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Genesis of Greenfields

Bringing Forth Co-enacted Embodied Organisational Knowing

Doctoral thesis
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A well-known scientist (some say it was Bertrand Russel)
once gave a public lecture on astronomy.
He described how the Earth
orbits around the sun and how the sun,
in turn, orbits around the center
of a vast collection of stars called our galaxy.
At the end of the lecture,
a little old lady at the back of
the room got up and said:
"What you have told us is rubbish.
The world is really a flat plate supported on
the back of a giant tortoise."
The scientist gave a superior smile before replying,
"What is the tortoise standing on?"
"You're very clever, young man, very clever,"
said the old lady.
"But it's turtles all the way down!"

Stephen Hawking, *A Brief History of Time*, 1988, p. 1.

Contents

Acknowledgements

This thesis is a result of an intellectual journey carrying me across geographical, cultural, and disciplinary boundaries. My main interests while conducting this PhD work have been people, places, and projects; it covers a broad range of activities: from travelling to other continents, visiting production sites under construction, and learning from new people, to the more silent work activities of delving into texts, thinking, and typing. This journey has now come to an end, and with profound gratitude I want to express my thanks to those people and institutions that made it possible for me to embark on my PhD in the first place—and not the least, kept me going with their guidance and support throughout the entire journey.

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Organisational Knowledge Theories: A Hybrid in the Making

Introduction

This thesis concerns a system not commonly addressed in organisational studies: greenfield projects, which convert undeveloped sites to commercial use. One example of a greenfield project is the process of setting up new production plants, which is the specific focus of this study. A fascinating characteristic about greenfield projects is that they start from essentially nothing, and within a short period of time—often a year or so—a new plant is up and running, processing raw materials with advanced machinery by a competent and self-contained organisation. It would appear mysterious to an outsider visiting such a plant to imagine the transformation of cultivating an entirely new production-ecology of collaborative and coordinated individuals, technologies, and artefacts into existence in such a short amount of time. Throughout the thesis, I will touch upon various aspects of this "puzzle" as I search for underlying forces and explanatory mechanisms making it possible to achieve such an accomplishment.

Projects in organisations are by definition temporal accomplishments: they have an aim and an end, and are commonly associated with collaborative enterprises outside everyday work activities. There are a lot of complexities involved in greenfield projects besides the physical constructing part; a new and local competent organisation operating the plant needs to be built from scratch in parallel. Before embarking on the work on site a lot of detailed and proper planning of the new facility needs to be done. This includes budgeting with a complicated risk picture, developing an efficient and detailed design basis for the plant, negotiating with authorities, suppliers, and contractors (often local firms if possible), as well as recruiting expert expatriates. During the construction and building phase, the project team needs to follow up on every issue that arises on site and ensures that all bits and pieces are taken care of, while maintaining relations with stakeholders and recruiting and training newly hired

employees. There might be overlap in knowledge between the people involved, but no single individual has all the necessary knowledge, or know-how of how to set up a new plant, or even know what it takes to do it. Succeeding with such a complex endeavour is intensely demanding, both in terms of mobilising the necessary competence and experts as well as managing and motivating people, with often no previous experience working together, to effectuate collective, coordinated and aligned efforts within the frames given by design basis and budget.

As the title of the thesis suggests, my aim is to understand the organisational knowing involved in the creation or mode of formation of greenfield plants: how they originate, emerge, and become objects for refinement of raw materials—all within an organisational context. Even though theories on organisational knowing build on the assumption of organisations being in continuous flux, Tsoukas and Chia (2002) argue that change is more fundamental and pervasive than what is commonly assumed in current literature. Especially for greenfield projects taking place in unknown territory and without an stable organisational environment, processes of organisational knowing should in this respect not be too narrowly framed and conceptualised. What thus seems of special importance in greenfield projects is to understand how the social structuring and organising of enacted knowing are brought forth in such "fluid" contexts.

A distinctive feature of greenfield projects is that none are equal, as they all differ in terms of size, technology standards, cultural setting, localisation, access to resources, etc. Staffing the project with the best people and providing enough resources seem like a recipe for success, but still—as numerous experiences of budget overruns in prestigious projects have shown—little guarantee for success can be prescribed. Attractive resources also come at a price and are persistently scarce. Focusing on the input side is just not enough to make sure success will be granted. We need to understand more of the constitution, configuration, and coordination of the actions and interactions across disciplines, cultural barriers, and social boundaries. A thorough understanding of the dynamics cannot be obtained outside the particulars of the locally-situated array of activities of how the site becomes materialised and circumscribed, how trust and confidence emerge, and how the "glocal" (Robertson, 1995) identity develops.

My studies thus follow greenfield projects closely at site as well as the wider organisational context including other organisational "sister" units and corporate headquarters. Overall my aim is to contribute to the emerging body of research on organisational knowledge theories within the field of organisation studies.

Structure of the Thesis

The first part of the thesis consists of this connective article, which provides an overview of the thesis. It introduces current debates on organisational knowledge theories, identifies a research agenda and a set of research questions relevant for the study of greenfield projects, and elaborates the theoretical underpinnings of my main research approach as well as a background to empirical and methodological considerations. It also includes a synopsis of the thesis' papers, and the main contributions as well as some implications for research on organisational knowing are included in the final section. The second part consists of four papers providing conceptual, theoretical, and empirical elaborations investigating fundamental aspects and issues of organisational knowledge theories as addressed here in part one.

Organisational Learning and Knowledge Theories

The last two decades have shown an increasing interest in studying knowledge in organisations or even viewing organisations as knowledge systems (e.g. Holzner & Marx, 1979; Pentland, 1995; Tsoukas, 1996; Grant, 1996; Daft & Weick, 1984). Besides technological, cultural, and economic conditions that have paved the way for such development, the "cognitive revolution" in the behavioural sciences and the subsequent evolution of perspectives on social cognition have radically enriched our understanding of organisational behaviour (Ilgen & Klein, 1988). Viewing organisations as knowledge systems draw attention to organisational life and dynamics at large as well as at the level of micro activities of individuals, and opens new pathways for making inquiries into organisational functioning. Such a perspective highlights knowledge, in its various forms and casts, as the stuff organisations are made of; it has given impetus to more complex, dynamic, and action-oriented views of

organisations beyond the commonly-held view often found in management studies of organisations as devices for planned, orchestrated, and purposeful actions by a body of people. Organisational knowledge theories are particularly concerned about how organisations are capable of knowing, acting consistently, repetitively and effectively over time, accumulating experience, and making sense of options for the future by using organisational knowledge "stored" in embedded routines, practices, processes, and stories.

I refer here to organisational learning and knowledge theories as one field for understanding creation and appropriation of knowledge, and use of tools and technologies for managing knowledge and knowing processes. A more precise way of seeing it is as a bundle of various fragmented and partly independent sub-disciplines with different origins: Organisational *learning theories* were developed after some groundbreaking theorisations in the 1970s (March & Olsen, 1975; Argyris & Schön, 1978) in organisation studies. Organisational *knowledge theories* build upon (and have adopted) Polanyi's (1962) insistence of knowing as tacit and personal (often found as a tacit/explicit dichotomy in the literature), Ryle's (1949) distinction between knowing that and knowing how, and Simon's (1957) notion of bounded rationality. An even more fine-grained distinction of the field can be found in both Easterby-Smith and Lyles (2005) and Gherardi (2006), who differentiate between organisational knowledge, knowledge management, organisational learning, and learning organisations. For my purpose here—to derive a relevant research agenda—it is not necessary to exploit all the subtleties of what constitutes a category, beyond noting that there are ambiguities and inconsistencies that prevails both within and between them. An example is the commonly used term "learning organisation", which is proposed to be an oxymoron because to learn is to disorganise and increase variety, while to organise is to forget and reduce variety (Weick & Westley, 1996).

One of the reasons for the lack of congruence can possibly be ascribed to the fact that learning and knowledge theories generally are multifaceted spanning a broad set of different theoretical traditions and epistemologies within such diverse fields as philosophy, sociology, economics, cognitive psychology, education, and cultural

anthropology. The topics studied within organisational knowledge and learning theories cover a range of topics like human learning, information processing, social structures development, competitiveness, efficiency, and meaning and identity formation (Easterby-Smith & Lyles, 2005). Although the field seems to be open for new perspectives and insights from other established traditions of knowledge studies, it has not yet been able to incorporate the various theories and constructs into its own distinct domain, and as such it can be characterised as immature and adolescent (e.g. Scott, 1987; Patriotta, 2003).

Through the thesis and the articles presented here, I develop an alternative to current theories on organisational knowledge. To explore and explain my empirical material I introduce a perspective on organisational knowing building upon embodiment theories in cognitive science highlighting the inseparability of our capacities for knowing and our bodies, language and social history. This enactive approach advocates a perceiver-dependent worldview, where possibilities for action are continually shaped and brought forth by the types of actions in which humans engage. In this perspective, knowing is enacted and ongoing in practice; it takes change as a fundamental aspect inherent in all human conduct, and social activity as the point of departure for building theories of social organising and learning. Thus, it is the interest in the spontaneous, tacit, intuitive, and dynamic aspects inherent in the mundane and everyday life of knowing in organisations that is at the core of this perspective. Exploring processes of knowledge creation as not pre-given but brought forth from a socio-historical background through perceiver-dependent actions go beyond the traditional dichotomies, objectification, and exogenously imposed constraints haunting contemporary organisational knowledge theories.

The aim of this thesis is to provide new contributions to the field of organisational knowing and learning by drawing on a set of case studies conducted in an international light metal company with production facilities all over the world. Rather than offer an exhaustive review of the fragmented literature in the field, I emphasise tensions, recurrent dilemmas, and challenges relevant for my studies based on a critical reading of the literature. I conclude the description of the research agenda by specifying a set of

research questions for the papers to follow. I have organised the research agenda into four trajectories:

1. Organisations as cognising subjects and extensions of human capacities

Learning and knowledge are strongly connected to human cognition, and the ability to learn is possessed by humans (Argyris & Schön, 1978; Nonaka & Takeuchi, 1995; Simon, 1991; Crossan, Lane, & White, 1999.) So to what extent does it make sense to attribute cognitive human capacities like mind, memory, and learning to *organisations*? Modern profit driven corporations are entitled some of the legal rights of a person and the book "The Corporation" from 2003 (Bakan, 2004) shows that the "personality" of this "person" resembles that of a psychopath. Even so, the question is whether depicting human capacities on organisations should be taken literally (i.e. ontology)—a possibility raised by Sandelands and Stablein (1987)—or as a metaphor (i.e. analogy) (Argyris & Schön 1978; Berends, Boersma, & Weggeman, 2003). From an artificial intelligence connectionist theory (Smolensky, 1988) point of view there are no essential differences modelling organisational memory versus human memory, and concepts from cognitive science like scripts and schemata are likewise used in the literature to explain organisational behaviour with few, if any, attempts to indicate what meaning they might have in an *organisational* context. Organisational structures and ways of operating (e.g. routines) are correspondingly viewed as reflecting *humans*' limitations and bounded rationality (Morgan, 1997; Simon 1957). Despite attempts of viewing organisations as super-individuals or describing the relations in terms of "levels" (Kim, 1993) there is a need for a better understanding of the relations between the individual and the organisation.

Moreover, are organisations more than its individuals and its knowledge more than that of its members? A way of avoiding the composition/decomposition problem of whether organisational knowledge represents the mere aggregate of the members' knowledge—or if the totality is something more—is, as suggested by leading authors (Cook & Yanow, 1993; Weick & Westley, 1996), to view organisational knowledge as a

metaphor of the organisations' potentialities and capabilities. The "more" is often assumed to be the organisational environment (consisting of structures, artefacts, and culture) providing norms and patterns of "how things are done here" which changes when *individuals* learn, i.e. it is the environment which constrains and enable individual—and subsequently—collective learning. However, organisational knowledge theories seem to be more occupied with description and accounting than what cultural and cognitive configurations, mechanisms and processes that enable organisations to develop and sustain organisational knowledge practices. It is thus a question whether depicting human capacities on organisations without any further specifications blurs more than it reveals understanding (Berger & Luckmann, 1966).

2. Reification and entification of knowledge

In the field of knowledge management (KM) (e.g. Nonaka & Takeuchi, 1995), the tacit/explicit dichotomy and the processes for transforming knowledge back and forth between these "modes" have been intensely explored and debated. Explicit knowledge is proposed to enable knowledge sharing across time, place, and boundaries while tacit knowledge is regarded as an effective inhibitor of imitation by competitors. However, several scholars have raised concerns questioning the underlying assumptions of whether knowledge can be objectified and managed in this way. Tsoukas (2005) is perhaps the one who has most persistently insisted that the original insights of Polanyi on tacit knowing have been misunderstood in the organisational literature. Following Polanyi (1962), all knowledge and knowing is inherently tacit and personal and originates from human experience and is thus not "transferable". The conversion of tacit knowledge to explicit knowledge to obtain more effective management as Nonaka and Takeuchi (1995) brought forth in their influential book on KM therefore does not make sense (Ray & Clegg, 2007). Explicit knowledge in KM is understood as context independent knowledge (similar to information)—communicated in a "value free" and universally comprehensible language—which is neither information nor scientific knowledge (ibid.).

However, the supposed misunderstanding of Polanyi's insights led to a huge interest in developing tools for how to measure and manage intangibles or "intellectual capital" (Edvinsson & Malone, 1997; Bontis, 1999) in the 1990s. While a slogan like "You can't manage what you don't measure" (Globerson, Globerson, & Frampton, 1991) represent a limited and uninformed view of knowledge, they created a demand for corporate management tools capturing more of the companies' "real value-creating assets". Balanced Scorecard (Kaplan & Norton, 1992) and various models for creating intellectual capital statements were used to initiate comprehensive initiatives for describing, documenting, and storing companies' "hidden assets" (Stewart, 1997). This branch of knowledge measurement adheres to an epistemology of possession (Cook & Brown, 1999), viewing knowledge as resources that can be explicated, reified, and objectified. However, following the resource-based-view (RBV) (e.g. Penrose, 1959; Wernerfelt, 1984; Barney, 1991) it is the *services* rendered from the resources that are important for companies (Penrose, 1959). That is, RBV directs attention to the *practices* and *routines* resulting in effective performance more than the resources per se as the essence behind company survival and growth.

Following the lead from RBV, another angle of obtaining insight into the complex interplay of social interaction processes in organisations that do not entail a total *conversion* of tacit to explicit knowledge is by means of storytelling. Stories or narratives have always been a natural and essential part of knowledge (and experience) sharing and thus represent an important part of organisational knowledge. To be human is to "live in language" (Maturana & Varela, 1987) and stories capture individuals' experiences—or more precisely, stories *about* experiences; in the past few decades, the use of stories in companies as a means for the identification, collection, and sharing of knowledge have received increased attention among both practitioners and academics. Other disciplines outside the realm of organisational studies should be visited in order to gain new perspectives and understandings of text and the narrative nature of social life.

In organisational knowledge theories assumptions about the workings of cognition—which is of central relevance for the study of construction of language, identity, organisational memory, and logics of action—are rarely made explicit. It has been suggested that knowledge developed in fields like cognitive science, psychology, and neuroscience might have a substantial impact on cultural research and organisational learning theories because implicit assumptions about the functioning of cognition might be rendered empirical in these fields (Ignatow, 2007; DiMaggio, 2002). Insights from these fields might provide us with a better understanding of what role representations and the explicit have in (re-)active knowledge creation processes. This development has, however, yet to be realised.

3. The parts of organisational knowing

In recent years, there has been an increased focus on actions and interactions constituting processes of knowing that have been inspired in a number of areas: theories of practice from continental philosophers like Heidegger and Wittgenstein, traditions like pragmatism, ethnomethodology, symbolic interactionism and more specific theoretical contributions like structuration theory (Giddens, 1984), situated learning theory and community of practice (Lave & Wenger, 1991; Wenger, 1998), and activity theory (Engeström, 2001; Blackler, 1995). Perspectives of *organisational knowing* emphasises learning and knowledge as social and cultural phenomena, and not as something residing solely in an individual's head (Orlikowski, 2002; Cook & Brown, 1999). Still, they are mostly silent on the relationship between both the parts themselves and the parts and the whole, and there is a need to examine the status on these more closely. This is an issue that raises some fundamental and interesting questions: how can people construct their knowledge individually and (apparently) independently know the same? Further, how can a *group* of autonomous people cooperate and coordinate their actions? And not least: why is it, when autonomous people act on the basis of their own authentic experience, their behaviour is observed to be culturally patterned (Baerveldt & Verheggen, 1999)? Current theories of knowing have so far not been occupied with such inquiries.

An alternative to the realist understanding of knowledge often found in management theories is a constructionist epistemology emphasising individual and collective knowing constituted in (or even *as*) practice. This implies a shift in focus from organisational knowledge to knowing which is enacted, situational, emergent, and provisional (Orlikowski, 2002; Nicolini, Gherardi, & Yanow, 2003). Knowing and practice are within this perspective co-constituted and it thus highlights the role of human agency in knowledgeable performances (Orlikowski, 2002; Emirbayers & Mische, 1998; Sztompka, 1991). While this approach seems to be promising for obtaining more insight into the flux of organisational life, by focusing almost exclusively on the role of the environment when explaining regularities in behaviour (Tomasello, 1993), it still ignores what the human brings to the process of cultural patterning.

Even though the constructivist approach holds that everything an individual knows is personally constructed, directly-experienced events only comprise parts of the basis for knowing; people also construct their knowledge structures on the basis of what they are told by others, whether in speech, writing, pictures, or gestures (Resnick, Levine, & Teasley, 1991). In cultural psychology, it has been argued that inherent biological or hard-wired structures in the brain will produce similar ideas in each one of us, but human cognition is also proposed to be so sensitive to cultural context that we must also seek mechanisms by which people actively shape each other's knowledge and interpretative processes (Resnick et al., 1991). At present there are few attempts in the literature on organisational knowledge theories to follow such a line of inquiry.

4. Endogenous change and novelty

Traditionally organisational knowledge and processes of knowing are studied under assumptions of recurrent situations and stable environments (e.g. Crossan and Berdrow, 2003; Orlikowski, 2002) and organisational change has to a large extent been reified and treated as exceptional rather than natural (Tsoukas & Chia, 2002). However, theories of becoming (ibid.) and enactivism (Varela, Thompson, & Rosch, 1993; Winograd & Flores, 1986) suggest that change is more pervasive and comprehensive

than commonly assumed and the question which arises is how organisational knowledge theories can account for changes which could be both incremental/radical and endogenous?

Organisations are commonly viewed as problem solvers which have available a repository of knowledge structures (schemes, scripts, "chunked" networks) consisting of collectively shared propositional rules, and prescriptions based on previous experiences from solving similar problems. Propositional statements require the world to be patterned, stable, and regulative and emerge as a result of a conjoint history, i.e. a congruence that unfolds from a long history of codetermination (Varela et al., 1993). The organisational memory associated with fixed explicit rules for cognitive processing is stored in routines (Nelson & Winter, 1982), databases (Hansen et al., 1999), theories in use (Argyris & Schön, 1978), and procedures. How effective the actions undertaken are depends on the degree of accuracy in the correspondence between the problem and the relevant knowledge structure. Thus, change has in this respect been conceived as incremental and externally imposed as a result of adaptations to evolutions in a steady-state environment.

But coordinated, concerted, and effective action may also occur when the environment is turbulent (Hutchins, 1995) or the organising context is open-ended (Tsoukas, 2005). Organisational learning theories should therefore allow for endogenous change and creative action, and in that respect there is a need to understand more of how organisational practices emerge and develop beyond a gradually fine-tuning of the recurrent and stable. Baker and Nelson (2005) found that entrepreneurial companies behave—sometimes dramatically—differently in their response to similar environments, indicating that the environment should not be viewed as ready-made backgrounds, but as co-specified and co-enacted in social activity by knowledgeable individuals. Following Tsoukas and Chia (2002), an ontological shift in theory construction might lead us to a better understanding of organisational performance and change:

> "Change must not be thought of as a property of organization. Rather, organization must be understood as an emergent property of change. Change is ontologically prior to organization—it is the condition of possibility for organization (...) organization is a secondary accomplishment, in a double sense: First, it is a socially defined set of rules aiming at stabilization an ever mutating reality, by making human behaviour more predictable. Second, organization is an outcome, a pattern, emerging from the reflective application of the very same rules in local contexts, over time" (Tsoukas & Chia, 2002, p. 570)

On the basis of the outlined agenda, I believe the following research questions have significant theoretical implications for the study of organisational knowing processes in greenfields:

1. How can we understand *organisational* knowing in turbulent or open-ended contexts as individualised day-to-day coping in a continuous stream of "microworld" situations?
2. What are the mechanisms and constituents enabling the *process* of intra-organisational sharing and mediation of knowledge capabilities and practices?
3. What are the relationships between locally constructed social actions and the patterning of these accomplishments into organisational practices?
4. How can the knowledge dynamics of locally constituted organisational knowing be represented and disseminated?

In the papers included in this thesis I pursue these research questions one by one. Based on empirical findings and analysis in the papers, I continue with a discussion and qualification of the overall contributions and implications related to the broader research agenda as presented here. I will then unfold the theoretical contributions to organisational learning and knowledge theories that is generated from the particulars of the papers. However, before we get to this I will discuss some methodological considerations for the whole dissertation—and provide an overview of the thesis' empirical and analytical work.

Research Approach

As a first response to the outlined research agenda I develop in this section a methodology denoted "Enactive inquiry" building upon the enactive view in cognitive science. This approach is developed throughout the thesis and brings forth an understanding of organisational knowing building upon cognition not as an extension of human capacities, but as a complex social phenomenon spanning mind, body, activity, and culturally settings. I draw mainly on embodiment theories as well as recent findings and conceptualisations within neuroscience and cognitive science in order to do so. Various parts of this elaboration will be found (and to some extent extended) in the papers that follow in part two of the thesis.

Enactivism – bridging critical realism and radical constructivism

The debate about various ontological and epistemological positions in organisation studies and management research often take the Cartesian subject-object dualism of human thought and the external world as a point of departure. In this respect, the main epistemological and ontological issues include (1) whether it is possible to access the external world objectively, and (2) whether reality exists independently of and prior to human cognition—or is an outcome of human cognitive processes (Johnson & Duberley, 2000).

Management scholars are frequently alleged to adhere to a positivist view of knowledge in their theorisations (Spender, 1996). A major criticism of what is regarded to be positivist management research is the lack of relevance for practitioners. The last two decades have witnessed a "practice turn" in organisational studies that gave rise to a renewed interest in phenomenology, pragmatism, and continental philosophy-inspired research streams that study the mundane micro-activities of everyday organisational practices. Strategy-as-practice (Whittington, 1996; Hendry, 2000), for instance, is an emerging field aiming at understanding everyday micro level strategy processes (i.e. actors, tools, and practices) attracting increased interest. But even within this growing sub-field of strategy, there is hardly any discussion about the ontological and

epistemological basis underlying the various research programs and projects. As a consequence, even such a "fresh" approach is influenced by the assumptions and research practices found in more orthodox strategy research, which is often associated with a realist paradigm (Mir & Watson, 2000). It is, however, important to distinguish between a positivist-inspired realism—which is what the new practice streams are assumed to distance themselves from—and critical realism which is a "growing movement transforming the intellectual scene" (Tsang & Kwan, 1999, p. 762).

