CMI working paper no. 14, 2016

Tensions between 'Design as Use', Service Design and ICT-Centric Services

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CMI Working Paper no. 14:

Jannick Kirk Sørensen (2015) *Tensions between 'Design as Use', Service Design and ICT-Centric Services*. AAU, Copenhagen

ISBN: 978-87-7152-096-5

This paper has been presented at the 35th WIRELESS WORLD RESEACH FORUM COPENHAGEN, DENMARK 14th-16th OCTOBER, 2015

Published by:
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Tensions between 'Design as Use', Service Design and ICT-centric services

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Abstract— **The question, which this paper examines as a very early and tentative question, is whether the process model for the relationship between users and designers, presented by [1], can be applied to understand the relationship between users and designers of ICT- and telecommunication infrastructure standards, e.g. 5G. Traditionally, user-centered design (UCD) approaches are being applied by researchers in this field e.g. through user scenarios, but is UCD the most precise category for the design processes actually taking place? Through the analysis of a scenario-based research for infrastructure requirements for wireless services in year 2020, the user scenarios method is being positioned on a continuum between 'observation-driven' (phenomenological approach) and 'idea-driven' (agenda-driven) constructions of users. Secondly, descriptions of respectively participatory design, non-intentional design and critical design are being examined for their potential contribution to an understanding of design processes taking place in ICT and telecom infrastructure development projects.**

Keywords—User Centered Design, Participatory Design, Non-intended design, Critical Design, telecommunication infrastructure design, scenarios, Wireless World Research Forum

I. INTRODUCTION

The innovation and design of new ICT technologies and services take place in a tension between knowing and assuming. In some cases solutions are developed for problems, which later have to found or constructed. In other cases the development of solutions address already identified or constructed user-needs. Where the first approach often meets criticism from user-centered design for being 'technology deterministic', the latter can be criticized for not being particularly visionary, neither from a service or a technology perspective.

Design decisions must be taken on behalf of future users and use situations. The uncertainty of the usefulness must be reduced to minimize the risks of wrong designs / solutions: Different types of user-involvement are traditionally applied in the development of end-user services and interfaces, but it is difficult to involve users in the development of generic technologies, such as telecommunication infrastructure standards. On the other hand is there a risk that the important user requirements – or more precisely: unidentified future potential uses and conditions for use – will be overseen if users are not involved in some way.

While the concept of user-centered design appears applicable on the design of ICT services that have well-defined end-users, distinct purposes and a 'tacit' expression as digital artifacts, e.g. with graphical user interfaces, it appears more challenging to apply user-centered design methods on the design of the underlying technical infrastructure that enables the ICT services: It is difficult to identify specific end-users and use-contexts, and it is difficult to make the potential design tacitly understandable for end-users, as the final design will consist of a set of standards and implementations, not any tangible or visual artifact. On the other hand, it is widely acknowledged that the design process, also in the case of infrastructure development, must be informed with requirements from the intended context for the future solution.

This paper applies this discussion on the case of the user-centered development of a new telecommunication infrastructure ("5th generation networks"), using an analytical framework that re-positions the traditional user-centered design approach in a bigger landscape of user – designer relations, indicating new ways for the conceptualization of the user – designer relationship in the case of development of large-scale telecommunication infrastructure.

II. RELATIONS BETWEEN DESIGN AND USE

Designers' biggest challenge is to anticipate the future use of the artifacts they design. Depending on the competition from other solutions, a wrong anticipation of the user needs may lead either - if the competition from similar solutions is high - to the lack of uptake and success of the designed artifact, or - if the competition is low - to unsatisfied users and possible low efficiency. But as the designers' profession is to make decisions on behalf of future users, the challenge is to qualify these decisions best possible. This produce the question how designers' construct the relationship to 'the users'. With mass-disseminated industrialized products the actual relation to all future users soon becomes impossible, meaning that users must be 'represented' or 'constructed' in some way.

If not only the representation of users is a problem, the representation of the design 'possibility space' [2] is a challenge, particularly if the design does not concern the

incremental improvement of an artifact but implies or presume a radical change of user behavior.

The discussion of this question can be informed by a recent PhD dissertation "Gebrauch als Design: Über eine unterschätzte Form der Gestaltung" [1]. The title could be translated to "Use as Design – about an underestimated art of Design". The purpose of the dissertation is to argue for a new approach to design that is less driven by the designers' intentions and more open the meaning the designed object gains through use. Bredies examines this through the users' interpretation- and sense-making processes of innovative interactive textile designs where purposes and functionalities (still) are very open for interpretation.

