

# **Individual Learning Styles and Perceptions of Experiential Learning in Design Teams**

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As part of reflective practice, reflection-in-action and reflection-on-action fulfil fundamental roles in designing. It has been suggested that, especially in teams, reflection-on-action plays a crucial role in overcoming instances when a team reflection-in-action process goes wrong. In this paper, it is considered how designers' reflection-on-action can be supported by design researchers in learning situations by providing descriptions that emphasise 'reflective practice'. A rich account is provided of how designers reflect-on-action using descriptions of learning styles and perceptions of the design process. Linkages between perceptions and learning styles are explored. Descriptions presented in this paper function as abstract conceptualisations and can be used by designers to make a connection to what went on in designing; these descriptions of designing encourage the transformation of knowledge.

**T**he design process seen as 'reflective practice' (Schön 1991) has been investigated both at the individual (Dorst 1997) and team level (Valkenburg 2000). As part of reflective practice, reflection-in-action and reflection-on-action fulfil fundamental roles in designing. Reflection-in-action in this respect concerns designers' on-the-spot reflective activities linked to concurrent action, whereas reflection-on-action denotes designers' reflection on a completed activity.

Whilst recent research into teams has mainly focussed on detailed reflection-in-action processes (Stumpf and McDonnell 1999, Valkenburg and Dorst 1999, Mazijoglou 2000), reflection-on-action has not gained as much attention. However, situations do arise when designers' reflection-in-action 'gets stuck'. It has been suggested that, especially in teams, reflection-on-action plays a crucial role in overcoming these instances when a team reflection-in-action process goes wrong (Schön 1987, Schön and Rein 1994). This paper discusses descriptions of team reflection-in-action and interaction that are used as a basis for reflection-on-action.

## **1. Reflection-in-action and reflection-on-action**

Reflection-in-action proceeds by a construction cycle of framing, naming, moving and reflecting. Framing and naming concern the problem-setting in that the designer constructs a problem out of a situation by naming the things to which she will pay attention whilst at the same time framing the way that the problem is viewed (Schön 1991). Framing in this sense imposes an order onto the problem; moves are made towards a solution in relation to how the situation is framed. However, the situation 'talks back'; surprise at the outcomes of moves leads to reflecting. Reflecting on outcomes may trigger either further moves or a new framing (Schön 1996). Reflection-in-action is not an interruption to fluid action; it is always embedded within action.

Reflection-on-action, on the other hand, draws on the experience of an action as a whole; it is a conscious 'stepping aside' to assess a situation. Yet, reflection-on-action may still make a difference to further acts of designing. Schön (1987) describes this as a 'ladder of reflection', where the designer climbs up from an activity to reflect on that activity and climb down from reflection-on-action to an activity that enacts what is learned through reflection.

There can be problems with designers' reflection-in-action. Team designing is particularly susceptible to frame conflicts (Rein and Schön 1993) and learning binds (Schön 1987). Frame conflicts stem from individuals' views of the problem: they see different things, they make different interpretations and support different solutions (Rein and Schön 1993). They have not achieved a team-frame that is a shared perspective towards the design problem. The communicative interactions through which frame conflict is effected may even result in the creation of a behavioural world that makes co-operative reflection-in-action impossible – designers have created a 'learning bind' (Schön 1987).

The resolution of these problems during reflection-in-action may be difficult for designers. Reflection-in-action is not a 'stop and think' activity (Schön 1996); it is seamlessly and fluidly contained in action. Hence, designers may not stop in the heat of the moment to take stock because this disrupts their design activity. Secondly, design teams may actually not be aware of frame conflict. The notions of framing and of frame conflict may not be available to them, since it is not part of a traditional conception of designing. Therefore, designers may feel that something is wrong, but may not be able to conceptualise what is wrong. Lastly, a learning bind has an impact on the behavioural world and the social interaction in a design team. It implies a shift from co-operation to contentiousness, from reciprocal reflection to conflict, which is difficult to resolve through further design activities.

Whilst the resolution of issues may be problematic during reflection-in-action, they may be addressed - through frame shift or

unbinding – by the use of reflection-on-action. In addition to reflecting on each other's framing of the design problem, it also behoves designers to reflect on their framing of what designing is and on the communicative interaction in which they are engaged that cloaks their reciprocal reflection. We are interested in improving awareness of framing and interaction by supporting design teams' reflection-on-action in learning situations.

## **2. Descriptions as a basis of reflection-on-action**

Descriptions of team reflection-in-action and interaction as they work on a design together can be made available to designers as a basis of reflection-on-action. Design researchers can play a part in this by presenting results of a particular team's design processes back to the design team as 'a kind of 'mirror' to focus attention on their background of interpretation, which is taken for granted, and the transparent routines of their everyday design work' (Glock 2000).

