Reflective Practice in the Digital Age

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Abstract. The digital transformation, in the form of rapid changes, increasing uncertainties and unique situations, poses new challenges to all industries. As a result, there is tremendous use of new techniques and methodologies in order to enable "non-designer" to design. However, professionals of the "non-designers"-fields do not have the same requirements as designers have to do design thinking. With this short paper we aim to set out a preliminary conceptual framework of reflective practice in design context. To answer the question we go back to the roots of the actual design thinking discourse and set out a preliminary conceptual framework on basis of "Reflective Practitioner – How professionals think in action" as common denominator.

Keywords: Reflective Practice, Reflective Practitioner, Reflection in Action, Reflection on Action, Design Thinking

1 Introduction

The digital transformation, in the form of rapid changes, increasing uncertainties and unique situations, poses new challenges to all industries. One challenge is the demand of permanent innovation, which is not based on standard transactional business processes but on creating and designing new products, services and strategies which are based on creativity (Müller-Wienbergen et al., 2011; Matt et al., 2015; Hess et al., 2016).

As a result, there is tremendous use of new techniques and methodologies in order to enable "non-designer" to design (Brown, 2008; Brown and Katz, 2011). E.g. the "design thinking-methodology". The paradigm helps to create user-oriented services and products. There is also a stream on how to apply design thinking principles on strategies and organizations "design strategy" (Ignatius, 2015)

and "change by design" (Brown and Katz, 2011), which is in line with the ideas of "managing as designing" (Boland and Collopy, 2004) and the idea of "science of the artificial" (Simon, 1967).

So, in order to progress we need to understand the commonalities and the differences in the underlying mechanisms of "how professionals think in action". This can be beneficial, because one critique is the practical orientation of common design thinking-approaches and that there is no explicit theory underlying in common design thinking-approaches (Schmiedgen et al., 2016). Is there a conceptual framework, which explains how professionals think in action? Such a framework can be helpful in order to identify possible connections and tailor-made applications of the design thinking method for different professions in practice.

To answer the question in further research, we go back to the roots of the actual design thinking discourse and set out a preliminary conceptual framework as common denominator. According to Johansson-Sköldberg et al. (2013) there is a discourse stream which is concerned with pragmatism epistemology what can help to gain insights for action, intervention and constructive knowledge (Goldkuhl, 2012). So Donald Schön – *Reflective Practitioner, How Professionals think in action* - is a first attempt of design discourse of designerly thinking in pragmatism paradigm (Johansson-Sköldberg et al., 2013).

With this short paper we aim to set out a preliminary conceptual framework of reflective practice in design context. Research question (RQ): *What is the framework of reflective practice in design context?* We want to derive the framework for ease of better understanding and ease of intervention in further research. To do so, we fist give an overview of Donald A. Schön's work *Reflective Practitioner - How Professionals Think in Action*. Secondly, we show the main dimensions of Reflection-in-Action in the case of an architect as an example for design context. Thirdly, we develop a framework. Fourthly, we make a proposal for further research.

2 Reflective Practice and the Ingredients

In order to understand the mechanism, we talk about Design Thinking – "the study of the cognitive processes that are manifested in design action" (Cross et al., 1992). With "Reflective Practitioner - How Professionals Think in Action", Schön has delivered a concept that describes situational thinking and action by practitioners (including architects). The concept consists of three parts (1) Knowing-in-Action (KiA), (2) Reflection-in-Action (RiA), (3) Reflection-on-Action (RoA). This serves as a basis for our framework of considerations.(Schön, 1983)[4]

2.1 Knowledge-in-Action

Knowledge – knowing-in-action – is of particular importance in practice for the following reasons. Professional practice has an element of repetition. The practitioner is often faced with repetitive tasks. The repetitions make his knowledge more and more specialized. This is accompanied by spontaneity, implicitness and automation. This helps to improve "processing economics" [ibid, p.60]. It also results in negative effects of knowing-in-action (described by Schön as knowing-in-practice), the so-called "overlearning" [ibid, p.60-61]. This manifest itself in an ever-increasing specialization, which can be avoided with the help of reflection-in-action in the following cases of overlearning: Blind spots: The high degree of specialization can result in a narrow view. This leads to the practitioner no longer perceiving problems outside his view as a problem. The practitioner no longer relates some phenomena to his area of responsibility. The practitioner loses sight of new phenomena that do not fit into his knowledge and ignores them. Fragmentation: Through specialization and "subcategorization", the big picture of a domain and its implicit knowledge can be lost. This relates to a specific knowledge about a problem, but interrelationship of phenomena (e.g. interdisciplinary problems) are ignored.