Critical realism has its origin in the pioneering work of Roy Bhaskar (1978); his approach draws upon a metaphysical ontology where the social and natural reality consists of "intransitive" entities, and causal mechanisms exist independently of human knowledge. These entities may not be observable and different humans may apprehend different "transitive" realities due to variations in individual's socio-historical life paths. Causation is identifiable by exploring the underlying "generative mechanisms" (ibid.), or "powers" (ibid.), which produce events, and knowledge is in this respect the ability to anticipate the consequences of manipulating things in the world. Our everyday practical actions as human agents tacitly presume that external causal regularities exist which we may act upon; our ability to undertake successful practical actions imply that we receive feedback from an independent "reality" which constrains and enables practices that would otherwise be inconceivable (Zolo, 1990, p. 155-7). For knowledge to be practically adequate, "...it must generate expectations about the world and the results of our actions that are actually realised" (Sayer, 1992, p. 69-70). While reality might sustain a variety of different descriptive and explanatory schemas, the structures of social reality favour particular schemas that are practically adequate, i.e. guides for action.

The enactive approach as will be brought forth here with its emphasis on embodied simulation and cognition as embodied action highlights two areas: the possibilities for perceptually guided action that fulfil something "missing", and the situations which yet have to become actualised to satisfy these possibilities (Varela et al., 1993). The functioning of these generative mechanisms is thus similar for the two paradigms, despite differing on the status of the environment. A realism ontology assumes that the

environment is independent and constrains possibilities for action, while the enactive approach holds that the environment is enacted by histories of structural coupling; that is, constraints in the environment are specified by the sensorimotor structure of the system and not pre-given (Varela et al., 1993). Still, they both view enduring structures of social reality, which unfold and transform in action, and human agency as reciprocalities presupposing each other for action to occur (Bhaskar, 1989). However, while a critical realist would search for regularities in the environment, the research task for an enactivist is to make transparent the mechanisms for how the emergence of structural couplings (between sensorimotor structure and environment) unfold and specific regularities arise (Varela et al., 1993)

Another approach to the study of organisational practices is constructivist methodology. For our purpose, and to avoid confusion, it is appropriate to make the distinction between realist constructivism—which is largely objectivist in its belief in a pregiven world—and radical constructivism, which holds that the world is a result of active construction (McGee, 2005). A radical constructivist claim is that human cognition has no access to an objective reality, and social reality is thus constructed by the researcher: "scientists do not discover the world but impose a structure on it or in some sense 'make' the world" (Hess, 1997, p. 35). Structures, entities, and practices are in this respect manifestations actively built up by the social constructions of the cognising subject. Both radical constructivism and critical realism display sensitivity toward context regarding theory building although their basis for doing so is different. While the former views theory as acts of generation (taking place "in the head"), the latter sees this as a realisation of underlying reality (a "transmission" between society and individual).

To illustrate: on one hand, there is the classic cognitivist assumption that the world has a set of pre-given features that are passively retrieved from the environment through representations that mirror the world. On the other hand, there are embodied theorists who argue that there is mutual specification occurring between the organism and its environment, so that the way the world looks is primarily determined by the way the organism is equipped. An enactive approach, I argue, can be understood as a synthesis

of these positions where social reality and individual experience are *co-enacted*: "The idea is that different cognitive phenomena across different scales are variously co-originating, co-generating, co-specified, co-determined, and co-emergent. Thus, society and individual co-arise, mind and world co-arise, micro and macro co-arise, and the like." (McGee, 2005, p. 32).

Enactive inquiry

Current debates on organisational knowledge and knowing emphasise the ambiguous nature and complexities involved in documenting empirically the processes of creation, mobilisation, and development of knowledge in organisations. Process research aims at examining how things manifest, how and in what ways they develop over time by means of "fluid" process data consisting largely of stories about the mundane, events, interactions, activities and decisions (Pettigrew, 1997; Langley 1999). Building theories from process research is a partly creative and embodied process relying on the researchers experiences and imagination (Weick, 1989; Alvesson & Kärreman, 2007). By building upon enactive organisational knowing as presented above, I introduce "enactive inquiry" as a viable means to obtain empirical material of organisational knowing processes.

An enactive inquiry is a methodological approach to the study of organisational practices as enacted accomplishments. An inquiry is not just merely questions, but quests or "acts of becoming" (Carlsen, 2005) and an enactive enquiry can in this respect be associated with conceptualisations of abstract and metaphoric thinking unfolding through enaction, allowing us to engage and develop new theories. Enactive inquiry is thus a way of being "present" by probing into experiencing where perception is intertwined with worldviews and theories that come into being through shared dialogue and interactions (Haskell, Linds, & Ippolito, 2002). The aim is therefore to study not the idiosyncrasies of specific individuals, but how the experiences and actions of individuals are attuned. So, although I take the cognitive and experiential domain of embodied human agents as my analytical starting point, it turns out that the empirical domain can only be the way in which meaning is consensually coordinated and

culturally mediated between me and the practitioners I engage (Baerveldt & Verheggen, 1999). Inspired by the extended case method and reflexive science which emphasises "engagement as the road to knowledge" (Burawoy, 1998, p. 5), I use empirical accounts to extract the general from the unique, to move from micro-activities to macro-processes, and to connect the present to the past in anticipation of the future (ibid.). Reflexive science represents an active involvement in the way that it "(…) commands the observer to unpack those situational experiences by moving with the participants through their space and time. (…) Like any other science, reflexive science has to perform some reduction. In this instance the reduction is an aggregation—the aggregation of *situational knowledge into social process*." (Burawoy, 1998, p. 14-15, italics in original). For the researcher out in the field this implies that while being present in the moment s/he should also perform higher level reflections, discern systemic characteristics and patterns and construct abstractions on a continuous basis. To be able to accomplish such an endeavour is an iterative process, and similar to what Weick and Sutcliffe (2001, p. 42) describe as mindfulness:

> "(…) the combination of ongoing scrutiny of existing expectations, continuous refinement and differentiation of expectations based on newer experiences, willingness and capability to invent new expectations that make sense of unprecedented events, a more nuanced appreciation of context and ways to deal with it, and identification of new dimensions of context that improve foresight and current functioning."

In enactivism, it is social activity that is the ultimate foundation of intelligibility; in order to study social and relational processes, it is not sufficient to study the observable aspects of human behaviour. Like in most other social sciences, there is a need to address what the behaviour means for the individual himself and how s/he construct meaning out of intersubjective experience (Lee, 1991; Suddaby, 2006). The range of methods used is not different from other qualitative research approaches but a potential distinct feature of an enactive approach is the awareness of the richness and complexity of real life—about living people whose experience and knowledge is implicit not only

in what they say but also in what they do—and observations and building rapport thus becomes important when being in the field.

By following a theory-driven line of reasoning similar to "theoretical sampling" in grounded theory (Glaser & Strauss, 1967), empirical accounts are not only inextricably fused with theory (Alvesson & Kärreman, 2007) but theory also "guides interventions, it constitutes situated knowledge into social processes, and it locates those social processes in their wider context of determination" (Burawoy, 1998, p. 21). For the researcher, it is the possible discrepancies between the carefully crafted empirical material and the theoretical underpinnings that attract attention, forcing him/her to rethink conventional wisdom that gives impetus to new theorisations (Alvesson & Kärreman, 2007). Still, the aim of the enactive approach is not to test theory or make generalisations, but to develop new theoretical building blocks to account for empirical phenomenon not previously accounted for. This approach should therefore provide a promising perspective for gaining insight into the relations between authentic experiences by autonomous individuals and the social organisation of practice. The challenge for the researcher as an outsider is in this respect twofold; first, how can a researcher not being part of the practice domain tap into collective sensemaking processes and obtain relevant empirical insights? Second, individual knowing is rooted in a background of distinctions, which is not accessible for inquiry or can be explicated. The background contains the history of structural coupling (i.e. history of experiences), repertoires, and capacities for actions, understanding, and language and provides the basis for the outcome of all knowing processes. So how can a researcher with a discursive aim get access to processes which is essentially of an embodied nature? In order to make experience based tacit knowing residing in the background manifest and transparent, I use in my empirical studies Patriottas' (2003) three methodological lenses of time, breakdowns, and narratives to elicit crucial aspects of the background. That is, the three lenses highlight processes of the development of structural couplings over time, the formation of viable responses to resolve breakdown situations, and the use of narratives as collective sensemaking processes. Time is strongly connected to construction, unfolding, and enactment of organisational knowing, and emphasises disclosure of path-dependencies and emergence of regularities and patterns.

Breakdowns occur when our embodied simulation "fail"—when our recurrent actions are not appropriate for the situation at hand—and provide insight into relations between order and disorder when one needs to explicitly interact with the tacit knowing capacities in the background. Narratives are a mode of knowing where individuals articulate how they represent and make sense of their everyday activities, organise their experiences (Czarniawska, 2004), and provide cognitive devices to guide action (Weick, 1995).

Data collection and analysis

Empirical overview

The main source of empirics for this thesis (a summary of the papers will be given in the next section) has been a set of greenfield projects conducted within a company that I call Phoenix. Phoenix is one of the largest integrated light metal companies worldwide, with a presence in more than 30 countries. Their business is highly capital and knowledge intensive, covering the whole value chain from mining to end-customer products. Independent observers have emphasized Phoenix's capacity to carry out both small- and large-scale investment projects as one of its foremost qualities[1]. My study of Phoenix has focused on a special group of investment projects called *greenfield projects*. This type of project is especially well suited for an enactive inquiry, as it provides a unique opportunity to explore central aspects of processes of organisational knowing in the making. These include how actions become coordinated and concerted under circumstances when "the ground beneath our feet is shaking" (Burawoy, 1998), which moves away from the stable, ongoing, recurrent, regulative, pre-organised, and predictable actions commonly associated with established operations.

The cooperation with Phoenix spans a time period of almost 10 years and includes various types of projects: from more action research oriented, characterised by intervention and co-generative learning (Elden & Levin, 1991) to reports documenting experiences and lessons learned from strategic business activities. In some settings my

[1] In a bulletin published by a confederation of employers in 2005 Phoenix was used an example of a high performer, "extraordinary", in accomplishing projects on budget and time.

role was a SINTEF researcher, and in others as a PhD candidate. The role as an action researcher attained through the SINTEF projects, provided me with an access to key personnel, meetings, classified documentation, and permission to observe work on-site, which I could otherwise hardly attain. The role as an action researcher also made it legitimate for employees to spend time teaching me about the subtleties of the light metal industry, as well as engage in discussions that provided me with rich empirical material that would otherwise be difficult to obtain.

My research colleague and I became involved in greenfield studies at Phoenix in 2001 when we met with the project team (also referred to as "dream team") responsible for the Mancha start-up in Spain. They had just been appointed for the team and met for the first time when we showed up. The background for our presence was that our SINTEF department at that time worked with a learning history approach (Roth & Kleiner, 1998; 1999), which was developed as a method for collecting experiences from an ongoing or recent activity for subsequent collective reflections and discussions—with the overall aim of stimulating organisational learning. The stories should not be normative in the sense that they give a description or "recipe" of how to conduct the activity (e.g. a project), but they should rather represent a multifaceted and sometimes contradictory message containing multiple views and perspectives from the different participants involved. The learning from such stories lies partly in the stories themselves; perhaps as important are the learning and reflection processes the stories initiate in the user/producer, both as an individual and in social settings among peers. The new greenfield project in Spain created an opportunity for us to develop a new layer on our learning history methodology—the knowledge hyperstories—incorporating video-clips and pictures to the web-story. The intention and goal with our project was to capture more insights and experiences gained during the accomplishment of this specific start-up, and to make them accessible and available for future start-ups. The main period of empirical investigation related to this project lasted from May to November 2001. This included three field trips of about one week each to the Spanish field site, two trips of two to three days to the site where most of the hands-on training took place, and two visits to the headquarters. Thirty people were interviewed, and about eight to ten of them were interviewed several times. In addition to face-to-face meetings, telephone

interviews, informal conversations, and discussions we received access to planning documents, minutes of meetings, presentations, and relevant e-mail exchanges. A narrative, web-based multimedia learning history that we labelled "knowledge hyperstory" (see Paper four "Knowledge Hyperstories and Context-sensitive Knowledge Enabling") was built with the project group, through several iterations. In 2002 when the plant was in operation we made another visit and added an "epilogue" to the story; in 2006, we had a final trip to see how everything went. In the period between these visits we were in contact with managers and experts in Phoenix on a regular basis.

With the study in Spain as a basis, two more studies of greenfield projects—this time in China—were conducted. The first one—which was studied in retrospect—was Phoenix's first wholly owned light metal plant. We were invited to study this with the aim of extracting as much significant learning as possible relevant for further investment projects in China. The second one took place not far from Shanghai and was a real-time study. In both studies, we conducted interviews, partook in meetings, observed what happened, and talked to project and operational personnel, and other expatriates. We also received access to similar documents as in the Spain project, that is, minutes of meetings, several Power Point presentations on progress, access to design basis for the plant and various other reports. The main findings of the studies were synthesised and reported back to Phoenix.

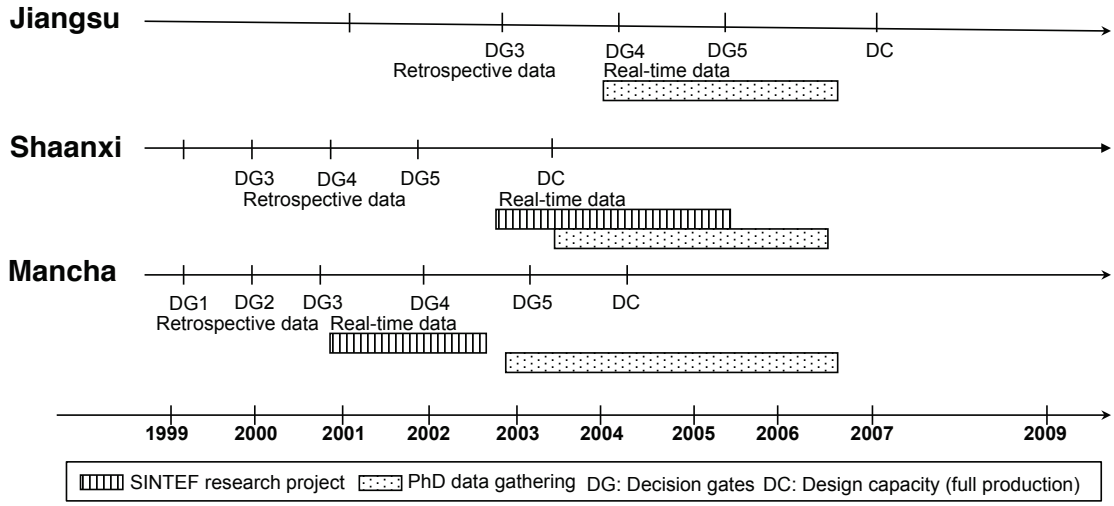

Figure 1. Timeline for data gathering

Overall as illustrated in Figure 1, the timeline for my fieldwork starts in 2001 with real-time data gathering in the greenfield project Mancha, and ends in 2006. During this period of time, my research fellow and I visited the various sites regularly in the time intervals labelled "real-time data" in Figure 1. "Retrospective data" indicates the time-periods where we obtained historically data from before, during, and after our visits to the sites. For each greenfield project, I indicate on the timeline the development of the project in terms of stages and decision gates following Phoneix' own decision support model for investment projects:

- DG1 is approval to develop (often several) ideas further.
- DG2 is the decision on what concept to develop into all the necessary details.
- DG3 is the decision about starting construction work is made.
- DG4 is the point where the formal takeover of the plant to the local organisation is approved.
- DG5 is the start-up of production.
- Design capacity (DC) indicates at what point in time full production should be expected.

Organisational unit	Location	Number of interviewees	Number of interviews	Number of visits
Mancha	Spain	15	30	5 (Spain)
	Norway	5	5	1 (training site)
	Norway	5	5	2 (headquarter)
Shaanxi	China	19	34	3
	China	5	5	1 (representative office)
	China	6	6	1 (joint venture plant)
	Norway	5	5	1 (plant)
	Switzerland	3	3	1 (sales office)
Jiangsu	China	12	27	3
	Norway	8	12	2 (headquarter)
Subcontractors	China	5	5	2
Corporate Headquarter	Norway	10	n/a	Regular basis
Corporate Representatives	Europe	5	5	n/a
Other global companies	China	12	12	2
Total		**115**	**>160**	

Table 1. Interviews and locations

Table 1 summarises both where I have been and what organisational units I have been in contact with. Overall, I talked formally and informally to more than two hundred people in Phoenix, and conducted interviews with about 115 of them—with the most

central people interviewed several times. I have visited ten of their geographical locations, the corporate headquarters, a division headquarters (including sales and marketing), seven project (and subsequent production) facilities (two of them including visits to research centres), and one representative office. In addition to interview data, I also received access to diverse material including newspaper articles, Internet presentations, a variety of official reports (e.g. annual reports, brochures), intranet web-pages, internal interactive net-café meetings, company ICT systems of diverse types, pictures and movies, internal and confidential documents like minutes of meetings, reports and evaluations, e-mail exchanges, presentations and forecasts. Even though the empirical material contain aspects concerning knowledge, culture, capital, management, technology etc. I have chosen *knowing processes* as the *organising concept* for my studies.

Data gathering and analysis

It is a rather extensive task to analyse a large amount of data in a proper way and I will now explain the three phases[2] of the analytic process that were conducted. It should be noted that even though these phases are here described in an orderly and linear manner they were more intertwined and the steps more iterative than the description indicate.

In the first phase we constructed a descriptive and chronological story of the greenfield project from idea to ramp-up of the new plant. Before we went to visit the actual site we were at the headquarter preparing ourselves of the particularities of the project by getting access to relevant documents and talk to managers, project engineers and business developers. Interviews on-site in the first round were semistructured with open-ended questions and the aim was to get "thick descriptions" (Geertz, 1973) of what happened during the project period. This was also complemented by following up questions probing particularities and examples from sensemaking processes: "In what way?", "Can you give examples?", "What happened next?", "Who others can we talk about this?". Besides filling the chronological case template with data this phase was

[2] For the first two phases of the analysis my colleague in the field and I were working closely together discussing, reflecting and coding the empirical material. Phase three is, however, conducted by myself alone.

also important for establishing a background understanding and for making us being able to ask more informed questions in the next round. Being new to this kind of projects there are a lot to learn and since we were two researchers present at site we had the advantage to discuss and make sense of our observations and interviews on a continuous basis when we where in the field. From an enactive inquiry point of view this opportunity to be present and at the same time reflect on higher level implications was particularly valuable. The output of this first phase consisted of a digital archive of audio files from interviews, video recordings and all other documents we got hold of structured according to the timeline of the unfolding of the project. We also wrote reflection notes of observations and preliminary findings and made sketches of the connections in the evolving project landscape.

In the second phase almost all interviews were transcribed and categorised first by means of an open-ended system of coding. Statements and paragraphs were labelled in order to help identify overarching themes and categories, for instance; “here is a local-corporate boundary issue”, “this is about issues which can not be planned for”, ”here she talks about building trust by giving away control” etc. After the first round of coding a set of more conceptually abstracted themes and patterns emerged as we discussed, interpreted and drew maps connecting related codings together. This was also the basis for conducting more focused and narrow, although semi-structured, interviews focusing on selected topics associated with organisational knowing processes when we went back to the field. The analysis continued out in the field and was influenced by Glaser and Strauss (1967) notion of “theoretical sampling” in which decisions about which data should be collected next are determined by the theory that is being constructed (Suddaby, 2006). An example of this iterative theory/data collection sampling was the emergence of “proscriptive mode of knowing” conceptualised in the first paper following this connective article.

Back at the office we started to analyse the empirics together to “calibrate” our understanding and then, since this is a rather comprehensive and time-consuming job, individually, but still we had ongoing discussions about our findings. This way of working is also in accordance with Glaser and Strauss (1967) who argue for joint

collection, coding, and analysis of data (Eisenhardt, 1989) to improve validity. All the material was then again examined closely and labelled according to the newly identified set of themes (when possible). In order to organise the empirics within themes we sorted out the relevant quotes and passages and organised them as clustered narratives of actions. This was our main mode of working in all the greenfield projects when we alternated being in the field and at the home office. When on-site we were not selective about whom we interviewed assuming that more or less everyone could add a piece to our understanding. However, in light of the research agenda pursued, some interviews were later discarded as they were outside the scope of my study. A typical reason for letting go of data was that the person interviewed was newly recruited and simply did not really have any relevant experiences from working on the project. The Spain project was the first case studied and analysed and the main chapters of the "thematic clustered case story" consisted of the following five main "chapters": "Enabling conditions", "Atmosphere of enabling", "Paradox of planning", "The practice of training", and "The timing of training". Figure 2 shows an excerpt[3] of the beginning of the "Enabling conditions"-chapter and a cluster containing some of the background for the decision of initiating the project. The left coloumn represents a contextualisation of the quotes used for further analysis, that is, next phase. The subsequent greenfield-projects in China were coded, anlaysed and clustered in the same way.

A decision to make an investment in a new plant – what are some of the underlying considerations and evaluations?	Henry: We feel that it is necessary to have a close relationship between the market people and the production people. And also to be able to handle the metal from the Norwegian melters, which also is a very important source for Spain. To combine these big deliveries from Norway with a more flexible production unit in Spain will give us an opportunity to develop the service towards the customer in a much better way. We feel that also putting sales and production together will make it easier for the production people to influence the sales and how the sales-people choose the products they are selling towards the customer.
The importance of close ties between sales and production.	
An opening in the market,	Henry: The Spain project came up fairly quickly because in Spain we have been present for only five-six years with the sales of billet. We saw

[3] The whole case story is about 40 pages.

and a quick move.	that we managed to get quite a big market share in Spain, and that one of our competitors has been running the re-melt business in quite a special way, so that was an opening for one more re-melter in that region.
By a coincidence they came across the Mancha-area, when looking at some other resorts. But the region was picked from a more strategic point of view.	Henry: I think it was more or less a coincidence. Actually I didn't take part in the first trip where we went down to look at it, but I think there was two or three people from Norway who went down, and was going to look at some other locations.
"C" is the origin and the spider in the "remelt-web". The importance of local re-melter presence. The two basic principles of the re-melt business.	Henry: We started in 1996 in "C", and found out that it is necessary to have local re-melters, to avoid too much transportation and logistic cost in this type of operations. So we will try to have local units in each region, and utilise the available scrap waste in those regions. The re-melting on scrap is actually based on two different principals: One is that we take back the primary scrap from our customers. And secondly also to utilize used scrap, which we buy from scrap-handlers out in the market. Hopefully we will have a fifty/fifty feed of these types of scrap into the re-melters.
The re-melt network. It's expanding from a European towards a global network.	Franz: To build a European remelt-network to support the market-activity, the business-activity and the flexibility etc. we can provide to the customer, we developed five years ago a re-melt network. "C" was the platform and in the last five years the Hydro re-melt area development at "C" has been supporting all markets. And we are in negotiations for all the other activities, like here in Spain were we will start off this year. And in the States, we know about "H", and we have a lot of discussion regarding a Texas-plant.
Some characteristics of the Mancha start-up: - Co-location of production and sales - the fifth re-melter	Henry: Mancha is one of the re-melters which is producing and reporting into the [donwstream] organization. In Mancha we have organised the sales and the production side together, and that is a principle we want to develop in other markets as well. Mancha is the fifth re-melter, and we have plans to build a couple of more in Europe.

