

Interrelations between Motivation, Creativity and Emotions in Design Thinking Processes – An Empirical Study Based on Regulatory Focus Theory

Madeleine Kröper^{1,2}, Doris Fay², Tilmann Lindberg¹ and Christoph Meinel¹

¹ Hasso Plattner Institute at University of Potsdam, Germany

² University of Potsdam, Germany

Abstract. Design thinking, here defined as a team-based innovation method, helps to deal with complex design problems by sustaining in-depth learning processes on problem perception and diverse solution paths. To carry out design thinking processes successfully, motivation is a central psychological aspect to ensure creativity of the project outcome. In this paper, we ask how motivation is affected by the design thinking process and how it is related to team member's emotions throughout the process. We adopted regulatory focus theory to conceptualize motivational variables. Experience Sampling Method within a field study with two samples was used, investigating people's motivation of setting and approaching goals throughout real-life design projects that used design thinking. Results of this study show that the different phases carried out in design thinking processes significantly impact motivation and emotions of the members of a design team.

Keywords: Design Thinking, Design Thinking Processes, Motivation, Creativity, Emotions, Teams, Regulatory Focus Theory

1 Introduction

In the broadest sense, design thinking refers to the “study of cognitive processes that are manifested in design action” (Cross, Dorst and Roozenburg, 1992). Practitioners as well as scholars in various disciplines have long been interested in understanding the cognitive processes that underlie design activities. Early research trying to unravel the thought processes in design activities studied how outstanding designers approach problems and develop creative solution concepts (e.g. Lawson, 2006; Cross, 2007). This research has initiated an extensive scientific discourse on the exploration and analysis of cognitive strategies that carry the generation, synthesis and creative transformation of divergent knowledge within design processes (e.g. Nagai and Noguchi, 2003; Owen, 2007). Identified design strategies have been

reinterpreted as normative guidelines for design projects and creative problem solving in general (Lindberg, Noweski and Meinel, 2010). In this context, design thinking has been translated into a holistic framework moving beyond designers' professional domains and it has since been gradually applied to various disciplines and fields of innovation in both academia and business (Beckman and Barry, 2007; Brown, 2008; Dunne and Martin, 2006).

The fundamental principle underlying design thinking is that design problems and solutions are explored in parallel in consideration of different stakeholder perspectives (Cross, 2007; Lawson, 2006). Design problems are regarded as made up of exogenous stakeholder perspectives (the user's, the client's, the engineer's, the manufacturer's, the law-maker's, etc.) that finally decide about the solution's viability (Dorst, 2006). Dealing with a design problem's complexity is therefore a matter of negotiation between different and probably conflicting perspectives, so that design processes are regarded as a “reflective conversation with the situation” (Schön, 1983). Design thinking thus supports all activities relevant for accessing the diverse knowledge and multiple perspectives that reside in the different stakeholders in order to use them for inspiration; and it facilitates the creative transformation of the knowledge base into new concepts.

The specific problem solving patterns in design thinking are rather determined by heuristic and situational reasoning than by analytical and rationalist thinking. Furthermore, instead of external standards for evaluating the quality of design outcomes, design thinking asks for developing those standards within the process. Therefore, design thinking assigns strong responsibility for deciding and evaluating how to proceed in a design process to the design team itself (that is what knowledge should be grasped and what concepts and designs should be elaborated). As a result, design thinking process models cannot be more

than a framework of suggestions that help design teams to go through their own learning and creativity processes.

Against that background, we assume that team motivation plays a decisive role in putting those suggestions into practice. We therefore seek to find out how motivation is affected by the different phases of the design thinking processes; this will enable us to better understand team creativity. We also explore whether motivation and emotions in design thinking processes are interrelated, as both concepts show strong interdependencies (Ryan, 2007). To deal with these questions, we draw upon a conceptualization of motivation offered by regulatory focus theory (Higgins, 1997; 1998). We conducted a study using the Experience Sampling Method with design teams. Design teams adopted design thinking methodology; they worked in two German IT companies. In the following, we present the conceptual and theoretical foundations and develop this study's hypotheses.