2.2 Reflection-in-Action

Although the practitioner in part consciously falls back on theories in everyday work, he is still dependent on his implicit perceptions, his ability to judge, and his skill [ibid, p.50]. His actions are often only unconsciously influenced by his "knowledge". In other places, however, his actions are shaped or enriched by conscious thinking and reflection. While he is acting, situations arise – sometimes ad hoc – in which he accesses his knowledge in the middle of the

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[4] The following sources are listed as page numbers in the text for ease of reading.

action [ibid, p.50]. This is expressed exemplarily in questions such as: "What features do I notice when I recognize this thing? What are the criteria by which I make this judgment? What procedures am I enacting when I perform this skill? How am I framing the problem that I am trying to solve?"

This is the central process of reflection-in-action, the way in which practitioners deal with situations of uncertainty, instability, uniqueness, and value conflicts [ibid, p.50]. It is not conscious thinking but a kind of heuristic through which the knowledge of the practitioner (knowledge-in-action) is applied. Schön describes this process as reflective conversation with a unique and uncertain situation. Below, we introduce two aspects that have a direct impact on the phenomenon of reflection-in-action (Timing, Modes). Timing: Reflection-in-action is generally limited in time. There is only a certain amount of time during which you can make a difference by making a decision about the action. This has something to do with timing. The timing depends on the nature of the task and the situation at hand and is related to the speed of the activity. Speed and timing are a limiting element of the phenomenon. Different domains have found different ways to deal with it [ibid, p.62]. Modes: The goal of reflection is often completely different. Norms and expectations, behavioural patterns (influenced by implicit strategies and theories), impressions of the situation and/or his self-image are further factors influencing the way in which reflection-in-action manifests itself.

Process: (1) The problem space is defined. There is a kind of dead end in which one gets stuck and/or has an unsatisfactory result at hand. Every practitioner understands his task as unique and has to define the problem to be solved as the first step (framing – "F" in figure 1). It is not about replicating standard solutions [ibid, p.129]. (2) The problem space is then reset - the "reframing" ("RF" in figure 1). The focal point is shifted away from the problem to a different focus of the situation and its variables. This can result in new design

possibilities. A practitioner succeeds in solving problems with a kind of craftsmanship. He succeeds in spontaneously and easily solving the difficulty and hopelessness posed by the complexity of a problem, which would unsettle a student or layperson [ibid, p.130]. (3) These will then be examined under the new problem space. It is a kind of experiment ("X" in figure 1) to enter into conversation with the situation. The practitioner succeeds in spontaneously comparing many solution variants and finding the best solution in his opinion without losing the flow [ibid, p.130].

Virtual Worlds: The experiments initially take place in a virtual world and serve as a context for the experiments [ibid, p.162]. The possibilities and abilities to influence virtual worlds are important characteristics of an architect and another facet of RiA [ibid, p.157]. Advantages of virtual worlds: The speed adjustment of RiA by means of drawing allows the architect to adjust the speed to his reflection. In this way, the architect can use it both ways in the design. On the one hand, he can draw a wall and test its effect on the ensemble much faster than in the real world. On the other hand, he can also pause to allow space for reflection-in-action in the flow of action [ibid, p.158]. Reversibility means that the practitioner can undo any "move". The quickly drawn idea of a wall can also be discarded just as quickly. This enables iterative loops and sequences of learning. And this without external restrictions, such as machine defects or similar environmental influences [ibid, p.158]. Restrictions: The repertoire of language makes it possible to study many phenomena. But it is also limited by the nature of graphic media. A good practitioner knows that drawings and representations cannot illustrate some things. This can only gain trust through experience [ibid, p.158]. The practitioner's experience influences the validity/reliability of virtual worlds. He must have wandered back and forth between building and drawing. An inexperienced architect therefore runs the risk

of not incorporating valid considerations into his reflection-in-action [ibid, p.159].

