Emotions Along the Design Thinking Process

Benedikt Ewald, Axel Menning, Claudia Nicolai, and Ulrich Weinberg

Abstract The creative interaction of a team is where most of the innovation work in organizations happens nowadays. Yet the creative team is an exceptionally messy place in regard to socio-emotional interactions. Working creatively means constantly navigating and negotiating uncertainty and ambiguity, which, apart from constant procedural adaptations, both evokes and needs adequate responses on the socio-emotional level. In this chapter we want to introduce the most important socio-emotional factors for creative teamwork and how the emotional dynamics of the team is shaped by the different phases of the design thinking process. To this end we review automated text analysis of design thinking team meetings as a method to unobtrusively track emotional dynamics throughout the whole design process.

1 Introduction

Creative work in a team nowadays is regarded as the "key building block for innovation and entrepreneurship" (Gilson et al. 2015). We regard a work as creative if its aim is to come up with new and applicable solutions to ambiguous and problems, e.g. coming up with new business models as well as finding a solution to a city planning problem. As much as execution power is needed to succeed with these solutions and eventually end up as an innovation (innovation = idea + implementation)—without the prerequisite of creativity the initial idea will look pretty bleak and lead merely to incremental improvements, if any at all.[1] Despite an abundance of structured innovation models from management theory as well as creativity definitions and measurements from the (cognitive) psychological

[1]We follow Amabile's canonical innovation model here (1996), establishing creativity as "a necessary but not sufficient condition" for innovation, as well as the clear-cut distinction between studying workplace innovation and individual and group creativity as presented by Anderson et al. (2004), based on West and Farr (1990).

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C. Meinel, L. Leifer (eds.), *Design Thinking Research*, Understanding Innovation,
https://doi.org/10.1007/978-3-319-97082-0_3

perspective available, the phenomenon of creative invention in organizational settings remains elusive and multifaceted. This elusiveness is due to two intertwined aspects. For one, creative work in an organization is influenced by all levels of the system—the individual level, the organizational context as well as the society it is embedded in (Csikszentmihalyi 1999). All these levels come together not only for the production of novel and useful ideas, but also for their evaluation. This makes it hard to pin down isolated sources and factors that linearly lead to a successful innovation. Second, creative work is heavily linked to socio-emotional factors that are not reflected in the traditional economic and managerial models of innovation. The team is, however, a place where the impossibility of definitely attributing an innovation to one actor or factor comes together with the importance of socio-emotional factors for both the creation and acceptance of new ideas in an especially tightly interwoven way. The creative team is a place of heavily interdependent and fast-paced interactions on all communicative levels—procedurally, problem-oriented and socio-emotional. These interactions become particularly complex to chaotic for high performance teams (Losada 1999).

In this chapter we want to point out some of the most important threads that make up this tightly interwoven socio-emotional fabric of a creative team, as well as give an example from our own research of a setup how to study these threads without interfering with or even destroying the delicate fabric of in situ teamwork. The first part of this chapter will present the most important socio-emotional process factors for creative teamwork. The second will illustrate these theoretical underpinnings with a concrete example of how the design thinking process shapes the emotional dynamics of a team, analyzed with the help of the unobtrusive and automatable Linguistic Inquiry and Word Count tool (LIWC).

2 Emotions in (Creative) Teams

In general, moods and emotions play a crucial role in how we approach tasks individually and in a team (Fisher and Ashkanasy 2000). They are considered to be the main mediating mechanism of how work environmental features impact us and how they facilitate teamwork. Especially innovation and creativity are strongly connected to emotions. Emotions accompany and form the whole innovation process, both on the creating and the evaluating and adopting side (Amabile et al. 2005; Gelbrich 2007).

This is due to several factors:

- Innovation and creativity involve navigating both uncertainty and ambiguity due to the nature of the problems treated. In teams, this inherent indeterminism can lead to variant, but equally sound, opinions about how to proceed, leading to disagreements about content and process.

- To be able to come up with and follow through with new, crazy ideas and solutions there has to be a certain psychological safety and support for innovation present at the workplace and in and around the team.
- The individual emotional reactions to uncertainty and goal attainment.

Problems in innovation and design are in general ill-defined—they are so called "wicked problems" (Reitman 1964; Rittel and Webber 1973; Goel and Pirolli 1992). These problems are open, dynamic, complex and networked (Buchanan 1992; Dorst 2015). Due to the nature of the beast, there is no such thing as a right or wrong solution to these problems, but only good-fits or bad-fits, which lead to ambiguous decision-making situations. This ambiguity and the resulting uncertainty involved in both problem and solution finding are not something that needs to be overcome, but is instead "essential to design process" (Bucciarelli 1994, p. 178) and an important driver of creative cognitive processes. Intentionally producing vague expressions is a crucial interactional strategy in design conversations to achieve an effective open and inspirational process (Glock 2009; Zenasni et al. 2008; Christensen and Ball 2017). Being able to deal with ambiguity has also been considered an integral element of a creative personality (Tegano 1990; Tracey and Hutchinson 2016).

