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RESEARCH ON DESIGN REFLECTION: OVERVIEW AND DIRECTIONS

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Abstract

Design reflection is getting increasing attention in design research, education, and practice. There are, however, a number of types of design reflection being studied, which differ in definition, goal, theoretical basis, and possible use. The same confusion about reflection on design processes occurs in practice and education, where terms like design reflection, design review, project evaluation, status report, and feedback session are mixed. As a result, it is unclear what has already been achieved and what are remaining questions for further research on design reflection. This paper gives an overview of the most important research results on design reflection and structures these according to the three types of design reflection distinguished by Schön, namely 'reflection-in-action', 'reflection-on-action', and 'reflection-on-practice'. As far as possible, characteristics of each type are described and similarities and differences between the three types are identified. Based on the created overview, directions for further research are indicated for each type and for their combination. The paper demands for more explicitness about type of reflection, proposes the development of a common understanding of each type, and encourages the development of different forms of support. This must help defining the possible contribution and benefits of each type in specific design situations in practice and education.

Keywords: reflective practice, experiential learning, type of design reflection, design management

1 Introduction

Design reflection is getting increasing attention in design research. Donald Schön made probably the first publication on this topic in the early eighties of the previous century [1]. Recent contributions are made by, for example, Badke-Schaub et al. [2,3,4], Lauche [5,6,7], Reymen [8], Stumpf and McDonell [9], and Valkenburg [10]. Also practitioners and educators show increasingly interest in design reflection. This may be due to its potential to improve the effectiveness and efficiency of design processes; it can help a design team learning from the design process and it is a promising instrument of design management. By reflecting, designers should be capable of modifying inadequate strategies and strengthen successful strategies, as stated in [3]; other authors make similar statements about the usefulness of reflection. The need for introducing reflection in engineering education (at universities and in companies) is also stated very often.

Currently, one can notice, however, the study of *a number of types of design reflection* which are not explicitly defined and which differ in goal, theoretical basis, and possible use. For example, some researchers mean by reflection 'individual reflection while designing', while others mean 'team reflection in specific reflection sessions'. Some research on design reflection is also based on theories from other disciplines like psychology, philosophy, and

management science. Differences in type of design reflection are also related to the perspective on the design process, which strongly influences the ideas on design reflection. The translation to design practice offers also some definition problems, given the differences between, for example, design reflection, design review, project evaluation, status report, and feedback session. All this makes unclear what has already been achieved with research related to design reflection, what are remaining questions, and how to continue in this relatively new field of study.

The objective of this paper is to structure the most important research results related to design reflection and to use this overview for defining main directions for further research. For achieving the objective, the author used her experiences in the field of design reflection and extended them with a literature study. An overview of literature on design reflection is given in Section 2. These results are structured in Section 3 according to some main types of design reflection. Possible directions for further research are discussed in Section 4.

2 Literature on design reflection

In the literature on reflection and designing, two streams can be recognised (with, however, also some overlap). These streams are related to the two paradigms recognised by Dorst [11]. The first stream can be classified in the tradition of 'reflective practice' (in the terms of Dorst) or 'experiential learning' (as called in [8]). This stream includes authors like Schon, Stumpf and McDonell, and Valkenburg. The second stream, with authors like Badke-Schaub et al., Lauche, and Reymen, mainly operates in the tradition of rational problem solving, and linked problem solving with learning and reflecting.

2.1 Design reflection: reflective-practice paradigm

Donald Schön [1,12, and improvements 13,14,15], is seen as the 'founding father' of literature on reflective practice in designing. Based on an observation of professionals, he deduced the following steps in design processes, called the mechanism of reflective practice: naming, framing, making a move, and evaluating. Schön sees designing as a 'reflective conversation with the situation': Designers work by naming the relevant factors in the situation, framing the problem in a certain way, making moves toward the solution, and evaluating those moves. Schön distinguished three types of reflection and explains them as follows (a more extensive description of the three types can be found in Section 3):

- '*reflection-in-action'* is reflecting in the midst of an action without interrupting it. Designers sometimes think about what they are doing in the midst of performing an act. When performance leads to surprise (when something fails to meet our expectations), pleasant or unpleasant, designers may respond by reflection-in-action: by thinking about what they are doing while doing it, in such a way as to influence further doing.
- '*reflection-on-action'* can take place after the fact in tranquillity or designers can pause in the midst of the action to make a "stop-and-think". In either case, the reflection has no direct connection to the present action. Designers can pause to think back over what they have done, exploring the understanding that they have brought to the handling of the task.
- '*reflection-on-practice'* includes surfacing and criticising tacit understandings that have grown up around repetitive experiences of designing. Examples are becoming aware of having fallen into an unfortunate pattern of design behaviour, such as "falling in love with an initial design idea".

