

**The Emotional Base of Knowing – Boundary Crossing (?)
in Inter-Organisational Innovation Projects**

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Introduction

In this paper, we focus on the emotional base of knowing in relation to boundary-crossing in inter-organisational innovation projects. Our focus on inter-organisational innovation projects rests upon the observation that inter-organisational cooperation is very common in innovation, as a single organisation need competences or resources that other organisations control (Jones & Smith, 1997; Bengtsson & Eriksson, 2002). Therefore, the combination of intra-organisational and inter-organisational knowledge sharing in such projects provide interesting complexities to study, in particular as most research focus on either intra- or inter-organisational knowledge sharing (Eisenhardt & Santos, 2002).

In inter-organisational projects, people interact across departmental boundaries in their own organisation, as well as across corporate boundaries, and the crossing of boundaries always implies interaction with individuals and work groups with different practices, goals, beliefs and identities. Boundaries play many roles in our daily work; both restraining and enabling different activities. For example, the mix of boundaries influence project work as it creates problems regarding for example how to achieve trust or safeguard corporate secrets or how to share knowledge. Of course, the complexity is enhanced as the content and effect of departmental as well as corporate boundaries vary between contexts.

It can be difficult to integrate knowledge across boundaries (compare studies on knowledge sharing, e.g. Larsson et al 1999; Powell 1998, Carlile, 2002, Østerlund & Carlile, 2005). Consequently, much research has focused on boundary crossing and how boundary crossing can be facilitated and different explanations as to why knowledge is shared or not have been provided. One such explanation claims that knowledge is difficult to transfer between people with different practices and reversely, that interaction and knowledge sharing across boundaries is facilitated by shared practices (Brown & Duguid, 1998; Cook & Brown, 1999; Orlikowski, 2002). This argument in turn is based on a view of knowledge as expressed and created through the practices in which we engage, that is in knowing (Orlikowski, 2002). Therefore, at least a basic understanding of each partner's practices is necessary for innovation in inter-organisational projects.

¹ This is a work in progress. Please do not quote.

However, boundaries are complex and multi-textured. The emerging body of literature on boundaries examine for example the cognitive, physical and social (Hernes, 2004) or the occupational (see e.g. Black, Carlile & Repenning, 2004) character of boundaries and not least the effects of these boundaries. Carlile (2002), for example, present three different types of boundary functions that influence the possibility to share practices, and thus for achieving knowing across boundaries. The newer an innovation, the more political the boundary and the more difficult the sharing of practice becomes. Through this brief description, it is obvious that boundary crossing and meetings between practices can give rise to emotions among the project workers. Emotional expressions arise based on current identities and are an indication of whether the practices, norms, boundaries or identities specific to a certain practice are challenged or reinforced when boundaries are crossed (compare the emotional expressions following change in Baldwin & Bengtsson, 2004; Huy, 2002). Emotions can also spread within a group or within a project (Bartel & Saavedra, 2000) and thus shape the project work through supporting certain routes of action and preventing others.

While scholars of knowing have explored and described the role of boundaries in shaping how the exchange of and integration/use of knowledge arises and occurs over boundaries, few have however elaborated on how emotion relates to these processes, and how the emotion-based dynamics of knowing can contribute to the success of inter-organisational innovation projects. Yet in recent years, there has been an "*explosion of interest in emotion in organisational behaviour*" (Fineman, 2004:720), where emotions are seen to pervade and shape processes and outcomes of organising (e.g. Fineman 1993;1996). The inclusion of emotion in the analysis of organising is grounded in the notion emotions shape our everyday life in the same extent as our thoughts. While being difficult to study, emotional expressions and the emotional bases for these expressions are important for understanding how shared practice and knowing develop or not in inter-organisational projects.

The purpose of the paper is therefore to describe how emotions influence boundary crossing and patterns of knowing in inter-organisational innovation projects. In particular, we focus on the interaction and the practices within the projects and whether this interaction implies boundary-crossing. The paper is based on case-studies with an explorative analysis and contributes to our understanding of the role of knowledge sharing and knowledge integration across boundaries by adding texture in the form of emotions.

The structure of the paper is as follows. First, we describe our theoretical frame of reference, focusing on knowing, boundaries and emotions. This is followed by a methodological discussion about how emotions can be studied a description of our empirical

cases and the data collection. Next, a results section sketches the emotional bases in the case and relates this to the knowing and boundary crossing in the respective cases.

Theory

This section begins with a discussion of practice-based knowing and the role of boundaries. We then address the issue of emotions in organisations, and focus in particular on the expressions of emotions as an indication of fit and dysfit of patterns of practice-based knowing and boundaries thereof.

Knowing within and across boundaries

The past decade has seen an increasing interest in practice and activity based perspectives of knowledge and organising (see e.g. Gherardi, 2001; Schatzki, Knorr Cetina 2002 & Von Savigny, 2002), enriching our understanding of knowledge sharing across boundaries. In our view, practice refers to repetitive patterns of activity that bring a sense of meaning and identity to those involved in the practice (cf. Rouleau, 2005). Further, practice expresses interaction within a collective, rather than actions and qualities inherent in one single person. A practice-based perspective relating to knowledge focuses the activity, the creation or utilisation of a resource, rather than the having or owning of knowledge as a specific resource (cf. Cook & Brown, 1999; Jarzabkowski, 2004). Likewise, the concept of knowing focus on the activity of using and creating knowledge rather than holding knowledge, on putting knowledge to use in practice (Cook & Brown, 1999; Orlikowski, 2002). Indeed, Orlikowski (2002) seems to use the term knowing almost synonymously for knowledge, and Cook and Brown (1999) use knowing to describe the practice in which collective and individual knowledge as well as tacit and explicit dimensions of knowledge are shaped and shapes knowing. Here, we follow the definition by Cook and Brown, allowing us to distinguish between knowledge as a result of innovation and knowing as the ever ongoing process of interaction.