A descriptive representation is an abstraction that captures some aspect of designing. A descriptive representation consists of a selection of data arranged in a meaningful way for some purpose. This selection of data is not arbitrary; it is congruent with a design paradigm (Stumpf and McDonnell in press, Stumpf and McDonnell 2000). Representations are developed within a particular design paradigm. In particular, this paper addresses descriptive representations that emphasise 'reflective practice', ones which highlight the conception of designing as reflection-in-action, a particular team's reflection-in-action which may give rise to frame conflict and their communicative interaction which may create a learning bind.

In general, representations that are used for reflection-on-action need to take into account that designers need to find themselves in the description, endow representations with meaning and find relation to their experience (Glock 2000). Designers themselves need to agree with the descriptions; this is a major criterion of validity in qualitative research (Gee 1999). Representations in this sense also form a medium to learning by making things salient for the learner (Suthers 1999), guiding the learner in a certain direction. Awareness needs to be raised about aspects that are not obvious to designers; representations need to enable them to reflect on their implicit processes. It is not suggested that designing can be taught by providing descriptions alone. Reflection needs to be bound up in a continuing, reciprocal cycle of action to enable experiential learning (Kolb 1984).

## **3. Encouraging learning**

Experiential learning is 'the process whereby knowledge is created through the transformation of experience' (Kolb 1984). It can be distinguished from a traditional view of learning, which treats the

learner as a *tabula rasa* who acquires fixed concepts and the static relation between them (Locke 1964). In this traditional view, learning can be measured through outcomes, which consist of a change in the number of facts remembered. A behaviourist notion of learning can also be identified, in which skills are learned through conditioning (Atkinson *et al.* 1993). In this case, learned behaviour is measured through its resistance to change.

Reflection-on-action can be readily seen in terms of Kolb's characterisation of experiential learning. The experiential learning cycle comprises the modes of concrete experience (CE), reflective observation (RO), abstract conceptualisation (AC) and active experimentation (AE), as shown in Figure 1. Reflection-in-action also forms an instance of experiential learning in that it displays the modes of the learning cycle (Valkenburg 2000).

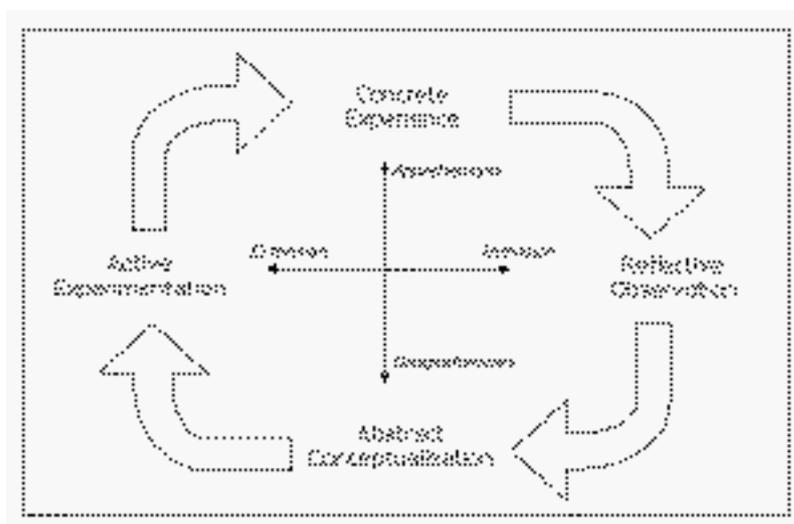


Figure 1. Learning Cycle (Kolb 1984)

Knowledge in this learning process is grasped through apprehension (A) of a concrete experience or through comprehension (C) of an abstract conceptualisation. Knowledge is transformed through intension (I) by reflective observation or through extension (E) by active experimentation. Hence, the transformation of a particular kind of knowledge can be described by a combination of these building blocks (indicated by  $\square$ ): A I, A E, C I, C E. The chaining of these elemental building blocks, e.g., A I C, form more powerful learning, i.e. the more elements that are involved in a learning exercise, the higher the level of learning (Kolb 1984). Encouraging experiential learning is therefore intricately linked to transformation of knowledge and the chaining of learning building blocks.

#### **4. Descriptions of 'reflective practice'**

The purposes of our work concern how descriptions function as abstract conceptualisations and are linked by designers to their concrete experiences as part of reflection-on-action. A set of descriptions are proposed and their use investigated through application in learning situations. It is not suggested that this set is complete; descriptions can be developed that capture other aspects of 'reflective practice'.