Although the research by [1] is located within the field of design research and has an experimental interactive physical product as object, it is relevant to discuss it in relation to the case of the user-centered design of telecommunication infrastructure because it exemplifies the situation where users' use of new technology has not yet stabilized into a fixed relationship between design and use. It exemplifies thus the tension between technology development as an open process, and design as a specific problem solving process. The question emerges if the claimed 'openness' of interpretations that she argues for also can be found in or applied on the development of new generic technologies? Does the technology contain certain interpretations that direct the possible use future of technologies? If the latter is the case, the question emerges: How can future uses then be anticipated? Furthermore we ask whether the generic ICT technology more open to "design through use" than specific ICT services, or is there a design-constraining rigidness embedded in the ICT-technology?

Bredies [1, pp. 50–64] depicts the user – designer relation in process of designing as two half circles. The left half-circle represents the designers' activities where as the right half-circle represents the users' activities. See also: [3]. The two half-circles are each divided into three sections. The design activities contain the three phases of analysis, projection and synthesis, where as the activities at the user side contains the three phases of adoption, appropriation and reuse (my translations). In a traditional pre-user-centered design understanding, the designer side and the user side would be isolated from each other. The phases on each side would not overlap. Bredies' work shows that these six phases shift, overlap or are located differently in the circle, when we look at user centered design, participatory design, non-intentional design and critical design.

The point of depicting the design – use relationship as a circle, is to highlight how different relations between users and designers results in different types of knowledge transfer: In user centered design the knowledge transfer is sequential: based on user-involvement designers produce an artifact that is presented to users. While using the artifact, users produce knowledge that can be incorporated in the next version – the next iteration – of the artifact. In participatory design the knowledge transfer is mutual and simultaneously. In non-intentional design there is little or no knowledge transfer, and in critical design the knowledge transfer is one-directional from designer (artists) to user (audience). It is however more than a knowledge transfer that takes place: the design process consists of phases of analysis, projection and synthesis, as well as the use process consists of phases of adoption, appropriation and reuse (my translation). Below we will summarize Bredies' analysis and expand it with a knowledge perspective.

A. User-centered design

If we look at user-centered design [4], [5] (or we could add contextual customer-centered design [6]) as a process, it is initiated by an analysis followed by a projection and a synthesis. The two first phases are entirely located at the 'designer-side' of the circle; only the synthesis phase has a small overlap to the appropriation at the use side. The relationship between designers and users is characterized by the dominance of the designers.

Unfortunately and ironically, user-centered design does not always leave much space for users: They are being described in the analysis phase maybe via interviews and observation, but also pure assumptions about their use of the production such as practiced in the methods of 'personas' and 'scenarios' [7]–[9] are possible. When designers have finished the analysis, its projection on the design material, and finally the synthesis in a design solution, this is presented to the users as a finished, closed, self-contained product. In user-centered design, users' actual influence on the product is limited. They must wait for the next version of the product, hoping that their appropriation and reuse of the solution is being observed and acknowledged by the designers of the next iteration.

B. Participatory design

In participatory design [10], [11], the users' role is conceived very different. The design process is seen as mutual learning process between designers and users and as a joint construction of both the design problem and its solution. The analysis part is thus halfway located into the use side of the circle, in the area of reuse. Also the synthesis part goes far into the 'use'-side of the circle: The synthesis of the design emerges (maybe) in the adoption and appropriation parts of the use side in the circle. The danger in this design-in-use approach is however the possible lack of consistency in the design decisions as well as the risk of errors.

C. Non-intentional design - bricolage

In non-intentional design [12], the professional designers play no role. The designed artifact is instead being used differently than planned or anticipated by the designers: the analysis, projection and the synthesis takes place on the use-side of the circle: The adoption is the analysis, the appropriation is the projection and reuse is the synthesis. The problem seen from the designers' point of view is to obtain insights into the non-intended use and collect the 'knowledge' generated by users, as this is not anticipated. Furthermore, characterizing the use as 'knowledge production' as the non-intended use only aims at solving specific users' local problems. There may not be much reflection, which could inform future design as the non-intentional design typically takes place as tacit non-verbal process that is not communicated to the designers.