Dealing with ambiguity and uncertainty is hard enough alone, but in a team this difficulty increases exponentially. Interpersonal communication per se is rarely unequivocal, and using it to try to reach a common understanding about an ill-defined object can lead to various conflicts and misunderstandings. The relationship between team conflicts and team performance has been explored extensively (see e.g. review by O'Neill et al. 2013). Going back to Jehn's qualitative analysis of 1997, one can distinguish three different types of team conflict: task, relationship, and process conflict.

While the distinction between *task conflicts*—content-related disagreements in the team—and *relationship conflicts*—interpersonal tensions or resentments based on the view of the other person—had been studied before both theoretically and empirically, the notion of *process conflict* was new at this time. Jehn frames a process conflict as "conflict about how task accomplishment should proceed in the work unit, who's responsible for what, and how things should be delegated" (1997, p. 540)—so *how* the team should go about solving the task at hand in contrast to *what* to do or decide on.

The research picture of the latter is relatively clear—both relationship and process conflict have a negative impact on team performance, team satisfaction and team cooperation (de Dreu and Weingart 2003; De Wit et al. 2012; Maltarich et al. 2016).

However, the research on task conflicts is indecisive. It has yielded everything from positive to negative to no relations between task conflicts and team performance (De Wit et al. 2013). This is because the picture for task conflict is complex and relies heavily on other factors and moderators. The relationship between task conflict and team creativity, for example, is mostly "a question of how much and when" (Farh et al. 2010). Early and moderate conflict can be stimulating, while late

or too much conflict has no or a detrimental effect (also see Kratzer et al. 2006). If and how conflict can be dealt with is also based on the conflict management style of the team and how it develops through the teamwork (Maltarich et al. 2016). How much task conflicts influence team performance also depends on the complexity of the work (innovation challenge), as it can take away cognitive resources from the task at hand and therefore have a stronger negative impact on complex tasks (de Dreu and Weingart 2003). The biggest threat to team performance coming from task conflict is the co-occurrence of task and relationship conflict (i.e. when a disagreement on the content level becomes intertwined with an interpersonal tension). This can happen coincidentally or causally and leads to more rigidity in decision-making and biased used of information. It negatively affects the performance of the team (de Wit et al. 2013). Task conflict can also turn personal and therefore negatively impact relationship conflict (Guenter et al. 2016). What impact conflict on both team and individual has also depends on the cognitive style of the individual team members (Kim et al. 2012).

How the team deals with conflicts is connected to another prominent socio-emotional factor for innovation: participative safety. Participative safety has been framed as "a shared belief that the team is safe for interpersonal risk taking" (Edmondson 1999, p. 354), which means that the team atmosphere is open and trusting and encourages participation and "speaking up" (West 1990; Peltokorpi and Hasu 2014). Team innovation and creativity needs risk-taking and the courage to pursue crazy ideas as an individual, in a team and on an organizational level (Dewett 2007; Kuczmarski 1996; Edmondson et al. 2001). Participative safety has therefore been considered as a decisive socio-emotional factor for innovation and team performance (Edmondson 1999; Anderson and West 1996). Indeed, it could be said that participative safety mediates the positive effect of task conflict for team performance in general (Bradley et al. 2012). Paradoxically, participative safety has also been shown to be only minimally correlated with innovative outcomes in general (Hülsheger et al. 2009). This is thought to be due to a certain kind of "comfort zone effect" leading to complacency discouraging criticism and divergence for high levels of participative safety. Participative safety could be actually detrimental to creativity. To examine this, Fairchild and Hunter (2014) looked at the combined influence of participative safety and task conflict in the two individual dimensions of creativity, originality and usefulness. They found, as expected, a positive effect of high task conflict on the originality dimensions in the presence of a high participative level. Surprisingly though, the highest positive effect was found in teams low on task conflict *and* participative safety. This points towards the findings of Feist (1998), which reveal that some highly creative individuals score high on openness, but are less conscientious, leading them to prefer a working style with less task interdependence. This could lead to a disconnect among team members, reflected in less attachment and therefore less conflict, but also less participative safety.

But participative safety has also been shown to be positively correlated to learning behavior as well as the quality of being outspoken towards leaders or supervisors (Edmondson 1999; Walumbwa and Schaubroeck 2009). This factor

can therefore also lead to a strengthened feeling of confidence of the team itself towards supervisors as well as organizational challenges, which—apart from the core creative work—could facilitate challenges further down the path towards innovation, namely in the implementation phase.