Experiment: The reflective conversation is a kind of experiment. However, it differs from the scientific experiment as we know it from research [ibid, p.143-146]. The biggest difference is objectivity with respect to the experiment [ibid, p.163]. The practitioner wants to influence the situation and therefore evaluates the situation according to the three features (1) solvability (Solvability), (2) coherence and intelligibility of the situation (Talk-back), (3) potential for further development of the situation and the conversation (Openness) [ibid, p.136]. Below, we will give a short introduction to these three features. Solvability: Even if an experiment of the practitioner cannot be evaluated on the basis of effectiveness, the practitioner must keep feasibility in mind when re-setting for "Reframing". An experienced practitioner always sets the new problem space in such a way that he feels he can solve the problem [ibid, p.134]. Talk-back: Talk-back with the situation arises and the practitioner thinks about it. Then the conversation is assessed by evaluating the direction in which the conversation is going. This judgement is at least partly based on his perception of coherence and congruence potentials, which he can realise through further investigation [ibid, p.135]. Openness: The openness of the architect is another dimension in the evaluation of the experiments. Within the framework of the experiment, the practitioner changes the problematic situation at hand without fully understanding the situation. In this way, he leaves room for something new and for unintended effects. These are then evaluated and answered with questions as to whether he likes it or not. In this way, new possibilities are discovered through conversation with the situation [ibid, p.134].

Experience: As the practitioner tries to solve a problem in a unique and unfamiliar situation, the question is how he succeeds in incorporating previous experiences. According to Schön, the practitioner brings in his experience in the form of a repertoire of examples, images, understandings and actions. When he faces a new situation with a problem to be solved, he sees both the unique and the equal (same and different features). He perceives the new problem as a variation on an old problem. On the other hand, there will also be moments in which he consciously compares the new situation with old situations and thus compares them in a reflective way [ibid, p.138-139]. Capability - "see-as" & "do-as": Decisive for the feeling of solving new problems where existing rules do not apply is the ability to see at unfamiliar situations as familiar ones and then judge them as if they were a familiar one. This enables practitioners to apply their experiences to new and unfamiliar cases. The quality of this ability – to use existing experiences in new, unique, and unknown situations – is reflected in the breadth and diversity of the repertoire. Through a feedback loop, each new experience will enrich the practitioner's repertoire [ibid, p.140].

Rigour: The necessary environmental conditions for a controlled experiment are very difficult or impossible to achieve in practice. In practice, the experiments are therefore rather nested [ibid, p.143]. In this sense, RiA is not an experiment. But, if one understands experiments more generically – "What if?" – then in practice there are different experiments that appear mixed up [ibid, p.145-146]. While research is only about pure understanding, the practitioner's overriding goal is to change the situation so that he likes it better than before and understanding the situation is only a means to an end [ibid, p.147]. The practitioner uses the hypothesis as a kind of imperative. He makes it "come true" and he tries to change the phenomenon he examines in the situation [ibid, p.149]. He thus breaks with all the rules that constitute a controlled experiment – objectivity and distance. While in research all biases (e.g. Hawthorne effect) should be eliminated [ibid, p.149], in practice they are more likely to be of use [ibid, p.63]. Transactional: Hypothesis testing in conversation with the situation is

neither self-fulfilling nor is it completely neutral. The practitioner's relationship with the situation is more transactional. He "manipulates" the situation but the situation, or rather the conversation with the situation, also influences him and his opinion and evaluation [ibid, p.150-151]. Stop: A crucial question is when to end the experiment. In research, the experiment is stopped as long as new theories can be introduced. In practice, it is about unintentionally finding something satisfying by (a) seeing something you like and (b) designing something that confers a new idea "as a whole" [ibid, p.150]. Appreciations: In practice, the primary goal is to generate an increase in value. Therefore, the practioner will stop as soon as a situation has been created that achieves an increase in value. Since there are other questions/issues regarding hypothesis testing that remain open and much can be investigated, hypothesis testing remains subordinate in practice/function [ibid, p.152].

Openenss: Conversely, practical experiments also have something that research experiments do not. The overriding intention is to change the situation. But, if the practitioner ignores the resistance against his intention to change, it becomes more of a self-fulfilling prophecy. Reflection on the situation is the goal [ibid, p.152].

Attidude: Objectivity towards the experiment influences the attitude towards the solution. How and where does the practitioner draw the boundaries between himself and the object/situation under investigation [ibid, p.163]? In contrast to the understanding of technical rationality, the practitioner becomes part of the situation and acts as a kind of agent/discoverer – which in turn influences the practitioners attitude. Thus, the attitude of the reflective practitioner is also shaped by a kind of "double vision" (two-headedness) [ibid, p.164]. On the one hand, it is about changing and adapting the situation but on the other hand it is also about keeping an openness for criticism of the situation. This is of course difficult with

increasing commitment and energy invested into altering the situation.

3   The Dimensions of Reflection in Action in Design - Architect

3.1   Design Domains

The design domains with which the architect works are names of elements, properties, relationships, actions, norms for assessing problems and solutions, consequences and effects [ibid, p.95-96]. Thus, all consequences that are evaluated by the architect from possible "traits" in the design thinking process come from the design domains that are available to the architect (repertoir). During the evaluation, the design domains fulfil a multitude of functions that can be divided into three areas. (1) descriptive functions, (2) constructive functions, and (3) normative functions. The effects and consequences often extend over several design domains, which only strengthens their significance [ibid, p. 98].