D. Critical design

Finally, critical design [13] aims not necessarily at producing useful solutions, but sees itself as an artistic contribution to the debate about society, social interaction and technology. In contrast to user-centered design, the aim is not to reach consensus on a design solution, but instead to make users – and the general public – aware of long-established conventions. Here the designers' analytical work reaches deep into the use side of the circle, giving designers' the possibility to make a projection of the design. Compared to user-centered design, the room for deviating or unanticipated use is big, as the design activity is meant as an artistic expression.

III. The design and use process model applied on ICT infrastructure design

The type of design that is topic in [1] as well as much other design literature is the design of physical artifacts / products or the design of user interfaces for machines, electronic devices, and IT-systems. This understanding of design is shaped by the history design: As the industrialization replaced the craftsman and the individual manufacturing of products, the knowledge related to the physical shaping of products became an independent profession. In this process users and producers also became clearly separated, possibly without knowledge about each other. To compensate for the designers' lack of contextual knowledge that followed the large-scale industrial production, we have seen the emergence of different methods, techniques and approaches to represent the users' knowledge, e.g. with ICT development as research in Human Computer Interaction. Another approach we see with non-intentional design: simply leave the question of use as a black box.

The question, which this paper examines – as a very early and tentative question – is whether the analytical framework presented by [1] can be applied to understand the relationship between users and designers of ICT infrastructure standards, such telecommunication infrastructure standards, e.g. 5G. The question seems relevant to ask, as the designers (the engineers) of the ICT infrastructure standards may have even less exact and detailed knowledge about the future users than the designers of physical products. The 'target group' of the telecom infrastructure standards solution suggests seems to be both very narrow and very wide. It seems narrow since only a relatively small group of engineers and business people within the telecom and ICT industries will be using the standards for development of services for end-users. At the same time, the target group potentially consists of all human beings (and machines) that communicate in any way using communication technology that builds on the standards developed. The latter kind of target group reaches a size that in no longer operational. Still the lack of involvement of any kind of user risks to produce useless solutions. Finally, compared to the design and use of physical products and user interfaces, it is much more difficult to both represent or construct the problem and thus the solution to a level where the above presented phases of analysis, projection and synthesis makes sense on a low level, in the actual intended context.

We assume however that some interaction takes place between the 'design' part and the 'use' part of the circle also in the case of design of standards of telecommunication infrastructure. But which of the above models – if any – describes the interaction between design and use best? The intent of this paper is not present a full overview the design activities taking place in relation to 5G telecommunication development. The following is thus based on a limited examination of the design work, an examination that should be expanded in future research.

The case: User Scenorios 2020 – a worldwide wireless future

To inform an early discussion of the potentials in applying Bredies' process model [1, pp. 50–64] for the analysis of the design processes of ICT infrastructure standards, e.g. 5th generation mobile networks, we will look at one case of research informing this design process. In the continuation of our research more sources should be analyzed as well as design processes should be observed.

In the following we will concentrate on a publication [14], issued by World Wireless Research Forum. It is presented as an outlook with "Visions and research directions for the Wireless World", more specifically presenting "User scenarios 2020" for "a world wireless future". The method used is the "user-focused scenario" [14, p. 5],[15]. According to [15] summarized in [14], the purposes of the scenarios are "to provide ideas and identify, to explore different possibilities for use of future technologies and for developing new technologies and services".

The authors note that "[i]deally, the construction of user-centric scenarios would be based on direct involvement of users enforcing the principles of user-centric design by application of for example contextual design or participatory design" but they also state that "resources have not permitted this approach" [14, p. 7]. The absence of actual user-involvement is however no exception in user-centered design. The methods of 'personas' and 'scenarios' [7], [9] operate with fictitious users and use situations, although typically informed by customer research, marketing information and field work [7], or qualified through methods normally used within fiction writing and drama to create psychologically 'deep' characters [8], [9].

According to the Outlook "it was decided to construct the scenarios to represent the WWRF research interests and activities" [14, p. 8]. The scenarios presented in the Outlook are based on a method and process presented in [16]. The process, described in [16, p. 36] had four phases 1) literature review, survey of the state of the art, input from industry and research, 2) creation of a WWRF vision expressed in user scenarios with a high-level story line from respectively a private sphere, a work sphere and a public sphere. This fed into 3) the visions of the different WWRF working groups and special interest groups, which subsequently fed into 4) "Interface and integration of WG / SIG inputs, expressed as detailed scenario. The process seems thus very oriented towards consolidations inside the WWRF organization, and less oriented towards external users.