1.1 Design Thinking Process Model

This study draws on a comprehensive design thinking process model that has been formalized at the Hasso-Plattner-School of Design at Stanford (US) and the HPI School of Design Thinking in Potsdam (Germany). It distinguishes six phases (Plattner, Meinel and Weinberg, 2009): *understand*, in which a design team is asked to build up general expertise about a design problem, to identify stakeholders and contexts of usage for further examination; *observe*, in which the design team goes into the field and gathers widespread insights and develops empathy for the stakeholders of the design problem; *synthesis/point of view*, in which the collected insights are summarized, shared in the team, and compiled in a framework of viewpoints on the design problem; *ideate*, in which – based on the lessons learned so far – ideas and concepts are created (for instance by brainstorming techniques) and roughly sketched out; *prototyping*, in which ideas and concepts are turned in tangible representations allowing to generate genuine feedback from users and other stakeholders; and *test*, in which this feedback is collected and processed for further refinements and revisions. As Figure 1 shows, these phases are not placed in a linear sequence, but are highly iterative. Therefore, the responsibility for the decision on when to move into which phase and how to get through an entire design process lies with the design team. The model is complemented by a set of rules that communicates a certain mind-set towards creative design. Rules emphasize 1) the readiness to explore seemingly odd paths as well (instead of going rashly for the obvious things) and 2) acting generally

quickly, experimentally, and iteratively. Those rules are in particular: “fail often and early”; “defer judgement” and “encourage wild ideas” (cf. Osborn, 1953).

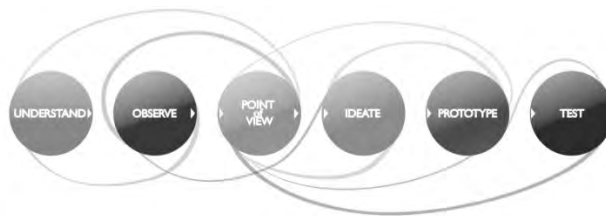


Fig. 1. Iterative design thinking process (Plattner, Meinel and Weinberg, 2009)

1.2 Regulatory Focus Theory and Creative Performance

We draw on regulatory focus theory to explore motivation in design thinking (Higgins, 1997; 1998). This theory presupposes that human motivation serves to satisfy the two basic needs of approaching pleasure and avoiding pain (hedonic principle). The theory suggests that these desired hedonic end-states are reached through self-regulatory processes, which refer to the processes by which people seek to align themselves with appropriate goals or standards (Crowe and Higgins, 1997). Two distinct types of regulatory systems, called promotion and prevention focus, drive this process of self-regulation. The promotion focus has a *desired* end-state as reference value, focusing individuals on goals they long for and is induced by nurturance needs, ideals and rewards (gain/no-gain situations). The prevention focus, conversely, has an *undesired* end-state as reference value, motivating individuals to avoid damages or unpleasant situations. This focus is induced by security needs, duties and the fear of punishment (non-loss/ loss situations). It is assumed that the promotion focus represents the “ideal self”, that is a person’s wishes, hopes, and aspirations, while the prevention focus represents the “ought self”, which includes a person’s obligations, duties, and responsibilities (Higgins, 1997). Both foci influence people’s perception, behavior, performance, and emotions (Förster and Higgins, 2005). The theory distinguishes furthermore between chronic and momentary foci. Individuals differ in their chronic tendency to be promotion and prevention oriented; furthermore, signals and stimuli of any type of situation also activate the promotion and/or prevention focus (Higgins, 1998; Crowe and Higgins, 1997). Thus, process feedback, task instructions or goal framing has a significant impact on the two dimensions of regulatory focus (Idson, Liberman, and Higgins, 2004; Higgins, Shah, and Friedman, 1997).

Experimental research has shown that regulatory focus affects creativity. Creativity can be defined as the ability “to produce work that is both novel (i.e., original, unexpected) and appropriate (i.e., useful, adaptive concerning task constraints)” (Sternberg and Lubart, 1999, p. 3). Creativity is not only a personality trait; it is also affected by situational factors, such as task characteristics, or expected gratifications or motivational variables (Förster, Friedman, and Liberman, 2004). Crowe and Higgins (1997) asked their study participants to complete different tasks, which tested among other things the capability to generate creative insights. Participants in the promotion focus condition found significantly more solutions compared to those in the prevention focus condition. These findings were supported by Friedman and Förster (2001). Furthermore, Crowe and Higgins’ (1997) studies also demonstrated that the promotion focus is conducive to a risky explorative processing style that facilitates insight-related processes; they also found interdependence between the promotion focus and cognitive flexibility. The prevention focus however was stronger related to analytical problem solving and attentive behavior. This research shows that to further our understanding of creative work, regulatory focus is a motivational variable worthwhile studying. Since regulatory focus seems to predict creative performance, we now want to understand what situational factors can enhance the one or the other focus.