##### **4.1 Learning styles**

A characteristic of designing as reflective practice is that designers engage in learning: they transform knowledge through reflection-in-action and reflection-on-action. Kolb (1984) has suggested that individual learning styles characterise preferences for particular modes of experiential learning – concrete experience, reflective observation, abstract conceptualisation and active experimentation. The impact of individual learning styles has also been investigated in relation to group composition (Kolb 1991). Learning styles are related through the modes of learning of CE, RO, AC and AE with notions of feeling, watching, thinking and doing respectively. Hence, an orientation towards CE engenders a personality that values people and an intuitive, open-minded approach to life. A person disposed to RO learning places emphasis on meanings of situations and ideas, values different perspectives and considered judgements. Learners who prefer the AC mode like systematic planning and symbol manipulation within logic, ideas and concepts. They value precision and rigour. Finally, a person oriented towards the AE mode favours a pragmatic approach to applications and the value of seeing results.

The role of learning styles in our work is to firstly bring to designers' attention their preferred disposition to learning based on experience. This then helps to prime designers to pay attention to the way that they approach learning situations and the limitations of their pre-dispositions.

Secondly, this approach allows individual learning styles to be investigated in relation to prevalent team learning styles. Whilst a balance of learning styles within a team, expressed as an average over individual learning styles, is desirable to facilitate a broadened style of working (Kolb 1991), there can be problems. Differences in learning styles between team members can result in communication problems; prevalent learning styles in a team can sharpen individual deviation of working.

Honey and Mumford (1992) develop a learning style questionnaire that classifies people according to their learning styles. They structure learning styles around four archetypes: activists, reflectors, theorists and pragmatics; these correspond to an orientation to CE, RO, AC and AE respectively. Individuals incur scores for all learning style archetypes, resulting in a classification of very low

to very strong preference. Combinations of different learning styles can occur, as well as a domination of a particular learning style.

## 4.2 Perceptions

Reflection-in-action cannot be stated objectively, since each designer construes the design process based on individual *apprehension*, which is internal and inaccessible. What can be captured as a characteristic is an individual's *perception* of the design process, their *comprehensions*, which can be externalised. We are interested in highlighting perceptions that relate to a particular team's reflection-in-action which may give rise to frame conflict and their communicative interaction which may create a learning bind.

In the first instance, we are interested in the perception of *whether* a team-frame has been constructed, which relates to what we term the perception of *framing*. As indicators of the construction of a team-frame, we propose attention to the following aspects of team designing.

If a team-frame has been established the team will agree about the design concept to be developed as a solution. Designers will feel that perspectives are aligned if a team-frame has been established over a design session. Furthermore, terms used by team members will be perceived to be readily understandable to other group members because they have spent time negotiating the meaning and they function as keywords (Nothdurft 1996) in the team-frame. Characteristics of when a team-frame has not been established are the perception by a designer that a multiplicity of perspectives are in operation at the same time.

Secondly, we are interested in the perception of *how* the team-frame was constructed, which relates to what we term the perceptions of *perspective sharing*, *appreciation*, and *progress*. As indicators of the way that a team-frame was constructed, the following aspects of team designing are highlighted.

During the construction of a team-frame, individuals must perceive that, as frame convergence takes place, they have communicated their own perspective to the team openly and co-operatively and that other team members did so as well. As a result of a smooth construction process, team members will have the feeling that they 'work as one' and have made good progress designing the solution. Designers uncover what is important about the design and develop individual 'appreciation' through the construction process.

Lastly, we can investigate the communicative interaction. This relates to, in our sense, the perceptions of *persuasion* and *team process*.

We elicit these perceptions through a questionnaire that probes designers' experience of a particular design session. To describe what was going on in a team, a set of statements for each perception was developed (Table 1 over), which capture the indicators discussed

above. Each statement allows a designer to express his or her degree of agreement on a 5-point scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Statements related to particular perceptions are distributed over the questionnaire, so that no obvious clustering of the same perception occurs. To detect inconsistencies, negative pairs of statements are introduced. Ratings of agreement to statements are aggregated according to each perception. A score for each perception is calculated for each individual and team for each design session and represented graphically.

Table 1. Statements developed to elicit perceptions

<b>Perceptions</b>	<b>Statements</b>
Persuasion	'At times I felt I was being railroaded.' 'Sometimes I had the feeling that one of us persuaded us that we should adopt his/her particular solution for the design.'
Team Process	'I think we work well together as a group.' 'I feel there is tension within the group.'
Framing	'When other people in the group talk about the way the design should be, I understand what they mean immediately.' 'The group has changed their minds radically about what the design should be like during this session.' 'I don't understand what other people in the group mean when they talk about the design.' 'We all have the same view of what the design should be.' 'As a group we don't agree on what design to develop.' 'Some individuals in the group seem to have their own design ideas.' 'As a group we don't agree about what we need to do to accomplish the design.' 'I think other people in the group have a different perspective of what the design is.'
Perspective Sharing	'We discussed our design as a team extensively.' 'We all worked co-operatively on the coursework.' 'I try to tell the group how I see the design from my perspective.'
Appreciation	'I could justify how to design our prototype in different ways.' 'I could explain how we came up with the current idea of the design.' 'I can explain how the design ideas evolved.' 'I could give reasons why we are implementing the design the way we are.'
Progress	'I don't know what problems the design is supposed to address.' 'I can't explain why we are developing the design the way we are doing.' 'I feel that the group has made more progress in the current design session than in previous design sessions.' 'I understand better than when we started the session what the problems are that the design is supposed to solve.' 'I think the direction we are taking with the design is the right one.' 'I feel that the group has made substantial progress in the current design session.'