The reference scenarios that are the starting point for [14] have been thus developed based on input from all WWRF

working groups and special interest groups [16, p. 35]. It is acknowledged that "[t]o be interesting the situations and actions expressed in the scenarios have to be linked to real life situations and as 'stylized facts' be a representation of the environment relevant to the WWRF research areas. Therefore principles from user-centric design [17] have been applied." [16, p. 35]. Furthermore, "it was decided to use a more futuristic template for the scenario construction" [16, p. 35]. The futuristic template use is based on [18]. Furthermore trends as they were expected in 2003 for the mobile world in 2015 [19] informed the development of the reference scenarios.

It is in the Outlook mentioned that during the process of creating the scenarios "a long list of driving forces and fundamental drivers for the scenarios were derived" [14, p. 8]. Driving forces are defined in [16, p. 35] as "elements which move the plot of the scenario", whereas fundamental drivers are "elements which have a reasonably high probability of coming true in all scenarios", see also [18].

The authors of the Outlook mentions some examples of driving forces:

- "Developments will be more user driven
- User mobility will increase
- The service and application market will grow
- User security, integrity and privacy will become more important
- The market concentration in the wireless industry will change
- The fight for market dominance in the wireless industry will intensify
- Short terminal usage time and complexity management will become increasingly important problems" [14, p. 8]

Additional "driving forces and fundamental drivers" are presented in the annex of [14].

The authors of [16] indicate the tension between perspective of technology development and user interests: "Fundamentally, this approach [driving forces and fundamental drivers] means that the user-centric scenario writing will drive the process to identify system capabilities and specifications. However, an adaptation process between the two sides has to be introduced in order to ensure that technology visions (which may be different from user' expectations) can also be displayed" [16, p. 35].

Analysis: Scenarios as observation-driven or idea-driven

The "driving forces and fundamental drivers" are presented as covering "overall technology trends, social and user perspectives, and environmental and economic perspectives in the wireless world" [14, p. 8]. In this way they attempt to present a holistic picture of the anticipated use and its socio-economical and technological context. As the process for creating the scenarios is not explicitly described, it is difficult to follow the cause – effect relationship: Have the driving forces and fundamental drivers been discovered during or after writing the scenarios, or are the scenarios illustrations of already observed or assumed driving forces and fundamental drivers? This question is important for on which level the use-side of circle is constructed:

If the driving forces and fundamental drivers have been derived from detailed, well-researched narratives of persons who might be actual persons, the 'use-circle' is constructed on a low level that does not contain any presumptions about technology needs. The neutral observation of the 'reality' (here in a condensed, edited version), suggests that the scenario is made with a phenomenological approach to user-centered design. The 'reality' is just observed, and the details that are relevant for the elicitation are collected afterwards. We could characterize this approach as 'observation-driven'.

If – on the other hand – the scenarios have been constructed to illustrate already identified driving forces and fundamental drivers, we could call it a high level approach. Here the narrative may be constructed with specific ideas in mind, in this case those that have been identified as relevant to the research interests and activities, here of WWRF. We could position this approach in opposition to the phenomenological approach and characterize it as 'idea-driven'.

While this echoes a classic tension in science between inductive and deductive approaches, it is in the above-mentioned example a bit unclear, which approach that have been chosen. Now for the quality of the predictions made in the Outlook this may have an importance, but a more interesting question is how this positions the Outlook in the different types of relations between designers and users, as presented by [1].

Via the use of scenarios, the Outlook can formerly be characterized as user-centered design (UCD). UCD requires no actual involvement of users, but as the name indicates, UCD places users or representations of users 'in the center' of the design process. Practiced in this way, UCD is programmatic and arguably 'idea driven'. As users are constructions made or summarized by the designers, there is a built-in risk that UCD will produce design solutions that are more oriented towards the design teams' need (and the company's), than the actual users, see [20]. An attempt to meet this potential flaw is to construct personas that are extreme in their needs or in the affiliation with the product: e.g. drug-dealers or homeless people, cf.: [21]. Another strategy is to examine the values and motives that underpin the UCD-approach. Reference [22] questions whether UCD actually ethically can justify that it ensures the user's fundamental needs.