Given a practice based perspective, the concept of knowledge as transferable can be questioned. Knowing cannot be shared as a resource; instead, we share and shape knowing through learning and engaging in a particular practice (Orlikowski, 2002; Østerlund & Carlile, 2005). To arrive at shared practice, it is generally assumed in the literature that people have to work together over time (cf. Brown & Duguid, 1998). Thus, knowing is for example considered to be aided in homogeneous groups such as communities of practice, where people

share the same practices, have a shared language and shared identity regarding for example their role in an organisation. The existence of a shared practice, a language and an identity thus also clearly create a boundary towards those who engage in other practices. A general idea among researchers in the field is that people who share a practice have a normative understanding of what should be done and how it should be done, which facilitates their work (see Østerlund & Carlile, 2005). They also define what is socially acceptable knowledge and competence in a certain context (Brown & Duguid, 2001; Wenger, 2000), which indicates that there are situationally contingent expectation on knowledge and competence, which in turn influences what type of knowing that arise. In the literature, examples of shared practice tend to coincide with departmental boundaries within firms as well as occupational boundaries.

Thus, it can be questioned whether an innovation project amounts to a community of practice, even if people work together over longer periods of time (see for example Lindkvist, 2005 for a discussion). Rather, project workers come from different communities of practice and need to develop some common ground (cf. Bechky, 2003) to align their practices, and if possible take additional steps to integrate practices and knowledge. Orlikowski (2002) present a number of practices that members in a distributed organisation engage in to overcome different boundaries. Each practice, such as aligning effort or supporting participation, incorporates a different type of knowing, for example knowing how to innovate in a dispersed organisation.

Turning to boundaries, we take our point of departure in Hernes (2004), who in turn builds on Lefebvre. Lefebvre (1991) emphasised three dimensions of space, physical, social and mental. Based on this distinction, Hernes classifies boundaries as having physical, social and mental textures (Hernes, 2003; 2004). The physical textures of boundaries in and between organisations comprise tangible material and regulative 'textures' that can be seen, felt or touched, and that bind organisational resources over time and space. Such physical boundaries include formal company boundaries, geographical distances, and written rules for interaction. Social textures comprise identity issues and behavioural norms, emphasising the social ties that hold members of a group together. Social boundaries can exist both within and across formal organisational boundaries, based on e.g. social or professional identities. Last, the mental or cognitive boundaries are similar to collective beliefs (cf. Abelson's (1976: 33) scripts or Weick's (1979) schema). These beliefs guide our actions in specific situations and help us to make sense of events in our environment (Louis, 1980). These mental boundaries, while limiting, also "lay the basis for new knowledge" (Hernes 2003: 41). Further, according to Hernes, boundaries have three different types of effects; regulating effects, distinguishing

effects, and threshold effects. This latter effect is particularly succinct for this paper, as such threshold effects of boundaries influences the possibilities for knowing across boundaries.

A focus on boundaries should however not be perceived as reifying boundaries and reducing human agency; boundaries are subjected to active sensegiving (cf. Gioia & Chittipeddi, 1991; Rouleau, 2005) as well as providing a support for sense making. In this paper, we further argue that there is a process of mutual shaping between practices and boundaries, and that the different effects of boundaries are challenged through boundary crossing activities. Carlile (2002), for example, distinguishes between information processing, interpreting and political functions in boundaries, and how such functions influence the ability to share knowledge across boundaries. New and radical innovations encounter political effects at the boundary, according to Carlile. For this paper, it means that the more radical an innovation, the more there is a need for active translation, sense giving, negotiations and power plays. In particular, processes of knowing that may result in changes in practice (and conversely, changes of practices that may affect knowing) can be perceived as threatening for a particular group who ‘guards’ or holds onto their practices; norms may be challenged, identities questioned, and mental models shaken, often giving rise to emotional reactions. Such emotional reactions, made tangible in expressions of emotion (verbal and/or observable), indicate, in the context of this paper, a potential dissonance in the fit of practices of knowing across organisational boundaries. In the following, we therefore outline our position on emotions and emotional expressions in organisational contexts, and how such expressions relate to knowing.

Emotions, emotional expressions and emotional bases

Emotions² can be defined as psychobiological responses that link cognitive, motivational and physiological systems in the individual (Salovey & Mayer, 1990). Three themes of research into emotion in organisational context can be discerned (see Domagalski, 1999); the relationship between emotion and rationality (e.g. Ashforth & Humphrey, 1995); the theoretical grounding of emotion (e.g. Fineman 1993; 1996); and control, power and dominance relating to emotions (e.g. Hochschild, 1983; Fineman & Sturdy, 1999). Issues

² Emotions can be conceptually distinguished from for example feelings and moods. We however draw upon Huy (2002; se also Baldwin and Bengtsson, 2004) when we argue that due to the nature and purposes of this paper; the role that emotions may have in the process of inter-organisational knowing, it is enough to use the concept of emotions in a broad sense. Therefore, at the intra- and inter-organisational collective level, we do not distinguish between moods and emotional expressions.

examined are for example 'emotional work' (e.g. Hochschild, 1983; Van Maanen & Kunda, 1989), work-related emotions within the organisation (Ashforth & Humphrey, 1995; Martin, Knopoff & Beckman, 1998), and, of interest for this paper, the relationship between change, emotions and behaviour at the work place (e.g. Huy 2002; 2003). Most studies of emotions have focused the organisational level, but increasingly, there are studies considering emotions at the inter-organisational level (see Bengtsson & Baldwin, 2004; Fineman & Sturdy, 1999). Common in research into emotions in organisations is that emotion is seen as social constructions (Fineman 2004; Barsade, 2002).

The main notion regarding emotions in organisations argues that individuals in organisational settings are said to be emotionally invested in the assumptions that subjectively shape their cognitive structures for sense-making and sense-giving (Huy 2003) and therefore emotions affect how individuals interpret and behaviourally respond to organisational events and processes or object and persons (Parkinson, 1995; Huy 2002). Negative emotions can be seen as responses to events, processes or people that challenge or question such stable cognitive structures (cf. Huy 2003:2). On the other hand, positive emotions can indicate a response to organisational that support and reinforce existing cognitive structures. Emotions are thus evaluative outcomes of change, and the evaluation is often an unconscious process (Lazarus, 1991).

While arising in the individual, it is frequently argued that emotions emerge in interaction (c.f. Goffman, 1956; Hochschild, 1983; Van Maanen & Kunda, 1989), guiding collective as well as individual action (Berg, 1979). In much the same way as collective cognition emerges, mutual interaction within a work-group setting can lead to collective emotion, a group's emotional charge (Huy 2003). As group members identify with each other, and experience each other's emotion, 'emotional contagion' takes place, in which individuals respond to the other's emotional expression by imitating and exaggerating these emotional expressions (Barsade, 2002). Emotion in this respect thereby also influences group behaviour and group processes.