Variability of personalities and backgrounds in a team can also become important when dealing with uncertainty and team goals. Different people respond emotionally different to goal attainment, mediated by the strength of their regulatory focus (Higgins et al. 1997). Regulatory focus theory distinguishes between a promotion- and a prevention-focused approach to life, based on the basic need to attain pleasure and avoid pain (hedonic principle). While the prevention focus is driven by the fear of loss and a certain convention dependence, the promotion focus approaches challenges from the "What do I gain from this?"—perspective. Both are part of the motivational system and facilitate and sustain activation towards a goal (Baas et al. 2011). These foci as well as the activation can be momentary as well as chronic. Activation is a state characterized by increased cognitive, emotional and physiological parameters such as alertness, attentiveness or heart rate (Watson et al. 1999; Brehm and Self 1989). Moderate levels of activation have been shown to enhance creativity (Byron et al. 2010). Before it was assumed that people with a predominantly promotion-oriented focus generally perform better on divergent thinking tasks, just as creating new insights, while prevention focus seems to be connected to analytical problem solving (Crowe and Higgins 1997; Friedman and Forster 2001). Based on Byron et al., it could be shown that this effect is indeed mediated by the level of activation and energy of the creative individual (Baas et al. 2011). Therefore, prevention focus can also promote creativity if the initial goal is not reached, which leads to the activating emotions of anger and frustration. This insight is in line with the findings of the meta-analysis by Baas et al. (2008), which found that activating emotions like happiness and anger are most positively and comprehensively related to creativity. While anxiety has a negative effect on flexibility, deactivating moods like sadness do not have an effect on creative performance at all.

All three aforementioned socio-emotional aspects—conflicts, participative safety and regulatory focus—share a strong reciprocity between each other and the emotional state (e.g., activated/deactivated, positive/anxious) of the creative individual or team (Shin 2014). One promising way of understanding, assessing and improving creative processes is therefore to look at the affective processes needed for and instigated by these (Amabile et al. 2005; Fong 2012). Affect in this context stands for both short-term emotions and more diffusively structured moods (Barsade and Gibson 2007). A group's affective state is a combination of the group's affective composition (bottom-up) and the affective context in which the group is behaving (top-down; Barsade and Gibson 1998). As we are especially interested in the team affect as it is mediated by a specific innovation process, we focus on the bottom-up dynamics of an existent and static team, which excludes organizational context, initial team composition and self-selection effects (see Paulsen and Kauffeld 2016). The emotions expressed by individual teammembers are one starting point for bottom-up dynamics. These can lead to a mood contagion in other team members (Bono and Ilies 2006). It has been shown that positive emotional contagion in teams

positively influences work-related outcomes such as improved cooperation, decreased conflict, and increased perception of task performance (Barsade 2002).

The effect of positive affect on creativity is mediated via cognitive and motivational processes (Bjørnebekk 2008; James et al. 2004; Nikitin and Freund 2010). These processes are e.g. neural arousal, divergent thinking and activation of other creativity-generating mechanisms (James et al. 2004). On a team level, a positive mood proved to be beneficial for idea generation and overall creative output by fostering the sharing of ideas (Grawitch et al. 2003; Rhee 2006). A negative tone, in contrast, can undermine an innovation team's reputation and lower a team's performance (Barsade and Knight 2015; Peralta et al. 2015).

2.1 Taking a Process Perspective

Although the mediating mechanisms of team affect on creativity are not fully understood, there is ample evidence that positive affect is beneficial for creativity, both on an individual and a team level. The ensuing question therefore is—how can this positive team effect of affect be achieved? Many consulting approaches to teamwork focus on putting together the right people to achieve successful teamwork. These approaches mostly rely on various personality tests, among which the Myers-Briggs Type Indicator (MBTI) and tests based on the Big Five personality trait model are the most popular. Although some personality traits have been scientifically shown to be beneficial for creative work (primarily openness to experience; McCrae 1987), there are two rather big limitations to this approach. First, apart from the canonical Big Five (e.g. Hahn et al. 2012), most of these tests lack validity and reliability, both internally due to theoretical problems (Boag 2015) and externally in their application for recruitment (Guion and Gottier 1965). Second, even if equipped with valid and reliable results from a personality test these do not carry very far in the heavily interactional and dynamic environment of teamwork. For example, it is still unclear how to determine a "perfect mix" for a team in the first place, as individual characteristics related to creativity say little or nothing at all about their effectiveness at the workplace and in team situations (Feist 1998; Madjar 2008). Accordingly, studies find that "different team compositional mixes will be more or less salient at different periods of performance episodes or stages of team development" (Mathieu et al. 2014, p. 130).