References: It is important for the architect to recognize references during the design thinking process and to understand their specific meaning in the new context. The references serve as a tool to use visions in all design domains. The importance of the design domains as a limiting framework is also evident when references are used. Repertoire of design domains, prioritization: Through prioritization, the repertoire of design domains experiences a further restriction. It is easy to imagine that the number of design domains the architect pays attention to has a strong influence on the design thinking process. The relative frequency of design domains serves as an indicator of the architect's attention and prioritization [ibid, p. 98].

Variation in priorities: How the architect prioritizes the individual design domains in design thinking is not static. Rather, it must be imagined that the architect "serves" different design domains depending on the status of the project (e.g. nothing at hand, first idea of

cubatur, nearly fixed floorplan) [ibid, p.103]. The priorities in the different planning phases of the architect are normative. Depending on the planning phase, the priorities must be set differently. At the beginning of a project certain domains are more important than others (e.g. costs have to be estimated very roughly or cannot be considered at all, whereas the use of the property becomes a central question at an early stage) [ibid, p. 98]. Different styles and "schools" also result from the different prioritization of the design domains [ibid, p. 103].

The dimension of the design domains has an enormous influence on the proposals the architect develops in design thinking. The design domains have a quantative effect on the variety of possibilities and thus evaluated variants. Only what lies within the repertoire of the architect can be considered as a possible solution. In the end, however, this quantitative factor is reflected as a qualitative property of the architect.

 "The practitioner has built up a repertoire of examples, images, understandings, and actions. Quist's repertoire ranges across the design domains. It includes sites he has seen, buildings he has known, design problems he has encountered, and solutions he has devised for them." [ibid, p. 138]

3.2   Implications

When you think about design thinking, you have to imagine the architect's thoughts as a whole network of possible "features". The consequences of each "move" have consequences for subsequent "moves". The web that the architect spins consists of further "features", consequences, effects, valuations. The effects can be partly expected from the architect and partly unexpected. From these unexpected effects, new possibilities arise for the overall idea [ibid, p. 94-95]. The design domains form the framework for action when the architect communicates the effects and their consequences in the form of words [ibid, p.95]. Communication often extends over several

design domains [ibid, p.95]. The evaluation of the effects takes place three times. (1) With regard to expediency. (2) In relation to previous intentions. (3) Based on the expected impacts [ibid, p.101].

Impact on what: The architect evaluates the impact in a way that creates the opportunity for change. He always does this against the background of different "disciplines". In other words, in terms of the effects his "move" has on exposure. Or against the background of the building organisation and the walkways made possible by the current floor plan. In some cases, however, there are also effects on a larger scale, such as the effects of its "trains" on border distances or distances from other buildings. Perhaps, however, it is precisely the effects of changes in the floor plan (which entails an increase in the building volume) on the building alignment, i.e. the building cubator in relation to the surrounding buildings. On a smaller scale, however, the decisions also have an impact on hiding places or the accessibility of rooms, parts of buildings or entire complexes. Elsewhere, however, the architect also evaluates the effects of his "traits" on the handling of existing buildings (e.g. appreciative, ignoring, neutral) [ibid, p.101]. Complexity: Because the network of "trains" has many branches, it becomes a great challenge for the architect within the network to discover new ideas and good solutions for his problem. In addition, it is aggravating that one must not only consider and evaluate a decision for the moment, but also the consequences for possible later decisions with different meanings and effects [ibid, p.100]. The architect addresses the problem of complexity and uncertainty by fixing assumptions and variables from time to time, thus simplifying the growing system of variables and uncertainty. The architect must make a binding decision from time to time (initially) in order to allow further investigation and not allow the system to become too complicated [ibid, p.100].

3.3   Shifts in Stance

Another dimension that can be seen in the architect's RiA is the ability to change one's own attitude towards one's own design ideas several times (very simplified: good policeman, bad policeman).

Can/might or should/must happen: In some situation the architect can leave decisions open with a certain non-binding character. This is not possible elsewhere. Then things are more binding and the architect regards them as a necessary condition [ibid, p.101]. Some "moves" have to be implemented in order to create further possibilities. The cubature of a building is often bound to the site and the boundaries. Here some "moves" have to be made. If you build in an existing building, there are often "moves" that arise and must be made. For example, if you decide to maintain an old development (e.g. staircase). Then there are liabilities which have to be "worked out".

