduced a new game inside the service, features related to the updated moderation policy, a simplified registration screen, some features for TeenSoMe club members, and a number of small fixes and incremental feature developments.

The game development team, which was around 15 people at the time, received release-specific user feedback from seven sources (Table 2). During the design of release 8, the new game was playability tested with users in a lab environment with video cameras. During the piloting of the whole release, a feedback questionnaire was used in the hotel country where the release was piloted for a month in advance. This questionnaire with 12 questions was developed for this feature, asking standard questions (please rate the feature, is the price right, is it easy to understand, and will you play it in the future), as well as four feature-specific questions. Moderators in different countries reported important issues to their community manager, who entered them into an internal issue management software service. The developers got statistics about feature use from the server logs and database via their in-house backend interface. In addition, some informal routines provided interested developers with more information. In the same way as users could, some developers logged in to the service to check how the feature was used and visited user-created forums to follow the forum discussion on the new features. Others in the organisation gave some feedback through informal discussions during spontaneous encounters, such as coffee breaks and hallway chats.

This feedback answered different questions. Game development needed to know if the new features were bug free, whereas marketing was interested in profiling the users based on feature use. A more strategic interest was to assess the new features' long-term impact on the service. However, at the time, there was little input to developers on their design during the actual design process, or it required expensive user recruitment for testing with users. For this reason, in the spring of 2006, the company recruited 200 volunteers from one country to act as a user panel. The online panel was given a weekly task consisting of a set of questions regarding design sketches and an opportunity to

Game Developers' Release-specific Method Mix, rel 8	
Formal methods	Playability test, release pilot questionnaire, internal bug reports, automated use statistics
Implemented results from prior studies	Usability test
Informal methods	Avatar activities, fansite discussions, internal discussions
Background resources	Official fanzine 2001-2003, market survey 2004, user segments Apr 2005, developers as users, e-mail feedback archive.

Table 2. TeenSoMe Method Mix 1.

share opinions regarding the sketches in a forum. The online panel was popular among developers, who queued to get design-time feedback from the users.

These release-specific feedback channels were supplemented by prior user feedback activities. Early in the service life cycle, the developers benefited from active users (e.g., immediate user feedback, user-created online forums and websites, user participation in service operations as volunteer moderators) and the developers were themselves deeply committed to the user communities (e.g., developers building the service for themselves and their friends, continuous informal engagement with users).

A few years after market launch, the developers' online presence became problematic for many reasons and more specialisation occurred in the development organisation, which implied that a decreasing part of the developers could be involved in the user communities. These changes made developer experience and in-house testing less adequate as arguments in quality discussions. With the international expansion emerged a need to know whether the user communities were similar or different in different hotel countries. An outsourced market survey in 2004 generated customer segments and their regional distribution. To prepare for the rapid international expansion that happened between 2004 and 2005, focus groups were

Country Operations Office Method Mix, 2006	
Formal methods	Weekly newsletter and polls, user questions from CRM-system, customer service calls, official fansite voting
Informal methods	Avatar activities, fansite discussions, internal discussions, volunteer forum discussions, summer meetings with users in real-life settings
Background resources	Market survey 2004, user segments Apr 2005, global youth survey 2006

Table 3. TeenSoMe Method Mix 2.

User Insight Method Mix 2009	
Formal methods	Focus groups, global user survey, data mining, automated surveys, user experience testing, personas (data-based)
Informal methods	Avatar activities, fansite discussions, internal discussions
Background resources	Global youth survey 2006, global youth survey 2008, other prior surveys and user segmentations

Table 4. TeenSoMe Method Mix 3.

conducted. The applicability of pixel-style graphics and use of colours were evaluated for the Asian market.

While game developers continued with the development of the technology behind the service, the company's policy during 2004 to 2010 was to establish a local operations office in each hotel country. This office was tightly involved with users, their parents, and advertising campaign customers. Table 3 lists their method mix.