Learning and personal development are key ingredients of today's working world, which conflicts with the static notion of personality traits. Especially creative methodologies and frameworks, such as design thinking, rely on the idea "that individuals and teams have the ability to build their innovative capacity through various tools and methods no matter their predispositions to creativity and innovation" (Martelaro et al. 2015, p. 41). Indeed, it has been shown through extensive meta-analysis that process factors "display stronger links with innovation than input variables" (Hülsheger et al. 2009, p. 1139). In short, and following the canonical

"input-process-output" (IPO; e.g. Hackman 1987) model for teamwork one can therefore state: process beats input in all things team.

3 Measuring Emotions Along the Design Thinking Process

To illustrate how a measurement of socio-emotional process factors in vivo can look like, we will dive deeper into a concrete case example: the measurement of emotions expressed in a team along the different phases of the design thinking process.

It has already been shown that a positive team mood also leads to better creative output during ideation (Baas et al. 2008). There also already exists a study looking into the predominance of different regulatory foci in the different design thinking phases by Kröper et al. (2010). However, it assessed only the regulatory focus level and via self-reported Experience Sampling, so not directly examining the emotions uttered.

Here, we will introduce text analysis as an unobtrusive tool to study team affect, present the most important features of the design thinking process and conduct a first analysis of a design thinking team during the key activities of the phases.

3.1 Text Analysis as an Unobtrusive Way to Examine Team Affect

Using text analysis to study team affect presents a new application that has not yet been deeply investigated. This is especially interesting as it presents a way to access the process in an unobtrusive manner. Prior research that focused on process evaluation mainly relied on ratings that are based on videos (e.g., Kauffeld and Lehmann-Willenbrock 2012; Schermuly and Scholl 2012). However, these coding and rating approaches are very time-consuming (e.g., coders using the TEMPO Instrument need nine hours to code one hour of team interaction; Futoran et al. 1989) and would compound the already time-consuming transcription work. Moreover, to ensure adequate reliability it is recommended that at least twenty percent of the video material be coded by two raters to enhance the effort. Nevertheless, error-free analysis is still not ensured. With the promise offered by enhancements in speech-to-text technology in regard to transcription, coding will soon be the rate-limiting step for such analyses. To overcome these problems and eventually move towards near real-time evaluation, we need an approach that is computerized, both to avoid humans as a source of biases and to speed up the evaluation process.

One way to computationally evaluate large amounts of text is the Linguistic Inquiry and Word Count software (LIWC; Pennebaker et al. 2015c). LIWC categorizes words in specific categories and subcategories which can be linked to several psychological models and processes. For example, pronoun use to attentional focus,

verb form and word count to social hierarchy and many more (Tausczik and Pennebaker 2010). In its current version, for example, the complete English dictionary contains 6400 entries which are all assigned to one or more of 55 nonexclusive categories, organized under four main themes: basic linguistic processes, psychological processes, personal concerns, and spoken categories (Pennebaker et al. 2015a, b). The LIWC word categories are well validated and their applicability to different contexts of real life interaction has been demonstrated in hundreds of studies (Tauscik and Pennebaker 2010). Research also shows that LIWC is an accurate and valid method to measure emotions in language use, being both in accordance with human ratings (Alpers et al. 2005) and having predictive power (Kahn et al. 2007).

LIWC has been frequently used for sentiment analysis, which analyzes the affectional relationship of individuals towards products, political opinions etc. on a bipolar scale that is usually positive–negative (Stieglitz and Dang-Xuan 2011; Tumasjan et al. 2010). The same approach has also been used to analyze mental health signals in Twitter data (Coppersmith et al. 2014). Although we do not generally look at sentiment (directed affect) but team affect, LIWC has proven to be very effective for such emotional, bipolar evaluations in general (Kahn et al. 2007).

3.2 The Phases of the Design Thinking Process

The conceptual structure of design (thinking) processes can be well approximated along two pairs of concepts: the problem and solution space, and divergent and convergent thinking (Lindberg et al. 2010). The problem-solution pair points to the specific structure of the type of problems which can and can best be solved with a 'designerly' approach—the so-called 'wicked problems' (see above). This special form of complexity mostly stems from the simple fact that these problem fields are inherently *human* problem fields—fields, where bona fide needs and wishes of different users and stakeholders clash, emerge and change continuously ("A design problem keeps changing while it is treated"; Rittel 1987, p. 2). In its approach to take this inherent humanity serious, design and design thinking takes a human-centered, empathetic approach. This approach relies heavily on empathy and a certain form of iterative framing and reframing of the problem. This eventually leads to a co-evolution of problem and solutions space, rather than just a linear development of one predetermined solution (Maher et al. 1996; Dorst and Cross 2001).