## **5. Learning situations**

Learning situations are situations in which designers are directed towards an engagement with design practice. We have investigated how descriptions function as abstract conceptualisations and are linked by designers to their concrete experiences; a rich account is presented of how descriptions are used by designers. Descriptions of learning styles and perceptions were used to encourage reflection-on-action in design team experiments, which function as learning situations. We now describe these experiments.

The experiments comprised a series of separate learning situations that involved a team. Initially, a team took part in a design exercise spanning three design sessions that engaged them in concrete experience. Once the design exercise had been completed, we held a learning tutorial with the design teams where learning styles and perceptions were presented as abstract conceptualisations, which were discussed with the design teams [1].

Two teams – Team 1 and Team 2– each consisting of up to four student designers were asked to carry out a co-operative design exercise and develop prototypes with a user (U) over three sessions. The designers were drawn from final year undergraduates studying User Centred Design as part of a BSc in Information Management, who volunteered to conduct their design sessions under observation. The design task concerned a scenario in which they were to design an order-delivery system for a pizza company, choosing either an external or an internal focus.

The three design sessions with the user, each lasting 45 minutes, were spaced over three weeks with a gap of at least six days between each design session. It was left up to the teams to structure and plan their activities over the three sessions. Before each session, 15 minutes were spent to brief the team. Before the first design session, participants were asked to complete a learning style questionnaire. The sessions concluded with a 15-minute slot during which the teams were asked to fill in a perception questionnaire. The perception questionnaire aimed to elicit individual perceptions about designers' interaction and design activities during the design session, out of which descriptions in a graphical form were constructed.

The team and user met in a room set up by the experimenter. A video camera was set up which allowed the design sessions to be recorded. The designing was observed by the experimenter who could take down additional notes and deal with any technical problems that arose. The experimenter did not participate in any team design activities.

## 6. An account of using descriptions for reflection-on-action

### 6.1 Learning styles

Learning styles questionnaires were completed by participants before the start of the first design session. Additionally, team averages for learning styles were calculated. To this end, each user was analysed in terms of individual learning style and the scores used to compute a team learning style average. The results of the analysis were presented to and discussed with design teams in the learning tutorial.

Team 1 consisted of four individuals (H, K, S and U), including the user. Three out of the four team members were very strong Activists and scored low or moderately on the other learning modes (Table 2). One of the team, participant K, formed a counterpoint to the rest of the team by being a strong Reflector and Theorist.

Table 2. Summary of Team 1 learning styles

	Activist	Reflector	Theorist	Pragmatist
U	Very Strong	Low	Low	Low
H	Very Strong	Moderate	Low	Moderate
K	Moderate	Strong	Strong	Moderate
S	Very Strong	Low	Very Low	Low
Team Average	Very Strong	Moderate	Low	Moderate

The average of Team 1's learning styles indicators was hence strongly biased towards the Activist learning style (Figure 2).

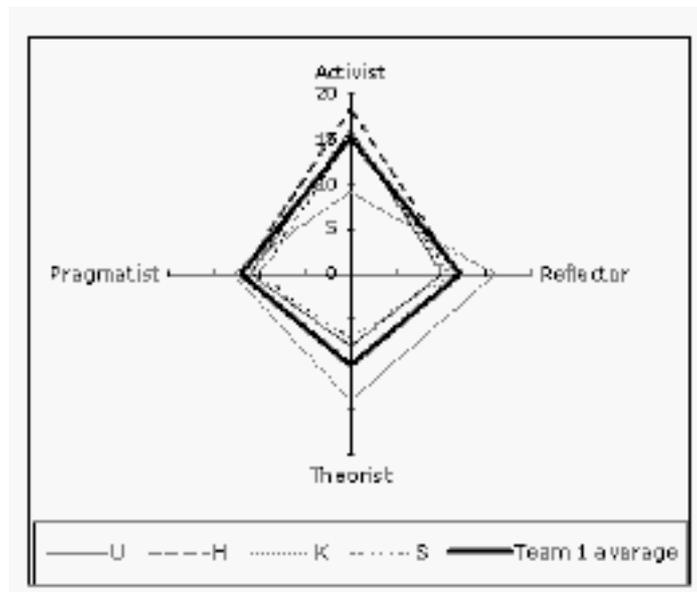


Figure 2. Individual and team average learning styles for Team 1

In designing the visual characteristics of the order interface Team 1 relished the chance to come up with lots of ideas, making for lively design sessions. It was evident that the group as a whole enjoyed being involved in new experiences; this is consistent with a strong Activist learning style.