Emotions thus generate dynamic, socially situated emotive expressions (e.g. Fineman, 2004) that others can feel and observe. Emotional expressions for example often arise following changes that challenge the existence or the identity of a group or their established norms for behaviour, and they are therefore important part in indicating the meaning constructed in relation to different change initiatives. It should be noted that emotions are not triggered by favourable or unfavourable conditions per se, individuals, events or processes, but by factual or perceived changes in conditions (Huy 2003, Frijda, 1988).

Emotional expressions are sometimes conscious and deliberate, at other times unconscious and unintended. As Fineman points out our “*subjective feelings and their outward expression may sometimes correlate, but frequently they do not*” (Fineman 2004: 720), which illustrates a potential lack of cohesion between what we actually feel, and what we express. People can also adopt particular strategies for how to interact, such as being friendly, when they are pursuing a particular goal or are acting within the bounds of a particular role or profession (Fineman & Sturdy, 1999). However it is our expression of emotion that is perceived, interpreted, and reacted to by others.

Huy (2002) has studied emotional-management patterns in an organisation undergoing radical change using a circumplex model of emotions. He identifies different emotions that are distinguished by two dimensions; the intensity or the degree of activation of an emotion, and whether the emotions are pleasant or unpleasant (see figure 1 below). Highly activated and pleasant emotional states thus include enthusiasm and excitement, whereas highly activated unpleasant emotional states are comprised of anger, anxiety and fear. Low activated pleasant emotional states on the other hand are denoted by feelings such as calm and comfort, whereas low-activated unpleasant emotions include disappointment, shame or dejection. This range of emotions is argued to convey the range of emotional states that appear in organisational settings.

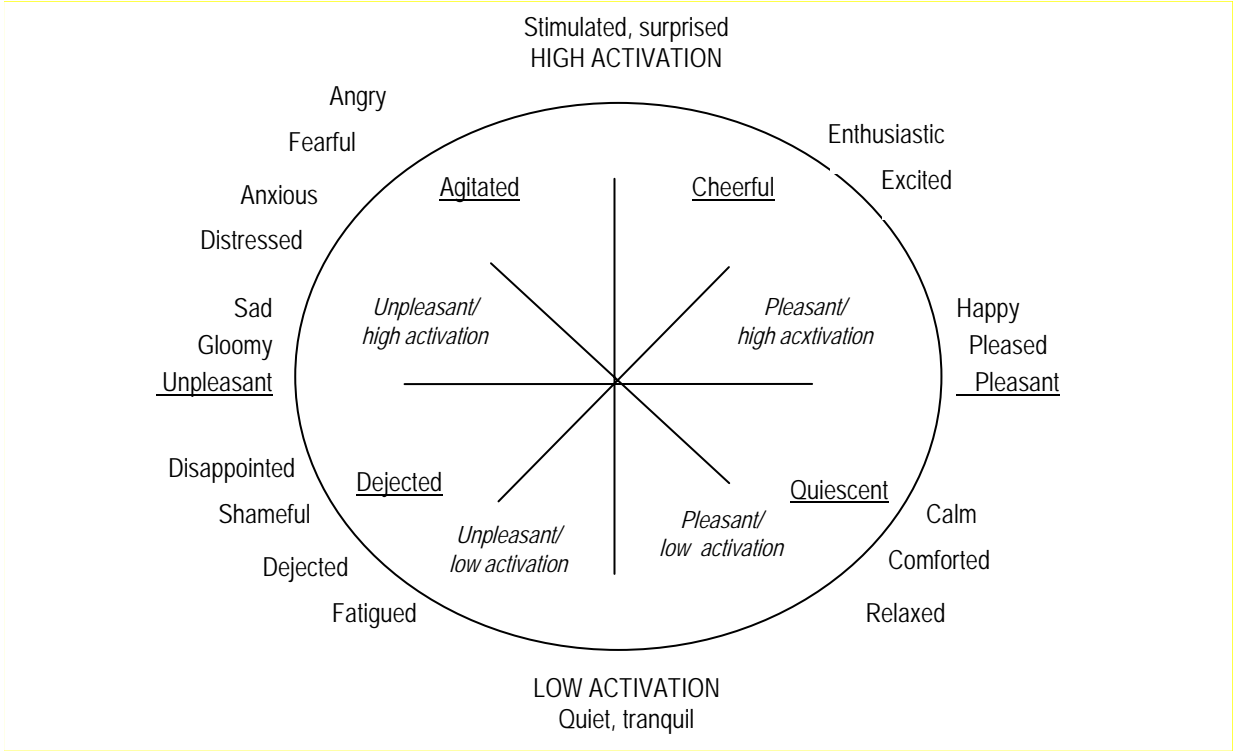


Figure 1. Circumplex model of emotions (Larsen & Diner, 1992 in Huy, 2002).

These and other emotional states can therefore be argued to comprise a platform or base for action, both individual and collective, in organisational settings (Huy, 2002; Baldwin & Bengtsson, 2004). While less clear in Baldwin & Bengtsson (2004), we distinguish here between emotional state (the psychobiological response), the emotional expression (the verbal or observable response) and the emotional base which we see as a feeling-based climate of, or platform for, contextualised organisational action. For example, if 'happy' can be described as an emotional state that characterises an individual's response to organisational events, processes or other individuals at work, the emotional expression may be an observable response such as laughter or a verbal response indicating being in a good mood, and may provide a emotional base or climate for action characterised by humour. This happy emotional states 'acts' as a humorous base for that individual's organisational performance and interaction, bringing a playfulness to the way that individual conducts his/her work, leading perhaps to knowing that is characterised by creativity and innovation. If, on the other hand, an individual or work-group is characterised by a negative emotional state, such as individual or collective dejection or disappointment, the emotional base of interaction may be depressive, and work performance is more likely to be non-developmental, and at best routine-based. Thus, emotional states in organisational settings create a climate for interaction, and thus organisational action and interaction can be argued not just to be cognitively structured, but also emotionally structured - the emotional base of organisational action.

Research setting and data collection

In this section, we describe the projects studied and the research site, and we discuss how emotions can be studied, how data was collected and finally how we analysed our data. In particular, we need to discuss how we study and analyse emotional expressions. According to Fineman, emotions are - apart from moods- context specific and reside "*in language used... emotion is a social construction – a feature of social learning, cultural conditions and discourses*" (Fineman, 2004; 732). As a consequence, we use data based on interviews, where we largely ask the respondents to describe their daily activities, how the project was started, how it has developed, and so on. The average interview has lasted about two hours.