A team creative process for innovation generally comprises four stages: identifying the problem; gathering and synthesizing information; generating ideas; and evaluating, refining and selecting them (Gilson et al. 2015). Following Guilford (1950), these four stages can be roughly categorized into the two thinking modes they require—divergent and convergent thinking. Divergent thinking means 'going broad', looking for a high quantity of different insights or ideas with a high semantic diversity (Guilford 1956; Shroyer et al. 2017). The ability of divergent thinking is an

important factor for ideational productivity and has been identified with cognitive creativity for decades (Runco and Acar 2012). The underlying assumption of any divergent activity is that a greater number of ideas will lead to more creative outcome. The Torrance test, still the most prevalent creativity test, essentially measures divergent thinking ability (Baer 2011). It has also been argued, that in various framings, this thinking ability of 'going broad' is a *condicio sine qua non* for creativity and innovation processes (e.g., abductive thinking—cf. Dorst 2015; Endrejat and Kauffeld 2017; lateral thinking—De Bono 1968; associative thinking—Mednick 1962). Brainstorming, for example, can be understood as a systematized approach to facilitate divergent thinking (Kalargiros and Manning 2015).

Convergent thinking, in contrast, is needed to boil down the variety of concepts in order to be able to focus and consolidate the explorative work. It consists of the naming, (re-)ordering and linking of concepts. Without convergent thinking, neither the concrete problem treated could be framed nor a final result produced (Cropley 2006; Guilford 1956). Convergent thinking therefore ensures the usefulness of the ideas generated by divergent thinking and prevents a purely novelty-focused "pseudocreativity" (Cattell and Butcher 1968, p. 271).

At the HPI School of Design Thinking these different thinking modes and space explorations are distributed over six phases. These phases are visited repeatedly and iteratively over the course of a full design thinking project, with 'Understand', 'Observe', and 'Synthesis' as part of the problem finding, and 'Ideation', 'Prototype', and 'Test' as part of the solution space. 'Understand', 'Observe' and the 'Ideation' phase can be roughly classified as divergent phases, i.e. as much data or ideas as possible should be gathered and generated, while judgement and selection are deferred. Roughly, because also during 'Understand' a first clustering or ordering can happen, and also the classical brainstorming phase 'Ideation' normally includes a selection of ideas. 'Synthesis' and 'Prototype', in contrast, are convergent phases, i.e. one to a handful of insights or ideas need to be selected, facilitated by certain methods to cluster and filter and make sense out of the vast variety generated before. The distilled insights will then be used to define a 'Point of View' (the pivotal point between problem and solution space), and the selected idea(s) to build a prototype (see Fig. 1). 'Test' can go both ways. This, on the one hand, depends on whether the activity is planning, conducting, or evaluating the testing, and on the other hand, what the outcome of the testing is. While the testing itself is rather divergent in the sense of again going into the field and collecting data in the form of feedback and observations about the interaction of users with the prototype, both planning and especially evaluating the testing can lead to both divergent and convergent thinking modes. Planning, because you can (a) either brainstorm on testing scenarios (divergent), (b) still further refine the prototype and its presentation specifically for testing (convergent), or (c) organize the testing itself (rather convergent or solely procedural). What happens during or right after the evaluation of the testing very much depends on the outcome of the testing. Did the general idea (the critical function) work and resonate with the user? Or does the whole concept need reworking in the form of better understanding the needs of the user (back to research) or coming up with better solutions (back to ideation)? The former would mean to go further towards

refinement of the prototype and thereby continuing down the path of convergence. The latter though means collecting (completely) new insights or ideas or at least revisit the ones gathered before, i.e. opening up the solution space again.

Each of the aforementioned phases therefore has its own objectives and key activities, resulting in a different working mode and differently structured outcomes. We capture these key activities and episodes in the form of video and audio recordings of the most decisive moments for the team in terms of content development, i.e. the key team episodes for the respective day. Although the working day for the teams at the HPI School of Design Thinking usually has a preset agenda, the teams diverge from it if needed. This especially happens in the later phases of a full design thinking project, when the first iterations begin.

3.3 Mapping the Emotional Journey of a Design Thinking Team

The different objectives and ensuing working modes of the different phases effect the emotional journey of the design thinking team differently, along with the general development of the team's climate over time. We want to illustrate how studying affect via text analysis can help to better understand the effect of both the general structure of the design thinking phases as well as, in the future, of the specific methods employed to reach the phase objective. To this end we will map out the emotional journey of one team working on a 6-weeks design thinking project in the dimensions of positive versus negative affect in the following part.