Figure 2. Excerpt of thematic case story from greenfield in Spain

The third phase is a response to the research agenda on organisational knowledge processes as previously outlined. This implies that in addition to the individual analysis of each case, systematic comparison within and between cases and the coded clusters has been an essential part of my inquiry and the subsequent conceptualisations and theorisations made. This involves carrying out several iterations and spirals in the hermeneutic circle (Gadamer, 1975) powered by my research questions. Somewhat roughly the principle of the hermeneutic circle can be described as a holistic dialogical process of reflection between empirical findings and theoretical assumptions, constructs and schemas brought forth as spirals of interpretation. Any clarification or other change in the interpretation of a passage (i.e. a part) has the effect of rippling through the circle and changing the framework supporting the previous interpretations of the other passages (i.e. the whole) (Lee, 1991). This is a research process similar to an abductive way of reasoning where theoretical assumptions are tested against surprising empirical phenomenon leading to potential new or revised theories (Alvesson & Kärreman, 2007). This includes searching for constituents and mechanisms for knowing, developmental sequences of actions, patterning of actions within and between cases while generating, testing, and revising theoretical conceptualisations across contexts. A more detailed explication of these processes can be found in the individual papers following this connective article.

My aim of the conducted studies is not to test theories; rather, it is to seek both an understanding of knowing processes in organisations and to advance the field of organisational knowledge theories with further theoretical building blocks that can be applied elsewhere (i.e. *perspicacity*). In this study, I have used several strategies for obtaining the *veracity* of my findings and constructs: An essential part of the interactions with my informants are *member checks*, not only as a validation of previous accounts, but as a way of making understanding coming into being through dialogue, that is, feedback on-site. Our findings have also been presented in several meetings for the project team and managers at the organisational headquarter and documented in internal reports written for Phoenix. Making sense of interview data, identifying categories and patterns of interactions, and developing new theoretical

conceptualisations are all part of a continuous learning process that involves creative leaps. These leaps are made possible and trustworthy by my prolonged engagement with the field (Lincoln & Guba, 1985) and are justified and warranted by making data and constructs available and transparent for discussions and critical reflections with informants and peers (colleagues and other researchers). As part of my analysis, I also *triangulated various data sources* (interviews, documents, observations) to obtain overall *verisimilitude* (and deeper understanding) by checking for consistency, similarity and robustness. An essential tenet of enactive inquiry is the emphasis on *alertness* and *receptivity to the views of others*, *empathy*, and *open-mindedness* (Stewart, 1998) when probing into experiencing with others what is intersubjectively observable, thus aspiring toward objectivity transcending the perspectives of the researcher (ibid.)

Paper Synopsis

In this section, I provide a brief summary of the papers that follow in part two. The end of the section includes a table that gives an overview of the thesis, showing how each paper connects to the outlined research agenda (Table 2).

Paper 1: "Individualised Organisational Knowing: Prescriptive and Proscriptive Modes of Knowing in a Greenfield project". The first paper argues that while organisational knowledge theories have provided new insights into the functioning of organisations, they also have been dominated by a tradition of viewing knowledge as abstract, discrete, and independent representations of objectively accessible state of affairs. The perspective I develop deviates from the traditional discourse of organisational knowledge by building upon the gerund of *knowing* rather than the noun of knowledge. Locating the act of knowing in activity rather than abstraction is to recognise and acknowledge that how agents cope with everyday situations is what constitutes the proper units of knowledgeability. The main questions raised in the paper is how individual knowing is connected to the organisation and a possible concept of organisational knowing, and what role determination, analysis and planning have when knowledgeability is associated with coping in everyday situations. A study of a project

team responsible for constructing and facilitating the start-up of a greenfield project in Spain provides the empirical basis for the conceptualisations made.

My approach builds upon various streams of theory including enactive cognitive science (Varela et al., 1993), literature on organisational epistemology (Tsoukas, 2005) and social becoming (Stzompka, 1991) as well as insights from continental philosophers such as Wittgenstein and Heidegger. On the basis of the theoretical positioning and empirical studies, I propose there are two modes of *individualised* organisational knowing prevalent in organisational life. These I denote *prescriptive* and *proscriptive* modes of knowing. The former dominates when organisations can offer generalised rules to stabilise and make organisational knowing predictable in terms of outcome and performance; that is, to align organisational actions as coherent and effective problem solving practices. The construction part of the greenfield project—the actual building of the plant—is found to follow a planned and coordinated set of actions (often referred to as "best-practice" at Phoenix) towards the initial targets decided from the outset. However, when the organisational setting or environment cannot provide stable conditions or appropriate precepts for a recurrent practice to be effectuated—or the actual situation is underdetermined by the organisational rules—a proscriptive mode of knowing becomes dominant as a mode of knowing that involves an enabling and unfolding of a co-constructed emergent and social problem domain. In this respect, the start-up project responsible for building a new and competent local organisation for operating the plant is characterised by changing conditions as the project progresses, which includes deviations from plans and on-the-spot problem solving.

Both the organisational modes are proposed to be *individualised* because the personal character of the individuals' knowing comprising organisational knowing is always embedded in the social. The capacity for knowing arises "from the individual's committed participation in mutually oriented patterns of behavior that are embedded in a socially shared background of concerns, actions, and beliefs" (Winograd & Flores, 1986, p. 78).

Paper 2: "The Sociogenesis of Organisational Knowing – a Study of the Translocation of a Organisational Practices to a Greenfield Plant". The second paper addresses the issue of how to share and mediate knowledge, capabilities, and practices within and across organisations. Managing a variety of knowledge flows across boundaries is critical for maintaining competitiveness and are mediated through a variety of tools and methods including personnel movement, technology transfer, replication of routines, patents, interactions, alliances, and interorganisational relationships. Knowing how to deal effectively with these mechanisms requires insight into both the nature of the various constituents, as well as the process of bringing them into action. However, the actual formation of organisational practices and how they originate, emerge, and develop over time are more or less black boxed in the literature. What cognitive and cultural conditions that facilitate or impede mediation and recreation of practices are in this respect rather opaque. In the paper, I explore the sociogenesis—i.e. the emergence and shaping—of organisational practices in two greenfield plants. I do this by outlining a descriptive process model of the translocation of a complex organisational practice to shed light on the stickiness, barriers, and challenges associated with the emergence and recreation of an organisational practice. A translocation as it is used here represents a transformation of practices from other sites in Phoenix to the greenfield into a new location (the new site). By transformation, it is indicated that it is not a copy-and-paste event, but rather a customisation, recreation, and reenactment which I describe as a sociogenesis of recurrent dialogical actions building upon various modes of cultural learning (Tomasello, Kruger & Ratner, 1993). Cultural learning consists of three stages reflecting the maturity in the development of the translocated practice. These are denoted as *imitative learning*, *instructed learning,* and *collaborative learning*, respectively (ibid.). Imitative learning is characterised by reflective reproduction in which the learner internalises intentions underlying the demonstrator's behavioural strategies. Instructed learning takes place when the learner internalises the intersubjective dialogue between their own understanding and that of the instructor; it is the cognitive representation of this dialogue which forms the basis for the subsequently co-enaction in the new context. Collaborative learning represents a co-construction rather than transmission of knowledge among interactants. The various stages and steps identified in the

sociogenesis includes various modes of learning and categories of knowledge like procedural and prescriptive knowledge representations, knowledge embedded in technology and structures, individual embodied knowing, and collective co-constructed understandings embedded in practice. I argue in the paper that the complexity involved in translocation processes implies a need for building upon multiple epistemologies in order to explore and understand such processes with the necessary granularity.

Paper 3: "Patterns of Connectivity: The Enactment of Organisational Routines in Greenfield projects". The aim of the third paper is to provide an understanding of how and why a seemingly non-routine organisational practice of establishing greenfield plants can display action patterns resembling organisational routines. Organisational routines have been proposed to represent an essential aspect of organisational functioning by enabling coordination, stabilise behaviour, economise on cognitive resources, and bind knowledge. They are commonly understood to represent more or less mindless and recurrent work efforts.

A study of three greenfield projects at Phoenix makes up the empirical basis for the conceptual elaborations. A set of four recurrent practices was identified as being critical for a successful greenfield project. These are practices for configuring boundaries enabling efficient workflows, coherent effort, action-oriented planning, and facilitating co-construction. The study shows that the constitution and conduct of these organisational practices display a similar kind of action patterns across the studied projects resembling organisational routines as patterns.

As patterns routines can, on the one hand, be understood as distributed dispositions in the organisation where "(…) the multiple actors carrying out the routines belonging to different organizational units, and are located in different places—linked by interaction" (Becker, 2004, p. 647). On the other hand, patterns can be depicted as essentially delocalised, but temporally fixed and concentrated enactments shifting around in the organisation over time. By building upon an enactive approach (Varela et al., 1993), the situational aspects of the constitution of practices are emphasised. The contextuality and instability prevalent in enacted efforts suggest that change and novelty are more

fundamental and ontologically prior to the presumed stability and regularity of organisational routines (Tsoukas & Chia, 2002). This implies that organisational routines might provide flexibility to handle a range of situations and events and still display similar action patterns in terms of isomorphic sequences, steps, and actions that are situationally justified and enabled. In contrast to a perspective of organisational routines viewing individuals' actions as more or less automated or programmed an enactive approach highlights the history-dependent aspects of the cognitive apparatus of individuals and their capacities for knowing, reflecting, and creating intersubjectively coordinated and integrated actions. In accordance with Feldman (2000), I argue that organisational routines cannot be taken as stable or given, but rather as achievements. As such they cannot be captured, described and transferred as "programs" or "scripts"—it is the individuals' capacity to enact that need to be developed (Orlikowski, 2003). This implies that organisational routines as patterns of social interactions consisting of consensual meaning and coordinated actions are important means for effectiveness enabled by the affordances of the connectivity of the parts comprising the routine.

The fourth and final paper is also a response to the demand of making the field of management studies more relevant to practitioners (e.g. Johnson, Melin, & Whittington, 2003); that is, showing potential practical implications and applications of theoretical frameworks and concepts. In this paper, my research colleague and I describe and discuss processes of experimentation and construction of new tools and methods for development of organisational knowledge and knowing capabilities.

Paper 4: "Knowledge Hyperstories and Context-sensitive Knowledge Enabling". Stories or narratives are essential for the fostering and maintenance of social dynamics in organisations. Bruner (1986) noted that a main feature characterising narratives is as "viable means for social negotiations", establishing and sustaining common ground, and enabling coordinated and concerted actions. In this paper we explore an extended concept and practice of learning histories (Roth & Kleiner, 1999) that is denoted knowledge hyperstories. Learning histories are a formalised approach for collecting and presenting learning efforts in organisations. It is a method for sharing knowledge with a

focus on giving voice to a multiplicity of perspectives on important events, told by the participants themselves in a "jointly-told-tale". Our extension—labelled knowledge hyperstories focuses on the use of ICT as a mediator and facilitator for a new type of purposeful, non-linear storytelling for organisational knowledge enabling and sharing. By arguing for an activity-based view of knowledge focusing on the relational, communicative interaction processes, our claim is that knowledge hyperstories form a "rich" identification and representation of the knowledge dynamics of practice in organisation.

Our concept of "knowledge hyperstory" can be positioned within what is commonly referred to as "digital storytelling"—an attempt of a human-centred and historically based "take" on stories and storytelling, combined with competent and creative use of digital tools. The empirical explorations were undertaken in settings that include a greenfield start-up project and a project aiming at developing a sophisticated intranet portal. Narratives which address and confront challenges of knowledge enabling, experience exchange, and communicative interaction were collected, and we argue that a possible constructive use of ICT enhanced storytelling examples can enable organisational development. We discuss this in light of how storytelling as a social practice offers powerful means of context-sensitive knowledge support and enables both tearing down barriers and triggering enabling factor.

Research agenda topics addressed	Research question	Core concepts and terminology	Main bodies of theory	Main source(s) of data	Paper
Primary: Individual and collective knowing Endogenous change and novelty *Secondary:* Tacit and explicit knowledge Organisations as cognising subjects and extension of human capacities	How can we understand *organisational* knowing in turbulent or open-ended contexts as individualised day-to-day coping in a continuous stream of 'microworld' situations?	Individualised organisational knowing Proscriptive and prescriptive modes of knowing Embodied cognition and action Embodied simulation	Enactive approach in cognitive science Social becoming Continental philosophy Organisational epistemology Organisational knowing	Phoenix	"Individualised Organisational Knowing: Prescriptive and Proscriptive Modes of Knowing in a Greenfield-project"
Primary: Tacit and explicit knowledge Individual and collective knowing *Secondary:* Organisations as cognising subjects and extension of human capacities Endogenous change and novelty	What are the mechanisms and constituents enabling the *process* of intra-organisational sharing and mediation of knowledge capabilities and practices?	Modes of cultural learning Translocation as a socio-cultural transformation process Sociogenesis of recurrent dialogical actions building upon various modes of cultural learning	Cultural learning Organisational knowledge Organisational memory and knowledge "transfer"	Phoenix	"The Sociogenesis of Organisational Knowing – a Study of the Translocation of Organisational Practices to a Greenfield Plant"
Primary: Endogenous change and novelty Organisations as cognising subjects and extension of human capacities *Secondary:* Tacit and explicit knowledge Individual and collective knowing	What are the relationships between locally constructed social actions and the patterning of these accomplishments into organisational practices?	Action patterns Routines as patterns of enacted distributed dispositions Organisational memory Agents and agency Experiential structures and relational networks Embodied simulation	Organisational routines Enactive approach in cognitive science Social becoming	Phoenix	"Patterns of Connectivity: The Enactment of Organisational Routines in Greenfield-projects".
Primary: Tacit and explicit knowledge Individual and collective knowing	How can the knowledge dynamics of locally constituted organisational knowing be represented and disseminated?	Knowledge hyper-stories Context sensitive knowledge support and enabling Collective reflection and action Cybertext and hypertext Stories form, content and function	Learning histories Storytelling Cybernetics	Phoenix ICT consultancy	"Knowledge Hyperstories and Context-sensitive Knowledge Enabling"

Table 2. Overview of the PhD thesis

Contributions and Implications[4]

The aim of this thesis is to provide new contributions to the burgeoning field of organisational knowledge theories within the frame of the research agenda presented in the beginning of this article (see also Table 2). In this final section, I will discuss some of the main contributions and implications for advancing the field further starting with a discussion of the four trajectories of the research agenda. I will then elaborate on some theoretical implications pointing towards future research.

From the outset of the thesis, I was occupied by the "puzzle" of how quickly a new "production-ecology" composed of various human, cultural, and technological parts came into being starting from essentially nothing: thus the thesis title of "Genesis of Greenfields". I examined several aspects connected to the process of making a new greenfield plant based on studies of three greenfield projects and theoretical approaches, building mainly upon the enactive perspective as outlined by Varela et al. (1993). With its origin within evolutionary and biological system theory, enactive cognitive science brings forth an understanding of how systems construe and choose viable—not necessarily optimal—next steps with what is at hand (i.e. a bricolage mode of operation). One of the main contributions from enactivism to organisational knowledge theories is how it provides a coherent conceptual background for examining the mechanisms which structures the relationship between autonomous individuals and the social organisation of the actions undertaken. The enactive approach addresses in this respect assumptions and questions the fundamentals and relations between concepts like language, identity, learning, knowing, action, memory, etc. in a way which are not common in contemporary organisational knowledge theories. This manner of making inquiries allows and makes it possible to connect, bridge, and extend theories about organisations, learning, and knowing to a broad set of theories from technical cognitive sciene to continental philosophy.

[4] This section assumes familiarity with the main concepts introduced in the thesis. I would recommend that the reader return to this section after reading the full papers.

The issue raised in trajectory one of the research agenda was to which extent it makes sense to attribute concepts of human cognitive capacities to organisations, and if so, whether they should be taken literally (ontology) or as a metaphor (analogy). Taken literally, concepts like scripts and schemata in cognitive science are understood to denote an "organisational mind" that display attributes and constraints resembling individual cognitive capacities. That is: humans as individuals, and organisations as an assemblage of individuals, display similar cognitive characteristics. Understood as metaphors, cognitive concepts provide language and ways of describing organisational capacities in a similar fashion as for individuals; that is, concepts are applied in a more open-ended way by also including environmental (structures, artefacts, and culture) impact. An essential tenet of the enactive approach brought forth here is that social activity is the ultimate foundation of intelligibility, and that all human activity is essentially social. As argued in paper one on individualised organisational knowing and paper three on enactment of organisational routines, I build upon theories of social becoming and enactivism to establish a view of social actions as consisting of a knowledgeable agency (which can be individual or collective) composed of unfolded structures and mobilised agents. I argue it is procedural individual memory that provides the necessary experiential structures and dispositions for organisational memory to be brought forth, and that it is *embodied simulation* that is the fundamental mechanism for mutually-adjusted and coherent collective action. The reason for introducing "embodied" concepts (embodied simulation, embodied cognition and embodied action) extending into the social and the cultural environment is to provide an explanation of why the the boundaries between the "mobilised" individual and the "unfolded" organisation become opaque. Also in paper two, on the sociogenesis of organisational knowing, the cognitive capacities of humans are found to be important for understanding organisational learning and knowing as modes of cultural learning. By subscribing to neither an ontology nor analogy approach for the use of human cognitive concepts on organisations, I argue that additional theoretical bridges and conceptualisations not frequently found in organisational knowledge literature are needed to understand the unfolding of actions and reactions, the learning, acting and knowing unfolding in the greenfield projects.

Trajectory two is concerned with reification and entification of knowledge often found in the branch of "knowledge management" in organisational knowledge theories. In particular, the literature debates the tacit/explicit dichotomy and the possibility of converting tacit knowing to explicit knowledge. If it cannot be converted, how can this critical knowing that gives raise to competitive advantage be nurtured, shared, and managed? While there is no straightforward answer to this issue, the literature on narratives emphasise stories about experiences, practices, and performances as a possible entrance to identifying, collecting, and sharing tacit knowing—not as a transfer of knowledge, but as a means to engage with the tacit background foundational for all knowing (Winograd & Flores, 1986). Paper four on knowledge hyperstories provides an account of a concrete effort of constructing a web-based hyperstory for presenting and reflecting about "rich" stories of the knowledge dynamics in the day-to-day coping with situations in a greenfield project. This is done by combining foundational thinking about how the functioning of the World Wide Web was originally designed along with the enabling of collective reflection and transactive discussions as a means to learn and recreate tacit knowing. In paper one, explicit knowledge as interpretations of rules and precepts has an important role for what I denote prescriptive knowing. Also in paper two on the sociogenesis of organisational knowing, explicit knowledge (as epistemology) is found to be one of several other ingredients in the translocation of organisational practice. While codified knowledge as *knowledge* might be contested, the empirical material does show that explicit representations are indeed an important aspect for constituting, sustaining, and "moving" social actions.

Trajectory three addresses the relationship between the parts and the whole of organisational knowing. While literature on organisational knowing emphasises learning as exogenously initiated, it is rather vague on the relation between the bodily foundation of experience and the observed cultural patterning of behaviour. As brought forth in this thesis, the social context is an integral part of activity, which suggests that the social and the cognitive cannot be studied independently. Accepting a greater recognition of the bodily foundation of culture and cognition as found in embodiment theories of knowledge has been essential to better understand and theorise about the constitution of organisational knowing present in my empirical material. As argued in

paper three on patterns of connectivity, recent developments in neuroscience suggests that the mirror neuron system plays an important role in recognising other conspecifics; that is, similar neural activity patterns of an individual performing a specific action can also be found in those individuals observing the action. For autonomous individuals to be able to identify, communicate, and interact with others, I suggest that this mechanism is fundamental for social action, that is, for coordinated action to occur concspecifics have to resemble each other: to let go of themselves and "become the other(s)", to be part of a collective "we". Thus, it follows that an intrinsic characteristic of social systems is that they aim for consensual coordination by enabling both mechanisms for establishing common ground and collective coherence for actions to occur. This collective co-orientation is of a patterning nature in which individuals adjust their behaviour in relation to each other while embellishing culturally-mediated rules and norms from the environment. Processes of mutual tuning takes place in the mundane through actions, negotiations, narrative exchange, observations, and learning. In this respect Birnholtz et al. (2007) have shown that thin slices of experience or limited exposure (observation, demonstration, interaction) can activate loosely coupled systems displaying recurrent action patterns over time and space. As argued in paper three on patterns on connectivity, artefacts (including language and rules) have generative powers because they embody previously useful ways to categorise and construct the world for both efficient interpersonal communication (Tommasello, 1999) and as footprints of prior successful solutions. They thus seem to play a major role for the functioning of mechanisms that enable consensual coordination. Language also contains cognitive resources for connecting the parts to the whole, and vice versa, in a coherent manner (Tomasello, 1999), and function also as "consensual coordination of a consensual coordination of action" (Maturana & Varela, 1980).

Trajectory four on endogenuos change and novelty is based on the observation that organisational knowing processes are often studied under conditions of recurrent situations and stable environments. Organisations are in this respect viewed as problem solvers which have available a repository of knowledge structures and rules which changes according to external evolutions in a steady-state environment. For recurrent and similar situations, the rules' potential for framing agential conduct is determined by

the extent they are enforced or how well they specify the paths laid to solve posed problems, or in Varela et al.'s (1993) more eloquent description:

> "…unless such rules are informed by the wisdom that enables them to be dissolved in the demands of responsivity to the particularity and immediacy of lived situations, the rules will become sterile, scholastic hindrances to compassionate action rather than conduits for its manifestation." (ibid., p. 252).

But as studies also show, coordinated, concerted, and effective action may occur when the organising context is turbulent or open-ended. This implies that an organisation's actions may be more creative and flexible than prescribed by established knowledge structures. Change therefore seems to be more pervasive than usually accounted for in the literature and that both the constitution of the problem domain and the environment, rather than recurrent and stable, should be viewed as co-specified and co-enacted. But how does this mutual co-tuning process take place in novel or ambiguous situations as for instance in greenfield projects? I introduced in paper one on individualised organisational knowing the concept of *proscriptive knowing* as a mode of knowing which applies in situations of complex or labile organisational environments where no knowledge structures apply. Central to this mode of knowing is to provide functional and effective solutions to emerging problem domains brought forth by collective codetermination. The self-referentiality of knowledge and articulation of experiences from the past and anticipations of expected outcomes in the future enable the constitution of an action domain composed as a bricolage (Lévi-Strauss, 1966) of available artefacts, resources, and capacities. The bricolage is composed of "…forward-looking projection of ends with a visualization of the means by which that projected future may be accomplished, as an emergent rather than explicitly scripted strategy" (Pitsis, Clegg, et al., 2003, p. 575). Proscriptive actions are shaped and constituted, not randomly, but as a result of ongoing creative acts that bring both past history and future anticipations into the present. They are not necessarily optimal, but feasible and viable, and bricolage can sometimes "reach brilliant unforeseen results" (Lévi-Strauss, 1966, p. 17). Thus, a shift from a "what is not allowed" to a "what is not forbidden" logic, i.e.

proscriptive knowing, opens up for a more radical dynamic of how organisational knowing is constituted and changes.