Stumpf and McDonell [9] extended notions about individual reflective practice to account for team designing. The research is concerned with formulating an argumentative approach to

understanding the process of frame negotiation among the team. They detect frame shifts by focusing on rhetorical schemes as markers of reality construction. They see possibilities of supporting reflection-in-action and reflection-on-action by providing representations of what goes on during the design process. One of these representations can be a representation of 'frame rationale', which is based on the coding scheme they developed.

Valkenburg [10] extended the reflective practice theory to design projects. She observed the reflective-practice activities defined by Schön (naming, framing, moving, and reflecting) in team design projects. For this purpose, she developed a description method for team design activities and used it for describing the nature of team designing. She found patterns and large-scale strategies in the occurrence of reflective-practice activities. An outcome of the study are new roles for a project manager, namely that of frame coach, reflection guard, and move helper.

2.2 Design reflection: rational problem-solving paradigm

A German research group with psychologists and engineers developed a training method that intends to enable a designer, as individual and as member of a group, to reflect on his/her own design process. Literature on the studies performed by this group, including much background information on the concept of reflection in psychology, can be found in among others [2,3,4]. The research is based on a large descriptive study of team design processes in which the concept 'critical situation' was developed and many influencing factors of a design process and their interrelations were inventoried. The training uses among others a diary sheet and a critical-situation sheet.

Lauche [5,6,7] describes reflection as part of a (prescriptive) model including heedful action, reflection, and transfer. She combines quality management and psychological action theory about goal-directed behaviour with design research. She states that milestones in a design project could be used to go through a post-mortem analysis in the team (which can be part of a quality management system): the performed actions can be reviewed, visualised, evaluated, and transformed into actions to be taken.

In Reymen [8], reflection on a design process means an introspective contemplation on the designer's perception of the design situation and on the remembered design activities. This means it is an individual process and it evaluates the own thoughts and experiences. She describes a reflection process as a process that consists of three main activities that are called preparation, image forming, and conclusion drawing. She used this model to develop a first proposal of a prescriptive model that supports structured reflection on design processes and that integrates structured reflection in a design process. Structured reflection is defined as the combination of reflection that is performed on a regular basis during the design process and that is performed in a systematic way. She developed support for the preparation step of a systematic reflection process, consisting of checklists and forms to describe and analyse the design situation and design activities. To perform reflection regularly during a design process, she proposed to reflect at the beginning and end of a design session.

2.3 Related literature on reflection

The overview of literature on design reflection is complemented in this section with literature on reflection not specifically related to design processes, based on disciplines in social sciences. The results might be inspiring for research on design reflection. Related literature that misses in this section (because of time and space constraints) is the relation between *reflection and critical thinking*, based on philosophy.

Reflection and learning are related, as illustrated in the experiential learning cycle of Kolb [16], which includes the following steps: concrete experiences, observation and reflection, formation of abstract concepts and generalizations, and testing concepts in new situations. Kolb also inventoried different learning styles; each learning style focuses more on certain and less on the other activities in the experiential learning cycle. This means that some people pay less attention to reflection than others do. When people are aware of their learning style, they can correct their behaviour to balance the activities of the experiential learning cycle.

Reflection and managing/learning: Daudelin [17] analysed the relation between managing and reflecting. She found that reflection plays a key role in enabling managers to learn from experience. She defines reflection as the process of stepping back from an experience to ponder, carefully and persistently, its meaning to the self through the development of inferences. Learning is defined as the creation of meaning from past or current events that serves as a guide for future behaviour. She also described four stages of a reflection process, described characteristics of reflection, created support for reflection by managers, and included a very good selected bibliography on learning from experience in organisations, on the use of reflection in traditional education settings, and on the underlying mental processes that guide reflection and learning.

Reflection and teamwork: In [18], a temporally based framework and a taxonomy of team processes is given. They distinguish episodes in which teams are actively engaged in different types of taskwork at different phases of task accomplishment. Sometimes teams are focused on activities related directly to goal accomplishment, while at other times they are reflecting on past performance and planning future action. They refer to these different emphasises as “action” and “transition” phases.