We have not asked questions about our respondent's feelings, instead, they talk about things that matter to them, and how they feel about their daily work in the project. Here too, we lean on Fineman (2004), who suggest that stories or descriptions of work often will embody emotions or "emotional messiness".

All interviews have been transcribed and longer case summaries have been compiled. The first step in this analysis was to go through transcripts of interviews as well as our resulting case summaries. Our stories were of three types;

- Stories on the project level; how cooperative projects were started, developed and evolved, and about partners that are involved.
- Stories on the activity level; people's everyday work with innovation.
- Stories about particular events.

We searched for emotional expressions (in a broad sense, inspired by Huy (2002)) in these narratives, relating emotional expressions to the projects, the work/activities, and the events (cf. Parkinson, 1995), and then interpreted them in context, rather than focusing on the phrases used or the placement of words relative one another. More precisely, we considered the constructing of meaning in particular situations, informing our analysis by an understanding of the social processes in each context. We then focused on what Fineman describes as the "outward" focus of stories, how emotions are used as an expression of the individual's or the group's identity. This is in line with a focus on emotional expressions, rather than the internal, subjective feeling.

We draw upon data from studies of three inter-organisational projects. We have primarily studied one partner and their view of the project. Further, the firms we have studied, all comprises two or more project or work groups that are integrated for this particular project. There is thus a need both for intra-organisational and inter-organisational knowledge sharing in these projects. The aim in all three projects is to innovate through integrating knowledge and learning from the other partners and thus achieving new knowledge and changes in practices. The three projects have been anonymised, changing some basic facts while still attempting to provide context.

Project 1 – The Biotech case

Our first inter-organisational project has been formed to develop a pharmaceutical drug. The project workers are four persons (one chemist and three biologists) within a small Swedish biotechnology firm, three persons at a Japanese pharmaceutical firm and two persons located at different university departments. The project has had several phases, where the cooperation with the Japanese firm represents more of a formalisation of the project and this phase has lasted for three years and is about to end. The project will then be reformulated. The studied phase is concerned with developing substances that can be tested on a larger scale and testing them (in Japan). At the same time, the aim is to create a knowledge base in Japan for

further development of testing procedures as well as development procedures and oppositely, the Swedish firm wants to learn more about commercialisation and industrial development. The project rests upon integration of knowledge from the two scientific disciplines and several university departments, and also on integration of scientific knowledge and business knowledge.

In the company lab, one chemist and two-three biologists work on this particular project. The biologists interact on a daily basis, whereas the chemists and the biologists interacts a couple of times per week. The biologists and the chemist are in close contact, but they mainly exchange information and data resulting from their work. They do not work together or partake in specific scientific discussions across their disciplinary areas. There are also different “languages” used in biology and chemistry, hindering communication to some extent. The chemist on the other hand interacts frequently with researchers in chemistry at the university, who are located in the same house. One of the chemists at the university is also one of the project owners, so contact with him is particularly intense.

Patents protect the company’s knowledge base, but the firm needs very precise contracts with the university researchers and departments they cooperate with in order to avoid conflicts with publication of confidential data etcetera. The interaction with the Japanese firm is based on occasional meetings and educational efforts, but the primary means of communication is e-mail and the use of postal services for transportation of results and tests. Coded e-mails are used to prevent third party access. The project owners and the Swedish staff do discuss what the staff can reveal and not, but they are not very worried about leaking confidential information.

Five formal interviews were made with project workers, and one project member was interviewed on two occasions. In addition, more informal contacts have taken place during a period of 14 months, including company visits and some observations³. Data relevant for the case has also been available through a study of a group of biotechnology firms in this region.

Project 2 – The Car case

The second project deals with development of a new component in cars, relating to the wheels. The innovation attempted is of strategic importance, and is comprised of three smaller project groups/sub projects at the parent firm. Each of these groups comprises between two and three persons. Electricians also take part in the project, although they are not limited to

³ This empirical study is still ongoing.

one project group. The project is part of a collaborative effort between a group of car manufacturers. Further, one or two international suppliers are tied to each sub-project. These suppliers develop important parts necessary for the innovation (in fact, one of them initiated the project), but they do not interact between each other, they only deal with the Swedish car manufacturer. The suppliers are located in Sweden, Japan and three European countries.

Communication within the project has mainly occurred within the subprojects and with their respective suppliers/partners in the development process. The project workers however perceive some difficulties in getting the knowledge and information that they need in each specific situation. CAD is important in the development because through CAD, the meaning of the development is visualised.

Confidentiality is important in the project, and there is a general confidentiality clause governing the cooperation. Yet at the same time, information is at times spread unintended. The project workers are not assigned only to this project, but to other projects as well. Thus, the time each individual spends working with the project varies strongly over each week.

The project has formally lasted for one year; there have however been a lot of informal contacts a year before that as well. The intention of the project, where three phases are to be passed, is to be finished in one year. At this stage of product development subprojects can work relatively independent but they are becoming more interdependent as the project develops.

The data collection phase lasted for five months and included nineteen interviews with most persons participating in the project, follow-up questions through phone and e-mail, and some observations from meetings.

Project 3 – The Fibre-optics case⁴

The third project focused on joint research and development between a German manufacturer of laser sources, and a Swedish manufacturer of fibre-optics. The purpose of the project was to develop lasers equipped with fibre-optics. The project was based on two project groups, one in Sweden and one in Germany. The (first phase of the) project lasted for more than three years.

This project demanded close cooperation between the two firms in order to fit the fibre-optics with the laser source. However, initially, the cooperation was hampered by difficulty in linking the knowledge base of each firm to the other. Therefore, an engineer at the fibre-optics firm spent a lot of time at the partner firm in Germany, working with the joint development.

⁴ This study has been described elsewhere, see Bengtsson & Eriksson (2002).

He came to understand the technology and the engineers there, and was thus able to establish new channels of communication and bridge the boundaries between the two firms, which was of importance for the continued communication. Engineers from the two firms also travelled and met each other face to face several times. Certain routines for the communication concerning adjustments and development of the product were developed, and later in the process the co-operation between the firms rested on agreements of different kinds. Formal legal agreements were made through the use of cross-wise patents of the developed products.