1.3 Hypotheses

1.3.1. Motivation and Creativity in the Design Thinking Process

In our first set of hypotheses we ask how motivation, focusing on regulatory focus, is affected by the different phases of the design thinking process. We propose that the diverse phases of a design thinking process influence the momentary regulatory focus differently, which would therefore explain situational changes in motivation. We assume that some phases consist of creative or novel tasks to a larger degree than other phases that consist of analytical tasks to a larger degree. We suggest that the phases ‘understand’, ‘observe’, and ‘ideate’ require a creative problem-solving style with regard to novel tasks and promotion goals. The phases ‘synthesis’, ‘prototype’, and ‘test’, in contrast, require an analytical problem-solving style to reduce information and thus problem complexity with regard to prevention goals.

On the basis of the previous discussion, it is hypothesized that the phases ‘understand’, ‘observe’ and ‘ideate’, in which creative tasks dominate, are

more likely to increase strength of the promotion focus in comparison to other phases of the design thinking process (*hypothesis 1a*).

The phases ‘synthesis’, ‘prototype’, and ‘test’, in which analytical tasks dominate, are more likely to increase the strength of the prevention focus compared to other phases of the design thinking process (*hypothesis 1b*).

Administrative tasks that accompany the design thinking process are more likely to increase strength of the prevention focus in comparison to other phases of the process. Furthermore, administrative tasks are more likely to reduce strength of the promotion focus in comparison to other tasks (*hypothesis 1c*).

As Florack and Hartman (2007) provided evidence for the fact that time pressure reinforces the momentary regulatory focus, it is assumed that time pressure moderates the relation between different phases of the design thinking process and the promotion or the prevention focus emerging in these phases (*hypothesis 1d*).

1.3.2. Motivation and Emotions in the Design Thinking Process

In our second set of hypotheses we explore the relationship of the momentary regulatory focus with emotions experienced and how this is affected by goal attainment; and we furthermore ask how the design thinking process affects emotions. It has been shown that the regulatory focus has an impact on problem-solving styles, but it bears also on emotions. Frijda (1988, p. 349) states that goals, for example in terms of promotion or prevention end-states, and emotions are strongly related to each other: “Events that satisfy the individual’s goals, or promise to do so, yield positive emotions; events that harm or threaten the individual’s concerns lead to negative emotions.” Thus, evaluating the personal degree of goal attainment gives rise to specific emotions (Brockner and Higgins, 2001; Higgins, Shah and Friedman, 1997; Higgins, 1998; Higgins, Bond, Klein, and Strauman, 1986). As Higgins, Shah and Friedman (1997) point out, emotions are differentially related to the two dimensions of the regulatory focus. While the degree to which the promotion focus is satisfied is associated with emotions of *cheerfulness* (in case of attaining a promotion goal) and *dejection* (when failing a promotion goal), prevention focus is associated with emotions of *quiescence* (when achieving a prevention goal) and *agitation* (when failing a prevention goal).

We hypothesize that goal attainment, conceptualized in terms of satisfaction with the performance, moderates the relation between the two

regulatory foci and particular emotions. Specifically, the following four interactions are predicted:

There is an interaction between regulatory focus and satisfaction with the performance, such that a) the relationship between promotion focus and cheerfulness emotions increases with high performance satisfaction (*hypothesis 2a*), and such that b) the relationship between promotion focus and dejection-related emotions increases with low performance satisfaction (*hypothesis 2b*), c) the relationship between prevention focus and quiescence-related emotions increases with high performance satisfaction (*hypothesis 2c*), and d) the relationship between prevention focus and agitation-related emotions increases with low performance satisfaction (*hypothesis 2d*).

Cheerfulness-, dejection-, quiescence-, and agitation-related emotions are influenced by the different phases and tasks of the design thinking process (*hypothesis 2e*).

2 Method

Participants. A total of 10 participants (3 men, 7 women) of two different teams adopting the design thinking method volunteered for the study. Their ages ranged from 24 to 58 years, with a mean of $M = 37.6$ ($SD = 7.15$).