Reflection and emotion: From a social-psychological point of view, reflection and emotion are related to each other. Rosenberg [19] illustrates that reflexivity (the process of an entity to act back upon itself) is a central feature of determining the nature of our emotions (emotional identification), of attempting to regulate their display (emotional display), and of seeking to control the experiences of these emotions by producing effects on our minds and on our bodies (emotional experience). Mills and Kleinman [20] describe a variety of ways in which people experience their thoughts and feelings. Their typology demonstrates four ways in which an individual may respond to a situation: reflexive and emotional, unreflexive and emotional, reflexive without feeling, and neither reflexive nor emotional. These studies evoke many questions when we apply them to the field of designing [21]. In [21], the authors advocate a balanced approach to design reflection in which both rationality and emotions play a role. They incorporate emotion in a reflection process by giving attention to the feelings of designers and stakeholders.

3 Types of design reflection

The three types of reflection distinguished by Donald Schön are used in this section for structuring the research on design reflection. These types correspond to the main types of design reflection found in the literature and they can offer a clear basis for reflection support. In doing so, one should note that the three types are ‘ideal’ types and that mixes of these types may occur. Existing descriptive and prescriptive results related to each type of design reflection are discussed for individual designers and design teams. I tried to define each type and to indicate its theoretical basis and its goal. I also tried to answer for each type the questions reflection by whom, when performing reflection, how long reflecting, on what must reflection concentrate, where reflection, how to perform reflection, and why reflection. These

questions are important when research aims at supporting designers and managers with design reflection. I based the description of the three types on the literature and on assumptions made based on implicit knowledge in the field. The section ends with a comparison of the three types.

3.1 Reflection-in-action

The first description of reflection-in-action is made by Schön [1], studying individual designers. An analysis and description of reflection-in-action in teams is performed by Stumpf et al. [9] and Valkenburg [10]. The description provides a basis for supporting reflection-in-action, although, not much support is developed yet. The studies have their *theoretical basis* in the literature of Schön, which they improved and extended. Also the theory of Kolb and argumentation theory (in the case of [9]) is used. Reflection-in-action can be *defined* as thinking about doing while doing it, in such a way as to influence further doing (based on [1]). The *goal* of reflection-in-action may be creating awareness of current doing in order to decide on the next activities. This can be done by answering questions like "What am I/are we doing (possibly in terms of naming, framing, moving)?" and "How is the design content developing?".

Who? Reflection-in-action can be performed by individuals while designing or the design team while designing as a team.
When? When a surprise occurs [1,9, 10]. Such a surprise may be a conflict between frames of individual designers [9,10].
How long? The protocol transcripts in [10] show a duration of reflection-in-action between 1 and 45 minutes, with an average of 9 minutes (these numbers may, however, not be representative).
On what? According to [10], designers (should) reflect on activities or on the current frame; according to [9], they (should) reflect on frames and frame shifts.
Where? Reflection-in-action is performed in the midst of the design experience. The reflection takes thus place where the designer or design team is designing at that moment.
How? Reflection-in-action can be performed with or without facilitator. The facilitator can be someone in the team or outside the team. An outsider can initiate a reflection process by introducing a surprise [9,10] or do some frame coaching [10]. A facilitator can also intervene in the reflection process, based on his/her observation of the reflection process and his/her experience. At the end of a reflection process, the facilitator can give feedback on the reflection process, to learn from it. However, for most reflection-in-action, no facilitator is involved. Another kind of support for reflection-in-action is using representations; for example, a representation of frame argumentation as proposed by [9]. For reflection-in-action, it is important to learn the skills how to recognise surprises and frame shifts and how to reflect on them. This learning process can best be practiced by doing, in special training sessions.
Why? Reflection-in-action is part of a learning process that aims at improving the micro-level design process (see Section 3.4).

3.2 Reflection-on-action

It was Donald Schön again who made the first description of reflection-on-action. Prescriptive results are developed by Badke-Schaub et al. [2,3,4] and Reymen [8] for individuals and by Badke et al. [2,3,4], Lauche [5,6,7], and Stumpf et al. [9] for teams. The *theoretical basis* of reflection-on-action may be the theory of Schön, Kolb, and some psychological, management, and design models. Reflection-on-action can be *defined* as thinking about doing after doing, in such a way as to influence further doing. The *goal* of reflection-on-action may be evaluating past and current design situations in order to adjust next situations. This can be done by

answering questions about the past like “What were critical situations?” and “What were factors influencing critical situations?” and about the current design situation like “Are the current design strategy and design methods appropriate for the problem?”, “Are the essential problems being solved or is time being waste on irrelevant aspects?”, and “Is the design answering the stakeholder concerns?”.