My studies of the everyday life of greenfield projects gave impetus to including theories from other disciplines not common to organisational knowledge theories. This in turn allowed me to elaborate on new theoretical building blocks that provides a more comprehensive, extended view on the mechanisms and complexities involved in the organisational knowing brought forth when developing greenfield projects. Across the four research trajectories, I found in retrospect that the role of artefacts might be more central than initially thought; I agree with Tsoukas (2009) that further research is needed to obtain a deeper and more fine-grained understanding of artefacts and how they unfold and mediate interactions. One way of embarking on this quest is by taking the enactive inquiry methodology as previously outlined and extending it toward a more comprehensive approach: by starting out from embodiment theories' suggestion that it is the co-enactments with the body (as a lived, experiential structure and context of cognitive mechanisms) and the social and cultural environments that provide a proper understanding of reflexivity and knowledgeability of social conduct, artefacts will come into play. Such an advancement should not only be obtained by integrating some of the more technical research in cognitive science, but also the other way around: social and cultural studies contain the potential to inform and direct further developments in cognitive sciences.

Enactive organisational knowing

Organisational processes of knowing are at centre stage of organisational life and are an important area of inquiry for the understanding of organisational functioning and behaviour. As indicated by the research agenda there is a need to examine the underlying assumptions behind different theoretisations and conceptualisations on organisational knowing to better understand the various contributions and how they are interlinked. On an epistemological level, it is possible to make a major distinction between realist accounts of knowledge as possessing and representation, and constructivist accounts of situated knowing and socially constructed knowledge. The former, which I term representational organisational knowledge, ascribes to

organisations' human-like cognitive abilities as memory, mind, and learning (Pentland, 1992) and knowledge as a result of symbolic processing of "elements"—whether it be schemas, scripts, routines, objects—corresponding with an external reality. The symbolic processing paradigm represent the oldest, most orthodox and widespread view of knowledge present in the literature on organisational knowledge and learning. This paradigm—often referred to as cognitivism—is inherited from artificial intelligence, cognitive psychology, economics, and strategic management.

A central tenet in cognitivism is the hypothesis that cognition is manipulation of symbols according to explicit rules and thus operates like a digital computer. This may also be the reason for the strong emphasis on "computer-like" concepts as organisational memory, scripts, explicit knowledge, and knowledge transfer in the literature on organisational knowledge. In this respect, cognition is the *mental representation* of symbols that represent features of a pre-given subject's independent world (Varela et al., 1993); perception is the information-processing of recovering pre-given properties of the world: "The tacit assumption behind the varieties of cognitive realism (cognitivism, emergence, and the society of mind) has been that the world can be divided into regions of discrete elements and tasks. Cognition consists in problem solving, which must, if it is to be successful, respect the elements, properties, and relations within these pregiven regions." (Varela et al., 1993, p. 147). Consequently, in cognitivism the potential for learning and knowing is limited and determined by the environment.

Cognitive embodiment theories represent an alternative approach to the symbolic paradigm arguing there is more to cognition than mental representation (Wilson, 2002). Cognition is within this approach viewed as a complex social phenomenon emphasising that cognition observed in everyday practice is distributed—stretched over, not divided among—mind, body, activity and culturally organised settings (Lave, 1988). Cognitive capacities are thus inextricably linked to histories that are lived (Varela et al., 1993) and consequently "...cognition is no longer seen as problem solving on the basis of representations; instead cognition in its most encompassing sense consists in the enactment or bringing forth of a world by a viable history of structural coupling"

(Varela et al., 1993, p. 205)—built up by a set of effective actions a being can perform. Some of the main sources to embodiment theories can be traced back to the works of Ryle (1949), Heidegger (1962) and Merleau-Ponty (1963) and talk of embodiment and situatedness has become increasingly frequent in a broad range of disciplines such as philosophy, psychology, neuroscience, robotics, education, cognitive anthropology, linguistics, and dynamical system approaches to behaviour and thought (Clark, 1997). In contemporary social theories, embodiment has been accompanied by a "practice turn" (Schatzki, Cetina, & Savigny, 2001), which provides us with ethnomethodological and phenomenological approaches and constructivist accounts of practical, mundane problems routinely encountered and solved by agents in the course of their day-to-day activities—thus adhering to the continental philosophers view of seeing agents not primarily as the locus of representation, but as engaged in practice—and social activity rather than the cognising subject as the ultimate foundation of intelligibility (Tsoukas & Knudsen, 2002). Despite the little impact technical research in cognitive sciences have had on social science (Turner, 2001), findings and accumulated evidence from cognitive psychology and cognitive neuroscience support to a large extent embodiment theories of knowledge (Niedenthal et al. 2005, p. 188).

Embodiment encompass reflection—both *on* experience and *as* experience—in which body and mind have been united: "Embodiment is the property of our engagement with the world that allows us to make it meaningful (...) embodied interaction is the creation, manipulation, and changing of meaning through engaged interaction with artifacts" (Dourish, 2004, p. 126). By embodied *action,* it is emphasised that sensorimotor processes, perception, and environment are relational and fundamentally inseparable in lived cognition (Varela et al., 1993, p. 173). In contrast to cognitivism, the overall concern is not to determine how some perceiver-independent world is to be recovered; it is, rather, to determine the common principles or linkages between sensory and motor systems that explain how action can be perceptually guided in a perceiver-dependent world (Varela et al., 1993). For instance, balancing a bicycle has more to do with our (in)abilities to control and coordinate the limbs and muscles in a precise way than it has to do with knowledge which is of a tacit nature (Collins, 2001). As a consequence,

embodied cognition theorists favour a relational analysis that views the organism, the action it performs, and the environment as inextricably linked (Cowart, 2004)

Thus, as an alternative to representational organisational knowledge, I introduce *enactive organisational knowing* building upon embodiment theories highlighting the construction of knowing as enacted and ongoing in practice, and the inseparability of knowing, learning and organising. Enactivism has its main historical roots within what could be called "biological system theory", and its theoretical basis is autopoiesis (Maturana & Varela, 1980), which is both a theory of living systems and cognition. The theory of autopoiesis has been applied in a wide range of disciplines including organisational studies (e.g. von Krogh, Roos, & Slocum, 1994). Enactivism as developed by Varela et al. (1993) is inspired by a phenomenological interest in bodies both as physical structures and as lived, experiential structures that highlight the embodiment of knowledge, cognition, and experience. A fundamental ontological tenet of the enactive approach is that the world is not fixed and pregiven but continually shaped and co-enacted by the types of actions in which humans engage—it is "perceiver-dependent" and experienced based (Varela et al., 1993). The world is more like a background—a setting of and field for all of our experiences, but one that cannot be found apart from our structure, behaviour, and cognition (Minsky, 1988). In an organisational context, the enactive approach may be a promising perspective because it addresses assumptions and explicates the fundamentals of concepts like language, identity, learning, knowing, action, memory, etc., which are rarely made explicit in contemporary organisational knowledge theories.

Individual knowing as enactment of distinctions

Cognition from an enactivism point of view is studied as embodied action. This means 1) that cognition depends on the body's sensorimotor capacities and 2) that these capacities are rooted in a more encompassing biological, physiological, and cultural context (Varela et al., 1993, p. 173). It is the social and situated activity of the mind and body—brought together—actively engaging with the world which is the foundation of intelligibility and not the cognising subject as such (Tsoukas, 2005). Cognitive structures emerge from recurrent sensorimotor patterns that enable action to be

perceptually guided (Varela et al., 1993), and their capacities for doing so are inextricably linked to histories that are lived. A distinct feature of enactivism which separates it from most other theories of embodied cognition and practice theories is that the constraints the environment impose is not something pregiven; rather, they are themselves specified by the sensorimotor structures. Possible regularities between the sensorimotor and environmental emerge from "structural coupling", i.e. an ongoing mutual co-adaptation between the individual and the world. The question is not whether a cognitive system adequately maps or mirrors a real world, but whether its actions are viable (von Glasersfeld, 1991).

One of the most fundamental cognitive activities that all organisms perform is categorisation (Johnson, 1987, p. 176), i.e. to make distinctions between this and that. It is the history of structural coupling that determines which stimuli and what thresholds that trigger an organism to enact a distinction, e.g. constructing an understanding of an outside environment. Individual knowing can in this respect be understood as an ongoing interpretation emerging from our capacities of understanding; that is, the enactment of a domain of distinctions out of an unarticulated background (of structural coupling) (Taylor, 1993; Varela et al., 1993; 1999). Tsoukas (2009) suggests that the creation of new distinctions is facilitated by self-distanciation; that is, by taking distance from unreflective ways of acting through articulation to gain new insight into customary practices. Knowing as an evolving capacity of the individual is therefore such that the content of knowledge and process of gaining knowledge are not clearly separable.

Embodied simulation and enabling community

According to Mead, a thought is a "conversation with the generalized other", suggesting that as we think individually, we respond internally and vicariously to the imagined responses of others to what we are thinking (Mead & Morris, 1934). It is, however, just recently that Mead's statement has been justified by cognitive science. Based on a review of recent neurophysiological findings, Gallese (2003) proposes that "…the capacity to interpret other's behaviour in a meaningful way is conceived as the result of a *simulation routine* by means of which we can *purposefully pretend* to be in the other's 'mental shoes' and use our own mind as a model for the mind of others." (Gallese,

2003, p. 520). The fundamental mechanism enabling this capacity of experiential understanding of other's action is the activation of the mirror neuron system (Gallese, Keysers, & Rizzzolatti, 2004). The function of the mirror neuron system is such that the activity pattern of the neuron system of an observer resembles that of the actual performer. "Embodied simulation enables models of real or imaginary worlds to be created. These models are the only way we have to establish a meaningful relationship with these worlds, because they are never objectively given, but always recreated by means of simulated models" (Gallese, 2003, p. 521). Imaginative simulation is the basic mechanism for engaging with the world but it is also essential for interpretation, formation of identity, meaning, intentionality, and for spurring and predicting consequences of actions.

I will argue that embodied simulation is essential for enabling the constitution of a shared and collective domain between ourselves and others through interactions, and that it is recognition of "others like me" (i.e. belonging to a larger community), which provides the basis for social cognition. It is by means of a shared meaningful intersubjective space—relying on embodied simulation—that intersubjective communication, social imitation, learning, and the ascription of intentions is possible (Tomasello, 1993). In contrast to a view of learning as a one-way transmission and adaption, cultural learning (ibid.), which is introduced in this thesis, brings forth a perspective of learning (individual as well as collective) as a relational and intersubjectively social process of interactions. Understanding other's intentions by means of simulation provides in this respect crucial impetus for learning-as-action because they on the one hand construe the world and possibilities for actions, and on the other hand they assess to which extent to the resulting situations fulfil these possibilities or not (Varela et. al., 1993).

Coordinated and co-constructed action

A notion of "collective mind" (Weick & Roberts, 1993) from an enactivism perspective represents an emergent joint accomplishment, which is manifested in the manner in which individuals articulate their backgrounds (i.e. their history of structural coupling) and interrelate their actions. It is this consensual coordination of action, by means of

interactions and simulations, which constitute our social reality. Knowing how to act within a collective domain of action—concrete contexts of beings and environment—is learning how to make competent use of historically evolved collective categories, distinctions, and cultural history constituting the domain (Tsoukas, 2005). Collective memory or remembering can thus be understood as a result of processing patterns that have been shaped by what has been experienced in the past and which still prevail in the present as an open-ended capacity waiting to be enacted. Organisation emerges as the result of interactions between actualised contextual cognitive patterns and reconciliation of situated agents generating recurrent and stabile behaviours. Language provides qualitative distinctions, which do not merely describe the world, but help create it and thus help define the domain of problems that is subject to appropriate actions (Tsoukas, 2005). The main function of language is to mutually orient linguistic agents within their cognitive domain (Maturana, 1978) and it is through linguistic interactions they continuously regenerate the consensual domain where they can recognise or acknowledge others. Language can therefore be considered as a "consensual coordination of a consensual coordination of action" (Maturana & Varela, 1980). Language and conversational interactions are important not only for aligning agents but also as means to making new or refined distinctions and creation of new knowledge in the collective domain through articulation and productive dialogues (Tsoukas, 2009).

I would like to close this connective article with the hope that the path laid down can be used to inform, extend, or point to, new strands for further research on organisational knowledge theories in general—and organisational knowing in particular. In addition to the theoretical implications there are also methodological implications; "enactive inquiy", and practical implications; the development of "Learning Hyper-stories" which is an applicable methos for collective reflection and learning. I want to emphasise that the purpose of introducing the enactive approach described here is not to disregard other perspectives, but to complement and extend existing research approaches to obtain more insights of the complex construction and dynamics of social practice in terms of agency and interactive coping. In the papers that follow, I will show some of the implications and possible gains of this approach in a "real-world" setting of constructing greenfield plants.

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1.
Individualised Organisational Knowing: Prescriptive and Proscriptive Modes of Knowing in a Greenfield project[5]

Abstract

While organisational knowledge theories should provide new insights into how an organisation functions, they currently view knowledge as reified assets or focus on processes of knowing in stable, recurrent situations. They are also vague on the relationship between individual and organisational knowing. Organisational knowing in labile or complex environments or situations deviating from the recurrent and well-known is hardly touched upon in the literature (a notable exception includes Hutchins, 1996). In this thesis, I study a greenfield project, an empirical setting where the dynamics of collective action is marked by lack of previous shared history or experience. By building upon an enactive approach from cognitive science, I believe it is possible to deduce two distinct modes of organisational knowing: prescriptive and proscriptive. The prescriptive mode dominates under circumstances where the organisation can provide relevant precepts and rules for action; the proscriptive mode can be conceived as a "bricolage"-like mode of knowing that is present in emergent and open-ended situations where no rules can be provided. I illustrate the two modes of knowing in a greenfield project by showing how the prescriptive mode dominates the construction process, and how the proscriptive mode works in the establishment of a new local organisation.

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Introduction

Viewing organisations as systems of knowledge have provided new insights into the functioning of organisations, such that the management of knowledge has become a central issue in understanding corporate competitiveness. In modern distributed and evolving organisations, it is crucial for survival and growth to manage knowledge flows and mobilisation of knowledge assets—whether embedded in people, tools or technology across socio-cultural and geographical boundaries—efficient. Greenfield projects of constructing new production sites in previously undeveloped land is an example of tabula rasa projects (Beaumont & Townley, 1985) where every "nut-and-bolt" of the knowledge fabric needs to be brought in. To prepare, plan, and execute such projects are challenging and require availability of a broad set of competences, but success is also dependent on the ability of the project team to cope with unforeseen surprises and other emerging issues in a smooth and proper way. Thus, to manage such efforts effectively; just as important as insight into how distributed knowledge can be elicited and transmitted is competence of how knowledge is coordinated, integrated, justified and manifested in practice. Traditionally theories of organisational knowledge have been occupied with what can be denoted as interpretative knowing, that is, how existing knowledge can be activated, adapted, and justified to situations similar to previous ones successfully dealt with. Less emphasis is put on understanding the nature of improvisational knowing where problems are unspecified or no previous experience apply, but still the outcome is satisfying or well suited to the task at hand.

The body of literature which can be placed under the umbrella of organisational knowledge is comprehensive and rises from a broad array of disciplines—but is still dominated by a tradition that views knowledge as abstract, discrete, and independent representations or distributed dispositions (Spender 1996, Tsoukas 1996, Orlikowski 2002). The perspective I will develop to provide a possible explanation of how various forms of knowledge manifest in practice deviates from the traditional discourse of organisational knowledge by building upon the gerund of *knowing* rather than the noun of knowledge. Locating the act of knowing in activity rather than abstraction is to

recognise and acknowledge that how agents cope with everyday situations are what constitute the proper units of knowledgeability. Agents always operate in some kind of immediacy with an ever-changing stream of situations or "microworlds" (Varela, 1999, p. 10). As human agents "our ability to take appropriate action is, in some important sense, how we embody a stream of recurrent microworld transitions" (Varela, 1999, p. 10). That is, knowing is produced and reproduced in people's ongoing engagement in situations that are perceived as similar over time and across contexts (Orlikowski, 2002). But how is knowing in novel situations constituted when our acting in these situations is considered adequate? What about determination, analysis, and planning when the focus is on knowing and microworlds coping with immediate everyday situations? And how is individual knowing connected to the organisation and a possible concept of organisational knowing? The shift in emphasis from an "offline" view of knowledge as an abstraction lodged somewhere tangible to "online" knowing inherent in practice leads to the recognition that conditions for action and mechanisms for cognition are essential for understanding how knowing is constituted.

The perspective of knowing which will be outlined here as a response to these challenges—"enacted individualised organisational knowing"—is inspired by and built upon enactive cognitive science (Varela, Rosch, & Thompson, 1993; Varela, 1999), autopoiesis theory (Maturana & Varela, 1980), organisational epistemology (Tsoukas, 2005; von Krogh & Roos, 1995), social becoming (Sztompka, 1991), and insights from continental philosophers such as Wittgenstein, Heidegger and Merlau-Ponty. The perspective builds upon the assumptions that 1) cognition consists not of representations but of embodied action, 2) social practice rises out of mutually-oriented patterns of behaviour enabled by active identity construction, and 3) knowledge is history dependent and self-referential. Knowing is thus constituted by humans actively engaging in jointly-created social realities undertaking effective actions towards anticipated expected outcomes. I will argue that such a perspective enables an understanding of knowing that spans a continuum from interpretative knowing to improvisational knowing.

The ideas behind the conceptual elaborations emanate from and are qualified on the basis of an empirical study of a greenfield construction project of a new production facility for light-metal production under the auspices of an international light-metal producer, here denoted Phoenix. A greenfield site has no history of established or recurrent social practices. A broad array of competences from the rest of the community of plants has to be mobilised in order to succeed with a project of this kind. I will show that the demands and requirements of such an endeavour is both of a prescriptive type, i.e. instruction-like, as well as proscriptive, i.e. open-ended.

In the following, I start with a brief overview of the perspectives of organisational knowledge that dominates the literature before developing a perspective on individualised organisational knowing. I then explore the processes of action-based knowing and organising of the greenfield project, discuss the presence of two different *modus operandi* of organisational knowing, and conclude with some implications for further research.

Organisational Knowing and Practice

Organisational knowledge and knowing

The dominant positions and trends in the literature on organisational knowledge can be subsumed under three perspectives; organisational knowledge as possession, disposition and practice, respectively (e.g. Cook & Brown, 1999, Tsoukas, 1996; Orlikowski, 2002). Knowledge as *possession* (Cook & Brown, 1999) views knowledge as something people inhabit and organisational knowledge represents in this respect an aggregate of the members' knowledge. Knowledge as possession is perceived to be of a taxonomic character (Tsoukas, 1996) and is typically classified as combinations of tacit/explicit and individual/collective. Within this perspective there is an emphasis on examining how various forms of knowledge can be created, utilised, converted, and stored and less on how "disembodied" knowledge is connected to actual organisational behaviour. Knowledge conceived in terms of *dispositions* recognises the distributed character, inherent indetermination (Tsoukas, 1996), and essentially non-decomposable nature of

knowledge. Instead of cultivating knowledge into discrete entities, the focus is on how it can be mobilised, coordinated, and integrated into communities, routines and capabilities. Knowledge as *practice*—or *knowing* which seems to be the preferred term (e.g. Orlikowski, 2002; Nicolini, Gherardi, et al., 2003)—emphasises the knowledgeability of individuals in everyday action as the basis for organisational functioning. This line of work is informed by theories of social practice (e.g. Giddens, 1984) and studies of cognitive anthropology (Lave, 1998). While the former gives us insight into the structuration of social practices, the latter provide insights into the formation and shaping of human experience and cultural embeddedness. So far, the various contributions have not taken into account knowing in labile or complex environments or situations deviating from the well-known and ordinary, and are also vague on the processes and relations between individual knowing and organisational knowing. The perspective on organisational knowing I outline in the next section highlights the non-separability and co-enactment of the individual and the social, and the co-construction of knowing *and* situations.

Enactivism and embodied action

One of the main basic assumptions behind knowledge as possession and knowledge as disposition perspectives is that of "representationism" (Tsoukas & Knudsen, 2002), which share similarities with what can be denoted cognitive epistemology. The basic idea behind this approach is that the mind can obtain representations of an outside pre-given reality (whether it is objects, events, states etc.) and by means of information processing and symbolic manipulation of already stored knowledge structures make decisions as to how to respond and act accordingly, i.e. thinking—and knowledge—is separated from and precedes acting. The increasing use of gerunds—forms that are derived from a verb but function as a noun—in organisation theory has shifted the emphasis from descriptions and conceptualisations of "offline" (objectified) structures and systems to a concern and interest in social activity and everyday practice as the foundation of social phenomena (e.g. Orlikowski, 2002; Weick & Roberts, 1993; Tsoukas & Chia, 2002). Enactivism is in this respect a promising perspective as it takes social activity, ontologically, as the fundamental building block of the social world

(Tsoukas & Knudsen, 2002) and, epistemologically, it considers knowledge and action to be—not separated—but co-enacted in practice. Even though the original proposal developed by Varela et al. (1993) had an evolutionary biological flavour and was directed at understanding first-person experience, it has developed into a more encompassing emphasis on social cognition (McGee, 2005). The theoretical foundation behind enactivism is autopoietic systems theory, which Humberto Maturana co-founded with Francisco Varela (Maturana & Varela, 1980). The theory of autopoiesis is both a theory of cognition and of organisation of living systems—two issues that merge when the issue of how a living system should be organised in order to act appropriately within its behavioural domain is raised (Baerveldt & Verheggen, 1999).

The point of departure for an enactive perspective on organisational knowing is that cognition is perceptually guided and embodied action. An essential tenet of this perspective is that the world is not (pre-)given, but brought forth through co-enactments with the environment based on individuals' history of experience as well as the affordances for effective actions the environment can provide (Varela et al., 1993). This implies that instead of *representing* an independent world, humans *enact* a world as a domain of distinctions inseparable from the structure embodied by the cognitive system: "Enactivism considers cognition to be rooted within the kind of experience that comes from having a body" (Varela et al., 1993, p. 173). That is, the body is an experiential structure in which cognition is inherent and intertwined. Every individual develops through their ontogeny—unique patterns of structural coupling with the world—and thus has unique knowledge about the world that cannot be transferred (von Krogh & Roos, 1996, p. 51). The question is whether it is possible or meaningful to introduce a concept of knowing containing a notion of *organisational* when knowing and action is *individually* constructed? If so, what are the basic mechanisms and processes for coherent and coordinated social action?