Method, procedure, and measures. Experience Sampling Method (ESM) was used to test the hypotheses ($N = 229$ measurements). ESM is a means of collecting information about the context and the content of people's daily life by capturing their immediate conscious experiences. Participants deliver self-reports each time they receive randomly sent electronic signals throughout several days (see Hektner, Schmidt and Csikszentmihalyi 2007; Feldman-Barrett and Barrett, 2001). In this study participants received signals for the whole observation period (6/8 weeks) three times a day, two days a week via handheld computers (10 Palm Pilots, system: PalmOS 2.0). The study took place between September and November 2009. Data was collected in German language, using a paper-and-pencil questionnaire and electronic data assessment via palm pilots.

A researcher introduced participants to the objectives of the study. Each participant was handed out one palm and completed the paper-and-pencil-questionnaire. It assessed a number of control variables (age, gender, nature of team), chronic affect and chronic regulatory focus. Chronic affect was assessed with the positive and negative affectivity measure (Watson, Clark and Telegen, 1988; German version by Krohne, Egloff, Kohlmann and Tausch,

1996). ("How do you feel in general?"; response was a scale from 1 (*not at all*) to 5 (*completely*)). The measure of chronic regulatory focus (Fay, Urbach and Möbus, 2010) obtained participants' enduring motivational orientation ("My thoughts and behavior are mainly directed to...") on a scale anchored at 1 (*does not apply to me at all*) and 7 (*applies to me completely*). Nine items recorded the promotion focus and nine items the prevention focus.

The electronic data collection, which took place several times a day, assessed the momentary regulatory focus (Fay, Urbach and Möbus, 2010). It was measured with the same items as used for the chronic focus; however, the instruction to respond to the items referred to "this very moment" ($\alpha = .94$, prevention focus scale; $\alpha = .87$, promotion focus scale). Furthermore, we measured eight momentary emotions related to the regulatory focus (Falomir-Pichastor, Mugny, Quiamzade and Gabarrot, 2008) on a scale anchored at 1 (*not at all*) and 5 (*utterly*). Effectiveness of and satisfaction with the performance represented further internal coordinates assessed in the first part (1 = *very unsatisfied/ineffective*, 10 = *very satisfied/effective*). Finally, participants were asked to describe the tasks or activities currently pursued, by indicating in which of a list of altogether nine activities they were currently involved. Nine activities comprised the six phases of the design thinking process and three other activities, specifically: administration, recreation, other. They also indicated for how long they had been involved in these activities, if they worked under time pressure (1 = *not at all*, 5 = *a lot*), their location (office, client, at home, other), and their social context (number of persons: no one, 1-2 persons, more than 3 persons; characters: with no one, workmates, disciplinarian, client, family/friends, other). Answering these questions took approximately two minutes.

3 Results

Before conducting t-tests and regression analyses to test the hypotheses, measures of each participant were centred and subsequently merged together. Analyses presented here are based on situations, not people.

3.1 Motivation and Creativity in the Design Thinking Process

T-test for independent samples revealed a significant higher promotion focus in situations in which participants executed novel tasks (phases understand, observe, and ideate) ($M = .22$, $SD = .84$) compared to situations of involvement in analytical tasks ($M = -.27$,

$SD = 1.09$), $t(152) = -3.3$, $p = .001$. This result is fully in line with the expectation according to the first hypothesis that the promotion focus, which refers to the need for growth, achievement of ideals, gains or maximal goals, is more strongly elicited by novel tasks compared to analytical tasks.

In order to run a more rigorous test of hypothesis 1a, a regression analysis on the promotion focus was conducted, with control variables (1. age, gender, team; 2. chronic regulatory focus, chronic affect) and tasks (0 = other, 1 = novel) as predictors. Consistent with the previous finding, this analysis revealed a significant main effect for tasks ($\beta = .301$, $p = .000$). This finding supports hypothesis 1a that novel tasks (phases: understand, observe, and ideate), relative to analytical or other tasks, trigger a processing style that enhances the promotion focus to a larger degree.

To test hypothesis 1b, stating that the prevention focus is significantly higher when executing analytical tasks (i.e., 'synthesis', 'prototype', and 'test'), compared to the prevention focus during administrative tasks or other phases of the design thinking process, another t -test for independent samples was conducted. Against the prediction, there was no significant difference in the prevention focus during execution of analytical tasks ($M = .02$, $SD = 1.01$), compared to the prevention focus when performing novel tasks ($M = -.05$, $SD = .88$), $t(170) = .497$, $p = .619$). Thus hypothesis 1b cannot be confirmed.