Who? Reflection-on-action can be performed by individual designers and by the design team, possibly with the help of a facilitator [5,6,7].
When? At the beginning and or end of a design session [8], at the end of a design phase/milestone [5], or at the end of the design task. It can also take place when the team got stuck [7] or when initiated by a facilitator [7].
How long? The duration of a reflection-on-action process may vary between about 15 minutes and some hours.
On what? According to [8], reflection-on-action should reflect on the current design situation and on the performed design activities. Stumpf et al. [9] propose to reflect on representations of the performed design process. Wallmeier et al. [4] propose to reflect on critical situations and their influencing factors.
Where? Reflection-on-action can take place where the designer or design team is working or somewhere else, what can facilitate ‘stepping out of the design process’.
How? Reflection-on-action can again take place with or without a facilitator, which is part of the team or an outsider. The facilitator can initiate the reflection process by indicating/planning a good moment for reflection, can intervene in the reflection process, and can give feedback on the reflection process. A reflection process can be performed following some steps, as proposed in [8]. In [8], preliminary checklists and reflection forms are also described to guide the reflection process. In [9], representations of frame argumentation as a guideline for reflection are proposed. These representations of the design process, made by the designers themselves or by outsiders, can be used to aid the reflection process and might also be useful as some kind of documentation of the design process. A strategy for reflection-on-action in design teams can be to perform reflection first by the individual designers and to discuss their reflection results then in the team. Training in skills to ask good questions for reflection may be helpful.
Why? Reflection-on-action is part of a learning process that aims at improving the macro-level design process.

3.3 Reflection-on-practice

Schön discussed reflection-on-practice briefly in [15]. The *basis theory* for reflection on practice may be Schön, Kolb, and literature on learning organisations. Reflection-on-practice can be *defined* as thinking about doing after repetitive doing, in such a way as to influence further doing. Reflection-on practice requires thus reflection that covers several design experiences, for example, several projects. The *goal* of reflection-on-practice may be discovering patterns of good and bad practices in order to influence next practices. This can be done by answering questions like “Which patterns in design activities (re)appear?”, “Which patterns in the team functioning (re)appear?”, “What are recurring neglected design aspects?”, “What are crucial patterns in interactions with stakeholders?”, and “What are critical patterns in the organisation of projects?”.

Who? Reflection-on-practice can be performed by individual designers, team designers, the design division, or the design organisation. Also the project or design manager and many stakeholders of the design process can participate in the reflection team. They can be helped by a facilitator.
When? At the end of a project or after a series of projects.

How long? A reflection-on-practice process may take some hours or even a whole day.
On what? Reflection-on-practice can reflect on the design process of one design project or on several design projects.
Where? Reflection-on-practice can be performed in the design department or somewhere else. The latter may help to take a distance from the design practice.
How? Reflection-on-practice can again be performed with or without facilitator. Given the number of participants of a reflection-on-practice process, a facilitator may increase the efficiency and effectiveness of the reflection process. Guidelines to perform a reflection-on-practice process must still be developed.
Why? Reflection-on-action is part of a learning process that aims at improving design projects.

3.4 Comparison

Some similarities and differences between the three types of design reflection are the following. A definition *common* for all three types of design reflection may be: Design reflection is reflection related to the design process in a broad sense, thinking about the design, design actions, designers, and design context, performed by individuals or teams, during or after the design process, in order to influence future design activities.

Table 1. Differences between the three types of design reflection.

Type of design reflection	*In action*	*On action*	*On practice*
Level	micro-level design process dynamics	macro-level design process dynamics	design project level dynamics
Focus of reflection	awareness of design cycle activities	evaluation of (critical) situations in design process	discovery of patterns in design projects
Most related to	designing	⟷	design management

The three types *differ* in the sense that they focus on three different levels of designing: micro-level design process dynamics, macro-level design process dynamics, and design-project level dynamics. The first two are related to the activities a designer carries out during designing; they are formulated in [9]. On the micro-level, reflection is part of the design cycle. Macro-level design process dynamics take place over the whole course of the design. Design project level dynamics is added to be able to categorise activities related to project organisation and planning. The focus of each type of design reflection is related to the level the reflection is performed on: the focus of reflection-on-action is on design cycle activities (micro level); on design situations in the design process in the case of the macro level; and on patterns in design projects in the case of the project level. As a result, the effect and consequences of each type of design reflection differs. As stated in [22], the different types are different means to learn from experience and can thus co-exist and may result in different learning experiences. We could say that reflection-in-action is most closely related to the activity of designing and reflection-on-practice is most closely related to design management. An overview of the differences between the three types of design reflection is given in Table 1.