Individual and social knowing

Unlike cognitivist epistemology, a theory of knowing within the enactive approach claims that knowledge is embodied (i.e. is formed through the actions, perceptions, and

sensory and motor processes that individuals are engaged in) and should not be viewed as abstract representations and symbolic processes in the mind. Embodied knowledge thus encompasses the body as a lived, experiential structure and as the context of cognitive mechanisms—but it also implies *reflection* in which body and mind have been brought together (Varela et al., 1993, p. xvi). As a consequence, not only is the distinction between tacit and explicit knowledge, as it is commonly understood in the literature, not applicable—because all explicit knowledge in one way or another contain a 'tacit' bodily element—but it also changes our understanding of what tacit knowledge is bringing us closer to Polanyi's (1966) original understanding of implicit knowing. Much of what humans regard as tacit knowledge is because of the way we are made—and not because of the 'tacit nature' (Collins, 2001) of that which is being known. For instance, balancing a bicycle has more to do with our (in)abilities to control and coordinate the limbs and muscles in a precise way than with knowledge of a tacit nature (ibid.).

Knowledge is from an enactive point of view self-referential, meaning that human beings use what they know to determine what they see and to choose what to look for in their environment (von Krogh & Roos, 1996). I argue that the basic mechanism behind this feature is an automatic, unconscious, and pre-reflexive process of *embodied simulation* (Gallese, 2003) whose function is to model objects, events, and interactions with other agents and artefacts as well as implications of possible actions to be undertaken (Metzinger & Gallese, 2003, p. 555). Knowledge is thus the result of an ongoing interpretation—understood widely as the enactment of a domain of distinctions out of a background—emerging from our capacities of understanding (Varela et al., 1993, p. 149). The background is "a setting of and field for all of our experience, but one that cannot be found apart from our structure, behavior, and cognition...all of our activities depend on a background that can never be pinned down with any sense of ultimate solidity and finality" (Varela et al., 1993, p. 142/144). Such a view is well aligned with the Heideggerian view of the hermeneutic circle. It is the background that provides us with the framework with which we operate; hence, our understanding of it can never be complete (Winograd & Flores, 1986). Still, even if it is our background which shapes the possible space for effective action, our actual behaviour at any

moment is not predicated upon it: "We are constrained by the path we have laid down but there is no ultimate ground to prescribe the steps that we take" (Varela et al., 1993, p. 214). It is through articulation that we make ourselves known with our background, assumptions, beliefs, and concerns—helping us to negotiate our way through a world that is not fixed and pregiven, but continually shaped by the types of actions in which we engage (Varela et al., 1993, p. 144). Our structural couplings with the environment are thus "ongoing mutual co-adaptations" (Whitaker, 1997) enabling a "shared action ontology" (Metzinger & Gallese, 2003) that can be conceived as a "co-operative domain of interactions" (Whitaker, 1997) with others. The capacity for knowing thus arises "from the individual's committed participation in mutually oriented patterns of behavior that are embedded in a socially shared background of concerns, actions, and beliefs" (Winograd & Flores, 1986, p. 78).

In his theory of social becoming, Sztompka (1991) also emphasises the non-separability of individuals and society: "Societies are made of individuals and exist only through individuals...There is no way to think of human individuals outside some social context, because the very definition of what it means to be an individual must contain reference to some social whole [and vice-versa]" (Sztompka, 1991, p. 94). Meaning is thus fundamentally social: "we must take social activity as the ultimate foundation of intelligibility" (Winograd & Flores, 1986, p. 33) and "the person and his environment have to be considered as *one* constellation of interdependent factors" (Lewin, 1946, quoted in Thelen & Smith, 1996, p. 320). The social and individual are thus co-enacted; individuals as individuals arise via the social and vice-versa. The individual's embeddedness in the social implies that knowledge originates from the collective and—by turning back to an organisational context—an individual's organisational knowing emerges as a result of "...interaction with various parts of what he distinguishes as the organization at various locations and time" (von Krogh & Roos, 1996). Thus, by fusing the personal character of individual's knowing (e.g. Polanyi, 1966) with the individual's embeddedness in the social, I introduce the notion of *enacted individualised organisational knowing* (e.g. von Krogh & Roos, ibid.) to better grasp, describe, and explain knowing processes in organisations.

In the following sections, I will explore a perspective on enacted individualised organisational knowing through a greenfield study of setting up a new plant. This will also be used as a point of departure for further theorisations about modes of organisational knowing processes.

Research Design

Phoenix is a leading international supplier of light metals with production facilities worldwide. The business spans the whole value chain from upstream primary production to downstream casting alloys and extruded products. Due to the competitive situation and low margins in the downstream end, a strategic shift directed towards growth upstream has recently been made. With the increasing consumption of primary metals the potential for recycling has emerged, and during the last decade Phoenix has established five remelters in their main markets in Europe. Production of recycled metal is environmentally more friendly and less energy consuming (only 5% of that of producing primary metal). Due to the relatively small production volumes compared with primary production, the role of the remelters is to provide flexibility for serving customers' needs for fast deliveries and to help obtaining a more efficient logistics for the bigger amounts of primary metals supplied from other European plants. The capacity of a remelter is typically around 10-20% of that of a primary producer.

The study of the greenfield project presented here was conducted in Spain in real time with an intention to generate both new insights of the constituents and compositions of organisational processes of knowing, and the relationship between individual and social knowing. As part of our preparations for the study, we spent some time at the headquarters conducting open-ended interviews with managers, business developers, and project personnel. We also visited a technical support unit for the casthouses consisting of senior personnel with strong experience in improvement of production processes and operations management. We let them introduce us not only to the various products and their characteristics, but to also give an overview of the light metal industry. In order to access any of Phoenix' production sites, we also had to pass an exam on safe behaviour in the production area.

The chosen approach to obtain data was intended to be exploratory—to generate and qualify theoretical propositions. Initial-stage interview were semi-structured and open-ended to provide flexibility in gathering data. Questions revolved around interviewees' daily activities and recent events, as well as plans and thoughts about future activities. Emphasis was given on how challenges were approached in context, with whom to co-operate and ask for advice, what artefacts are being used (software, corporate policies), about communication flows across boundaries, and what were the barriers and obstacles when conducting work tasks (if any). As our understanding of the project and the context developed through several rounds of iterations of data collection and analysis, our questions gradually became more focused and directed at specific themes.

Most of the data was obtained during four stays at the greenfield site in Spain from 1999-2002. During each weeklong stay, a research colleague and I interviewed the project team (both for construction and the start-up organisation), local managers, expatriates, and newly-hired personnel. In sum, we conducted approximately 40 interviews lasting 1-2 hours each. We also participated in project meetings and had lunch with the project team, allowing us to obtain data in informal ways. In addition, we had access to documents such as the design basis for the plant, project plans, and minutes from meetings; we received emails from ongoing discussions on selected topics regarding establishing the new organisation.

The methodological approach used in this paper builds upon a theory-driven line of reasoning: "Empirical material—are simply not capable of showing the right route to theory or screening out good ideas from bad. (…) Data are inextricably fused with theory" (Alvesson & Kärreman, 2007, p. 1265). That is, it is the fusion of the empirical material and the theoretical approach that generate theoretical building blocks leading towards a consistent theory of knowing processes in organisations. Since I am concerned about explanatory power, my aim is to develop conceptualisations and constructs characterised by verisimilitude and applicability in addition to being recognised and acknowledged by informants (Stewart, 1998). This was achieved by an analysis consisting of multiple readings of transcripts, field notes, and other

documentation in combination with qualitative techniques for building theory (e.g. Strauss & Corbin, 1990; Eisenhardt, 1989) as well as member checks (i.e. presentations and discussions) for the core project group.

Individualised Organisational Knowing in Practice: A Greenfield Study

Designing a greenfield project

A greenfield project is essentially about commercial development of a previously undeveloped site, which implies that everything that constitutes the new production facilities, i.e. buildings, technology and organisation, has to be developed from scratch. A greenfield site is often regarded as a *tabula rasa* as it offers opportunities for innovation and experimenting with new ways of designing and organising work places (Beaumont & Townley, 1985), and they are often located in less-developed industrial regions with high levels of unemployment (Patriotta, 2003). This was, however, not the case for the greenfield remelter studied here. It was the fifth in a series of start-ups and it was designed—in terms of layout, production technology, and organisation—to be similar to the previously-established remelters. It was also located in a rapidly developing industrial region with an unemployment rate well below the average in Spain.

Phoenix has an excellent track record for completing projects on time and within budget because, as they themselves suggest, they have their own project development unit that has cultivated the project management discipline for decades. As a consequence, all project managers are thought to be well aligned with the procedures and practices described by the internal project management handbook. Our studies support this view at least for the construction part of projects, which in most instances are "done by the book". A thorough and detailed design basis covering all issues from development of the land, infrastructure, construction, production technology, layout, capacity, budget, time schedule, etc. is developed and decided upon before the project is initiated. Possible deviations—which require a well-documented and reasonable basis—have to

be approved by the business unit management. What is not covered by the project management handbook and therefore not part of the established planning regime are the more "soft" issues of recruiting, training and development of those in the new organisation who would operate the new facility.

The preplanning of the start-up project started late Autumn 1999 and ended in February 2002 when the project was kicked off. During this time, the investment proposal was made but beyond that not so much work was going on. A couple of meetings were held and a first project file of activities to be taken created. It was not before people responsible for the different areas (commercial, production, financial, etc.) were appointed that the project work really left the ground. The outcome in terms of organisation structure, roles, and responsibilities is similar across all remelt units and known; how to actually get there was not described by any formal procedures or corporate "best-practices". Instead of stocking the design basis with documentation of how the previous greenfield projects were accomplished, much emphasis and effort were placed into selecting the initial project core team, with experts on operations joining just before the equipment was installed:

> "The most important thing is to have the right people available in the first phase. To make sure that we have people who know how to handle the equipment, and who is used to handle liquid metal. That is also the reason why we have chosen to work with this "dream team"; to have experienced people who can go in and help the locals in the start-up phase." (Business unit manager)

From the beginning, the business unit management realised by that "letting go" of detailed control and direction of the project was not only necessary, but also the most viable strategy for the project team to cope effectively with emergent issues. It was a strategy that the project team also used later in developing and maturing the new local organisation.

Atmosphere of enabling

From the beginning, the greenfield project was organised as two separate, though closely connected, projects with a common steering committee responsible for following up with development and progress. These two projects were the building project that included construction, technology, and infrastructure, and a start-up project responsible for establishing the new local organisation. For the start-up, a core project team of five Phoenix people were appointed. In addition to two locals—the managing director and the newly-hired production manager—the other three, with strong experience in finance, production management, and production technology, came from three other European units. None of them had worked together before; in the beginning, most of the time was used to figure out how they should structure the work (i.e. how to break down and make tasks manageable and more-or-less independent) and enable a shared understanding and common ground for the project:

> "The main challenge has been to find the right way of how we should work together. First to get the group together, and then make it work together. But also to define the scope of the project and see how we should structure it, what kind of issues we had to take care of in the steering committee meetings and in our workshops. I think that in the beginning we were mixing those two together, and now we have learned that we have to have a clear idea of what we do, and how to get things in progress. So you are maybe doing more work than needed, but I guess that all contributes for the result in the end." (Project manager start-up project)

For the project team it was important to early get control over the situation by defining the scope, their domain:

> "You know we started at the end of February and it was a lot of work, really a lot. But the point is that after a few days you loose the overview. And that is something so important in this position; to have control over something. If you loose this overview you have no control. You are like when you jump from a

> plane in the air: You are somewhere but you cannot control." (Plant Manager of sister site)

The feeling of being in control is in many ways similar to *knowing*; knowing how, why and what actions to come, and *meaning construction*, that is, framing and constructing of a collective shared understanding and common point of departure for actions.

The building project team are obliged to take the design basis as a given and it represents in many ways a package of embedded knowledge which needs to be unfolded. The design basis provides among other things a description of what equipment that will be installed and based on capacity measures the size of the local organisation can be calculated. It is, however, up to the project team to figure out how this unfolding should occur, how to plan the work and communicate the progress to corporate business unit. In the initial phase it is important to get an overview of all the work to be done and ensure that they have the necessary resources and are capable of accomplishing the task within the given time and budget frame. With a total investment of 25 million Euros, this project was regarded as a rather small project for Phoenix. The challenge with small projects is that there are few buffers available on the resource side to handle unexpected events and also that the persons involved—because they are so few—need to engage and take responsibility for areas they have limited knowledge of. The feeling of uncertainty this bring along is not something that can be easily compensated or wiped out by introducing more procedures and management systems:

> "Phoenix has over time developed systems for systematisation, documentation and steering of work efforts. Parts of it has come from the offshore industry, maybe also from the power industry and the nuclear-power industry, but one can not uncritically use these methods both in large and small projects. You have to be careful and not do things too complicated or build up systems you perfectly well can live without: Either you have control, or you don't. You have to stop when you have the necessary control and not take into use more systems, because it is resource demanding to build up and maintain. One should think of what is necessary to do and not to do in the administrative planning and start-up

> of a project. That is always the key. Search for simple solutions if they are good enough. And it is for sure a matter of training to do something simple." (Project Manager Building Project)

The most important issue that overrides all others, and is never compromised, is the weight put on safety. In Phoenix, the focus on safety is deeply embedded in all their affairs and is always taken into account. Especially for a plant "in-the-making" which is not circumscribed by established routines, the attention toward safety is a top priority, and the overarching success criteria is to have a safe start-up without any accidents. Even though the project team is given an open mandate and allowed to deal with issues quite freely, the safety imperative is non-negotiable. It defines an absolute boundary that cannot be crossed in order for the project team to continue on the assignment.

Co-evolvement of practices

An important and integrated part of the project was to make sure that the local organisation would make it "on their own" after the project was terminated and all support people were gone. Thus it was important to generate an endogenous knowledge creation process by mobilising and enabling the local people to do most of the job:

> "Our priority is to delegate. We have to get the Spanish organisation to work well, and that is not by doing the things ourselves. It is rather by bringing knowledge from Phoenix into the Spanish organisation, and do it from the operational and start-up side. They should do the work, they should not believe that we are here to actually do the job, we are just facilitators (...) Involvement is important because when you are in a process then you are committed." (Project Manager, Construction Project).

Building up and making the new organisation competent and routine is not a straightforward effort. The design basis specifies the production technology and organisation models in terms of the expected outcome but the path of actual getting there is underdetermined and open-ended and needs to be locally generated. This

implies a process of knowing—not as activation of transferred knowledge from the broader network, but as a construction of a collective effort that would make the locals participants co-constructors, and not recipients. The site thus becomes an arena for an ongoing process of sensemaking and identity construction as a result of local enacted knowing.

As the project progresses and the new local organisation grows and matures, roles and responsibilities of the project team change accordingly; the more experience the newcomers acquire, the more challenging tasks and responsibilities they receive. Hence the project team can take a more peripheral role of following up and ensuring that progress is in accordance with the overall schedule:

> "I don't know whether I am spending less time on the start-up project. Maybe I spend it with different kinds of issues, but I am not very often in Spain...We have a lot of contacts per email and I am checking by phone, it is maybe less now but it is maybe at a different level than it was earlier. I think that I was earlier more into the details, and now I may be looking more at the different areas where things are going on. But I think that Juan [newly recruited plant manager] shows a very good development, and he is taking a lot of responsibilities and takes care of a lot of issues." (Project manager, midway in the project period)

The context for the onsite work is constantly changing as more people are recruited and tasks increase both in number and complexity. But also the work itself is continuously changing with plans that have to be revised and issues both large and small that emerge and have to be dealt with on the spot. Examples of such issues range from preparing and organising alternative training when training sessions at other plants have to be postponed or even cancelled to dealing with suppliers who did not deliver critical equipment on time. The project team constantly has to discuss and resolve issues, confer with other experts, and make decisions based on available knowledge believing that they are on the right track:

> "We were six persons, now we are thirty persons so the number of persons taking actions and responsibilities are expanding. Now I know a lot more of the complexities of a start-up! I do not feel more nervous now, that we are loosing control or things like that, but it is just that I realise more and more that there is a lot of details that have to be taken care of (...) All the people that are engaged or hired to the organisation have to have tasks. We have to prepare the training. We can't have 30 people hanging around here without anything to do. So there are a lot of tasks that we have to solve daily...We just have to believe that we are doing an honest job, that we are on the right track and still try to contact the right people and do quality checks." (Technical advisor)

The work of the project team came to an end early Spring 2002 with the commissioning and formal takeover by the Spanish organisation. The plant then gradually went through a period of production ramp up until design capacity level was reached and other processes of organisational knowing became relevant.

My proposal is that organisational knowing practices emanate out of patterns of activities conducted by individuals who have established a common background, which they then use as a point of departure for negotiating and navigating their actions. They can appear as recurrent, stable and recognisable over cultural, technical, and social barriers; they can also appear as temporal, emergent, and situated constituted achievements that resolve complexities and unsettled problems. In the next section, I will give a conceptual elaboration differentiating between these two modes of organisational knowing. They should not be viewed as binary modes operating independently of each other, and describing them as a dichotomy is solely for analytical purposes.

Discussion: Organisational Modes of Knowing

The main objective of this article is to bring forth some theoretical building blocks toward a consistent theory of knowing processes in organisations. I am especially concerned with the constitution and dynamic of knowing in various situations spanning the well-known, regular, and recurrent to the novel, unspecified, and emergent. My focus on embodied knowledge highlights the relation between individual knowing and organisational action. In order to establish a link between the individual and the organisation, I introduced the term *enacted individualised organisational knowing*. This implies that on the one hand all knowing is personal (Polanyi, 1966) and "everything known is known by somebody" (von Krogh & Roos, 1995); on the other hand, it implies that all knowing is embedded in the social. It therefore rejects the idea that organisational capacities are a mere aggregate of individual's capacities, instead adhering to a view where: "...only individuals can contribute to a collective mind, but a collective mind is distinct from an individual mind because it inheres in the pattern of interrelated activities among many people" (Weick et al., 1993, p. 360)—a pattern that is shaped by the fitting together of individual lines of action (Blumer, 1969).

Enabling of a collective mind and agency is a continuous process of "tuning" and complex problem-solving where actions and structures are mutually constituted and aligned, and does not always follow a solely explicit "clockwork"-process. In the early phase of the project an internal audit was performed by staff from the headquarter. The purpose of such an audit is to minimise risk by evaluating the project's organisation and structures in terms of corporate procedures for project management:

> I would have been fighting not to have the internal audit so early in the process, if I knew that it would cause so much confusion and discussion, which I felt didn't contribute very much. They commented quite a lot the organisation of the steering committee, because most of the steering committee members are also very active in the project itself. But this is something we have discussed with the management. The steering committee maybe has been earlier more like a project group, or project management. But we said that "OK this is the way, how we

> feel, that matters or issues are taken well care of". And of course you could rename it and say it is a project group, and then put the steering committee on top of it, and put a lot of important people into it. But we don't believe that it would improve the situation, because this has been done in other projects but did not help to avoid mistakes. So we feel that actually in the way we are organised now, we can take care of the issues better. [When the report came] we had to explain a lot to the management, because reading through the reports gives the impression that: "Oh, this is going to be a disaster, and nothing works" but everybody of us and also the management felt very confident and comfortable with our work. And we believed so firmly that we were going in the right direction. But I still have to say that I am sure that they also brought a lot of good issues up as well" (Project Manager)

The conventional view, here brought forth by the auditing corporate staffs' standards for revising projects, implies an understanding of managing the process of accomplishing projects by imposing structures for planning and organising to obtain control and coordination of fragmented knowledge elements and traits possessed by the organisation. Such pre-determined structures build upon an atomistic view of "connecting the dots" and prescribe a path for the process to follow. As the participants also indicate the actual efforts are more of a fluid nature of bringing forth an understanding through a collective generation of trust, coherence and energy towards projected ends and what means that are required for its fulfilment. Thus, what can be observed is that there is a tension between whether a proper management approach should adhere to a prescriptive *rationality* of command and control or a proscriptive *reality* of coherence and confidence as guiding principle for the execution. While the former favours mechanisms for configurations and dispositions of resources the latter is directed at facilitating local enactments out of a background of entangled flows and movements.

In contrast to knowledge conceived as possession or as disposition, a practice-based approach shifts the emphasis from viewing knowledge as stable and stored to knowledge and knowing as something volatile and fluctuating. For instance, Orlikowski (2002, p. 252-3) describes knowing as an "...ongoing social accomplishment, constituted and reconstituted in everyday practice. As such, knowing cannot be understood as stable or enduring. Because it is enacted in the moment, its existence is virtual, its status provisional". Similarly, Feldman (2000) observes "work practices such as organizational routines are not only effortful but also emergent accomplishments...as flows of connected ideas, actions, and outcomes" (ibid., p. 613). However, the reproduction of knowing and practices requires individuals to recognise the situations and their actions to be similar over time and across contexts, which can, according to Tsoukas (2005), be accomplished by generalisations generated and provided by the organisation:

> "(...) knowledge becomes organizational when, as well as drawing distinctions in the course of their work by taking into account the contextuality of their actions, *individuals draw and act upon a corpus of generalizations in the form of generic rules, produced by the organization*." (2005, p. 123-4, italics in original)

Rules can here be understood as exogenously imposed propositional statements, such as, procedures (e.g. project management handbook), or as collectively experienced based understandings as capabilities and practices. The use of "generic rules" necessarily requires the organisational environment both to display some kind of stability and consistency over time, and to ensure that possible changes in both rules and environment takes place at a slow pace. Organisational knowledge represents factors aiming at stabilising and sustaining individualised knowing by extrapolating the past into the future alongside a continuous (collective and individual) adaptation to new or refined distinctions. Thus, rule governed organisational knowing represents a mode of knowing suited for environmental stability and recurrence in order to stabilise and make organisational knowing more predictable in terms of outcome and performance; that is, to align organisational actions as coherent and effective problem solving practices. It encourages adaptability as a means to obtain the most effective actions, and

represents a mode of knowing I denote as prescriptive organisational knowing. The following is an example of an open-ended propositional "rule" or heuristic which was suggested by an expert on maintenance with broad experience from other start-ups:

> To organise the store of spare parts in a proper and well functioning way is a topic in itself. For us on maintenance it is important to have this in place from day one. Because when we need spare parts, they are wanted right away. We want to know where they are, and if they are not there. And if we don't have them internally we need to know where to go externally to get them. That is quite a demanding job. To find local suppliers is an extremely important job. Just as important as the spare parts we have in our store is the spare parts not readily available, but which the machinery also consists of. It is those that will give you problems, and I am a bit concerned about that. I have always said that the spare parts should be organised with responsibilities and systems already before the spare parts arrives the plant. Then you can label the spare parts and put them in the right place at once, keeping your data system updated etc. , and then you have a routine from day one. Unfortunately we are a little bit late sometimes in this respect. (Expat maintenance expert)

What the expat suggests and warrants is the *idea* of having a working routine in place before any spare parts are delivered to the plant, he is not introducing the content of the routine or presenting a solution to how one should proceed in concrete terms. As an expert with previous experience establishing maintenance systems in other start-ups he is an authority on the subject and can provide a "flash" or slice of experience appropriately timed in order to focus efforts to resolve a "problem" not yet actualised. The proposed idea is generic in the sense that it is apt for the construction of almost all new plants and it is open-ended because it needs to be locally situated and resolved by involving the newly recruited maintenance people. When we payed another visit to the plant some months later the routine was then in place organised and structured according to the expat's previous suggestions.