For hypothesis 1c it was tested whether prevention focus was higher and a promotion focus lower in situations of accomplishing administrative tasks in comparison to completing other tasks. The t -test for independent samples showed no significant difference in the prevention focus when performing administrative tasks ($M = .06$, $SD = 1.1$) compared to performing other tasks ($M = -.02$, $SD = .95$), $t(227) = -.51$, $p = .611$). The second t -test, however, revealed that the promotion focus was significantly lower in situations of administrative tasks ($M = -2.8$, $SD = 1.2$), to performing other tasks ($M = .09$, $SD = .90$), $t(73.055) = 2.118$, $p = .038$). To confirm this result, a regression analysis on the promotion focus was conducted with control variables (age, gender, team, chronic regulatory focus, and chronic affect) and tasks (0 = other, 1 = administrative). Task proved to be a significant predictor ($\beta = -.184$, $p = .010$; $\Delta R^2 = .029$, $p = .010$). Thus, hypothesis 1c is partly confirmed.

To test hypotheses 1d, which presumed that time pressure moderates the relationship between the promotion focus and novel tasks and between the prevention focus and analytical tasks, two moderated regression analyses on the prevention and the promotion focus were performed (with control

variables, time pressure, novel, respectively analytical tasks and the interaction term of time pressure and novel tasks or time pressure and analytical tasks). The first analysis revealed a significant main effect of time pressure on the prevention focus, suggesting that the prevention focus increases with increasing time pressure ($\beta = .247$, $p = .001$, $\Delta R^2 = .063$, $p = .000$). There was no main effect for analytical tasks ($\beta = .050$, $p = .554$). The interaction term of analytical tasks and time pressure was marginally significant ($\beta = .216$, $p = .095$). This demonstrates that the prevention focus depends on time pressure and fractionally on the interaction between time pressure and analytical tasks. Thus, only strong time pressure affects mainly people's prevention focus when they execute analytical tasks. In the second regression analysis, the assumption was tested that time pressure moderates the relationship between novel tasks and the promotion focus. There was a main effect for novel tasks ($\beta = .301$, $p = .001$, $\Delta R^2 = .075$, $p = .000$), which confirms the findings of hypothesis 1a. But against the presumption, there was neither a main effect for time pressure ($\beta = .002$, $p = .983$) nor a significant interaction between time pressure and novel tasks ($\beta = -.066$, $p = .498$).

These results can only partly support hypothesis 1d. Evidence could be shown for a direct effect of time pressure on the prevention focus and for a moderation of time pressure of the relation between analytical tasks and the prevention focus. Time pressure however neither affected the promotion focus nor did it moderate the relation between novel tasks and the promotion focus.

3.2 Motivation and Emotions in the Design Thinking Process

For hypothesis 2a, it was tested whether satisfaction with the performance moderates the relationship between the promotion focus and cheerfulness-related emotions or not. Regression analysis did not reveal that satisfaction with the performance moderates this relationship ($\beta = -.077$, $p = .179$) but showed a main effect of the promotion focus ($\beta = .325$, $p = .000$, $\Delta R^2 = .378$, $p = .000$) and of satisfaction with the performance on cheerfulness related emotions ($\beta = .476$, $p = .000$). While focusing on ideals, hopes or aspirations, people experience cheerfulness-related emotions, independently of the degree of their performance appraisal. Thus, hypothesis 2a can at least partly be confirmed.

The analogous regression analysis with dejection-related emotions yielded a significant main effect for satisfaction with the performance ($\beta = -.354$, $p = .000$, $\Delta R^2 = .122$, $p = .000$). Neither the promotion focus

($\beta = .047, p = .468$) nor the interaction of the promotion focus and satisfaction with the performance were significant ($\beta = .049, p = .474$). Hypothesis 2b cannot be confirmed.

For hypotheses 2c and 2d, we tested in two separate analyses whether satisfaction with the performance moderates the relationships between the prevention focus and agitation-related emotions and the prevention focus and quiescence-related emotions or not. Regression analysis on quiescence-related emotions showed a main effect for satisfaction with the performance ($\beta = .370, p = .000, \Delta R^2 = .173, p = .000$) but not for the prevention focus ($\beta = .023, p = .714$). The interaction term of satisfaction with the performance and the prevention focus was not significant ($\beta = .042, p = .520$). This implies that quiescence-related emotions depend on satisfaction with the performance, but neither on the prevention focus nor on the interaction between both variables.