Let us then move to practitioners whose main task was to understand users. In addition to game development and country operations, a team focused on understanding and analysing users emerged with the big user surveys. In 2010, this user insight team employed four people. Besides the manager, who had been doing the research for more than five years, one expert was tasked with data mining, another one focused on quantitative methods and a third professional conducted qualitative methods. The process of learning from surveys had been significantly developed with the aid of automation. Based on certain triggers—for instance, soon after becoming a TeenSoMe user, or within a few months, or after not being active for a while—users received a survey to answer. Approximately one hundred

Stage	User Involvement Routines, First Occurrence
Concept 1999–2000	Avatar activities, developers as users, informal evaluations, e-mail feedback, volunteers
Beta 2001–2003	Volunteer forum, weekly newsletters and polls, fansites, official fanzine, summer meetings, sales statistics, customer service
Expansion 2004–2005	Market survey, focus groups, usability evaluation, playability testing, CRM system, release pilots
Complexity 2006–2007	Online user panel, global youth survey, user and group homepages, tags
Competition 2008–2010	Data mining, automated surveys, user experience testing, personas

Table 5. First occurrences of user involvement routines by service evolution stage.

different surveys were in progress at any one moment. Table 4 lists this method mix.

Let us then examine TeenSoMe at the level of the whole company and service evolution. Table 5 summarises the observed user involvement routines and pinpoints their first occurrence to service evolution stages.

Prior method-use history shaped what was sensible and consequential method use—e.g., after the main contours of TeenSoMe had been usability evaluated, usability evaluations turned towards smaller details. Similarly, after overall user mappings, the following enquiries fine-tuned specific issues that remained open. This practice can be interpreted as a sensible, ongoing tailoring of methods that becomes necessary when dealing with complex and changing phenomena.

In addition to the accumulation of knowledge about users, the study found that the development organisation’s co-design practices were strategic. Users were involved differently as business focus changed from a ‘cool hangout online’ and typical usages, to catering for a changing target group (younger users and their parents), to cost-efficiency, multi-sided business, and global competition [18].

Case 2: Public Service Website for Teachers

TeachWeb (2007–2013) was an online service for teaching and learning purposes and focused mainly on teachers. The public service company developed it as an add-on to an educational TV program with history from the 1970s. As online demand grew, in 2009 a new development process started that resulted in an independent online learning resource for a broader public, here called TeachWeb2 (2013–).

This case started in 2009, as two of the authors facilitated the new service development through lead-user identification, interviews, and four workshops, together with the service development team, thus resulting in a novel online service concept. After this period of active intervention in the service design process in 2009–2010, the research continued with interviews. To date they have totalled 54, focusing on user involvement practices in different parts of the development organisation.

While doing these interviews on user involvement practices, we mapped the implementation of the service concept developed in the project, captured and recorded the different stages of the evolving new service concept, as well as the overall method use by practitioners and, more broadly, in other productions and professionals in the development organisation. Public reports (e.g., annual reports, financial statements) and documents concerning company internal communication regarding this service development (e.g. steering group memos, manuals, presentations) supplement the interviews.

Case 2: TeachWeb Method Mixes

In terms of resources, TeachWeb2 can be compared to the early stages of TeenSoMe, as around ten people have been

Service Development Method Mix 2009–2010	
Formal methods	User panel, lead-user interviews and workshops, online feedback form
Informal methods	Collaborative content production, field visits, informal discussions
Background resources	Public youth studies, prior teacher experience

Table 6. TeachWeb Method Mix 1.

actively engaged full-time with this service development. In 2009, when the website still was an add-on to the main TV program, some users were involved through their participation in content production, online feedback, and a user panel of about 100 teachers whose opinions were regularly polled. The service development team included members with prior teacher experience and who also participated in large annual networking events aimed to enable teachers to keep up with professional trends.

A nagging uncertainty about where the field was headed in terms of online education and emerging technical solutions resulted in the launch of lead-user involvement with the aim of identifying lead users, interviewing them and engaging them in service development through workshops. Table 6 outlines the method mix of 2009–2010.

While service development was fairly inactive in 2011, it restarted in 2012 after it achieved clarity in funding for the public service organization. A series of different user involvement methods were used (Table 7): Theme interviews with five teachers, an online focus group to discuss trends in education, and a beta version was released, which received user feedback. Internal feedback was summarised in a report and use statistics collected. The development also benefited from the prior engagement with lead users and a resulting service design concept with follow-up interviews through e-mail.