3.3.1 The Data

The team recorded worked on a real-life design thinking project with project partners from the music industry for two full days per week, over the course of 8 weeks. All in-house project (meeting and working) days were audio- and videotaped to capture the most decisive phases of the design thinking process. These phases were: (1) first approximation of the challenge ('Understand'), (2) bringing together and synthesizing information gathered in the field ('Synthesis'; 'Point of View' in Fig. 1), (3) developing ideas ('Ideation'), (4) preparing the 'Testing' and (5) building and refining prototypes ('Prototype'). The two phases 'Observe' and the testing itself are conducted outside of a traditional team meeting setting in the field and as such are not included in our analyses. The video and audio data were transcribed and segmented into speaker turns. A turn begins when a new speaker starts her utterance and ends when she stops to speak or is interrupted.

The transcribed text was analyzed with the LIWC2015 software. The LIWC2015 Dictionary comprises almost 6400 words, word stems, and selected emoticons, all of which are categorized into one or more categories and subcategories. For our

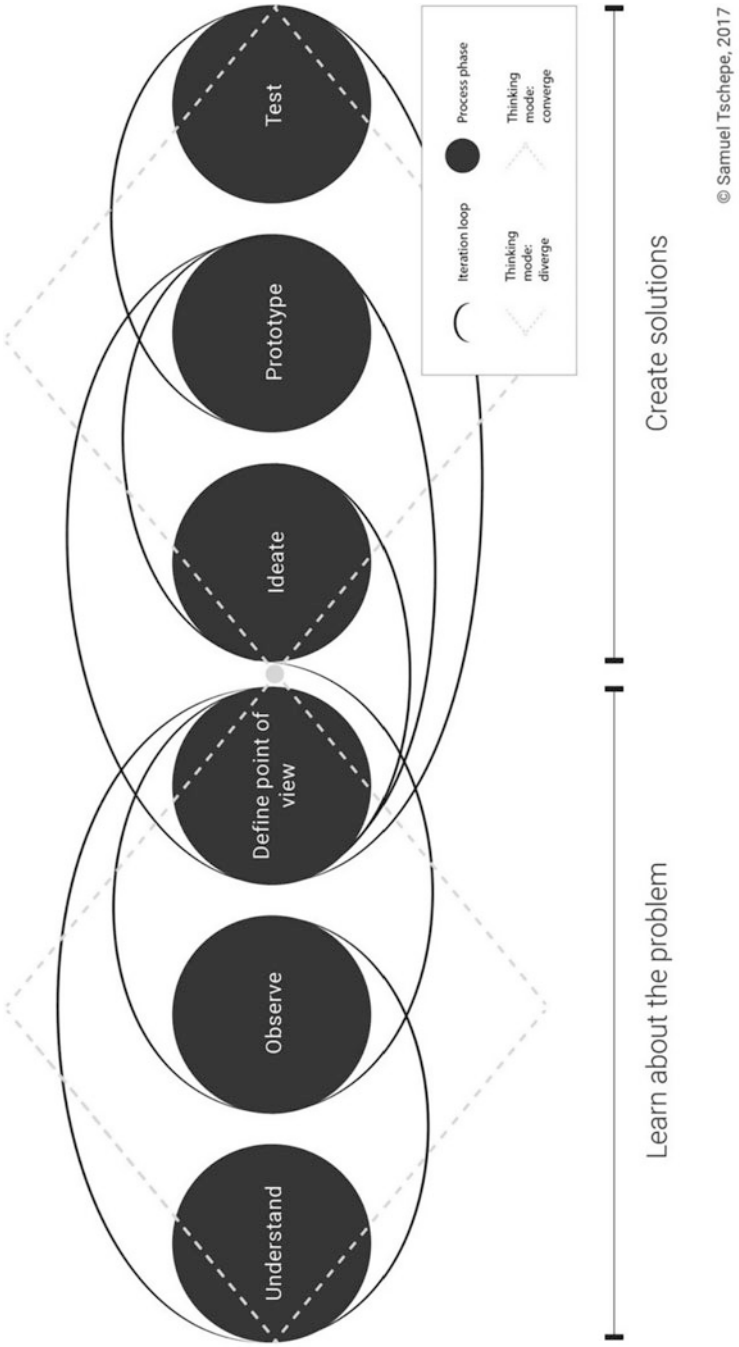

Fig. 1 The design process used at the HPI School of Design Thinking with the six phases 'Understand', 'Observe', 'Define point of view', 'Ideate', 'Prototype' and 'Test'; with an overlay indicating the convergent and divergent phases (dotted line) as well as indicating the problem ("Learn about the problem") and the solution phases ("Create solutions"; Tschepe 2017)