In this case, data was also collected through interviews. Six interviews were performed with additional interviews in the value-net of the firm. The interviews were performed when the first part of the project had been successfully completed and a second phase had been initiated.

The emotional bases of knowing in the three projects

In this section, we combine our empirical description with more analytical comments. Within projects, we find differences between emotional expressions towards the project and the project partners, the project work and specific events. In the following, we first describe the emotional bases in the project, and then we discuss the functions of emotional bases for shaping innovation and engaging in knowing. Regarding knowing, we particularly focus on whether and how knowing is related to boundary-crossing activities in the projects.

Strongly activated negative emotions – Agitation and frustration

Highly activated emotional expressions are very obvious in the interviews, in particular when they are negative. This category of emotional expression can largely be characterised as agitation and strong frustration.

First, these emotions are expressed in relation to the project as such and the project partners. In two of the projects, there is anxiety or even agitation regarding information sharing and the possibility of betrayal by a partner. At the car manufacturer, this emotional base directed towards the project or a partner in the project, leads to parallel versions of certain reports. That is, reports about test results have been made in different versions to avoid one of the partners accessing them, as this partner is a competitor in other projects. The justification of this act and the agitation (agitation rather than resentment) lies in the interpretation of earlier events, where the project workers believe that the partner was disloyal and acted as a competitor. Similar stories exist at the fibre-optics firm. There are no feelings of disloyalty, but rather an anxiety that they will be perceived as the betraying partner. Thus,

there has been an extensive process to reduce this type of anxiety and create a situation where the emotional base instead is in line with a trustful atmosphere. In all our the three projects, care is taken to avoid leakage of test results, drawings, plans, etcetera, but these activities are presented and discussed as a matter of fact without much emotion. Anxiety relating to the project as such and to the partner firm however also arises based on a developing fear for a partner's potential failure to deliver on time or at the correct quality.

Second, strong frustration and agitation appear frequently in the descriptions. One engineer in the car case talks about how the lack of control provides frustration with the fragmentation of work. *"It can be very frustrating as every day I'm thrown between different activities outside my own control. Constantly there are meetings, phone calls and other things pertaining to different projects [...]. It does not feel that good, I want to decide what I should do, but external factors run my work. That means that I never get to finish anything. I never have the time to do things as well as I would like to do them, instead I, as I feel, haste through things to finish on time, so that is unsatisfactory."* Other engineers also find it stressful to work on several tasks at the same time, going as far as describing it as "juggling balls of fire".

Frustration with work also arises based on demands on administration. The administrative "worriers", demand a multitude of reports, causing problems when some project leaders need to guess rather than make qualified estimations about costs and time plans. The administration is described as stifling and as preventing problem solving and construction/innovation. Long-running administrative processes also evoke emotions of frustration, at times causing dejection rather than agitation. This frustration is partly present in the other cases as well, but much more sporadically.

In the car case, the frustration regarding work and at times also a lack of communication across administrative boundaries remains over time. In one instance, frustration with administrative decisions, a certain event, led to the creation of a new work group and new meeting places CAD constructors to make information flow more smoothly and avoid project workers being bypassed by administrative decisions and inflexible interpretations of rules for cooperation. Similar frustrations about with whom to communicate and about who sets the form for cooperation were present in the fibre-optics case, but this was a less highly activated emotion.

High activation of positive emotions – Enthusiasm

High activation of positive emotions is mainly present in the forms of enthusiasm and descriptions of what is "fun". Stories about the work express enthusiasm when it comes to

innovation activities, (but administrative activities supporting innovation and routine work is generally presented with negative or at least low activation of emotion). Examples of enthusiasm are found in all the three cases, to some extent regarding the ventures but largely related to the work. Several activities in the Biotech case are presented as "fun", or "interesting", although in a rather low-key way. For example, interaction with other people is often put forward as something "fun", it is fun to attend conferences, to achieve attention for scientific progress, and it is fun to mingle with competitors at the local level. Certain work is perceived as more creative, engaging and outright fun, and such work is much preferred. For example, a group leader in the car case talks about being pressured to start new projects to avoid routine work. This particular project is therefore met with positive overall emotional expressions;

"In this case, there were expectations from the employees to get something started, because everyone finds R&D interesting to work with. I mean, there is nothing interesting in routine work, you have to use your creativity and it is in this type of project you can do that. [...] I had one guy who quit among other things because he felt that we did too little R&D, but he left before we started this [...] and that was a bit of a kick because he was kind of frustrated, a capable guy, a doctor in engineering"

An engineer working on the component development tells us that the activities he engages in depends on his mood; *"fun things make it easier, boring [things] I tend to down prioritise, to do them later, it's probably that simple. Of course, those who shout the most and can threaten me with something; 'If I haven't done this until Friday, then the entire company will grind to a halt, and it never does, but they say it, then you have to do it even if it is boring. The ones who shout the most also get a certain priority."* He also says that his attendance of meetings is decided based on how fun they are, although occasionally he may ask a superior what he should attend and he also tends to take into account who else is affected by his prioritisation. Similarly, in the drug development project, the chemist, tells us that he wanted to work in this field because organic chemistry was the most 'fun' (part of his education), and that this was the reason he ended up working at this project. The work is comprised of the fun part, modelling, and other, more administrative and problem-solving parts.

Some activities with high activation of emotions are described both as positive and negative, depending on situation. For example, engaging in a number of parallel projects is perceived both as stimulating and stressful; for certain it ejects an emotional base that is highly activated. One of the engineers describes the "fun" in meeting people and getting

responses from them. This positive emotion can however turn negative quickly if problems arise on several fronts at the same time;

I: How do you believe that it affects you, to balance a bundle of projects at the same time?

R: [...] it is both stimulating and sometimes very stressful.

I: In what way?

R: In that when there is a flow, it is stimulating. One feels broad and active and as being some [important], it is fun to participate on different arenas, and people know who you are and listen and such. But you could call that a sense of power, without my meaning [exactly] that, a sense of satisfaction like an actor; you are part of acting on different places, and that is the positive parts; the negative part is perhaps when there is a problem in five projects at the same time, then it can be very stressful.”

Emotional expressions towards different event are also often enthusiastic in all three cases, and there are several examples of people who talk enthusiastically about meetings. For example in the biotech case, integration with the Japanese partner took place during a three week visit; *“they were at the lab the entire time. Then we had some social events ... Yes, they were at the lab. We had one day of education. We had a consultant here talking about development of pharmaceuticals in Sweden and Europe. [...] they turned out to be very knowledgeable...”*

However, this enthusiasm is rarely connected to stories about any changes in practices or in interaction across boundaries; rather the examples provided depict one-time off events.