However, Activists, as Honey and Mumford (1995) warn, may find it difficult to 'assimilate, analyse and interpret lots of 'messy' data' and fail to work through a problem and solution in detail. A negative effect can also be caused through their tendency to claim the centre of discussions. A bias to this style of working in Team 1 was observable. Additionally, team member K, the Reflector and Theorist of the group, was pushed to the background.

Members of Team 2 consisted of five individuals in total (C, E, J, S and U). In contrast to Team 1, the majority of the team members had strong preferences for a Reflector learning style and only moderate preferences for the Activist learning style (Table 3).

Table 3. Summary of Team 2 learning styles

	Activist	Reflector	Theorist	Pragmatist
U	Very Strong	Low	Low	Low
C	Moderate	Strong	Moderate	Strong
E	Moderate	Strong	Strong	Strong
J	Moderate	Strong	Low	Low
S	Strong	Strong	Strong	Strong
Team Average	Strong	Strong	Moderate	Moderate

The user was the only one in Team 2 with a very strong preference for the Activist learning style (Figure 3 over), whereas team member S was an 'all-rounder', being strong on all learning styles.

The way that Team 2 approached the design sessions was markedly more restrained than other teams. The team tended to prefer to question the user and absorb information, rather than committing to and working through a hypothetical solution. They tried to understand the interrelationships of the situation, but action was mostly absent.

This seemed to be very frustrating for the user, who adopted a much more low-key behaviour with this team. Her feedback after the design sessions also indicated that she felt that the sessions with this team were 'hard-going'. This difficulty in communication may be related back to differences in learning styles (Kolb 1991).

Whilst the strategy that was adopted by the teams could be characterised as solution-focused with respect to Team 1 and problem-focused with respect to Team 2 (Lawson 1997), in this paper we do

not make any claims in relation to this view of design activity. Instead, the description of designing that is addressed here fits within a view of designing as experiential learning (Stumpf 2001).

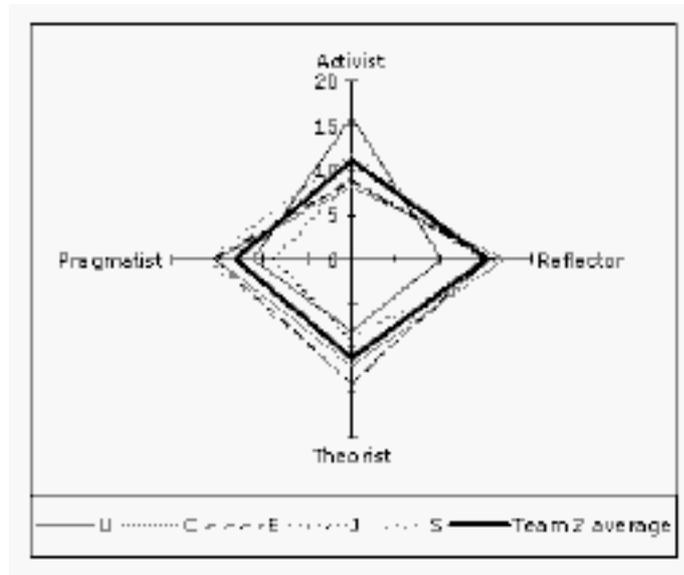


Figure 3. Individual and team average learning styles for Team 2

During the discussion in the learning tutorial where the learning styles analysis was presented, the designers were able to 'find themselves' in the representation. The learning styles were seen as useful by individuals and teams to explain their attitude and behaviour in the design process as a learning situation. In this respect, learning style analysis and its subsequent use in discussions with designers encouraged reflection about the way that designers approach learning. Learning styles is an abstract conceptualisation but the designers were able to relate this conceptualisation to the concrete experiences of the design sessions. In other words, designers' comprehension was applied via intention to apprehension (C I A). Learning styles as a description of designers encourages designers' reflection-on-action about how they engage in designing.

## 6.2 Perceptions

After each design session, participants were asked to fill in questionnaires to elicit their perceptions related to the week's design session. A score for each perception was calculated for each individual and team for each design session and represented graphically as a resource for reflection. These graphical representations were shown to and discussed with participants during the learning tutorial.

Team 1's individual scores were analysed and shown as a team average over the three design sessions (Figure 4 over).