It is noteworthy here that some of the methods used in the TeachWeb method mixes were used, to a large extent, because they were available and familiar in the organisation. Some became a regular part of the TeachWeb ‘dietary

Service Development Method Mix 2012–2013	
Formal methods	Beta-user interviews, theme interviews, user survey, internal feedback report, online focus group, e-mail interviews, user panel, online feedback form, automated use statistics
Informal methods	Field visits, informal discussions, Facebook page interaction
Background resources	Lead-user study, technical feasibility study, national statistics, public youth studies, prior teacher experience

Table 7. TeachWeb Method Mix 2.

Producer (Culture and Entertainment) Method Mix 2014	
Formal methods	Program pilots combined with a focus group, email feedback, company feedback system, audience data/statistics, internal customer segmentation
Informal methods	Informal internal pilots, user interaction through program Facebook page, Twitter as part of content creation and user interaction, live audience feedback, interns (high school and B.Sc. students as a test audience), personal contacts as test audience, friends' media consumption
Background resources	International attitude survey, Youtube as trend resource, audience research, background research, benchmarking

Table 8. TeachWeb Organization Method Mix 3.

regime' because it was relatively easy to conduct them and it felt appropriate: User panel participation and online feedback was plentiful from teachers, for instance. Yet other methods became used because of strategic reasons. The lead-user study was commissioned by the head of the organisation and its head of strategy in order to trial the suitability of the method as part of the generic method resources available in the organisation. The method's use in TeachWeb owed to a practical fit between the need to redesign the service and the timing of commissioning.

The method mixes of particular projects are sensible to contrast to those by particular professionals. Table 8 depicts a mapping of a producer's method mix that was used in her productions. As we can see, it includes methods that are widely used in the organisation, such as focus groups, email feedback, audience data and internal customer segmentation, as well as equally widespread informal methods, such as social media use to solicit opinions from the audience, and informal pilots to assess colleagues' perspectives. The method mix further drew from an array of findings from earlier user research as a backbone, as did many other producers in the organisation. However, the method mix was not entirely routinised or standard; she had her own specific (mostly informal) ways of knowing her audience and the use of formal methods hinged on what information was already available.

Method Mixes in Three Other Cases

Having now described two social media applications in medium to large organisations in detail, let us turn to examining how the method mixes more briefly in other contexts. Let us first examine project-specific method mixes in two health care start-ups that provide ICT-based monitoring for the elderly.

The first case, WristMon, is a health monitoring system at its 2.0 version (described in detail in [13]), a health ICT

WristMon, Version 2.0 Developer Team in 2000 Method Mix	
Formal methods	Field visits to pilot customers, field testing at pilot customer location, heuristic usability evaluation, on-site iterative prototyping with users on interface details
Implemented results from prior studies	User-centred design study 1995-1996; pilot and feasibility studies 1998-2000
Informal methods	Discussions with customers and stakeholders, internal discussions.
Background resources	Market survey 1993; 1994, user-centred design study 1995-1996; pilot and feasibility study 1998-2000.

Table 9. WristMon Method Mix.

system developed in a small, 15-person start-up. Here the bulk of the knowledge was generated through earlier marketing, HCD studies and, particularly, through two years of pilot studies in real-life settings (Table 9). During the design process, formal methods were used mostly for tuning details with the exception of systems' new control software being iterated and tested more thoroughly.

In another health monitoring project, FloorMon, developed between 2006 and 2012, the method mix (Table 10) that was used was heavily influenced by the overall set-up, a living lab set at a healthcare facility and the gradual iterative development of the technology. This allowed the health care side project workers to use a suite of informal and background skills to inform hardware developers: their professional experience, current workplace experience and informal discussions. The formal methods that were used included participatory observation, regular biweekly meetings in which user experience was elaborated and the use of a feedback notebook to gain ideas from the involved staff [8].

The relative scarcity of formal methods in the start-ups is probably due to fewer resources, as well as the availability of HCD-related staff, not a diminished need or wish to gain insight on users and customers.

Health Monitoring Floor Application, Version 1.0 Project Workers at Living Lab Development 2010	
Formal methods	User experience meetings, participatory observation, Feedback notebook.
Implemented results from prior studies	-
Informal methods	Current workplace experience, informal hallway discussions
Background resources	Professional experience

Table 10. FloorMon Method Mix.