Testing ICT infrastructure design as user centered design

If we should locate the WWRF Outlook [14] with its future scenarios defined through high-level technical and societal objectives in the process model proposed by [1], the first observation we can make is that the object of the design – future telecommunication infrastructure standards – appears to be very far from anything that can be demonstrated to users today: The prerequisites are not only a technological infrastructure that has not been developed yet, and when

developed still will remain invisible to the end-users, but also a set of applications that have the new infrastructure as a precondition. What can be discussed are thus only functional ideas; proposed future solutions. In this way, it is correct to describe this work as user-centered, as this indicates a relative clear one-directedness from the designers to the users. In UCD the users are presented with a solution that one the one side builds on the analysis of information from or about users, but the analysis, projection and synthesis take place in the designers' part of the circle. Only in the adoption, users are partly invited to contribute to the synthesis of the product. The users' role is to wait for the product to be finished, then adopt it, appropriate it, and finally find reuses for it. These reuses can then become the inspiration for the next iteration.

When it comes to development telecom infrastructure standards, iterations are not that frequent. The process of developing, implementing and earning the invested money back has a slow pace. Iterations are referred to as 'generations', now currently the 5th generation of mobile telecom infrastructure is being discussed while the 1st generation (e.g. Nordic Mobile Telephony – NMT) was designed in 1970's, and launched publicly 1981 [23]. The subsequent generations followed in a faster pace, but compared to the speed of iterations of the ICT services running through the infrastructure, pace is slow.

It is thus basically a question of the iteration model of UCD can contribute with design insights for the development of telecommunication infrastructure: not only are iterations few but it is also difficult both to identify target groups as well as making the importance of the design decisions clear to users through actual examples of use. If we compare with the design process for a coffee pot or door handle, their tacit character makes it easy for the intended users to develop their opinion about the design suggestion. But when the design object is a set of technical standards the implications seems much more difficult for users to relate to. One can refer to fundamental common-sense requirements, such as those expressed in the "driving forces and fundamental drivers" above, but their status – their justification – in a real setting of users remain fragile.

TESTING ALTERNATIVE DESCRIPTIONS OF USER – DESIGNER RELATIONSHIPS FOR ICT INFRASTRUCTURE DESIGN

If the relation between designer and users in the case of development of telecommunication infrastructure cannot be clearly categorized as user-centered design, we can test it against the other categories suggested by [1].

A. Participatory design

If we look at the relation as participatory design, we notice that a central characteristic is the mutual learning process between designers and users. Here we are again confronted with the question about the users' identity: Who are the users actually? Is it the end-users (consumers) that one day is going to utilize the infrastructure, possibly without noticing that they are using a novel design since they may focus on the meaning of the content transmitted over the network, rather than the network itself? Or are 'the users' those professionals and those ICT-service companies that can utilize the improved or changed design to present improved services? In the latter case, the side-question emerges: How can they make qualified decisions regarding the future behavior of the users? It is however also possible to separate entirely the infrastructure level from the end-user level by ensuring that some basic end-user requirements, e.g. concerning price, stability, usability and privacy are fulfilled. Instead of seeing end-users as participants in the design process, it is possible to describe the ICT-service industry as the actual participants in the participatory design process. As with traditional participatory design, the danger may be that the mutual learning processes and the search for a common language and for consensus about decisions may slow down the design process.

B. Non-intentional design - Bricolage

To describe the development of telecommunication infrastructure standards as 'non-intentional design' might be inappropriate. Efforts made during the design work are big and discussions conducted during the design work are many, as well as the number of involved designers – engineers. Alone the time-span over which the design is developed makes the category 'non-intentional design' likely to be highly unsuitable. But the history of mobile communication can however present examples of end-users' non-indented, un-foreseen use of the technology. A classic example would here be the short message service (SMS).

The slow pace but big-impact of design decisions taken in a technical infrastructure development project, such as 5G may however justify the term 'non-intentional design': It is virtually impossible to foresee all possible consequences of the high-level design decisions taken in such a project, as the use context for the design is the entire world and since quick iteration cannot easily be conducted repair wrongly made assumptions about the users' needs or behavior.

By describing this kind of design work as 'non-intentional' it at first looks as if designers are evading their responsibility as planners (cf. Rittel and Webber's proposition about wicked problems that the planner has no right to be wrong and that every design is a one-shot operation [24]). But the characterization as non-intentional design helps explaining the freedom of appropriation and reuse that particularly characterizes an infrastructure. The number of constrains and limitations imposed on users by designers is small – the purpose of an infrastructure is to be a medium, not a message in itself, to paraphrase McLuhan [25].