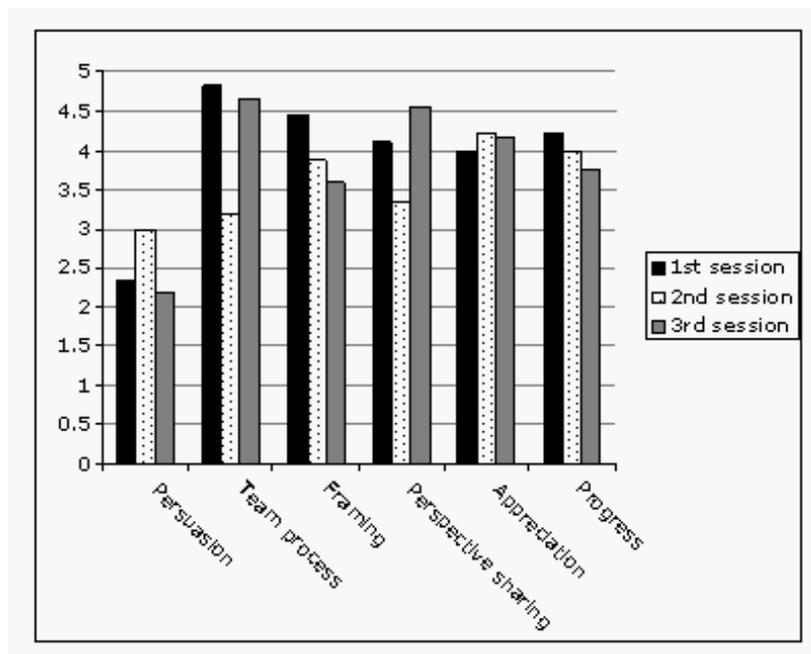


Figure 4. Team 1 averages over perceptions

It can be observed that there is a marked drop in the perception of good *team process* and *perspective sharing* of Team 1 in the second design session, together with an increase in the feeling of *persuasion*. This can be related to problems experienced in the second design session in the way that two participants interacted with each other. All three team members give lower ratings in the *team process* perception, indicating that the result of their problem is group tension. However, looking at individual ratings, the nature of the problem becomes clearer when perceptions of *persuasion* during the second design session is further investigated. The team is split: some members feel railroaded by another, since the feeling of persuasion is above 3 in participants K and S, whereas team member H rates persuasion low (Figure 5 over). The pattern in this case can lead participants to reflect on the level of illegitimate persuasion that team members perceived.

Team 2's individual scores were similarly analysed and shown as a team average over the three design sessions (Figure 6 over). The graph for Team 2 shows perceived *persuasion* increasing in the third session, whilst all other measures decrease.

The team was able to connect this to the experience in the third session where it became obvious rather late in the design session that the user had a different meaning for a crucial term than that understood by the rest of the team. Consequently, the team had the perception that their designing went awry, indicated by a decrease in team process and progress. Furthermore they were unsure how to see the design and their understanding of why they were designing the

design concept the way they did, indicated by lower scores in framing and appreciation. Furthermore, perceptions of *persuasion* went up since the team felt that the view of the user was imposed.