A prescriptive mode of knowing is dominant for recurrent situations resolved on the basis of contextual adaptations of history-dependent propositions. In the greenfield project, it is the building project which most clearly displays a prescriptive way of knowing. The design basis represents a stock of propositional knowledge waiting to be unfolded by a project management team (appointed from Phoenix's internal project management unit consisting of engineers) with strong experiences worldwide in building production facilities. Even though all projects are unique in terms of local culture, infrastructure, regulations, experience of subcontractors, design basis for the facility etc. the overall approach of pre-planning, planning, execution, commission and evaluation is similar for all kinds of projects and described by formally approved systems and procedures. The significance of the available prescriptions are dependent upon to the extent to which they fit the situations in which people act, and the extent to which they provide fixed sets of propositions for people to interpret their situations (Blumer, 1969). Even if there are differences between projects concerning the extent to which the prescribed systems and procedures for project management are used—among other things decided upon by the size of the project—the actual structure and sequence of project tasks, beyond some local idiosyncrasies, are strikingly similar across projects[6]. An important advantage of formalisation of knowledge is that propositions can be made accessible for people across time and place to make sure that processes and outcomes are configured according to valid specifications and quality requirements. A generalised template, which can be understood with limited experience of the relevant domain, also makes it easier to establish cooperation (including contracts) with third parties (e.g. sub-contractors). It is, of course, a caricature to describe the Phoenix engineers' work solely as rule-followers. According to Lévi-Strauss (1966), an engineer takes what is at his disposal and "questions the universe" by going beyond imposed constraints by using or creating the necessary means to fulfil the purpose of the project. As indicated in the empirical description people, in the construction project emphasise simplicity—"don't do things more complicated than necessary"—and express a critical attitude towards established "best-practice" project management methods generating

[6] See "Patterns of Connectivity: The Enactment of Organisational Routines in Greenfield projects" elsewhere in this volume.

more pain than gain. The bricoleur on the other hand operates within a "closed universe" with a rich set of previously developed means adjustable for a range of situations (Lévi-Strauss, 1966). But as Tsoukas (2005) also points out:

> "While propositional knowledge *retro*spectively explains (or at least describes) the functioning of a social system in terms of rules, it cannot *pro*spectively provide actors with the knowledge of how to apply definitively a set of rules in the future, or how to create new rules" (2005, p. 76, italics in original).

Humans, from an enactive point of view, are autonomous in the sense that there are no linear causality between intentions imposed and actual outcome implying that all actions include a residual space for improvisation. The contextuality and instability of knowing in action suggest that change and novelty are more fundamental and ontologically prior to stability and recurrence of organisational knowing (Tsoukas & Chia, 2002). For social systems the future is therefore not a linear continuation of the past (ibid.); situations might just as well be perceived as 'novel' and ambiguous rather than variations of the past. The inherent open-endedness of actions is especially prevalent in "break-down" situations (Winograd & Flores, 1986) where previous consensual domains are no longer applicable and valid organisational generalisations cannot be provided. Situations of complex or labile organisational environments, or situations where the correspondence with the organisational generalisations and the actual situations are underdetermined, are particularly apposite contexts for such processes. Thus, knowing in these situations can be said to be of a proscriptive type following a logic of "what is not forbidden is allowed", in contrast to a "what is not allowed is forbidden" logic dominating prescriptive knowing (Varela et al., 1993). The aim of the proscriptive mode of knowing is not to achieve stability and sustained practices. Rather, it is to provide functional and effective solutions to emerging "problem domains" that are waiting to be unfolded and brought forth by collective co-determination. In that respect, the self-referentiality of knowledge and articulation of experiences from the past and anticipations of expected outcomes in the future enable the constitution of an action domain composed as a bricolage (Lévi-Strauss, 1966) of available artefacts, resources, and capacities. A proscriptive practice is neither random

nor optimal, but it is possible and satisficing such as, for example, bicycle-riding in crowded streets. These kinds of actions require behaviour to be varied—not randomly, but according to social circumstances (Collins, 2001).

The other main part of the greenfield project, the organisational start-up project, is associated with the kind of knowing I denote as a proscriptive mode of organisational knowing. This mode of knowing typically operates in situations where few, if any, relevant propositions can be provided to shape or interpret the situations. Browning (1992) contends that organisational narratives provide members with a way of acting in recurrent as well as novel situations. When organisational members confront a new situation for which no rules or procedures exist they can rely on stories to help "fill in the residuals" for what they can do (Barge & Little, 2002). In the beginning of the organisational start-up project much emphasis is put on structuring the work of recruiting, training, and building the new organisation, i.e. to create a consensual domain of what they are going to achieve. This implies bringing the future into the present; however, a meaningful relationship between the present and the future is not given, but always recreated by means of embodied simulation enabling models of real (present) and imaginary (future) worlds to be created (Gallese, 2003). Proscriptive actions are shaped and constituted—not randomly—but as a bricolage of continuous simulations and even though they are not necessarily optimal, they are feasible and viable, and can sometimes "reach brilliant unforeseen results" (Lévi-Strauss, 1966, p. 17). The bricolage analogy is also apt because the start-up project is circumscribed and destined to adapt to the progress of the construction project and the potential to the available means are thus "pre-constrained". Knowing represents in such circumstances an enactment of a bricolage of available resources directed at achieving satisfying and viable solutions to emergent and unfolding problem domains. The solutions are composed of "...forward-looking projection of ends with a visualization of the means by which that projected future may be accomplished, as an emergent rather than explicitly scripted strategy" (Pitsis, Clegg, et al., 2003, p. 575): In the project the new plant manager with no prior experience from light metal production and the expert of operation hired from a sister site teamed up and developed a very good relationship. This constellation helped the plant manager to become more confident in his job

through continuous dialogue and feedback on what to prioritise and how they should preceed. The expert also introduced him to her network by advising him to what persons in Phoenix who could provide him with assistance when needed. During the construction phase of the plant they had a walk every day on site observing what happened and if they had any doubts or questions, independent of whether it was their responsibility or not, they brought the issue in to weekly steering committee meetings. This way of caring and showing interest in others' work and problems, establish good relationships across interfaces fosters a "culture of cooperation" and help tackling the main challenges in a complex project "on the go".

Conclusion and Implications

Recent approaches to organisational knowing emphasise the situated, provisional, and emergent aspects of knowing as something constantly changing. Enactive knowing is closely associated with embodied cognition and action, whereby being embodied means reflection in which body (as a lived, experiential structure and context of cognitive mechanisms) and mind are brought together. Enactive individualised organisational knowing is in this respect self-referential and brought forth through mutual specifications and communicative actions of releasing intersubjective intentionality as ongoing co-enactments with an ever changing organisational environment.

In this paper, I have explored the relation between the social and the individual in terms of practices of knowing, identifying two organisational modes of knowing. A prescriptive mode of knowing is dominant when organisations offer generalised rules for the individuals to draw upon, with the aim of obtaining coherent and coordinated actions and effective problem solving practices. However, when the organisational setting or environment cannot provide stable conditions or appropriate precepts for a recurrent practice to be effectuated—or the actual situation is underdetermined by the organisational rules—a proscriptive mode of knowing becomes dominant as a mode of knowing that involves an enabling and unfolding of a co-constructed emergent problem domain. A bricolage of the necessary capacities are then brought forth to obtain viable and satisfying solutions to the perceived problems. Even though enabling of the

problem domain and construction of the bricolage are history dependent and draws upon actors' (individual and collective) experiential structures no linearity between past, present, and future is assumed.

Both modes of knowing put forth a view of social actions as consisting of a knowledgeably agency composed of unfolded structures and mobilised agents. An intrinsic characteristic of social systems is that they aim for consensual coordination by enabling both mechanisms for establishing common ground and collective coherence for actions to occur. This collective co-orientation is of a patterning nature in which individuals adjust their behaviour in relation to each other while embellishing culturally-mediated rules and norms from the environment. Processes of mutual tuning takes place in the mundane through actions, negotiations, narrative exchange, observations, and learning, and *embodied simulation* is suggested to be the fundamental mechanism for enabling these processes. By following the lead from embodiment theories of knowledge greater recognition of the bodily foundation of culture and cognition might be a promising approach for better understanding and theorising of the constitution of organisational knowing. Another implication of embodiment theories is that organisations as cognising capacities should be understood not literally (ontology) or as a metaphor (analogy), but rather as praxeology, that is, study of human action.

As I have indicated, there is a tendency in the literature on organisational knowing to see knowledge practices as ongoing, situated, recurrent, and directed towards problem solving. Organisations are in this respect viewed as problem solvers which have available a repository of knowledge structures and rules which change according to external evolutions in a steady-state environment. For recurrent and similar situations, the rules' potential for framing agential conduct is determined by the extent they are enforced or how well they specify the paths laid down to solve posed problems. But as studies also show, coordinated, concerted and effective action may occur when the organising context is turbulent or open-ended. This implies that an organisation's actions may be more creative and flexible than prescribed by established knowledge structures. Birnholtz et al. (2007) suggest it is the coherence of dispositions for action which is the essential property that allows novices to figure out and perform relevant

and well-suited actions in equivocal situations. Dispositions are latent traits or skills that can be socially attuned and shared; ambiguity is reduced by sharing opinions and interpretations of situations (Volkema et al., 1996); and knowledge can be made relevant by capturing the affordances of the situations (Tsoukas, 2009). Central to proscriptive knowing is that it applies in situations of complex or labile organisational environments where no knowledge structures apply. Proscriptive actions are shaped and constituted, not arbitrarily, but as a result of ongoing creative acts that bring both past history and future anticipations into the present. A proscriptive mode of knowing opens up the possibility for a more radical dynamic of how organisational knowing is constituted and changes as well as bringing us towards a deeper understanding of the processes of origin.

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2.

The Sociogenesis of Organisational Knowing – a Study of the Translocation of Organisational Practices to a Greenfield Plant[7]

Abstract

For distributed enterprises it is crucial for survival and growth to develop a capacity for spreading well-functioning and competitive organisational practices between the nodes in their organisational network. This is a challenging and demanding effort, requiring a deeper understanding and more comprehensive perspectives than the influential one-way "transmit and receive" transfer models underlying many of the present conceptualisations which largely ignore the actual *process* of spreading. Knowledge transfer literature lacks both a systematic understanding of what is learned and how, and what constituents and mechanisms is deemed necessary for configuring and creating such "translocation" processes. A translocation can be described as embodied translations of encoded experiences (for instance in technology, procedures, routines), recreation of the parts and integrative enactment of social co-constructed knowing "in-the-making".

Based on two greenfield-studies, I develop a descriptive process model of the translocation of organisational practices to two new plants producing light metal alloys. The model consists of three stages I have denoted 1) Captivation: Recruitment and selection, 2) Emulation: Developing a background, and 3) Animation: Co-enactment and justification. A greenfield site can be characterised as a tabula rasa since it has no previous history of production and as such the translocation can be studied without any bias from what are already present. I view the process of developing an organisational practice from scratch as a sociogenesis building upon various modes of cultural learning (Tomasello et al., 1993). This approach highlights cultural and cognitive aspects of

[7] This paper is submitted for review in an international journal.

learning, and I show in this paper that bringing the largely ignored socio-cognitive dimensions of human action into the picture reflects more of the underlying social dynamics of the conjoint making of a organisational practice and community of knowing.

Introduction

The increasing globalization in recent years has given impetus to a movement of industrial production from developed to emerging economies and the issue of how to share and mediate knowledge, capabilities, and practices within and across organisations has attracted increased attention. For a manufacturer the ability to construct and build cost efficient and flexible production facilities, achieve a rapid development of well functioning organisational practices, and keep a sustained and effective production rate is essential in order to compete on a global scale. Managing a variety of knowledge flows across boundaries are thus critical for maintaining competitiveness and the concepts of organisational knowledge, learning and transfer are in this respect of significant practical and theoretical importance. Knowledge and learning are commonly perceived to disseminate through a variety of tools and methods including personnel movement, technology transfer, replication of routines, patents, interactions, training, alliances, inter-organisational relationships (e.g. Argote et al., 2000) and knowing how to use what tools in which situations requires deep insight into the processes of how to enable effective organisational functioning. However, at present there is little systematic understanding about the *process* of intra-firm knowledge transfer (Szulanski, 2000; Maritan & Brush, 2003). The literature on knowledge transfer provides only a rudimentary and shallow knowledge about the social processes underlying how intraorganisational units learn from each other (Tsai, 2001) and it is also scarce on what is learned and the phases and sequences of the developmental processes by which learning takes place (Bingham, Eisenhardt & Furr, 2007). Consequently, the actual formation of organisational practices, how they originate, emerge, and develop over time are mostly black boxed in the literature. By ignoring the role of human action, the influence of cognitive and cultural conditions becomes rather opaque in current descriptions of such development processes.

In this paper, I wish to analyse what constitutes an effective movement and regeneration of an intra-organisational practice embedded in the interplay between people, tools and artefacts. I do this by exploring a process model describing the sequences in the regeneration and making of a "blueprint" organisational practice in two greenfield plants. New organisations are usually not bothered with rigidities and are often found to be open to learning from experiences of others, but the lack of pre-existing relationships might prevent or make it difficult to share or make knowledge in the network available for the unit (Argote, Beckman, & Epple, 1990; Ingram & Baum, 1997; Tsai, 2001). A greenfield can be considered a tabula rasa and provides the opportunity to study the formation and shaping of organisational practices from scratch and I will thus denote this process of becoming as "sociogenesis"[8] (Vygotsky, 1986). By using a process approach highlighting cultural and cognitive aspects of learning as dialogical actions and social interactions my aim is to develop an understanding of what are constituting—and to what extent they are adaptations or (re)creations—and configuring processes of sociogenesis.

My approach and arguments are based on empirical studies of the construction of two medium-sized greenfield plants producing various light metal products for a company I here denote Phoenix. The paper is organised as follows: I first present an overview of current perspectives on dissemination of knowledge and practice. Then I develop a socio-cultural perspective called the "translocation of organisational practices", which is explored in the empirical section. I conclude the paper by suggesting some broader implications for research into cultural learning and translocation processes.

[8] There are some discussions (see for instance Lloyd and Fernyhough 1998) about who is the originator to the term and what it circumscribes. My concern here is to use it as a term to describe a "social mode of formation" and not to engage in the fairly comprehensive literature on "sociogenesis" as such.

Translocation of Organisational Practice

The interest in knowledge transfer has emerged as important and widespread means of contributing to improved organisational performance (Argote & Ingram, 2000; Szulanski, 1996). Knowledge transfer involves sharing of knowledge and its embedded parts, capabilities (i.e. configurations of knowledge) and patterns of use. It is often assumed it is the organisation as a *whole* which possesses capabilities and practices but empirical studies show that these may not be readily available throughout the organisation (Maritan & Brush, 2003). Studies of intra-firm knowledge transfer show that dissemination of knowledge is not straightforward due to "stickiness" of knowledge and considerable variations in effectiveness among organisations (Argote, 1999; Szulanski, 1996).

The terminology used for describing how knowledge is shared gives an indication of what epistemological assumptions underlie the researcher's position. These assumptions span a continuum from the objectivist flavoured "transfer", "transmit", and "implement" to the more constructionist inspired "interpretation", "recreation", and "transformation". They are also reflected in the means and mechanisms that are correspondingly suggested to facilitate enabling of knowledge; from procedural prescriptions and formal instructor training via knowledge brokers facilitating contextual learning processes to learning-by-doing. Within this continuum it is possible to discern at least two perspectives on managing knowledge across boundaries in the literature. The first is the traditional approach of viewing transfer or dissemination as building upon a transmission model logic where knowledge—whether it is capabilities, practices or routines—in one unit is captured, transferred and implemented in another one. The transmitter and receiver are assumed to resemble each other and have some common knowledge (Carlile, 2004) for effective transfer across boundaries to take place. A low rate of novelty is assumed as situational and contextual factors are conceived as stable and not considered to be an essential part of the transfer chain. What is emphasised in this kind of "transactions" is what types of knowledge and know-how that are critical for a successful transfer, whether it is embedded in technology, people, routines, and structures as well as evaluations of what strategies and mechanisms for

disembedding that are appropriate. Explicit and codified knowledge embedded in technology, for instance, has been found to transfer more easily than most other stocks of knowledge (Zander & Kogut, 1995; Argote & Ingram, 2000; Edmondson et al., 2003). For knowledge with crucial tacit elements moving personnel—or even networks—is generally seen as an effective way for facilitating transfer of knowing (Galbraith, 1990; Argote & Ingram, 2000; Szulanski, 1996). The focus on the various knowledge types as separate, distinct, and definite entities stored in people or artefacts, and how they can be extracted, codified or converted does not recognise the processual aspects related to the "stickiness" of transferring knowledge (Von Hippel, 1994; Szulanski, 1996; Amesse & Cohendet, 2001; Maritan & Brush, 2003) or the creation and architecture of organisational capabilities (Spender & Grant, 1996).

The second and more recent approach is a process perspective, which highlights knowledge as knowing and practice as enactments—where human actions and interactions are placed centre stage. The cruciality of knowledge and capabilities are not first and foremost found in, or as configurations of, people, structures, and technology; rather, they are ongoing collective practices and know-how embedded in the social, i.e. as communities of knowing characterised by reciprocal coordination and co-constructed actions (Brown & Duguid, 1991; Orlikowski, 2002; Gherardi, Nicolino & Odello, 1998). Much of the essential and critical know-how is complex, fluctuating, temporal, and difficult to capture and categorise, and exists or is "stored" only in practice. Collective learning processes through which knowledge and capabilities are developed are inherently indeterminate, situated, and not easily replicable (Edmondson, 2003; Tsoukas, 1996; Orlikowski, 2002). A process perspective can thus be proposed to subscribe to a view of moving knowledge as a translation (Czarniawska & Joerges, 1998) of encoded experiences—i.e. interpretations, negotiations, modifications, and (re)creations within a knowing community extending in time and space—and, as such, is more learned than disseminated. Learning-by-doing is not primarily a result of knowledge transfer from a source to a recipient but actually highlights the need for discovering knowledge *de novo* and learning *in situ* (Attewell, 1992).

A practice can be defined as situated recurrent activities of human agents (Orlikowski, 2002, p. 253) that display stable and robust performance characteristics. The steady-state inertia of practices can be explained in terms of a "ratchet" effect, which proposes that everything will stay the way it is until a modification is made and spread within the community (Tomasello et al., 1993; Tomasello, 1999; Boesch & Tomasello, 1998). Thus, the initial stages of practice generation provide a window of opportunity (Tyre & Orlikowski, 1994) for constructing effective and well-functioning social practices; in later stages, much more effort is required to make significant changes in recurrent achievements. However, currently there are few attempts in the literature that explore the process of sociogenesis of a practice before steady-state is reached. Relying on a notion of "transfer" or "dissemination" becomes too narrow as a means to understand the complex social interplay and co-construction of an emergent, shared, and stable human array of activities resembling other units in the organisation. I thus introduce *translocation* as an extension of the established notions to provide a broader examination of the development dynamics in an emergent community of knowing. A translocation can be described as embodied translations of encoded experiences (i.e. in technology: procedures and routines), recreation of the parts, and integrative enactment of social co-constructed knowing "in-the-making".

Since I am concerned here about the making of viable and stable behaviour in the creation of a community of knowing, I put forth an understanding of sociogenesis as the emergence of a recurrent organisational practice that develops through social relationships and interactions. I argue that this development process within the context of a translocation can be described as following various modes of cultural learning (Tomasello, Kruger, & Ratner, 1993). Here, culture is meant to denote that—whether the parts or the whole—which needs to be known to operate reasonably effectively in a specific human environment (Bloch, 1998, p. 4). Individuals inhabit social-cognitive capacities, which are often underrated in learning theories that emphasise the role of the culture and its artefacts. The process of enculturation should be understood in terms of the cognitive apparatus of individuals: "In cultural learning, learners do not just direct their attention to the location of another individual's activity; rather, they actually attempt to see a situation the way the other sees it—from inside the other's perspective,

as it were...what is retained by the learner after the social interaction has terminated is still in essence social." (Tomasello et al., 1993, p. 496). Cultural learning consists of three stages reflecting the maturity in the development of the emergent practice. These are *imitative learning*, *instructed learning,* and *collaborative learning*, respectively (Tomasello et al., 1993). Imitative learning is characterised by reflective reproduction, where the learner internalises intentions underlying the demonstrator's behavioural strategies. Instructed learning occurs when the learner internalises the intersubjective dialogue between their own understanding and that of the instructor; it is the cognitive dispositions rendered by this dialogue, and not solely of the instructions, that is later re-enacted in similar situations. Collaborative learning represents a co-construction, rather than transmission, of knowledge among interactants. This stage can be viewed as an integrated, open-ended learning among peers where no interactant is an authority or expert over another (Tomasello et al., 1993). It is in this stage where groups develop "transactive memory" in which individuals know who knows what (Edmondson, 2003). This often leads to greater task understanding, because different peers often focus on different aspects of the problem (Kruger & Tomasello, 1986). Within the frame of translocation, sociogenesis can be understood as iterations of enactments of embodied translations, dialogical actions, and social interactions following various forms of cultural learning. In the following section, I explore the emergence of organisational practice in two greenfield plants owned by an international leading light metal supplier.

Research Design

Phoenix is a leading international light metal producer with production facilities in all main light metal markets worldwide. In order to respond to changes in markets, the portfolio of all production facilities is continuously evaluated. Low-performing units are shut down; when conditions are found to be favourable, new plants are acquired or built from scratch as greenfield projects. The study presented here describes two such greenfield projects—one in Spain and one in China—concerned with developing and constructing production facilities for remelting and upgrading of light metal alloys. The primary goal of the Chinese project was to build production facilities for upgrading primary metal to alloys designated for the automotive industry; it became the first

wholly-owned plant for Phoenix in China. This project was also conceived by top management as a strategic learning project for how to plan and execute potential future projects in China. The other greenfield project studied was the creation of a new remelt facility in Spain. Phoenix already had several similar remelt facilities in other European countries; by covering the Iberian market, this plant was designed to be a new node in the network.

Traditionally greenfield sites provide opportunities for innovation and experimentation. However, the goal for the plants in this study was to build facilities similar to existing ones to minimise risk, achieve rapid construction and production ramp-up, and generate profit within a short period of time. For a new greenfield venture to be successful, it is therefore not enough to complete the construction within time, on budget, and at a satisfying level of quality. It also has to display an appropriate ramp-up in terms of production volume, which requires a well functioning start-up organisation from the outset. The critical issues for both reaching a satisfying performance level and being competitive are to organise the production and establish well-functioning routines, procedures, and practices—which all contribute to a stable and high quality production at the lowest possible cost without accidents or other unforeseen negative consequences. Thus, for a greenfield plant it is essential to learn from other plants with strong experience and adopt and customise what is regarded as Phoenix's "best available practices" at their own site. Table 3 gives an overview of the two greenfield projects.