If we see non-intentional design as an antithesis to user-centered design, we can also see how the aim of representing users (both end-users and commercial users / institutional users) becomes obsolete: The infrastructure will – in an evolutionary manner – find its use. An argument against this interpretation is that an infrastructure always has communicative properties: It will support or stimulate certain kinds of communicative activities and be less suitable or even block other activities. The design of the infrastructure properties must thus still be embedded in a societal – cultural context, as well as in the economical expressions of these through the structures of markets, regulations and institutions.

Another objection to the characterization as 'non-intentional design' is that this type of design – as described by [1] – not foresee any reflection or collection of knowledge: The inventions and innovations made by users as non-intended design are normally never communicated to the source of the original design, the professional designer. In this way, non-intentional design can be described as a very inefficient way of innovation. In the context of ICT-infrastructure design, the non-intentional design could be understood as the various ways which end-users use the infrastructure in an unanticipated way to solve actual and practical problems. This we could call 'the black box of actual use as sense-making'. Another type of non-intended design is the test of the robustness of the network by third parties (e.g. hackers) in terms of privacy, security, performance, and stability, which eventually intent to exploit design vulnerabilities.

C. *Critical design*

The last of the four types of user-designer relations discussed by [1] is critical design. As presented above, the purpose of critical design is typically not to solve problems but to provoke users to critical reflections, but more important to address an audience. It may thus be fair to characterize critical design as art, as the expected functionality of an object often is turned into 'para-functionality' (cf.: [13], [26]). A chair may send out light signals if stands close to strong electromagnetic energy or city map may display the use of different frequencies in different parts of the city [13]. The useful functionality of the design seems here replaced by an ambiguous artistic expression. The purpose here is thus obviously not to solve an actual problem, or to involve users in the solution, but to re-direct the audience' attention towards the societal and cultural conditions in which the technology participate, expresses or facilitates. The aim seems thus to create a critical reflective reasoning in the audience that questions the existing use of technology. But as other art, the purpose is not to produce answers but questions.

To describe the development of telecommunication infrastructure as 'critical design' seems odd, except if the new design intends to question established operations of mode and businesses in the field; if the new design becomes a 'game changer'. As we are discussing infrastructure that is, if not value-free, then very open for interpretation, it is difficult to see how specific intentions with the design – such as those embedded in critical design - should aim at raising the consumer's awareness of the value of the technology. A re-occurring problem for infrastructure networks is their transparency to the end-users. It makes it difficult to their value present to end-users (provided that the infrastructure works well) [27], a marketing strategy – however daring – is to use elements of 'critical design' in the marketing of networks, to make the technology present and valuable to users. It is however also with the critical design approach possible to see the development of ICT structure standards as a statement made, an expression to public containing a specific worldview. Here the critical dimension is less dominant, as a successful design strategy builds on consensus (which explicitly not the goal of traditional critical design). But the critical dimension exists as the design proposal argues for its raison d' Etre through a criticism of existing solutions, which will not be sufficient for the future demand of telecommunication.

IV. Conclusion

The analysis presented in this paper centers on testing alternative conceptualizations for the user – designer relationship in the development of ICT infrastructure standards and praxis. The very tentative analysis has shown that it is possible to understand what in this context is described as user-focused research not just as user-centered design, but also as participatory design, non-intentional design and to some extend as critical design.

More than using other terms to signify the same research method, the analysis indicates a potential in shifting the viewing angle for the conceptualization of the relation between users and designers in this special context. One suggestion, drawing on the tradition of participatory design is to see not the end-users but the ICT- service industry as co-designers. Another suggestion is with non-intentional design, to acknowledge the unpredictable effects of the high-level design-decisions being made. Finally, with critical design, one can see the design and development of a set of standards and practices for new ICT infrastructure as a statement made to the world, however possibly not with the same intent as in critical design.

Further research must be conducted to describe the design processes including the influence from user-related research on these and on the final result. The suggested alternative approaches to the user – designer relationship as suggested in participatory design, non-intentional design and critical design must examined more closely not only for the programmatic potential in changing the view on the user – designer relation, but also for the practical implications – e.g. techniques and methods from respectively participatory design, non-intentional design and critical design that can be translated and re-interpreted to the new context of the design of ICT infrastructure standards and practices.

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