Finally, the assumption was tested that satisfaction with the performance moderates the relationship between the prevention focus and agitation-related emotions. The prevention focus ($\beta = .355, p = .000$) and satisfaction with performance ($\beta = -.228, p = .000$) significantly influences these emotions ($\Delta R^2 = .183, p = .000$). The interaction of satisfaction with the performance and the prevention focus was not significant ($\beta = -.040, p = .525$). These results confirm hypothesis 2d partly: Agitation-related emotions depend on the prevention focus, and on satisfaction with the performance, but not on the interaction between both variables.

Hypothesis 2e predicted that emotions are not only influenced by the regulatory focus and satisfaction with the performance, but also by the different tasks currently performed. In each regression analysis we regressed emotion on control variables, momentary prevention focus, momentary promotion focus, and task. First, it was analyzed whether cheerfulness-related emotions are influenced by the nature of the task. Regression analysis on cheerfulness-related emotions with all predictors including tasks (0 = novel, 1 = analytical) showed a significant main effect of the promotion focus ($\beta = .376, p = .000$) and of tasks ($\beta = -.162, p = .050, \Delta R^2 = .020, p = .05$), suggesting that the promotion focus and novel tasks relate positively to cheerfulness.

Furthermore, a regression analysis on dejection-related emotions revealed two significant main effects of the prevention focus ($\beta = .278, p = .001$) and of tasks ($\beta = -.186, p = .034$), ($\Delta R^2 = .026, p = .034$). Although dejection is theoretically speaking related to the promotion focus, here, dejection-related emotions were influenced by the prevention focus. Likewise, they are positively affected by novel tasks. A regression analysis on quiescence-related emotions

with momentary regulatory focus and tasks as predictors revealed no significant effect of tasks ($\beta = -.063, p = .480$) but a significant effect of the promotion focus ($\beta = .171, p = .044$), albeit quiescence should be positively related to the prevention focus. A last regression analysis on agitation-related emotions revealed one significant main effect of the prevention focus ($\beta = .346, p = .000, \Delta R^2 = .134, p = .000$). Tasks did not affect these emotions ($\beta = -.084, p = .324$).

These results suggest that only cheerfulness- and dejection-related emotions are partly influenced by the tasks participants conduct in the design thinking processes. Both emotions are positively influenced by novel tasks. For these two emotions, which are described as promotion-emotions, hypothesis 2e can be confirmed. Hypothesis 2e has to be rejected for the prevention-related emotions quiescence and agitation.

4 Discussion

Previous research has revealed many effects of the regulatory focus on problem solving, creativity and emotions. Using Experience Sampling Method, this study sets out to explore the reverse effect by testing whether promotion and the prevention focus *are affected* by the nature of the task pursued. Results suggest that regulatory focus changes depending on the specific phase of the design thinking process. We furthermore investigated emotions in the context of design thinking. Both regulatory focus and the nature of the tasks pursued influenced emotional experience.

The results of this study support the assumption that the promotion focus is significantly higher while executing novel tasks (which are assumed to predominate in the phases ‘understand’, ‘observe’, and ‘ideate’) in comparison to the other tasks performed in the design thinking process; and lower when performing administrative tasks. This is interesting from two perspectives. First, the dominant approach in studying motivation in the context of design and innovation research treats motivation as a critical antecedent to successful design and innovation; and from the perspective of regulatory focus, this research has demonstrated that higher levels of promotion focus facilitate high levels of creative performance (e.g., Crowe and Higgins, 1997). Second, if a high level of the promotion focus is beneficial for creative performance, this raises the question as to what momentary or situational factors can increase the momentary promotion focus. Our study suggests that motivation itself is affected by pursuing tasks that require learning, exploration, and creative problem solving. This breaks ground for a new field of research in which creativity-relevant motivation is

conceptualized as a key aspect of a cyclical process. In this process, the nature of the task – in terms of design thinking, for example engagement in “observe” or “prototype” – influences motivation such as the regulatory focus; and the regulatory focus in turn affects the level of creative performance. Creative performance may then operate as a stimulus to increase the promotion focus even further.