Low activation of positive emotions – Contentment

Low activation of positive emotions is present in all cases, but most of all in the biotech project. The biotech project is based on integration of knowledge from different disciplines as well as across a geographical distance, but there is very little actual boundary crossing interaction. The knowing relating to boundary crossing thus become a knowing how to align practices, as boundaries are stable and guide the daily interactions. For example, the Swedish development staff can interact daily with their academic counterparts without leaving the building, whereas interactions with other employees in the project occur via e-mail, phone and biweekly meetings. As one respondent says *“I don’t go outside of the building that much. Usually I go, the department of medical chemistry is right across, and some of them are here as well. And they have microscopes and such things that I use. [...] I go there quite a lot, but it is just across the corridor”*. And the project leader says; *“They mainly stay in the house, and that depends on what old university classmates or friends they have”*. The same applies with regards to the Japanese partner. These physical/geographical boundaries coincide with

cognitive boundaries such as the academic subject boundaries and the divide between business society and academia.

The project workers in the biotech case are at times anxious to express positive emotions about the location, the local support for their project and the partners in the project. Of course, a number of problems are described, such as costly equipment, the need for new facilities and the (lack of) understanding of scientific principles at the partner firm. In general however, a positive spin is put on such statements; disadvantages are always balanced with advantages. This apparent desire to project positive emotions is also balanced with the overall emotional expressions as fairly positive. There are examples of attempts to span boundaries and the project workers are clearly aware of the need for this, as well as they do not achieve it; *“It became obvious ... to me personally, that people are very creative and that if you are to bring about ideas and suggestions for how to build these platforms, then you need to be innovative”* – the problem then becomes how to bring this about at the Japanese partner firm.

Low activation of negative emotions – Dejection and frustration

More long-term frustration was related to low activation and dejection. There are several reasons for this; dejection is often related to the work situation, which is difficult to change. Therefore, the complaints are seldom strongly expressed but at the same time an emotional base based on dejection easily becomes something that is acceptable to complain about, and a vicious circle begins. An example of this is the frustration of not having the time to engage in construction work. Problem solving on a very basic, administrative level is not perceived as fun and often as depressing and demotivating.

Dejection with work also arises based on demands or orders from higher levels in the hierarchy in the car case. The “worriers”, place demands on reporting and so on, causing problems when some project leaders need to make guesses rather than qualified estimations about costs and time plans. The administration is described as stifling and as preventing construction/innovation. Long-running administrative processes also evoke frustration, at times causing dejection rather than agitation. An example provided relates to the writing of contracts, where some over time ignore the contracts because they are so extensive and detailed.

The initial frustration in the fibre-optics case was due to the difficulty to communicate with the staff at the laser manufacturer, and even resistance at the laser manufacturer to fully engage in the project. Information was at times scarce, deliberately and undeliberately. But through a continued daily presence over two years at laser manufacturer, this changed, and

frustration with the project at the fibre-optics firm was reduced. Knowing evolved that included an understanding of both firms and integration of knowledge and practices across the corporate and geographical boundaries. Nowadays, the atmosphere is very open, and they share patents; *“We chose to share the [first] patent that we applied for. When we have shared something, we have taken bits from them and bits from us in patents that are dependent on us both, so we have consciously entered a tight relationship.[...] And this is a sign that we after all have been able to overcome this anxiety [about trust].”*

.There is also some evidence of indifference; bordering between positive and negative emotions. One project member in the biotech case for example expresses indifference towards the project and its location; *“I do not really know how it [the location] affects us. They tell us it is an advantage.”* And she continues to discuss the location and its advantages and disadvantages for the project in the abstract, rather than in relation to her own work and to the progress of the project or in relation to knowledge sharing.

In all three cases, specific events evoking emotional expressions of dejection are typically of the “yet another” kind; yet again people feel drowned in an administrative assignment, or a decision working against them is yet again made, or yet again they fail to communicate with their project partners.

Resulting emotional bases in relation to boundary crossing

Present in the three cases are two different types of organising for boundary crossing. One where there is knowledge integration across the boundaries between the cooperating firms and their respective knowledge base, another where knowing as much as possible is kept within the traditional frames of development work in the respective firms and work groups and the practices of the participating partners are at best aligned. Explanations to the differences above could of course be found in the character of the projects, different organisational and institutional factors relating to the different technological areas concerned. However, emotional bases of knowing also add to our understanding of how individuals and groups interact, as emotional bases affect how people make choices and how they set priorities.

Overall emotional bases of knowing can be identified through the cases, even though emotional expressions vary within each case. Based on the circumplex model of emotions, four main emotional bases are illustrated; one emotional base signifying agitated frustration, a second one signifying enthusiasm, a third illustrating contentment and a fourth being dejected frustration. In our matrix (figure 2), the three cases have been placed according to our interpretation of the overall situation in the case.

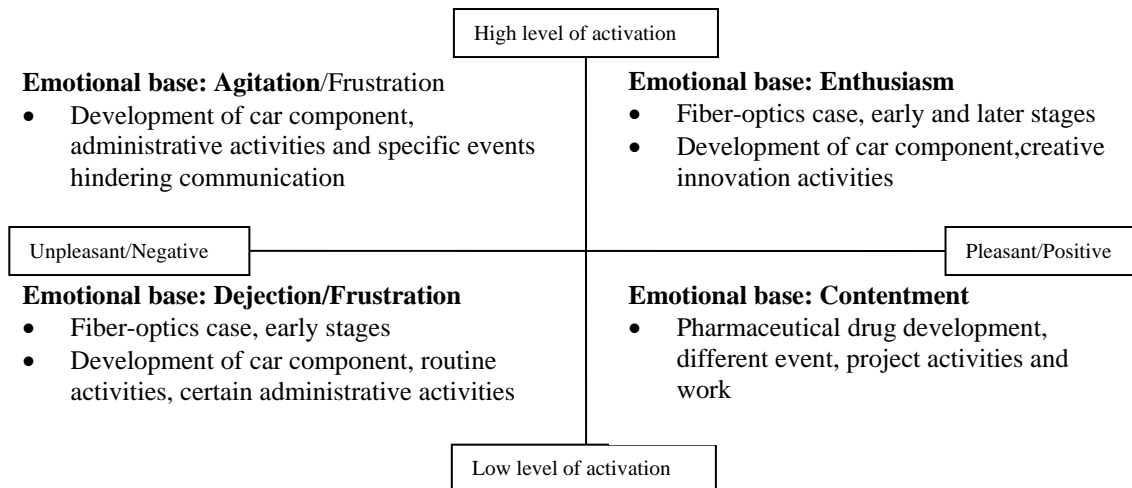


Fig 2: Overall emotional bases in the different projects.