Project	Site characteristics	Technology and knowledge
Mancha	Loacted in a well developed industrial area with low unemployment and strong unions. Supply of experienced workers are limited. Budget NOK 200 millions.	Industry-standard technology with few competitive advantages. Other sister plants in Europe with similar technology and processes supported the Mancha-project.
Jiangsu	Located in an industrial park established by the authorities. Due to the clustering of Western companies the competition for skilled workers led to high turnover rate and pressure on salaries. Good supply of workers from state owned metal plants and young well educated operators. Budget NOK 40 millions.	Competitive technology but not state-of-the-art in the industry. In the local market - compared to competitors' technology - it is regarded as cutting-edge. Project supported by personnel from the R&D center and senior workers with strong experience with this 'proven' technology.

Table 3. Profile of greenfield projects

The objective of the study is to develop a descriptive process model to analyse the sociogenesis, or the emergence and shaping, of organisational practices as modes of cultural learning. A case study approach was chosen because I am are interested in the progress of a process more than its frequency or incidence. The data I obtained were largely of a qualitative nature and, given a focus on exploration, I had more variables of interest than data points (Yin, 1994). Most of the data were collected through more than 60 semi-structured interviews of the corporate project team, supervisors (i.e. expatriates), local management team, shift leaders, and operators as well as members of the staff who were involved in the establishing of the new organisations. All primary interviews were conducted face to face on site by my research colleague and myself. For key informants several follow-up interviews face to face or by phone and email were conducted (see Table 4 for details). During our stays observations and informal discussions with our informants were an essential source of insights and data on everything that was happening at various times. We also had access to documents like budgets, plans, minutes, and reports which were valuable for our understanding and in preparing ourselves for the interviews.

	Number of interviews at site	**Time period of main data collection**	**Timing of study**	**Length of fieldstudies**
Mancha	30	May 2001 - November 2001	Real time	Four fieldtrips of one week each. A final visit was made in June 2006
Shaanxi	34	September 2002 - May 2005	Retrospective	Three fieldtrips of 14 days each (includes trips to other offices/sites Phoenix has in China)

Table 4. Field data overview

The Spain start-up was followed in real time on site and by email and phone. During the main construction phase and ramp up, a period of time of about 1.5 years, we visited the

greenfield site four times, staying about one week each time. An effort was made to avoid too much time lag between important events and interviews in order to not miss out noticeable outcomes. For the Spain start-up most of the interviews were recorded by a video camera, and we also used the camera to document the development of the site. Afterwards we composed a multimedia hyper-story covering important events concerning recruitment and development of the new start-up organisation. This hyper-story was then presented, discussed and made available for the business unit locally as well as at the headquarters and generated invaluable feedback for our understanding and conceptualisation of what took place.

We became involved in the China start-up in the ramp-up phase of production and much of the data was therefore obtained retrospectively. Retrospective accounts may suffer from biases and inaccuracies and we were therefore especially concerned about interviewing multiple informants on the same subject when it was relevant. We accomplished following-up interviews of the most central people at a later time and performed member checks of their previous accounts. We also visited the headquarters and the R&D unit for the business unit in Europe. In total more than 30 semi-structured interviews were conducted. In order to communicate with the operators we needed to use an interpreter; for all other organisational levels the interviews and conversations were in English.

Analysis and Results

Based on data from the greenfield project in Spain a first version of a model denoted "training trail" identifying and describing the emergence and sequential cultivation of an organisational practice was made. This model was presented, discussed and refined in collaboration with experts on operation, business developers, and managers in Phoenix with experiences from other start-up projects. I will use the model as a frame for describing and discussing both the greenfield projects studied. Even though the training trail does not directly corresponds to Phoenix's own model for training they agreed that the model captured in an accurate way the main events, activities and progress in developing and maturing organisational practices on a greenfield site. The

model consists of three stages each describing a set of activities constituting the steps in our proposed training trail as is illustrated in Figure 3. The stages and steps described by the model broadly follows both Szulanski's (1996) model of practice transfer, and the more detailed and empirically grounded model of Maritan and Brush (2003). I have denoted the three phases as 1) Captivation: Recruitment and selection, 2) Emulation: Developing a background, and 3) Animation: Co-enactment and justification.

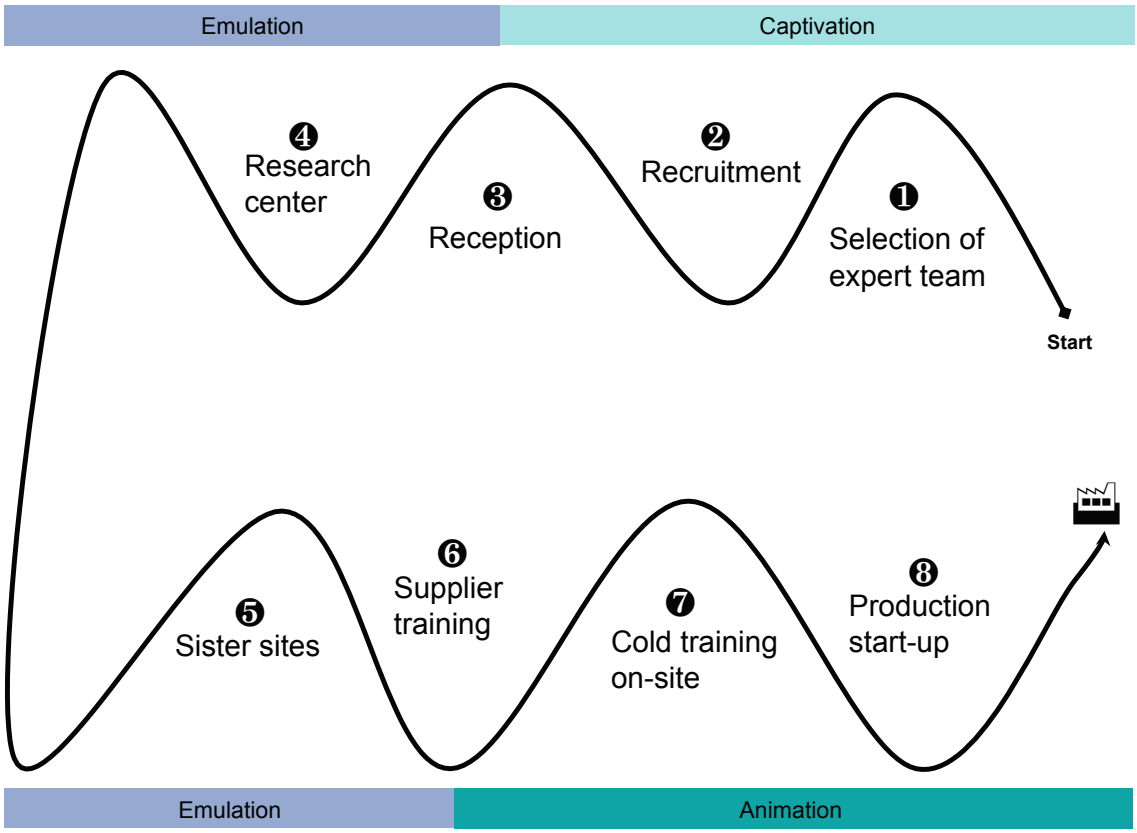

Figure 3. Training Trail

By captivation, I mean seizing and enabling of the project domain including recruiting and aligning training supervisors, preparing for upcoming training activities, recruiting managers and operators, and providing an introduction to the company and safety issues when working with liquid metal. This stage is followed by an emulation phase, which involves travelling to an ongoing real-life production site for training—by developing a common frame of reference, thus becoming part of the company network. The final stage, animation, represents the co-construction and fine-tuning of the new practice. Even though the model is linear, iterations between steps could happen; it should also

be noted that there is not one, but several interdependent, training trails at the various organisational levels that are initiated. For analytical purposes, the description that follows focuses on one training trail with an emphasis on training in operation and production.

In the following section, I examine the sequence of the various training activities using the training trail as a point of departure for exploring and analysing the process of developing the organisational practice in the two greenfield projects described above.

Captivation: Initiation, recruitment and reception

Selection and alignment of instructors

The first step in the training trail is the preparation, enabling, and alignment of the required training resources. Since Phoenix has no pool of instructors readily available, they need to take experienced people out of their daily work from several plants to organise the training program. There are differences between plants regarding what equipment, processes, and routines they have; to avoid confusion and secure a rapid and effective training of the newcomers, a coherent and structured approach covering all the necessary topics has to be planned and training packages prepared. When working with hot liquid metal, safety is a high priority. Most of the training is therefore organised as working hands-on in ongoing production in a safe manner under supervision of instructors and co-workers. The newly-hired managers are also engaged in training operators. The managers are sent around to several plants to learn hands-on about the light metal industry in general and their own job in particular some months before the operators arrive at the greenfield site.

For the Spain start-up, the support organisation for the casthouses located in Norway spent time together with the project team responsible for the planning of the main training activities. This unit consists mostly of senior personnel with strong experience in improving production processes in casthouses all over the world. The China start-up organisation used a slightly different approach using experienced operators and managers from one specific European plant as the main resources for the planning and

preparation of the training packages. This was possible because this "sister" plant was going to be shut down just short time after the start-up in China.

Recruitment

Once the training approach is agreed upon and the need for new workers is determined, one then calculates when the different layers of employees should be recruited. Timing is a balance between cost efficiency and providing the right amount of training and needs to be done in accordance with the progress of the construction project. The recruitment of personnel is usually done in a sequential top-down manner, starting at a higher management level, continuing with middle managers in production and maintenance, and ending with the hiring of operators. Higher-level management (and some staff functions) are enrolled in the project team from day one and are given responsibility for parts of the new organisation's planning and development. The managers and staff are assisted by others in the project team as well as a support team consisting of experts in technology, production, and maintenance from other parts of Phoenix's network. This approach is consistent with adult learning theories (e.g. Knowles, 1980, 1984), which argues that adults prefer self-directed learning and learn most effectively from experience and day-to-day coping with real-world tasks that provide interconnection and meaning through problem solving (Brookfield, 1986).

Involving managers in training the lower levels of the organisation allows them to develop their own understanding, as teaching implies a reenactment of the instructions they themselves were given recently. This also contributes to an identity shift from "me" to "us", giving impetus to an emergence of a collective identity. Middle managers, including some maintenance personnel, are recruited at a later stage during plant construction, but before production equipment installation. Finally, operators are hired during the equipment assembly phase.

Although there was good availability of an educated workforce—and many Chinese prefer to work for Western companies (and especially Fortune 500 companies)—the main challenge was to keep them in the company. This is because other Western-based companies in this industrial park prefer recruiting people with experience from other

Western companies more than those solely with experience from Chinese companies. The localisation of the Spanish start-up was in an industrial area in central Spain with low unemployment. Here also the main challenge was to retain the best employees, and doing that is not just a question about the size of the wages as commonly assumed. In addition to being competitive with salary, they needed to find ways to motivate and create expectations about a future of meaningful jobs, satisfying job conditions, and training and career opportunities that resonate with the individual's expectations and needs.

Reception

This step covers the time period from when new employees arrive at the site for the first time and till they start training at sister sites where they are introduced to the plant, its products and their applications, and the plans and visions for how the new plant is going to be when in operation. On the one hand, they are shown that they are about to join a leading international network of light metal producers with state-of-the-art competence and technology. On the other hand, they are presented for the manifold of industries and end products in which their semi-manufactured products play an essential role, showing that their jobs are important and meaningful giving them opportunity to be inspired, committed, and motivated for what is to come. Another important aspect introduced and highlighted in this step is safety. For Phoenix, it is an overarching goal to impose the importance of working in a safe manner when working with liquid metal and this give them a sense of being taken care of and welcomed:

> "It is very good for me because I didn't know anything about the light metal world. I think there are many things to understand, many things about the company, the light metal world, about all the processes in the factory. I noticed that the company is very interested in safety...I think this is very important for the people who are going to work here. I am grateful about it, because the other companies I have worked for... I have never seen a company like this." (Spanish operator)

The overall aim of the captivation phase is to shift the perspective of the newcomers from being outsiders to become insiders, i.e. taking the perspective of internals. This implies learning the company language and construction of a "we" identity through social interactions and social bonding with colleagues and outside experts.

Emulation: Developing a common frame of reference

Involvement of R&D personnel

Phoenix has several research centres responsible for developing technologies, production processes, and products, as well as conducting more basic research projects. Personnel at the research centres are highly skilled experts who are used to making modifications and improving and optimising critical production parameters in new and established plants. Their competence is therefore essential for the training of newcomers on all levels. In the Spanish start-up, operators and shift foremen were sent to a reference centre (part of an R&D unit) for hands-on learning for how to solve potential incidents in a proper manner. This centre is like a laboratory, providing equipment and setups for simulating situations—such as what to do if a sudden loss of power leads to a flow of metal into the system, or a loss of cooling water that might lead to a major bleed-out. According to the trainers, the most effective way of making people cautious about their work and following safety instructions is to actually observe a minor explosion of metal due to small amounts of moisture. This gives rise to a 3-4 meter fountain, which spreads liquid metal over the working area.

For the Chinese plant, dedicated experts from the research centre were sent to optimise the production line and to help prepare and execute the most advanced training sessions. Although installed technology should be "proven" and not necessarily state-of-the-art, some novel solutions not tested anywhere else regarding how the hot metal was transferred to the casting belt were implemented. Another important contribution from the research centre was the help and training provided in connection with the production of a profitable but especially demanding alloy for the automotive industry. Producing the right amount of this alloy that meets prescribed quality standards was a really

challenging task, which they solved successfully. These efforts also contributed to raise the overall efficiency of the production to such an extent that the plant later received an internal Phoenix award for superior quality.

Sister sites

The next training phase involves visits to sister plants producing similar products, technologies, and processes. During the captivation phase, the management level staff has been to several other plants to learn how they organise, operate, and manage their production line. At the sister sites, they meet others in similar positions and establish relationships, which later make it easier to ask for support and help when back at their own site. Some of the more experienced managers from sister sites will also join the start-up team at the greenfield site and assist during the commissioning phase of the new plant. An important input from sister sites is the description of systems and procedures which represent valuable stocks of knowledge. This provides a good basis both for developing their own procedures, and for achieving the various certifications needed for customers to accept their products.

Shift foremen and operators are sent in groups to sister plants to work side-by-side with experienced shift-workers for some weeks. This practice training is organised as a kind of scaffolding learning (Vygotsky, 1978), consisting of a combination of ad-hoc verbal and non-verbal instructions and demonstrations, along with working on specific tasks under supervision. Scaffolding learning is characterized by starting learning tasks in the zone of proximal development (Vygotsky, 1978), i.e. tasks that are so challenging that they have to be learned with some assistance from a supervisor. As the trainees gain more and more experience through practicing, they gradually become competent operators. However, observations indicate that the learning taking place extends scaffolding learning when operators discuss what they are doing and ask questions that force both trainees and trainers to learn about each others' understanding. Thus, a mutual understanding and social bonding arise, giving impetus to a positive and inspiring atmosphere for those involved. As the manager responsible for the training commented:

> "The local shift people think it is very fun to have people coming here like this. They [visiting operators] are eager about learning and ask a lot [of questions]. So I think everyone is having a rather good time doing this. It is meaningful even if it costs a lot of money and I am sure it is worthwhile and that the start-up procedure in Spain will be very good."

Due to high travel costs from China, only select staff from various organisational levels were sent to European plants for training. Some experienced operators and shift foremen from a production unit in Europe were therefore brought in to do training on-site. The training was done in the same manner as in Spain—consecutively following the equipment's installation steps—and partly overlapped with the cold training (see below). Operators' responses were similar to that in Spain:

> "The [Chinese] operators were extremely attentive, willing to learn and eager to do things on their own. It was really a positive experience to teach the operators. In the beginning they did some things at their own discretion—the learning curve was a bit to steep, they tried to figure out some new and 'clever' ways of doing things, but that is in my experience quite normal. I think the quality of the operators was very good." (Technical expert, expatriate)

Supplier training

Suppliers of technology are, according to their contracts, obliged to give lessons in how to use the equipment. For maintenance workers and foremen, this represents an opportunity to participate in the installation of the equipment, giving them both a thorough understanding of the construction and functioning, along with in-depth knowledge essential for the planning and execution of effective maintenance that only years of ordinary maintenance experience can match. This also gives operators and shift foremen the possibility to receive advanced equipment training and guidance in basic maintenance and finding errors. After the installation is complete and the equipment is in place, this window of opportunity for hands-on learning disappears.

The learning that occurs in the emulation stage is a combination of instructed learning and scaffolding hands-on learning, starting out with simple tasks that gradually become more advanced. This occurs in a combination of verbal and nonverbal demonstrations. During the training, mentors and trainees enter into an intersubjective understanding of the tasks as the mentors regulate the trainees' performance through hands-on guiding while the trainees try to understand through the perspective of the mentors: "Why are you saying this? Why can't we just…?" There is a recurrent dialogue between "rules" and concrete actions; gradually, a common background providing guidance for why and how the various tasks should be conducted emerges, allowing trainees the ability to master their work step-by-step.

Animation: Co-enactment and justification

The third main training stage consists mainly of a collaborative affiliation and justification of the work practices among peers. Up until now, training has been led and brought forward by mentors, with the newcomers acquiring a certain level of process knowledge and workplace safety. The next step is to develop a sustainable and a durable collective work practice among the operators. This takes place as the instructors leave more space for the operators to develop their own community of practice (Lave & Wenger, 1991) of co-constructing a collective knowing of peer interaction—where neither interactant is an authority or expert.

Cold training

This stage starts with "cold" training (i.e. training without hot metal in the production system) and continues through the commissioning phase, where the new plant is formally delivered to the new organisation. The take-over phase is strictly controlled by the construction project; it follows the project management handbook because of the concomitant transfer of responsibility from the project to the organisation. The aim of this training is familiarise oneself with the equipment in the new plant and test functionality under safe conditions. It is also used to establish a framework of standard operating procedures that describe in detail how various operations should be executed. These efforts take place as collaborations between operators, supervisors, and

managers. As argued by Tomasello et al. (1991, p. 501), collaborative learning is possible because different peers often focus on different aspects of the problem or situation. This gives rise to transactive discussion, where different perspectives come to light in the interaction. During this phase, they come up with suggestions and discuss implications of their actions, interpret effects, construct explanations, and resolve ambiguities in the process of co-constructing and aligning their practice.

Production start-up

This step covers the time period from when hot metal enters the system for the first time to the next couple of months after. The start-up of the Spanish plant was postponed approximately two months due to a supplier's delay in delivering equipment. A strong support team covering all critical positions assisted the Spanish organisation during the first weeks of production, but was gradually reduced as the local organisation became more experienced and could take on more responsibility. After only two months of production, the plant was able to make six and sometimes seven casts a day. Being stable on seven casts a day was the original goal by the end of the first year of production. The quality of the produced billets was also comparable to that of similar plants within few months after start-up.

The Chinese plant had a more troublesome ramp-up, demonstrating that cultural learning also can be a cumbersome affair. It was not before the third general manager in one year was in place that the quality and production volume reached design capacity. An expatriate expert explained what went wrong:

> "In the start-up, we had people hands-on first and foremost to make sure that the safety aspects were handled properly. But we had some problems with the quality and produced a lot of scrap. Someone higher up [in Phoenix] suspected that the equipment wasn't good enough, but we made it clear that the reason for this was that the operators were too relaxed and didn't do what they were expected to. The introduction of the bonus-system resolved the issue. After just a couple of days the quality and production volume raised to level where it more or less should be."

What had happened was that the production manager at that time told the operators to slow down because an incentive system based on piecework measured relative to a standard production rate was going to be implemented. By keeping the normal level low, they would get bonus with a minimum of extra effort. This issue was, however, quickly resolved and the final incentive system was in the end designed in a similar fashion as other Phoenix units' bonus systems. The production volume and quality was then stabilized at a level slightly above what was expected.

The training in the animation stage consists of collaborative learning and transactive discussions bringing forth collective practices from a shared background of understanding. This stage is characterised by continuous justifications and co-enactments before reaching a stage of maturity when the practices become settled. Tyre and Orlikowski (1994, p. 114) denoted this stage as a "window of opportunity":

> "We find that the initial episode of adaptation is especially important. The decisions and directions taken during a short period following initial installation—a period that may be as brief as two or three months—are major determinants of how the technology will be used by the organization over the longer term. Indeed, it appears that further adaptation is rare unless some sort of unusual event or discovery (such as a breakdown in the technology, the entry of more new technology, a managerial intervention, or the culmination of user's own frustration) triggers subsequent episodes of adaptive activity. We have called the initial period following installation a window of opportunity."

Discussion

I have in this paper brought forth a perspective on the conjoint creation of an organisational practice and the making of a community of knowing capable to perform orchestrated and coherent actions through various modes of cultural learning. A translocation perspective is first and foremost concerned about developing organisational knowing and expertise, and not as establishing a practice-*routine* of

recurrent actions based on replication and adaptation. Overall the empirical data show that intra-organisational spreading of competitive organisational practices do not fit well with neither a "transfer"-logic of "copy and paste" nor a passive "dissemination"-logic of interpretation and re-creation of an already existing practice. Not only is it in the initial stage of an emerging plant the foundation for establishing effective and well-functioning practices is made, it is also in this phase the destiny of the plant is sealed:

> "Our competitive advantage does not lie in the technology per se. Everybody, including competitors, is free to buy the same or similar technology, as they may feel like. It is the competencies of our employees and the way they together utilise the possibilities offered by the technology which award us competitive advantage." (Phoenix executive)

A proper understanding of the process of how organisational knowing comes into being is thus essential when building new plants. I have been concerned about the unfolding of the enabling process of what is learned when and the sequence of events taking place. The chosen approach was to develop an empirically-based sequential-stage model describing how two greenfield plants developed their organisational knowing by means of resources provided by the mother-organisation. An organisational production practice is a complex and multifaceted technical and administrative capability. I identified stages and steps in the development which included various modes of learning and categories of knowledge like prescriptive knowledge representations, knowledge embedded in technology and structures, individual embodied knowing, and collective co-constructed understandings embedded in practice. The process model denoted "training trail" describes the emergence of an organisational practice in terms of the three phases of captivation, emulation and animation.

The captivation phase is about creating an atmosphere of enabling for the organisational practice to emerge and unfold. The foundation for accomplishing this is by establishing common ground: "[It is] important right from the start to think 'totality'…a concept that is coherent." (Project manager).

Even though the technology is similar between plants there are no plants that are an exact blueprint of another. There are always some local adaptations and the layout of the production lines and the organisation of the work might also differ and consequently no standard training program can therefore be provided. Thus, in order to provide a coherent training scheme the content and what learning "style" to apply needs to be agreed upon in advance:

> "In our discussion about training, learning and building competence the emphasis of the communicative aspect of learning was highlighted. What is often missing is the pedagogical skills to make learning happen! Models, figures, procedures and everything is of no use if you cannot communicate, if you do not get across to the others." (CEO, sister plant)

Learning and building the capacity for knowing on the collective level are a consequence of development of relations between people engaged in joint activity. For this to happen some kind of common ground is required and this is obtained through conveying a picture of the totality and developing an identity as a community with a purpose. Developing identity is what motivates and gives meaning and are as such important means for becoming knowledgeably skillful (Lave 1988). Even though a conceptualisation of identity is not part of the formal training or learning regime it is still close beneath the surface when it comes to how the training is enacted. For instance, already from the very beginning of the training the instructors communicate a broad view of the whole and why the participation of the newcomers is important:

> "I feel that it should always be so that everybody feel they are part of building the cathedral and not lay brick by brick…that's really important."