However, no statistical support could be found for a higher level of the prevention focus when performing the phases ‘synthesis’, ‘prototype’, and ‘test’ as well as when conducting administrative tasks (in which analytical tasks are supposed to predominate). The fact that there are no differences in prevention focus between the different phases suggests that none of the design thinking process phases focuses in particular on constraints, obligations or duties. Furthermore, the rules that should guide the design processes (e.g. “encourage wild ideas”, “fail often and early”) had been well internalized by the teams observed; it may have been that those implicitly operating rules constantly hinder the activation of prevention goals. We take from this that the design thinking process supports creative behavior primarily through its strong promotional orientation; the nature of the design process as well as the above named rules shield motivational processes that may restrict creativity.

Also the investigation of the interplay between the design thinking process, regulatory focus and emotions resulted in interesting insights. First, it could be shown that novel tasks performed in the design thinking process influence the same emotions positively that the promotion focus influences according to regulatory focus theory (cheerfulness and dejection), whereas analytical and administrative tasks have no effect on emotions, so that the emotions quiescence and agitation (in theory prevention focus emotions) are not affected directly by any tasks. However, when we change our view and look at how the regulatory focus influences directly emotions in design thinking processes, we could observe a paradoxical situation. In contrast to what regulatory focus theory suggests, in this study quiescence does not relate to the prevention but to the promotion focus. Likewise, dejection – being in theory related to the promotion focus – does not correspond to the promotion but to the prevention focus. These findings indicate that participants experience emotions either related positively to the promotion focus (cheerfulness and quiescence) or negatively to the prevention focus (dejection and agitation). Thus, in opposition to hitherto existing research, both foci are associated with only “one-sided” emotions, favoring the promotion focus while disregarding the prevention focus. Therefore in design thinking processes, emotions appear to be in a certain imbalance, which may be a key component of

provoking teams to go beyond certain states of knowledge and concepts, and thus to increase their creativity.

Since our context of research is design and creativity, we emphasized the importance of the promotion focus for design thinking. However, an elevated level of the prevention focus might be as important for specific phases of design thinking as the promotion focus. Previous research demonstrated that people tend to initiate goal pursuit faster in situations of elevated levels of prevention focus (Freitas, Liberman, Salovey, and Higgins, 2002). Thus, to understand what makes or breaks successful performance in, for example, “prototyping”, we need to identify momentary triggers of the prevention focus. This study already identified one variable: time pressure seemed to increase the prevention focus. Even though time pressure is typically regarded as harmful in design processes, in specific phases it may help to remain focused on project progress and to consider organizational constraints. Therefore, we regard ‘time pressure’ as a fundamental element in design thinking processes to stabilize creative workflows.

To summarize, the results of this study show that the regulatory focus, in particular the promotion focus, plays an important role in the design thinking process. However, optimal motivational structures in the design process are likely to include both foci, and in particular a successful change between them depending on the nature of the task at hand.

5 Outlook

In order to corroborate the results of this study, future research should investigate the relation between motivational variables and design thinking processes considering the hierarchical and nested structure of this research (Raudenbush and Bryk, 2002) in larger samples, possibly complementing it with other theoretical frameworks. Within the frame of regulatory focus theory, further studies on design thinking should investigate the precise role of the prevention focus throughout the process, in particular at which moments an elevated level of prevention focus is decisive for the quality of the process outcome.

References

- Beckmann SL, Barry M, (2007) Innovation as a Learning Process – Embedded Design Thinking. *California Management Review* 50(1):25–56
- Brockner J, Higgins ET, (2001) Regulatory focus theory: Implications for the study of emotions at work.