MeTools, Product Designer 2014	
Formal methods	Research ethnography: a combination of field observations, semi-structured interviews, video observation and stimulated recall, and research analysis workshops. Field usability tests at customer location
Implemented results from prior studies	Internal idea bank
Informal methods	Internal usability walkthroughs and tests with employees. Discussions with sales and customer support.
Background resources	Accumulated experience from previous studies and products in the same and other companies.

Table 11. MeTools Method Mix 1.

Let us finalise a review of the empirical material by examining the method mixes of individual professionals in a medium-sized metal tools manufacturer to contrast the social media and health ICT cases. In Finland, MeTools is known for its high user experience focus and the high maturity of its HCD. Table 11 shows the method mix of an individual professional in product design whose main source of HCD knowledge are the company's field ethnography research in which a mix of different HCD methods are routinely used over the course of weeks. Variations of usability tests at user locations and informally inside the company are also actively used, accompanied with personal experience and informal discussions with other staff.

A project manager (Table 12) participated in the same research ethnographies. This complemented accumulated product feedback and his experience from prior products.

These method mixes from the health ICT and metal tool cases provide us a view of the considerable variation that exists in how HCD methods are used in projects and professionals, but equally, how the mixing of formal and informal methods prevail as the norm, regardless of the context.

MeTools, Project Manager 2014	
Formal methods	Research ethnography. Separate semi-structured interviews.
Implemented results from prior studies	Product feedback analysis
Informal methods	Own experience
Background resources	Accumulated experience from previous studies and products in the same and other companies.

Table 12. MeTools Method Mix 2.

DISCUSSION

The method-as-recipe view of HCD and evaluation methods is under increasing reconsideration. Part of this reconsideration is to examine the relevant units of analysis in the methods research. This critique has precursors in ethnographic and ethnomethodological work in HCD [35], as well as in activity theory [12, 19, 22] and design research [1], which all argue that methods are, in fact, the means used for attaining broader objectives within design practices. Woolrych et al. [38] point to this aspect as that nobody cooks recipes but meals.

These streams of critique and research do not deny the value of recipe-like method descriptions—recipes are a useful way to communicate methods in everyday life or science [23, 25]. The concern lies in HCD having become detrimentally locked into method-recipe development and validation.

In the present paper, we have extended the unit of analysis of methods use in HCD based on richly documented real-life cases. Our data on Finnish companies' HCD practices lends support to the idea that *HCD work* does not equal applying a method recipe. Over a decade of these studies has taken place and we have *never* seen this happen outside academia.

Instead, what we have sought to demonstrate in the course of the current paper is that method mixing consistently takes place in the scope of real-life projects, in project teams, in individual practitioners' work, as well as at the level of whole companies. It is, thus, not an artefact of a particular analysis unit but, rather, a pervasive condition.

These are substantial reasons for why method mixes and 'dietary regimes' should be seen as an important emergent theme in HCD.

Considered from a traditional methods research perspective in HCI, increasing the ecological validity of method development and validation would hold:

- In method validation, we *also* need studies that look into synergies and gaps between commonly used method mixes, both in laboratory as well as in real-life projects.
- New methods and methods transfer may be best evaluated as parts of a larger portfolio, rather than by presumably providing information on their own. For instance, guidelines for method transfer [e.g., 2] needs to account for method mixes. Indeed, as the above data demonstrates, even the 'same' single method can be adequately used in varying extent and intensity in analysis, depending on what other methods and prior knowledge it is complemented with and the aim of its use.
- It may also be somewhat illusory (albeit proven to be good for consultancy business) to package methods into methodologies that supposedly work across a

range of contexts, products and user bases. It rather appears that even a methodology will be mixed and matched in the developer organisations by other means, and, hence, a more flexible approach to method complementarities may be beneficial from the outset.

For the design-oriented fraction of HCI and HCD, there is hardly any news in that methods are mixed in practice. However, how this mixing is practically accomplished and how adequate mixing could be supported remain among the topics to enquire further. Our studies underscore in particular

- That findings produced by methods are weighted against each other (HCD practitioners are quite intelligent) and also that they are combined and cross-pollinated in creative ways (and this is not limited to so-called creative methods).
- That it is, by now, a relatively rare occurrence that a company would be gaining a virgin look at its users through a (mix of) HCD method(s), but whatever findings the deployment of a given method produces, they become related to earlier studies as well as informal ways of knowing the users and customers. How to support the adequate assessment of different sources of information about users is a topic that merits further attention [11, 16].