In the biotech case, the overall dominant emotion expressed in the interviews is contentment. There appears to be a low level of activation of emotions and the impression arising is one of pleasant emotions. There is contentment with the work, with the project and with most events described, and this applies across the interviews. At times, there is enthusiasm, but it is always controlled. At other times, there is frustration or indifference, but again, controlled. Further, practices are mainly aligned, and knowing is thus directed to how to align rather than how to integrate practices. The type of knowing that people engage in varies, for example depending on their background; *“As a molecular biologist, you think about the cells, the bacteria and what is going on there, [...] The organic chemists, they think more..., they might not have that in the back of their head in the same way. [...] it is like when we have meetings, when they talk about the **substances**, they draw the **structures**, the chemical structures, and then they we make a small alteration (in our work) and they draw. And there we do not quite follow, in the same way. “*

The different actors do (barely) achieve some common ground through these drawings (cf. Bechky, 2003), but the meaning of learning here is not to engage in a mutual process of knowing across boundaries, integrating knowledge, but rather to “know whom”, in order to ask the right person for the right thing and to use the information provided from the other partner (compare Orlikowski, 2002). Despite this, the project leader emphasises the need for shared interaction and for sharing practices, but all examples provided deal with *exchanging* information. No practices or norms are challenged and boundaries remain stable.

In the car case, the situation is more fragmented and it is difficult to talk about one specific emotional base. In comparison to the first case, there are more explicit expressions of

negative or unpleasant emotions, and the level of activation is generally higher. Stories about the project as such – in relation to the different partners, are generally a mix between slightly frustrated and dejected emotions and enthusiasm. Stories about the work are very enthusiastic when it comes to innovation activities, but administrative activities supporting innovation and routine work is often presented with negative emotional expressions. These negative expressions are at times characterised by high levels of activation and at times by low levels of activation. This mix of emotional bases are largely a result of the many different parallel projects, making this particular project an important one – it contains innovation, but also providing frustration when people have to prioritise among different tasks.

The interaction with the different partner firms in the car project varies. Project meetings are scarce between the three smaller sub projects, and interaction with the different partners mainly occurs on the sub-project level. Thus, boundary-crossing mainly refers to alignment of boundaries and less to integration of practices across these boundaries. An exception to the division of practices in the car development case occurs when the car is tested. Then all different components come together and the different project workers thus receive feedback on their work. *“You get an immediate response [...] and there were some things that we felt very clearly, and they felt too, that things weren’t working exactly as we had planned, they hadn’t come as far as we had hoped; you could see that both in the curves and when it catches [in the machinery]”*. The project leader also emphasise the need for different people in the project to run the car, not just have others test drive it. The test drive facilitates communication and the possibilities to discuss and negotiate with the project partners.

In the fibre-optics project, two overall emotional bases can be discerned, but over time. Early on, the emotional expressions are fragmented. On the one hand, there is enthusiasm for the project as such, with the partner and with the work tasks; on the other hand there is frustration, even dejection, that the project is not going anywhere. In later phases, the emotional base varies between contentment and enthusiasm. When the project reached a stage where the cooperation was firmly established, mainly satisfaction with the project as such is expressed.

More negative emotional expressions are of smaller significance and relate to specific events, such as when the owners talk about selling the fibre-optic firm to a competitor to the laser firm, which threatens the follow-up project. This leads to suspicion and frustration from both partners as a new ownership would be a potential strategic disadvantage for both firms. In this case, there was clearly alignment as well as integration of practices. Both firms learn from each other and change their way of working as a result of new knowledge gained.

About dynamics

Huy (2003) states that negative emotions can be seen as responses to events that challenge stable cognitive structures, and conversely, positive emotions can reinforce certain cognitive structures. Dissonance arising from confrontations between different practices and cognitive structures can however give rise to emotional expressions in a number of areas. In this paper, three such areas are in focus:

- Emotional expressions related to work.
- Emotional expressions relating to the project or the project partners.
- Emotional expressions relating to events

First, emotional expressions related to work are intimately tied to specific specialist practices regarding the profession or trade, e.g. how to perform tests according to good standards in biology, or how to use CAD to provide the best visualisation of the new component. Positive emotions connected to work are constantly reinforced through choices and therefore reinforce the existing cognitive structures, already stating the meaningfulness of an activity. In these cases, innovation work is considered more “fun” than other types of work; it evokes positive emotional expressions and therefore reinforces the cognitive structures that prioritise innovation work. However, in order to achieve boundary-crossing integration of knowledge, changes in practices, in the knowing, must occur. It then depends on whether the norms connected to a set of work practices allow for changes in these practices – that is how specific are the norms or the cognitive structures?

The scientific norms regarding how work is to be performed appear to be strong to the extent of hindering integration across boundaries. In the biotech case, the contentment is strong, and therefore even threats to existing structures are met with calm. One particular reason to this is the strength of the scientific practices and adhering boundaries; the project workers are very comfortable in their belief in the scientific principles underpinning their practices, and these principles are continuously reinforced even when challenged. (Given a *strong* threat, the experiences would be likely to be different). Thus, the ordering effect of boundaries (Hernes, 2004) appears to be strong in this particular, institutionalised, context of academia. It could also be argued that the ordering effect as well as the distinction effect is stronger when people engage in things they enjoy and perceive not only as meaningful in a general sense but also are truly passionate about.

On the other hand, in the car case, the project workers are also truly passionate about innovation work, but have more complex connections to different work groups, providing

them with a more unclear identity and thus an identity and a set of norms that more easily are perceived as being threatened. Further, the positive emotions evoked by innovation work are interpreted more broadly, partially allowing for integration of knowing across boundaries. In the car project, there is to some extent more integration between partners than between different subprojects. This can be compared to Brown and Duguid's (1998/2001) claim that inter-organisational knowledge sharing can be easier than intra-organisational knowledge sharing depending on the similarities between practices, and in this case, some practices are more similar between a sub-project and a supplier or a partner, than between two sub-projects.