- Organizational Behavior and Human Decision Processes 86(1):35–66
- Brown T, (2008) Design Thinking. Harvard Business Review 84–92
- Cross N, (2007) Designly Ways of Knowing. Basel etc: Birkhäuser
- Cross N, Dorst K, Roozenburg N, (1992) Preface to Research in Design Thinking. In: Cross N, Dorst K, Roozenburg N. (eds.): Research in Design Thinking, Delft
- Crowe E, Higgins ET, (1997) Regulatory focus and strategic inclinations: Promotion and prevention in decision-making. Organizational behavior and human decision processes 69(2):117–132
- Dorst K, (2006) Design Problems and Design Paradoxes. Design Issues 22(3) Summer:4–17
- Dunne D, Martin R, (2006) Design Thinking and How It Will Change Management Education: An Interview and Discussion. Academy of Management Learning & Education 5(4):512–523
- Falomir-Pichastor JM, Mugny G, Quiamzade A, Gabarrot F, (2008) Motivations underlying attitudes: Regulatory focus and majority versus minority support. European Journal of Social Psychology 38:587–600
- Fay D, Urbach T, Möbus J, (2010) What motivates you right now? Development of a state-regulatory focus measure. Unpublished manuscript, University of Potsdam
- Feldman-Barrett L, Barrett DJ, (2001) An introduction to computerized experience sampling in psychology. Social Science Computer Review 19(2):175–185
- Florack A, Hartmann J, (2007) Regulatory focus and investment decisions in small groups. Journal of Experimental Social Psychology 43:626–632
- Förster J, Friedman RS, Liberman N, (2004) Temporal construal effects on abstract and concrete thinking: Consequences for insight and creative cognition. Journal of Personality and Social Psychology 7(2):177–189
- Förster J, Higgins ET, (2005) How global versus local perception fits regulatory focus. Psychological Science 16(8):631–636
- Freitas AL, Liberman N, Salovey P, Higgins ET, (2002) When to begin? Regulatory focus and initiating goal pursuit. Personality & Social Psychology Bulletin 28(1) :121–130
- Friedman RS, Förster J, (2001) The effects of promotion and prevention cues on creativity. Journal of Personality and Social Psychology 81:1001–1013
- Frijda NH, (1988) The laws of emotion. American Psychologist 43(5):349–358
- Hekter JM, Schmidt JA, Csikszentmihalyi M, (2007) Experience sampling method: measuring the quality of everyday life. Thousand Oaks: Sage Publications, Inc.
- Higgins ET, (1997) Beyond pleasure and pain. American Psychologist 52:1280–1300
- Higgins ET, (1998) Promotion and Prevention: Regulatory focus as a motivational principle. In M. P. Zanna (Ed.), Advances in Experimental Psychology 30:1–46
- Higgins ET, Bond RN, Klein R, Strauman T, (1986) Self-discrepancies and emotional vulnerability: How magnitude, accessibility, and type of discrepancy influence affect. Journal of Personality and Social Psychology 51(1):5–15
- Higgins ET, Shah J, Friedman R, (1997) Emotional responses to goal attainment: Strength of regulatory focus as moderator. Journal of Personality and Social Psychology 72(3): 515–525
- Idson LC, Liberman N, Higgins ET, (2004) Imagining how you'd feel: The role of motivational experiences from regulatory fit. Personality and Social Psychology Bulletin 30(7):926–937
- Krohne HW, Egloff B, Kohlemann C-W, Tausch A, (1996) Untersuchungen mit einer deutschen Version der „Positive and Negative Affect Schedule“ (PANAS). Diagnostica 42(2):139–156
- Lawson B, (2006) How Designers Think. Oxford: Architectural Press
- Lindberg T, Noweski C, Meinel C, (2010) Evolving Discourses on design thinking: how design cognition inspires meta-disciplinary creative collaboration. Technoetic Arts: A Journal of Speculative Research 8(1):31–37
- Nagai Y, Noguchi I, (2003) An experimental study on the design thinking process started from difficult keywords: modelling the thinking process of creative design. Journal of Engineering Design 14(4):429–437
- Owen C, (2006) Design Thinking - Notes On Its Nature And Use. Design Research Quarterly 1:2 December 16–27
- Plattner H, Meinel C, Weinberg U, (2009) Design Thinking. Munich: mi-Verlag
- Raudenbush SW, Bryk AS, (2002) Hierarchical linear models: applications and data analysis methods. Thousand Oaks: Sage
- Roney CJR, Higgins ET, Shah J, (1995) Goals and framing: How outcome focus influences motivation and emotion. Personality and Social Psychology Bulletin 21:1151–1160
- Ryan MR, (2007) Motivation and Emotion: A New Look and Approach for Two Reemerging Fields. Motivation and Emotion 31:1–3
- Schön DA, (1983) The Reflective Practitioner – How Professionals Think in Action. New York: Perseus Books
- Sternberg RJ, Lubart TI, (1999) The concept of creativity: Prospects and paradigms. In Sternberg RJ, (Ed.), Handbook of creativity 3–15
- Watson D, Clark LA, Tellegen A, (1988) Development and validation of brief measures of positive and negative affect: The PANAS scales. Journal of Personality and Social Psychology 54:1063–1070