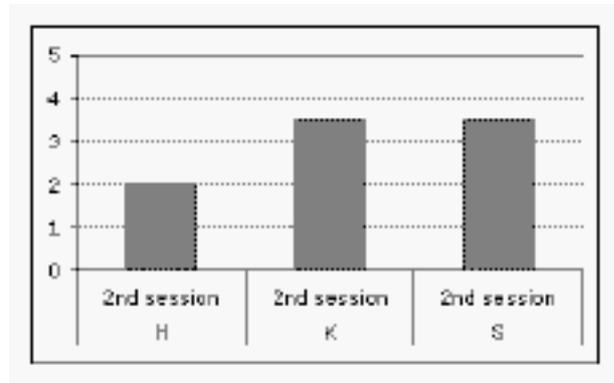


Figure 5. Team 1 individual perception of persuasion in second design session

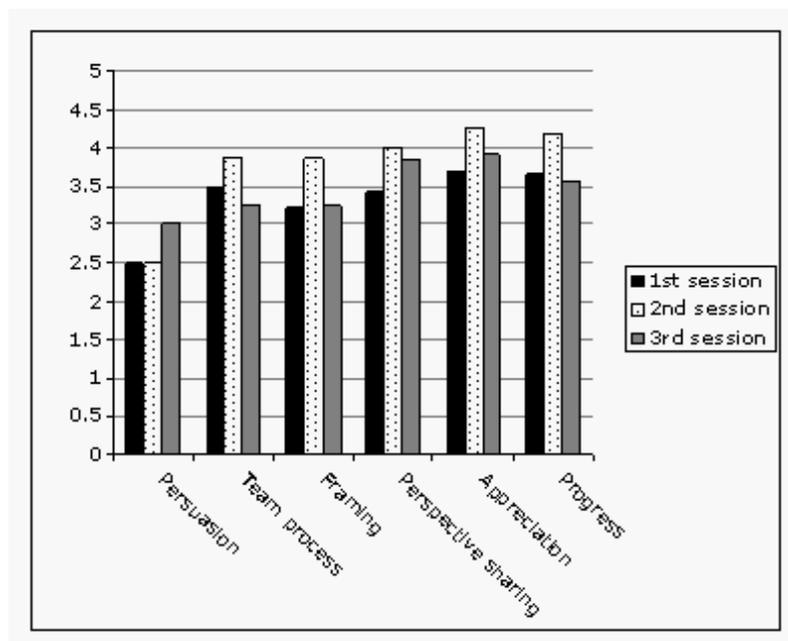


Figure 6. Team 2 averages over perceptions

In the analysis and subsequent use of the descriptions, the overriding criterion for relevance is that designers can find themselves in the description and make a connection to their concrete experiences. The validity of the descriptions is hence assessed through a qualitative approach, rather than through quantitative tests. Furthermore, it appears that designers are sensitive to even slight

changes in the pattern of perceptions, which may not be considered significant from a quantitative analysis of perception scores.

During the learning tutorial, the graphs served as devices to probe and explore aspects of team designing. In particular, the graphical representations of perceptions were used to relate to concrete experiences in the design sessions by concentrating on patterns of perceptions over the three design sessions. By presenting this representation, abstract conceptualisations are reflected on and linked to concrete experience. Comprehension is applied via intension to apprehension (C I A).

### 6.3 Linkages between learning styles and perceptions

During the analysis of perceptions, the patterns of perceptions observed lead to the supposition that there are links between the scores across perceptions i.e. there might be a correlation between the scores for perception. A study of correlation between perceptions was carried out and tested for statistical significance (t-test,  $p < 0.05$ ); a summary of correlation is shown in Table 4.

Table 4. Significant correlations between perceptions

	Persuasion	Team process	Framing	Perspective Sharing	Appreciation	Progress
Persuasion		-0.55	-0.43		-0.35	
Team process	-0.55		0.47	0.67		0.46
Framing	-0.43	0.47			0.55	0.55
Perspective Sharing		0.67			0.45	
Appreciation	-0.35		0.55	0.67		
Progress		0.46	0.55			

It was found that *persuasion* is significantly negatively correlated to *framing*, *appreciation* and *team process*. This means that if the feeling that one is being (illegitimately) persuaded is high in the team, then the feeling of good *framing*, *appreciation* and *team processes* will decline. Obviously, it cannot be stated which categories are dependent ones and which are controlling, however it appears from the example of Team 1 that feelings of *persuasion* has a resulting effect on the evaluation of *team process*.

Furthermore, one should be aware that feelings of *perspective sharing* and *appreciation* have an impact on each other, and especially the feeling of *perspective sharing* and *team process*. More obviously, *progress* and *team process* are also correlated. Furthermore, the correlation indicates that low scores in *framing* (i.e. the perception that

a team-frame has been established) will find resonance in decreased scores in *appreciation*, *progress* and *team process*. This supports work by Mitchell and Sackney (1998) who point out that framing and naming activities in organisational learning are linked to developing common understandings, engaging in co-operative processes and building trust amongst the team.

During the analysis of perceptions and learning styles, patterns in the data suggested that there exists a link between learning styles and individual's perceptions. Initially, this was based on observations that individuals scoring high as reflectors seemed to be more sensitive to feelings of persuasion than other learning styles. A study of correlation was conducted between learning styles and related scores of perceptions. A summary of correlations with statistical significance (t-test,  $p < 0.05$ ) is shown in Table 5.

Table 5. Correlations between perceptions and learning styles with statistical significance

	Persuasion	Team process	Framing	Perspective Sharing	Appreciation	Progress
Activist		0.68		0.61		0.55
Reflector		-0.32		-0.35	0.43	
Theorist	-0.37		-0.39		0.51	
Pragmatist	-0.31		0.42		0.38	

It shows that there is no link between the Reflector learning style and perceptions of persuasion. Instead, there is a significant correlation between feeling persuaded and scoring high on the Theorist and Pragmatist learning styles. At the same time, these learning styles also showed a correlation concerning their perceptions on *framing* and *appreciation*. Reflectors are more susceptible to lower scores in rating *perspective sharing* and *team process*, but have greater feeling of understanding the design. Activists are sensitive to *perspective sharing*, *progress* and *team process*.

## 7. Conclusions

In this paper, descriptions of 'reflective practice' were developed and made available to designers for use in reflection-on-action and learning. Experiential learning – a process of knowledge transformation – can only be increased by the way that knowing – comprehension or apprehension – is transformed through intention or extension. In this paper, we have investigated how descriptions of

designing encourage the chaining of transformations and higher-order learning.