4 Further research on design reflection

Based on the literature study and the description of the three types of design reflection, an overview of research on the three types of reflection is made and presented in Table 2. A distinction is made between descriptive research, prescriptive research, and research on the effect of design reflection. Between brackets, it is indicated whether individual designers (I)

or design teams (T) were studied. Blanks in the table indicate that no or few research on the topic is performed. This overview is used to indicate directions for further research.

Descriptive research can be split in research based on the observation of laboratory tasks and of 'real' design projects in practice. Valkenburg [10] and Stumpf et al. [9] based their results about reflection-in-action on a laboratory task of team designers. Schön described the three types of reflection based on his observations in practice. For *prescriptive studies*, a distinction can be made between the development of support and the validation and verification of the support (against some criteria). All mentioned authors developed support, but only Badke et al. [2,3,4] also validated and verified the support extensively. Prescriptive studies can also include the development of guidelines on how to train and educate designers with design reflection. A training method is proposed in [4]; a framework for reflective activities that students can perform in order to enhance their learning from engineering design experiences is given in [23]. The *effect of design reflection* can be studied in the case that reflection support is used and when no reflection support is used for improving the process of design reflection. Valkenburg [10] compared the performance of design teams reflecting-in-action with teams that did not. To my knowledge, no other studies looked explicitly at the effect of design reflection in practice (for example, in terms of consequences and implications). Many assumptions about the effect and usefulness of design reflection are, however, already made (see also Section 1).

Table 2. Overview of research on design reflection.

Research on design reflection	***In action***	***On action***	***On practice***
Descriptive research	Schön (I) Valkenburg (T) Stumph et al. (T)	Schön (I)	Schön (I)
Prescriptive research	Stumph et al. (T)	Badke et al. (I, T) Lauche (T) Reymen (I) Stumph et al. (T)	
Research on the effect of design reflection	Valkenburg (T)		

Further research on *reflection-in-action* can extend the descriptive results by taking into account the maturity of design teams (group development stages), leadership roles, and languages in a team, as proposed by Valkenburg [10]. Developing various ways for supporting reflection-in-action, based on a number of theoretical perspectives, and considering the effect of the support seems important. Further research on *reflection-on-action* can inventory in a large empirical study different forms of reflection-on-action performed in different situations in practice, by designers and design teams. Support should answer the questions by whom, when, how long, on what, where, how, and why reflection. Specific research questions are "When to reflect on which topics?" and "What attitudes are needed to perform reflection-on-action?". The prescriptive results must be validated and verified in different situations in practice and it must be indicated when the support can be used. Research on *reflection-on-practice* needs extension in descriptive and prescriptive studies, as well as in research that measures the effect of this type of reflection.

Besides the study of each type separately, it is also worth studying the *combination* of two or three types of design reflection. Interesting questions are: "Do the types occur together in practice?", "When supporting two or three types, what are efficient time intervals for each type of reflection?", "What can be said regarding the effectiveness of combined reflection

types?", and "Is the preference and effectiveness of a certain type of reflection related to the personality of the designer, to the composition of the design team, to the design situation, to the moment in the design process, and or to the type of design task?".

Because the three types of reflection are situated on three different levels and are being studied from different theoretical perspectives, and because research can be performed descriptive, prescriptive, and evaluative, different (new) research methods will be needed. Further collaboration with researchers from disciplines like design, (design) management, psychology, and philosophy that are interested in reflection research can be sought to set up joint (interdisciplinary) research programmes.

5 Conclusions

As stated in the introduction, design reflection is assumed to be important. It is however not yet clear what is the possible contribution and possible use of each type of design reflection to improving the effectiveness and efficiency of design processes in practice and design education. A first step to obtain a clearer picture of each type of design reflection is made in this paper by putting together results related to each type. By referring in future work explicitly to (one of) the three types of design reflection, some confusion about design reflection in research and practice can be taken away. Research should also further define the types. Studying each type from a number of perspectives can offer benefits in terms of obtaining a more complete picture. It can also start a fundamental discussion about the nature of design reflection. The development and testing of various forms of support needs further attention. Analysing the effect of each type, with and without using developed support, should result in defining explicitly the goal and possible use of each type in specific design situations in practice and education. This paper must be refined based on incompleteness's noticed by other authors and improved by the discussion it hopefully raises.