Focusing unit/whole: Another change in the attitude that the architect makes in design thinking is the change of perspective between the unit and the whole, i.e. the overall idea of the design. This is reflected in a change of attitude from participation on the one hand and demarcation on the other. Participation manifests itself in the form of active design of small elements of the design, while demarcation manifests itself in the form of observation of the overall situation [ibid, p.101-102].

Tentative adoption / eventual commitment: The complexity and uncertainty in the network of "trains" requires a further change of attitude on the part of the architect. That manifests itself on the one hand in a very hesitant assumption, which is quickly rejected again and questioned, and on the other hand in a final commitment towards a "train", which is binding for further investigation. Especially with a large number of iterations, this is extremely necessary to make the investigation manageable.

4   Framework

We can identify three dimensions that are critical to the way a practitioner works. Design domains decide the architect will include in his considerations. The Design Domains form the action framework for the solution attempts and have a "limiting" characteristic. Due to the repertoire of design domains with which the architect goes into conversation, the WHAT of the possible solution is decisive. The implications have an influence on HOW the architect deals with possible solutions in the decision tree. The Implications no longer ensure that something is taken into account or not, but much more in what quality the considerations are carried out.
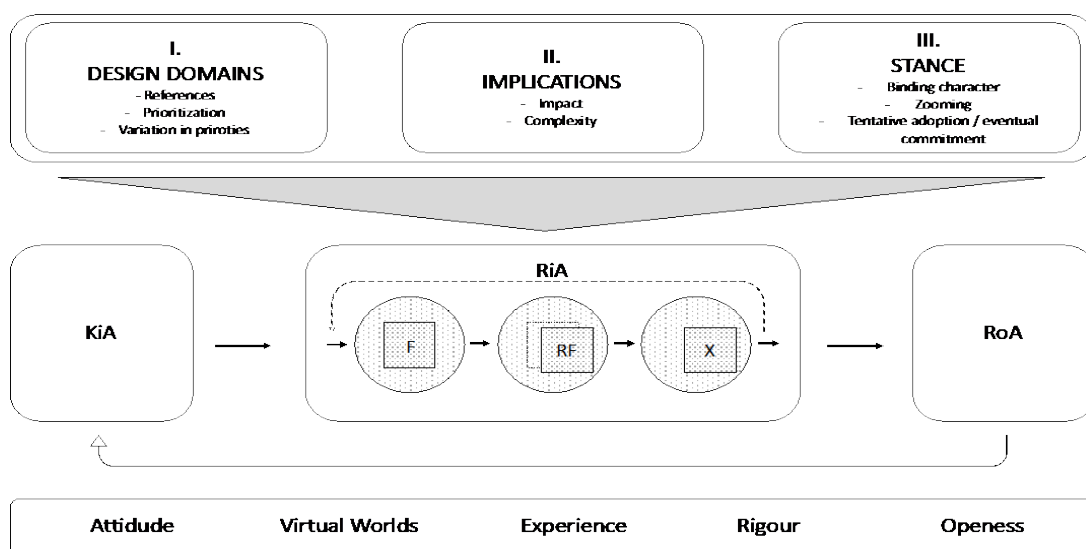

Figure 1. Framework of Reflecitve Practice

115

Stance towards the conversation with the situation is a kind of personal characteristic of the architect, HOW he is confronted with investigation. This is also a qualitative dimension. But more on the part of the architect and less easy to influence and implicit than the other two dimensions. New tools (VR, AR) make it easy to change perspective, both literally and figuratively. It can be possible to change the scale, but also to get away from the design.

5   Further Research

This purely conceptual framework shows possible starting points. However, the framework is only a preliminary orientation and a first attempt to better understand the creative problem-solving practices of practitioners.

As a next step, we propose to validate our framework. In order to do so, we will conduct design thinking-sessions (n=6). In three sessions the participants (n=8) are software-developers. The other sessions will be with participants (n=8) of the design-oriented practice (architects and industry designer (50%/50%). We suggest semi-structured interviews for further research to identify focal points within the framework at the beginning, in the middle and at the end of the session and validate the dimensions and process of framework.

With an iterative approach we will further develop our framework. So, after the first design thinking-sessions with designers and non-designers, we will revise the framework for next sessions.

The framework can help to understand which individuals` competencies and personal qualities do influence practical design thinking. That can help to gain insights on how to design systems that interact and collaborate between humans and robots (e.g. CSS) and how to adapt methodologies in order to make them more beneficial in the era of industry 5.0.

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