These inference and decision-making processes as a part of design should be researched more, both within projects [13, 39] as well as between projects, in same development organisation.

Finally, our findings underscore that HCD work and the method mixing connected to it appears within real-life constraints and opportunities. Routine, extant competence and strategic considerations affect what methods and method mixes are deployed. Indeed, method mixing opens the door wider than just to method development; it calls for a shift of attention from method development to methods deployment.

- This means taking seriously that design is a part of business; that is, organisational and economic activity. The criteria that companies use in assessing the value of information include its strategic importance, timing, corporate factions, power play and so on.
- The companies will also position whatever new knowledge is produced within the already accumulated data and beliefs on users and customers [11].

This, in turn, calls for a new set of competences and, perhaps, new entrants as reference disciplines for HCI. The extant overlaps between HCI, computer-supported co-operative work and information systems research could perhaps be revitalised to a better effect in looking at how HCD is a part of changes in technology, work and organisation. Moving further out, research in organisation studies,

innovation research, entrepreneurship, as well as science and technology studies have all dealt for considerable time with how organisations renew themselves, how procedures and routines are enacted, and how strategic decisions and practices are carried out.

CONCLUSION

Instead of searching for a best method for HCD, we argue that more attention is needed on the different method mixes that characterise development over extended periods in the service life cycle. The impetus this finding has for HCD research is shifting the focus it holds for methods research. Concerning method development and validation, method mix agendas should feature design practices, the support, choice and inferences concerning method mixing and their findings presents an array of topics worthy of further research; with regard to method mixes happening in real-life organisations' new lines of enquiry on how and why HCD efforts and methods therein are used in the first instance. What is particularly clear to us is that, in educating practitioners, we need to teach them not only how to conduct particular methods as part of HCD work, but also how to choose and combine different ways to produce insight about users and customers in different settings. This is the reality of how they will be conducting their HCD work.

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REFERENCES

1. Cockton, G. Designing worth is worth designing. *Proc. NordiCHI*, ACM (2006), 165–174.
2. Cronholm, S., Neubauer, M., and Stary, C. Guiding situated method transfer in design and evaluation. *Univ Access Inf Soc*, (2013), 1–18.
3. Denzin, N.K. *The Research Act: A Theoretical Introduction to Sociological Methods*. Prentice Hall, Englewood Cliffs, N.J., 1989.
4. Desurvire, H., Kondziela, J., and Atwood, M.E. What is Gained and Lost when Using Methods Other Than Empirical Testing. *Posters and Short Talks CHI*, ACM (1992), 125–126.
5. Følstad, A., Law, E., and Hornbæk, K. Analysis in Practical Usability Evaluation: A Survey Study. *Proc. CHI*, ACM (2012), 2127–2136.
6. Glaser, B.G. and Strauss, A.L. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine, Chicago, 1967.
7. Gray, W.D. and Salzman, M.C. Damaged Merchandise? A Review of Experiments That Compare Usability Evaluation Methods. *Human-Computer Interaction 13*, 3 (1998), 203.
8. Hakkarainen, L. and Hyysalo, S. How Do We Keep the Living Laboratory Alive? Learning and Conflicts in Living Lab Collaboration. *Technology Innovation Management Review 3*, Dec (2013), 16–22.