References

[1] Schön D., "The Reflective Practitioner: How Professionals Think in Action", Basic Books, New York, 1983.

[2] Badke-Schaub P., Wallmeier S. and Dörner D., "Training for Designers: A Way to Reflect Design Processes and Cope with Critical Situations in order to Increase Efficiency", Proceedings of ICED '99, Vol. 1, München, 1999, pp.205-210.

[3] Frankenberger E., Badke-Schaub P., (guest-eds. special issue) "Empirical Studies of Engineering Design in Germany", Design Studies, Vol. 20, Nr.5, 1999.

[4] Wallmeier S., Badke-Schaub P., Stempfle J. and Birkhofer H., "Empirical Diagnoses and Training in Design Departments", Proceedings of the Third International Symposium on Tools and Methods of Competitive Engineering, Delft, 2000, pp.439-450.

[5] Lauche K., "Qualitätshandeln in der Producktentwicklung. Theoretisches Modell, Analyseverfahren un Ergebnisse zu Förderungsmöglichkeiten", Ph.D. Thesis, Zurich, 2001.

[6] Lauche K., "Heedful Action, Reflection, and Transfer in the Design Process", Proceedings of ICED '01, Vol.1, Glasgow, 2001, pp.267-274.

[7] Lauche K., "Facilitating Creativity and Shared Understanding in Design Teams", Proceedings of International Design Conferences Design 2002, Dubrovnik, 2002, pp.823-828.

[8] Reymen, I., "Improving Design Processes through Structured Reflection: A Domain-independent Approach", Ph.D. thesis, Technische Universiteit Eindhoven, 2001.

[9] Stumpf S. and McDonell J., "Talking about Team Framing: Using Argumentation to Analyse and Support Experiential learning in early design episodes", Design Studies, Vol. 23, Nr. 1, 2002, pp.5-23.

[10] Valkenburg R., "The Reflective Practice in Product Design Teams", Ph.D. Thesis, Technische Universiteit Delft, 2000.

[11] Dorst C., "Describing Design: A Comparison of Paradigms", Ph.D. Thesis, Technische Universiteit Delft, 1999.

[12] Schön D., "Educating the Reflective Practitioner", Jossey-Bass, Oxford, 1990. (4th ed.)

[13] Schön D., Wiggins, G. "Kinds of Seeing and their Functions in Designing", Design Studies, Vol. 13, Nr. 2, 1992, pp.135-156.

[14] Schön D., "Frame Reflection", Basic Books, New York, 1994.

[15] Schön D. and Bennett J., "Reflective Conversation with Materials", Bringing Design to Software, Winograd T. (ed.), ACM Press, New York, 1996.

[16] Kolb D., "Experiential Learning", Prentice-Hall, London, 1984.

[17] Daudelin M., "Learning from Experience through Reflection", Organizational Dynamics, Vol. 24, Nr. 3, 1996, pp.36-48.

[18] Marks M. and Mathieu J., "A Temporally Based Framework and Taxonomy of Team Processes", The Academy of Management Review, Vol. 26, Nr. 3, 2001, pp.356-376.

[19] Roozenberg M., "Reflexivity and Emotions", Social Psychology Quarterly, Vol. 53 Nr.1, 1990, pp.3-12.

[20] Mills T. and Kleinman S., "Emotions, Reflexivity, and Action: An Interactionist Analysis", Social Forces, Vol. 66, Nr. 4, 1988, pp.1009-1027.

[21] Hammer D.K. and Reymen I.M.M.J., "The Role of Emotion in Design Reflection", Proceedings of the 3rd International Conference on Design and Emotion 2002, Loughborough, 2002. (to be published)

[22] Seibert K., "Reflection-in-action: Tools for Cultivating On-the-Job Learning Conditions", Organizational Dynamics, Vol. 27, Nr. 3, 1999, pp.54-65.

[23] Turns J., "An Activity Framework for Fostering Reflection in Project-based Engineering Design Classes", Proceedings of ICLS 96, 1998, pp.316-323.

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