During a learning tutorial, learning styles and perceptions were used to encourage designers to reflect-on-action. Representations that make use of learning styles describe designers and allow them to reflect on their predisposition to approach designing, learning and interaction with other team members. Representations that describe designing can also be based on perceptions of designers; a way of eliciting perceptions of persuasion, team process, framing, perspective sharing, appreciation and progress through a perception questionnaire was described. Correlations were explored between perceptions, which suggest connections between some categories of perceptions. Graphical representations of these perceptions can be made available to designers for reflection. These abstract conceptualisations can be used by designers to make a link to what went on in designing. However, no description is value-free: personality types show sensitivity to certain perceptions, as evidenced by correlations between learning styles and perceptions scores.

### **Notes**

[1] Further learning situations, which were based on reflective observation of 'critical instances' were held with designers. A more detailed discussion of designer's reflection-on-action using critical instances can be found in Stumpf (2001).

### **References**

- Atkinson, R.L., Atkinson, R.C., Smith, E.E. and Bem, D.J. (1993) Introduction to Psychology (11<sup>th</sup> edition), Harcourt Brace and Company, Orlando.
- Dorst, K. (1997) Describing Design – A Comparison of Paradigms, PhD Thesis, TU Delft, Netherlands.
- Gee, J.P. (1999) An introduction to Discourse Analysis, Routledge, London.
- Glock, F. (2000) Design Tools and Framing Practices, in COOP2000 Workshop Proceedings Workshop 2: The Role of Objects in Design Co-operation: Communication through Physical or Virtual Objects, Sophia Antipolis, France.
- Honey, P. and Mumford, A. (1992) The Manual of Learning Styles, Peter Honey, Maidenhead.
- Honey, P. and Mumford, A. (1995) Using your Learning Styles, Peter Honey, Maidenhead.
- Kolb, D.A. (1984) Experiential Learning, Prentice Hall, London.
- Kolb, D.A., Rubin, I.M. and Osland, J. (1991) Organisational Behaviour, Prentice Hall, London.
- Lawson, B. (1997) How Designers Think: The Design Process Demystified, Butterworths Architecture, Oxford.

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- Locke, J. (1964) *An Essay concerning Human Understanding*, Fontana, London.
- Mazijoglou, M., Scrivener, S.A.R. and Valkenburg, R.C. (2000) Matching Descriptions of Team Design, in *Proceedings of CoDesigning2000*, Coventry.
- Mitchell, C. and Sackney, L. (1998) Learning about Organizational Learning, in Leithwood, K. and Seashore Louis, K. (eds) *Organizational Learning in Schools*, Swets and Zeitlinger, Lisse.
- Nothdurft, W. (1996) Schlüsselwörter Zur rhetorischen Konstruktion von Wirklichkeit, in Kallmeyer, W. (ed) *Gesprächsrhetorik – Rhetorische Verfahren im Gesprächsprozess*, Gunter Narr Verlag, Tübingen.
- Rein, M. and Schön, D. (1993) Reframing Policy Discourse, in Fischer, F. and Forester, J. (eds) *The Argumentative Turn in Policy Analysis and Planning*, Duke University Press, London.
- Schön, D.A. (1987) *Educating the Reflective Practitioner – Towards a New Design for Teaching and Learning in the Professions*, Jossey-Bass Publishers, San Francisco.
- Schön, D. (1991) *The Reflective Practitioner - How professionals think in action*, Avebury, The Academic Publishing group, Aldershot.
- Schön, D.A. and Rein, M. (1994) *Frame Reflection: Toward the Resolution of Intractable Policy Controversies*, Basic Books, New York.
- Schön, D. (1996) *Reflective Conversation with Materials in Winograd T (ed) Bringing Design to Software*, ACM Press, New York.
- Stumpf, S. (2001) *Analysis and representation of rhetorical construction of understanding in design teams' experiential learning*, PhD Thesis, University College London.
- Stumpf, S. and McDonnell, J. (1999) *Relating Argument to Design Problem Framing*, in *Proceedings of the 4<sup>th</sup> Design Thinking Research Symposium (DTRS99)*, MIT, Cambridge, Massachusetts.
- Stumpf, S. and McDonnell, J. (in press) *Talking About Team Framing: Using Argumentation to Analyse and Support Experiential Learning in Early Design Episodes*, *Design Studies*.
- Stumpf, S.C. and McDonnell, J.T. (2000) *A Representation of Rhetorical Construction of Understanding in Teams During Early Design Episodes*, in *Adjunct Proceedings CoDesigning 2000*, Coventry.
- Suthers, D. (1999) *Effects of Alternate Representations of Evidential Relations on Collaborative Learning Discourse*, in *Proceedings of the 3<sup>rd</sup> Conference on Computer Support for Collaborative Learning (CSCL99)*, Stanford.
- Valkenburg, R. (2000) *The Reflective Practice in Product Design Teams*, PhD Thesis, TU Delft, Netherlands.
- Valkenburg, R. and Dorst, K. (1999) *Frame Cognition*, in *Proceedings of the 4<sup>th</sup> Design Thinking Research Symposium (DTRS99)* Cambridge, Massachusetts.