9. Heiskanen, E. and Repo, P. User Involvement and Entrepreneurial Action. *Hum. Technol.* 3, 2 (2007), 167–187.
10. Hollingsed, T. and Novick, D.G. Usability inspection methods after 15 years of research and practice. *Proc. DOC, ACM* (2007), 249–255.
11. Hyysalo, S. and Johnson, M. The User as Relational Entity: Options that Deeper Insight into User Representations Opens for Human-Centered Design. *IT & People*, (in press).
12. Hyysalo, S. Some problems in the traditional approaches to predicting the use of a technology-driven invention. *Innovation* 16, 2 (2003), 117–137.
13. Hyysalo, S. *Health Technology Development and Use*. Routledge, New York, 2010.
14. Jacobsen, N.E., Hertzum, M., and John, B.E. The evaluator effect in usability tests. *Proc. CHI, ACM* (1998), 255–256.
15. Jeffries, R., Miller, J.R., Wharton, C., and Uyeda, K. User Interface Evaluation in the Real World: A Comparison of Four Techniques. *Proc. CHI, ACM* (1991), 119–124.
16. Johnson, M. and Hyysalo, S. Lessons for participatory designers of social media: long-term user involvement strategies in industry. *Proc. PDC, ACM* (2012), 71–80.
17. Johnson, M., Mozaffar, H., Campagnolo, G.M., Hyysalo, S., Pollock, N., and Williams, R. The managed prosumer: evolving knowledge strategies in the design of information infrastructures. *Inform Commun Soc* 17, 7 (2014), 795–813.
18. Johnson, M. *How social media changes user-centred design*. Doctoral dissertations, Aalto University, Finland, 2013.
19. Kaptelinin, V. and Nardi, B.A. *Acting with Technology*. MIT Press, 2006.
20. Karat, C.-M., Campbell, R., and Fiegel, T. Comparison of Empirical Testing and Walkthrough Methods in User Interface Evaluation. *Proc. CHI, ACM* (1992), 397–404.
21. Kotro, T. User Orientation Through Experience: A Study of Hobbyist Knowing in Product Development. *Hum. Technol.* 3, 2 (2007), 154–166.
22. Kuutti, K. Activity theory as a potential framework for human-computer interaction research. In B.A. Nardi, ed., *Context and Consciousness*. MIT Press, Cambridge, MA, USA, 1996, 17–44.
23. Latour, B. and Woolgar, S. *Laboratory life: the social construction of scientific facts*. Sage Publications, Beverly Hills, 1979.
24. Law, E.L.-C., Hvannberg, E., and Cockton, G. *Maturing Usability - Quality in Software, Interaction and Value*. Springer, 2008.
25. Lynch, M. *Art and Artifact in Laboratory Science: A Study of Shop Work and Shop Talk in a Research Laboratory*. Routledge & Kegan Paul, London, 1985.
26. Molich, R. and Dumas, J.S. Comparative usability evaluation (CUE-4). *Behav Inform Technol* 27, 3 (2008), 263–281.
27. Molich, R., Ede, M.R., Kaasgaard, K., and Karyukin, B. Comparative usability evaluation. *Behav Inform Technol* 23, (2004), 65–74.
28. Molich, R., Thomsen, A.D., Karyukina, B., Schmidt, L., Ede, M., van Oel, W., and Arcuri, M. Comparative evaluation of usability tests. *Proc. CHI EA, ACM* (1999), 83–84.
29. Nielsen, J. and Phillips, V.L. Estimating the Relative Usability of Two Interfaces: Heuristic, Formal, and Empirical Methods Compared. *Proc. INTERCHI, IOS Press* (1993), 214–221.
30. Nielsen, J. Finding Usability Problems Through Heuristic Evaluation. *Proc. CHI, ACM* (1992), 373–380.
31. Olson, G.M. and Moran, T.P. Introduction to This Special issue on Experimental Comparisons of Usability Evaluation Methods. *Human-Computer Interaction* 13, 3 (1998), 199–201.
32. Pollock, N. and Hyysalo, S. The Business of Being a User: The Role of the Reference Actor in Shaping Packaged Enterprise System Acquisition and Development. *MISQ* 38, 2 (2014), 473–496.
33. Pollock, N. and Williams, R. *Software and Organisations: The Biography of the Enterprise-Wide System or How SAP Conquered the World*. Routledge, London, 2008.
34. Standish Group. *Chaos Manifesto 2013: Think Big, Act Small*. 2013.
35. Szymanski, M.H. and Whalen, J., eds. *Making work visible: ethnographically grounded case studies of work practice*. Cambridge University Press, Cambridge, 2011.
36. Tosh, J. *The pursuit of history*. Longman, London, 1991.
37. Wixon, D. Evaluating usability methods: why the current literature fails the practitioner. *Interactions* 10, 4 (2003), 28–34.
38. Woolrych, A., Hornbæk, K., Frøkjær, E., and Cockton, G. Ingredients and Meals Rather Than Recipes: A Proposal for Research That Does Not Treat Usability Evaluation Methods as Indivisible Wholes. *IJHCI* 27, 10 (2011), 940–970.
39. Ylirisku, S. *Frame it simple! Towards a Theory of Conceptual Designing*. Aalto ARTS Books, Helsinki, Finland, 2013.