Table 1 LIWC natural speech means vs the LIWC means of the design thinking team

	Phase	Turns	WC	Affect	Posemo	Negemo
LIWC	Natural speech means		–	6.5	5.3	1.2
Design thinking team	Total/Average	1570	21,228	13.0	11.7	1.3
	Understand	321	4948	13.4	12.2	1.0
	Synthesis	265	4140	9.3	8.0	1.2
	Ideation	267	4633	12.9	11.5	1.3
	Testing Feedback	355	4656	16.1	14.4	1.6
	(Refining) Prototype	362	2851	13.4	12.1	1.2

analysis, we make use of the *affect* categories *posemo* (i.e. including positive emotion words) and *negemo* (i.e. including negative emotion words).

The *affect* category comprises 1393 words in total, reflecting different affective states. The two mutually exclusive and mutually exhaustive first order subcategories are *posemo* with 620 words reflecting positive emotions (e.g. 'love', 'sweet', 'nice') and *negemo* with 744 words reflecting negative emotions (e.g. 'hurt', 'ugly', 'nasty'; Pennebaker et al. 2015c).

3.3.2 Communicative Style in General

We included 1570 statements (21,228 words) uttered by the design team during the key episodes of the above-mentioned activities in our analysis.

With an overall value of 13.0 the *affect* average of the design thinking (DT) team is much higher than the means for natural speech provided by the LIWC Development manual of 6.5 (Pennebaker et al. 2015c). This above-average affectivity is predominantly due to positive emotions voiced (*posemo*; LIWC2015 natural speech mean = 5.3, DT team = 11.7), whereas the expression of negative emotions (*negemo*) stays on an average level (see Table 1).

The design thinking team therefore seems to be generally more emotional, and of these emotions expressed above-average are positive.

3.3.3 Positive and Negative Emotions in the Different Phases

In Fig. 2 we can see graphically, what the numbers in Table 1 describe—after a very positive start in the 'Understand' phase, expression of positive emotions (*posemo*) drops about to about three quarter of the initial value in the 'Synthesis' phase. It then again rises during 'Ideation', until it reaches its high point when collecting the feedback of the 'Testing'. *Posemo* then again levels out at nearly the same value during refining the 'Prototype' (12.2 to 12.1) as it was during the first phase.

The negative emotion category, *negemo*, in contrast shows no notable variation and stays very close to the general LIWC2015 *negemo* mean for natural speech of 1.2 (see Table 1).

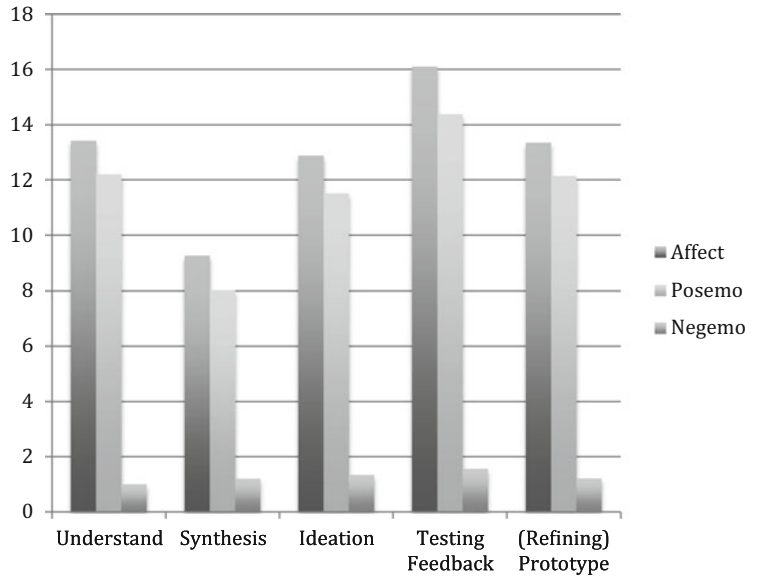

Fig. 2 The *affect*, *posemo* and *negemo* averages of the investigated design thinking team along the key activities

This result indicates that—like already in the overall mean—also nearly all of the affect dynamics are due to the dynamics of positive emotions expressed.