Second, emotional expressions relating to the project/the project partners refers to direct attempts to share knowledge across boundaries and the practices that facilitate or hinder knowing across boundaries, and not to the performing of specific work practices. Examples of this were present in the car case – compared to the involvement in innovation work, there is a dissonance between these two areas; the project and the partner on the one hand, and the work on the other hand. Engaging in work that is perceived as fun can conflict with the norms and emotional expressions regarding earlier experiences of a partner, or vice versa.

Third, emotional expressions relating to events provide fuel for the continued patterns of knowing, and emotional expressions towards different events challenge different norms. The challenges however also depend on the overall emotional base, strongly influenced by the emotional base or climate arising from the emotional expressions relative work and the project as such. Emotional expressions add to this base, but are primarily, we argue, are an important starting point for sense making and possible for action.

High activation make the potential dissonance between normative assumptions connected to emotions and the cognisation of potential change larger than if there is low activation of emotions. Strongly expressed frustration or anxiety can thus be a start of a sense making process; the emotions tell us that something is out of order. High activation of frustration demands attention in a way that low activation do not. It therefore also becomes an opportunity to consider what kind of knowledge sharing that is going on, and to reflect upon knowing. Further, high activation of frustration can also be a conscious strategy for certain actors in order to command attention, thus functioning as a form of sense giving in relation to a specific event or a change (Rouleau, 2005). Emotional expressions are an integral part of the sense giving process; emotional expressions are actively used to show the unreason ability of specific work conditions, of incompetence at the partner firms and so on.

The emotional base of agitation and frustration is characterised both by active attempts to facilitate as well as resist integration of knowing across boundaries – either to overcome

experienced difficulties or to prevent being betrayed by a partner firm. Thus, this base mainly supports knowing within boundaries, but potentially also across, depending on the causes for agitation. It follows that the situation is unstable, and that it is easy to challenge norms; the high activation and the fluctuating boundaries provide many norms to encounter and a challenge is perceived strongly. This emotional base holds many similarities with enthusiasm as an emotional base. The instability is an example. Dissimilarities arise due to enthusiasm providing active attempts to facilitate knowing across boundaries and the existence of such knowing. High activation of positive emotions may also be difficult to uphold for longer periods of time. However, projects can still have a more or less strong, positive emotional base, where certain activities and events are met with other emotional expressions, but where the main emotional base of knowing is enthusiasm.

The emotional bases with low activation on the other hand are similar in that they are more stable. However, this also means a tendency to reinforce existing practices and thus existing knowing. Boundaries appear stable and when norms are challenged, the emotional expressions are not as strong as in situations with a generally higher level of activation. In one case, the negative emotions reinforce the state of dejection, whereas in the other, positive emotions reinforce the contentment. It is difficult to initiate new knowing across boundaries in both cases.

Low activation of positive emotions, such as in the emotional base labeled contentment, could can be a main emotional base for certain periods of time in a project. Here too, certain activities and events are met with other emotional expressions. Similarly, dejection/frustration as an emotional base is consequently fairly stabilising. In the cases, dejection mainly leads to passivity, confining knowing to established areas or favourite tasks and avoiding problematic interaction where norms are challenged. In this situation, individual initiatives to facilitate knowing across boundaries are important, and here these initiatives need to be encouraging and motivating. These simplified suggestions are presented in figure 3 below.

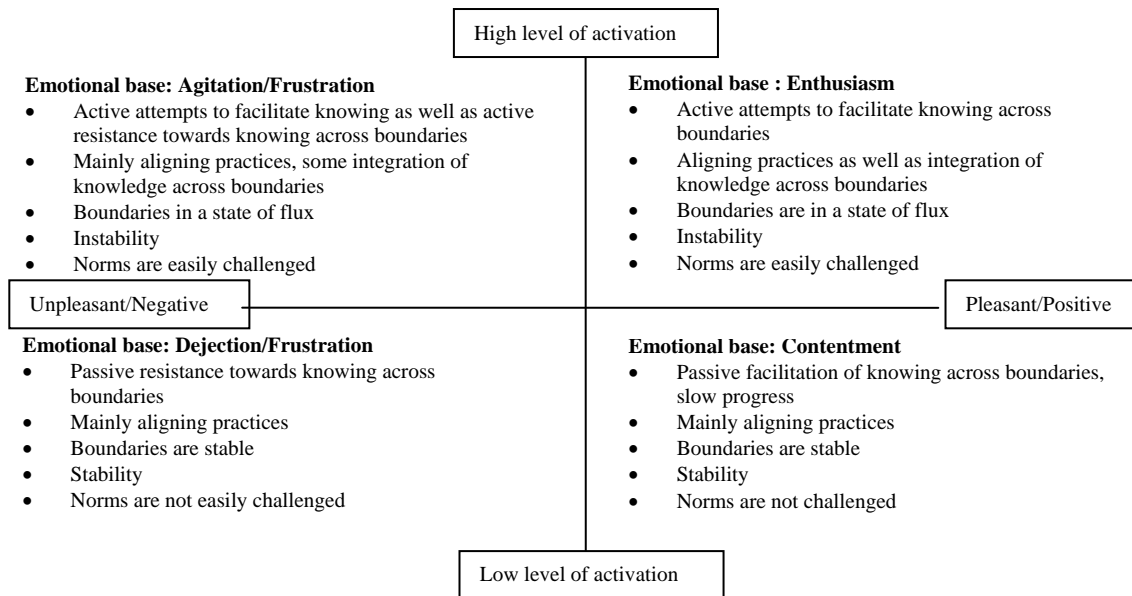


Fig 3: Emotional bases of knowing in the different projects.

Conclusions

The study provides a context based approach to studying emotions, and has added to our knowledge of knowing through elaborating on how knowing across boundaries is facilitated or restricted through different emotional bases in two ways. First, the paper demonstrates that the emotive expressions about work, different events and the project as such are indicative of how people set priorities and how they engage in different activities, and therefore, what knowing they engage in. Thus the emotional bases are important in determining what knowledge that results from a project. Second, a tentative “dynamics of emotional bases and knowing” has been described. In our study, we focused on the emotional base of project workers mainly from one of the cooperating organisations, but there is a need for studies involving the emotional bases of all collaborative partners.

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