Especially noteworthy is the sharp drop in the 'Synthesis' phase. It is here where the problem and the solution space explicitly get connected via the 'Point of View'. Distilling the "best" insights from an often verwhelming mass of data collected during 'Observation' is also often the hardest part, especially for less experienced design thinkers. But this difficulty also is attributable to a decisively different working mode necessary during 'Synthesis'—in contrast to the propagated and prototypical diverging thinking mode in design thinking. 'Synthesis' needs clustering, selecting and—hence the name—synthesizing information, rather than going broad and crazy. This convergent thinking mode can come with some serious challenges to design thinking teams. The comparison, discussion and subsequent selection of insights puts the team under argumentative and judgmental pressure, potentially resulting in more conflicts and also a higher cognitive load (Kim et al. 2012). Studies on transactive memory have shown that especially under time pressure teams with a similar level of expertise about the problem at hand suffer from a higher cognitive load (Hollingshead 1998). In general, it has been shown that the process of weighing arguments comes with a higher mental effort than constructing new solutions (Shehab and Nussbaum 2015). A greater cognitive load finally can lead to a reduction in emotional intensity (Van Dillen and Koole 2007; Van Dillen et al. 2009).

The importance of the convergent movement has been highlighted before, and the 'Synthesis' can often be a decisive working phase for a design thinking project. It is therefore no accident that experienced designers are said to be especially good 'synthesizers' (Goldschmidt and Tatsa 2005).

Maybe it is this cognitive difficulty what we can see in the data here, leading to a drop in (positive) emotionality. But to prove this hypothesis more than this first probe will be needed and should be subject to further, more comprehensive studies.

The global maximum we see for the collection of the 'Testing' feedback can in contrast be quite easily explained when we look into the real-life data. The feedback for the prototype of the team was just very positive, which was reflected in a positive team mood. This as well could be an interesting starting point for further studies, especially in combination with accounting for the different cognitive style or regulatory foci of the team members, as this will influence the reaction to positive or negative feedback.

For the end of this chapter though this first illustration of how LIWC can be used to probe the emotional journey of a design thinking team shall be sufficient.

4 Conclusion

Our pre-study shows how LIWC can be used as an unobtrusive instrument to examine the affect dynamics of an innovation team in the wild. Affect analysis is an important step towards studying other, more complex socio-emotional constructs introduced in Sect. 2, like regulatory focus, intragroup conflict, and participative safety on a process-level. It has already been shown that the closer a project approaches its end, the more important a team's affect for outcomes becomes (Paulsen et al. 2016). Thus, future research following the phase structure of innovation processes might also look at the different impact and relevance of team affect in the different phases. Also, the interplay between different constructs as well as the manageability of these is an important field to further look into, especially for real-life application in education and industry. Such as participative safety can mitigate high conflict levels, which in turn can be due to diverging momentary regulatory foci, there are several other mechanisms and interdependencies which need to be better understood. For example, there are already studies on how to "hack" into appraisal processes to improve creative ideation (De Rooij et al. 2015), as these are also connected to emotional reactions via regulatory focus (see above). Another example is that loading the working memory of individuals can reduce negative mood and make them more robust against negative stimuli (Van Dillen and Koole 2007). To make these and more insights frugal for creative team work would also mean to look deeper into single activities instead of broad phases to evaluate the methods being used in regard to how they affect the emotional level of the teams. This could be used to formulate recommendations to innovation practitioners and facilitators alike on which methods to employ and when. Such recommendations would be particularly helpful for team and leadership coaches in becoming aware of

the importance of coaching interventions on the emotional level. This would allow them, as well as (future) members of creative teams in general, to develop the emotional intelligence much needed as enablers of creativity and innovation (see Ashkanasy and Dasborough 2003; Ashkanasy and Daus 2005; Goleman and Boyatziz 2008).

The study of groups over time in general is still underrepresented (Cronin and Weingart 2011), especially in the wild. Laboratory settings and tasks are often not engaging enough to measure realistic emotional involvement (Shin 2014; George and King 2007). Text analysis makes both an unobtrusive and high-resolution process study of team dynamics over time and in the wild possible, as it only needs (though proper quality) audio data. Text analysis also does not need any coder-training, tests for inter-rater reliability or the high investment of time for coding itself. The transcription effort though still remains.

Although LIWC has its limitations due its lexical and therefore static nature, as newly designed categories need to be validated anew individually. The next step here lies with more adaptable machine-learning algorithms (e.g., Empath by Fast et al. 2016). Such computational tools, lastly, also open up many more opportunities for statistical analysis, which may be more revealing for implicit emotional processes than a qualitative analysis of language (Paletz et al. 2017).

For the concrete study of team affect through the different phases, this case study of course only has very limited validity. We are currently working on making more text data of teams and phases available. Especially the difference between divergent and convergence phases is something to look into more in detail and quantitatively. Additional measures, such as self-reports and outcome measures, could be included and would allow for a comparison between reported and observed emotions, as well as the collection of data on other, related socio-emotional constructs. Also, the outcome should be taken into consideration to be able to be able to identify how the emotional journey of a successful team differs from an unsuccessful team.

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