> "To see yourself in the big picture, try to see the totality: 'What is my role in this and why is what I am doing important?'"

It is the environmental and cultural context which encourage communication and interaction, and generating identity is both a result of and motivation for participation

(Lave 1988). Consequently identity develops as newcomers' perspective changes as the learning, characterised by dialogical action and reflection creating cognitive templates for how and why things should be done in a specific way, evolves from imitation and instruction to collaboration.

The emulation phase is about creating a structural and cultural context which is appropriate for the operation of the new plant and to let the organisational practice emerge within this domain. The learning is dominated by hands-on practical training and include "hard" learning of how to operate the technical equipment in a safe manner by means of directed learning as well as "soft" learning of developing language, attitudes and community.

> "When the training is planned it is important not to make it boring. You know you can take the people and put them in front of a screen, or in front of the video-projector or at the front of me. And I can explain them during thirty days about ligt metal, about the market, about the customer, about the equipment, about everything. But in the end the people will be impressed by me, and will say: "Ah Franz, very good!". And if I have said the truth or not that will be the same, OK? And then I can say: "OK, you are ready to go and burn yourself to death there, because it is dangerous!" – I'am being aggressive again [grinning]…" (CEO sister plant, responsible for training)

The "soft" learning associated with exploring connectedness and relationships and developing joint language and collective memory should not be underestimated and comes as a non-deliberate "side-effect" of learning through day-to-day coping with actual real world work tasks. This kind of learning is facilitated by visits to sister plants offering a structural context similar to that in the new plant where experts, skilled operators and newcomers are engaged in joint activity and co-construction of knowing:

> "I went to [site in Norway] the first time we sent a group of people from [Mancha] to be trained there. This is a way of developing people to *discuss with*

> *their hands*, not only with words, because there are not the same languages on the floor." (Franz)

A central aspect when going from developing individual skills to establish a collaborating community is experiencing the dependency of others to perform well. The learning-by-doing enabling collaborative orchestrated actions is dialogical in the sense that it is performed by a "shared" agency. For those involved the identity as a "we" is constituted as actions conducted on the basis of a shared understanding by a common agent made up by the participants. Thus, our identity is not defined simply in terms of individual characteristics, it is in essence social (Varela et al., 1993). Cultural learning provides us with an understanding of knowing not solely as individual knowing but as common knowing enacted by *co-agents*. The construction of individual cognitive templates is mainly a collective enterprise of dialogic intersubjective understandings with others and is fundamental for an organisational practice and community of knowing to emanate.

The animation phase is when the organisational practice is brought to life and community expertise and identity continues to develop in parallel with the ramp-up of production. In the previous phases valued elements of a sustained production culture have been passed on to the new site. Still there are some supervisors present from sister plants but the further development of the organisational practice and knowing are now locally created and co-constructed. There are less asymmetrical discussions with experts and more symmetrical conversations among peers displaying intersubjective characteristics of collaborative learning and understanding through social interactions. The practice reflect the individuals' understanding of what is important, and expertise manifests in the ability to solve non-standard and complex tasks. This can be illustrated briefly by the following example:

At the end of 2005 the Jiangsu plant produced the second best quality alloy products in the world, better than their more experienced sister plants in Phoenix and only one competitor displaying better quality characteristics world wide. This was confirmed by

laboratory tests. In addition they were able to produce a special alloy to a car manufacturer that none of their sister plants were able to:

> "What happened there…two things coming out of it, first was [that] it brought people together that were trying to overcome the challenge. A lot of innovation and hard work. Second, the economy of the plant, the minute we started to ship this material, all of a sudden we were making a lot of money." (Phoenix executive)

> "It is very well done up and running in such a short time. They have been certified by one of the largest car producers in the world, they are ISO-certified and are in the process of being certified for their new system which include safety, health and environment" (Phoenix expat)

The "training trail" is not exhaustive and the content and how each "training post" is accomplished can and probably will differ between start-ups. I have used two greenfield projects within the same corporate context to illustrate similarities and to enrich the description of how the trail is accomplished. The trail and its posts are in this respect open-ended but still it provides insight into the main mechanisms and modes of learning which are present in such greenfield start-up projects, and as such it can be perceived as a template for understanding and opening up the "black-box" of how an organisational practice emanates.

Conclusion and Implications

Accomplishing greenfield projects and establish a totally new competitive plant within an organisational network is a demanding task. To succeed with such an effort the support from the mother-organisation and the sister-plants in terms of technology, expertise and knowledge is not only needed but crucial. I have suggested that the becoming of an organisational practice in a greenfield plant and the conjoint making of a community of knowing can be explained as a translocation which follows the phases of captivation-emulation-animation. The translocation perspective outlined here

represents a transformation and reconfiguring of practices from other organisational units to a new site. Using the term translocation indicates that it is not a copy and paste event, but rather a customisation, recreation, and (re-)enactment which I describe as a sociogenesis of recurrent dialogical actions building upon various modes of cultural learning. In this approach, learning is viewed as co-constructed actions (between peers and instructors) bringing forth a background of understanding allowing people in the new organisation "...to take multiple perspectives on things, including their own behavior and cognition" (Tomasello et al., 1993, p. 510). Viewing the emergence of an organisational practice as a dynamic multilevel process extending over time bring forth new directions and implications for future research:

First, the dynamics of the evolution of organisational practices and community of knowing are important as means to understand functioning and development of ongoing social practice in general and what gives it a competitive edge in particular. A competitive advantage can be gained if mechanisms for impeding imitation by competitors are present or can be established (Teece, Pisano, & Shuen, 1997; Eisenhardt & Martin, 2000) and following the resource-based view such mechanisms can be explained in terms of resource heterogeneity not only across organisations but also within organisations, leading to resource configurations generating "sticky" knowledge (Szulanski, 1996). From a constructionist perspective sharing of know-how is not viewed as a "...problem of knowledge transfer or disembedding of 'sticky'-knowledge...it is a process of enabling others to learn the practice that entails, the 'knowing how'" (Orlikowski, 2002, p. 271). Studying practices in the making give insight into how this enabling process unfold, evolve and change as the practice emerge. It also provide a background for understanding how heterogenous resources become connected and concerted. A sociogenesis approach through its emphasis on the ontogenetic (historic development), intricate and often unnoticed provides a broader perspective on change and stability in organisations in general and hence represents a lens to understand the nature and emergence of organisational idiosyncrasies in particular.

Second, compared to traditional perspectives on sharing and reproducing practices a translocation perspective advocates a more comprehensive view consisting of multiple epistemologies in parallel covering the mutuality and temporality of the social and the material in the cultivation of organisational knowing. Sources of relevant knowledge is represented in procedures, encoded in technology, embodied in people and encultured in the organisational ethos and (re)created, justified and practiced within a community of socio-cognitive individuals. Even though it is evidently known how difficult sharing of organisational practices are we know less of what the difficulties consist of. The "transfer"-approach in general provides a too simplistic and narrow understanding of the process of sharing and reproducing a practice. The tangible and material aspects such as technology, equipment, rules, norms, and procedures are at the core of the transfer perspective—which leaves the social, agentic and situated aspects out of the appropriation process. For instance the concept of "absorptive capacity" (Cohen and Levinthal, 1990) is perceived as an organisations's fixed physical capacity to receive and absorb without inducing any change in the socio-cognitive capacities or identities of the community in the making (Amesse and Cohendet, 2001). The translocation perspective directs attention to the sequence of what is learned and how combinations of learning approaches and mechanisms might work together over time.

Third, the socio-cognitive dimension of learning and identity generation are undervalued in current organisational knowledge theories. As brought forth here it is through a combination of reflective imitations and shifting between perspectives—whether it is instructors' or peers'—dispositions and collective capabilities are being acquired and built up. The manner in which newly-hired operators participate in shift work under supervision of experienced operators, and how greenfield managers visit other plants to learn hands-on how to do their job, illustrate the importance of the relational aspects of the training as manifested by the mutual adjustments, joint interactions, and alignment of understandings that take place as the practice evolves. In contrast to a institutional logic a translocation approach also considers heterogenity and tensions among members giving raise to transactive discussions and memory as important for collaborative learning. By bringing the largely ignored socio-cognitive dimensions of human action into the picture—not at the expense of, but in addition to,

the cultural and explicit—reflects more of the underlying social dynamics of a community of knowing "in the making". It might also leads us towards a more systematic and in-depth understanding of by what means building the capacity and dispositions for a collective to enact orchestrated and skillful performance can be facilitated and managed.

For managers the main implication is to think more critically about their approach to knowledge transfer. Even if an organisation already posess superior operational excellence at specific locations it is not a straight forward task to establish new sites with the same capacities, and the study presented here adds to the pool of explanations for why "best practices" do not transfer easily. The building of a plant and making an organisation capable of robust and skillfull performance are simultaneous processes and careful attention to both explicit and implicit learning are needed to succeed. While formal training interventions indeed helps us facilitating knowing in the making the importance of the associated "hidden", "unorganised" and experiental learning are often underfocused and needs to be harnessed in better ways than what is usually done.
Meaningful adult learning occurs when it is based on problem solving and connects with a person's general life events and activities, and can not always be controlled by the organisation even though it is at the heart of providing added value to the prospect. The dilemma for organisations is how to loosen up their control over the learning process while obtaining the benefits from it, to make a shift "from command and control to engage and enrol".

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3.
Patterns of Connectivity: The Enactment of Organisational Routines in Greenfield Projects[9]

Abstract

Organisational routines are commonly associated with recurrent work practices as an important means to achieve organisational efficiency. They do so by enabling coordination, stabilising behaviour, economising on cognitive resources, and binding knowledge. This paper investigates why observations and explanations of seemingly non-routine complex practices across space and time display action patterns resembling characteristic features of organisational routines. The empirical basis consists of studies of three greenfield projects conducted by a light metal supplier with locations all around the world.

The analysis shows that the constitution and performance of four cross-organisational practices display similar patterns of interactions in each project resembling organisational routines. In contrast to an understanding of actions underlying organisational routines as scripted and programmed, I introduce a perspective of routines that build upon the enactive approach in cognitive science and theories of social becoming. This perspective views organisational actions as everyday social interactions emanating from a nexus of intersubjectively generated and shared meanings that emerge and are maintained through articulation, stories, and negotiations. In this respect, a stable collective co-orientation is of a patterning nature where individuals adjust their behaviour in relation to each other while embellishing small structures, artefacts, their own procedural memory, systems, and practices—all located in and between organisational nodes and domains. In the greenfield projects described here, these structures include corporate principles for organising and reporting project status,

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project management models, and locally co-constructed knowing stored in transactive memory systems and brought forth by experienced personnel. This implies that organisational routines as patterns of social interactions consisting of consensual meaning and coordinated actions are important means for effectiveness enabled by the affordances of the connectivity of the parts comprising the routine.

Introduction

It is common to view organisations as devices for planned, orchestrated, and purposeful actions by a body of people. A central aspect to organisational learning theories is that routines underlie organisational behaviour and performance by making it possible for an organisation to effectuate efficient and recurrent work processes (e.g. Levitt & March, 1988). Routines develop over time, represent an accumulation of history, and are carriers of crucial experiences constituting organisational life. Still, organisational routines are commonly conceptualised as fixed entities such as programs, scripts, and procedures that give the influence of human agency a limited role in organisational conduct (Feldman & Pentland, 2003). However, empirical studies of the execution of "simple" routines (i.e. routines for hiring, or mundane practices at call centres) indicate that a routine operation in fact is "effortful accomplishments" (Pentland & Reuter, 1994, p. 488) consisting of repetitive actions, mindful doing, and even novel performances as a means to achieve the balance between adaptability and stability (Feldman & Rafaeli, 2002). That is, routines can be perceived as regulators that stabilise organisational performance by an ongoing integration and justification of new experiences, leading toward more efficient organisational practices.

Pentland and Rueter (1994) studied the sequential structure of apparently non-routine work processes in a software company's customer service department, discovering that it displayed a high degree of regularity. They constructed a symbolic grammar resembling a repertoire of actions the actors could make, and showed that the sequential interactions they studied followed functionally similar patterns parallel to organisational routines. I will, however, argue that a "mind"-grammar of this kind follows a prescriptive logic of "what is not allowed is forbidden" (Varela, Thompson, & Rosch, 1993). For complex practices where the rules change during execution, no linearity can

be assumed or causalities derived; thus, in these instances a grammar approach has its limitations.

Routines are lately studied as regeneration of practices at a specific location on a regular basis (e.g. Birnholtz, Cohen, & Hoch, 2007; Feldman, 2000). But what if routines understood as patterns of recurrent practices can occur at different locations under various settings and circumstances and still be perceived as the same routine? What are then the underlying organisational dispositions, mechanisms, and configurations giving rise to such patterns? A global manufacturing enterprise's ability to accomplish greenfield projects is not something one would expect to resonate well with a traditional understanding of organisational routines. Such projects imply bringing a diverse set of experts, competences, and technologies from an international company network into an (for them) unknown area and cultural setting, with the aim of constructing state-of-the-art production facilities. But why is it that observations of seemingly non-routine organisational practices nonetheless display interaction patterns resembling organisational routines across greenfield projects?

Routines are supposed to be at the core of understanding organisational behaviour. The aim of this paper is to develop an understanding of organisational routines as culturally mediated patterns building upon a social theory of becoming (Sztompka, 1991; Tsoukas & Chia, 2002) and enactive cognitive science (Varela et al., 1993), highlighting the non-separability of unfolded structures and reflective and knowledgeable embodied agents in action. Empirical material from a longitudinal research project exploring a global light metal manufacturing business' greenfield projects will be used to illustrate how organisational routines can be perceived as patterns of temporal, emergent and open-ended enactments. Studying routines as complex, recurrent, and shifting organisational endeavours may be a source to new insights on organisational functioning in general, and the regeneration of organisational practices in particular.

Organisational Routines as Patterns

Organisational routines were placed centre-stage on the research agenda in organisational theory by Nelson and Winter's (1982) influential book on evolutionary economics. The concept has since been used widely in varying senses and several attempts have been made to consolidate the various contributions and make the field more coherent (e.g. Cohen et al., 1996; Becker, 2004). Organisational routines are often conceived as a complex phenomenon for which it is difficult to give a proper conceptualisation and it seems that it is easier to describe what they do than what they are. Still, routines have been proposed to represent an essential aspect of organisational functioning by enabling coordination, stabilise behaviour, economise on cognitive resources, and bind knowledge (Becker, 2004). The downside is that they could also be sources for rigidity and inertia (Leonard-Barton, 1992; Levitt & March, 1988), becoming an obstacle for organisational renewal. Feldman and Pentland (2003) identified three dominant metaphors on how routines are described in the literature. First, organisational routines are conceived as a division of "head and hands" where the organisation is the head, and the people within are the hands that conduct habitual and automated actions. Second, organisational routines are paralleled to executable programs of steps of predefined actions similar to scripts and programs. Third, organisational routines are viewed as the genetic material determining organisations' possible behaviours. As Feldman and Pentland (ibid.) point out, all three metaphors convey an image of organisational routines as fixed, unchanging objects, abstracted from organisational activities ignoring contextual impact on performance.

Organisational routines can be understood as consisting of two domains: a structural or "memory" domain, and a performative domain (Feldman & Pentland, 2003). While the former has received a lot of attention in the literature, the latter has often been neglected (Feldman & Pentland, 2003). An implication of this imbalance is a shift towards approaches focusing on the constituents and configuration of organisational routines and the extent to which these correspond to resolving recurrent tasks and problems. Within the structural domain, organisations are commonly assumed to be problem solvers which develop task-specific knowledge, giving rise to knowledge structures

embedded in the organisation and its routines (Feldman & Pentland, 2003; von Krogh & Roos, 1995). The more fine-grained and accurate the knowledge structures represent the domain of action they are supposed to match, the more effective they are considered to be. Organisational routines are thus conceived as stocks of knowledge representations based on successful solutions to previous problems—with the corresponding outcome viewed as a "fixed response to given stimuli" (Pentland & Reuter, 1994), "mindless rule-following" (Ashforth & Fried, 1988), or "learned behavior" (Cohen & Bacdayan, 1994; Cohen et al., 1994). That is, organisational routines are perceived as representations of mindless, recurrent, and stable entities and prescriptive performances. Even though they are commonly regarded to be an important component and product of organisational learning, they provide no account or explanation of why and how routines change (Feldman & Pentland, 2003). Change might be acknowledged, but it is done so without giving up the prior commitments to stability and order—resulting in a caricature understanding of change (Weick, 1998).

It is currently debated whether organisational routines should include only less-mindful work tasks conducted by a "blind" agency or if an adequate and empirically relevant conceptualisation also needs to include aspects of mindful efforts. Viewed as less-mindful work, routines are understood as repetitive standard operating procedures and scripts that are executed as goal-oriented and pragmatic actions economising on cognitive resources. By also including elements of mindful actions, the agentic aspects of social interactions are brought forth. This gives impetus to a more comprehensive and empirically suitable approach for studying more advanced routines—consisting of complex and intertwined practices—at the possible expense of making the concept more blurred. Levinthal and Rerup (2006) distinguish between less-mindful and mindful processes, suggesting that not only do important elements of mindfulness underlie routine behaviour, but also that novel actions build upon established action repertoires. Weick and Sutcliffe (2006) argue in a reply that less-mindful routines and mindfulness should be positioned as opposites of a continuum, rather than being viewed as a dichotomy. However, the performances of routines extend in time; when studying the sequences of actions, they span a continuum (or positions) containing both less-mindful and mindful actions. A perspective aiming at separating less-mindful actions

from mindful actions in a stream of interdependent practices to identify "islands" of non-reflective performances in this respect seems less promising than a more inclusive and empirically applicable approach that transcends the less-mindful/mindfulness dichotomy of viewing organisational routines as *patterns of practices*.

Feldman and Pentland (2003), who highlight the performative and agentic aspect of organisational routines, provide a definition of organisational routines as "…a repetitive, recognizable pattern of interdependent actions, involving multiple actors" (Feldman and Pentland, 2003, p. 96). In his review of the literature, Becker (2004) found examples of patterns of action, activity, behaviour, and interaction. As patterns, routines can, on the one hand, be understood as dispositions distributed across the organisation where "…the multiple actors carrying out the routines belonging to different organizational units, and are located in different places—linked by interaction" (Becker, 2004, p. 647). On the other hand, patterns can also be depicted as essentially non-localised but concentrated and temporally-fixed enactments shifting around in the organisation over time. In a greenfield project—often perceived as a tabula rasa—the team is recruited from various organisational units to contribute to the commercial exploitation of a site. The team consists of a combination of technical specialists, production managers with varying degrees of experience in project work, and senior project managers. The performance of a routine will necessarily have to display some kind of similarity to be perceived as such. However, that does not imply that it will be a replication of previous achievements and patterns: "An organizational routine is not a single pattern but, rather, a set of possible patterns—enabled and constrained by a variety of organizational, social, physical, and cognitive structures—from which organizational members enact particular performances" (Pentland & Rueter, 1994, p. 491). In the greenfield projects described here, these structures include corporate principles for organising and reporting project status, project management models, and locally co-constructed rules and prescriptions brought forth by experienced senior project personnel. The changing nature of organisational routines as patterns will here be explored in terms of a perspective building upon the enactive approach in cognitive science (Varela et al., 1993) and theory of social becoming (Sztompka, 1991), viewing social interactions of a reflective and knowledgeable agency (which can be individual or

collective) as composed of unfolded structures and mobilised agents. This is an approach which will be shown to comprehend organisational routines as enacted efforts aiming for viable—or functional—rather than optimal solutions; this "good enough" distinctiveness is both a provider of stability and an impetus for change.

An enactive approach (Varela et al., 1993) starts from the performative domain, viewing problem complexes as being brought forth, and structures becoming specified and enabled, through actions performed by the organisation. Organisational actions can in this respect be understood as enacted dispositions in emergent situations specified by the organisation where "...context-dependent know-how [is viewed] not as a residual artefact that can be progressively eliminated by the discovery of more sophisticated rules but as, in fact, the very essence of *creative* cognition" (Varela et al., 1993, p. 148, italics in original). The contextuality and instability prevalent in enacted efforts suggest that change and novelty are more fundamental and ontologically prior to the presumed stability and regularity of organisational routines (Tsoukas & Chia, 2002). Routines are thus from an enactive point of view of an open-ended nature, which provides the flexibility needed to resolve a range of "similar" situations and events.

By building upon Sztompka's (1991) theory of social becoming, organisational routines can be interpreted as patterns of social interactions where mobilised agents and unfolded structures are fused together in inseparable unity. In this respect, agency represents the fusion of agents (individuals or collectives) and structures which are co-enacted in practice. Dispositions are manifested in conduct, but they are not fixed. Rather, they are shaped by earlier conduct produced by previous actualisations. In turn, their actualisations reshape the dispositions for future conduct. There is a continuous bringing forth of what is possible and what actually occurs, extending in time. Although constrained and enabled by its history, agency is brought forth through mutual specifications and ongoing co-enactments within an ever-changing organisational environment. Such an understanding of agency emphasises that how a structure is perceived, what purpose it serves, and how it is actually used is not given. It needs to be interpreted and situated in the actual situation, and its meaning negotiated—with this process of creation possibly changing over time and/or space.

As indicated above, I will explore the extent to which seemingly independent greenfield projects and non-routine organisational practices display patterns of interactions which can be characterised as organisational routine. The aim is to create new theoretical insights and explanations about how such patterns emerge, their composition, and their fit towards an understanding of organisational routines as isomorphic (i.e. similar in structure and relations) and functionally similar patterns of enactments. I will then conclude with some broader implications for our understanding of routinisation in organisations.

Research Design

In our[10] studies of greenfield practices at various locations, early observations indicated that there might be more similarities across sites in terms of actions and sequences of actions that were performed than one would expect, especially given that in many respects, each greenfield is perceived as a rather unique accomplishment. Based on these preliminary observations or mysteries (Alvesson & Kärreman, 2007), I searched for theories that could explain why, how, and to what extent apparently (more or less) independent investment projects display similar interaction patterns. This theory-driven methodological approach builds upon an abductive line of reasoning and is inspired by the extended case method (Burawoy, 1998), which emphasises that theoretical building blocks are not developed *tabula rasa,* but start out from a stock of academic theory. That is, it is the fusion of the empirical material and the theoretical approach that generates theoretical building blocks leading towards, in this case, an "extended" understanding of organisational routines.

This explorative study takes as its point of departure the construction of three small and medium-sized greenfield plants under the auspices of a large international company, here denoted Phoenix, with production facilities worldwide. The study has been conducted as a multiple case study at two greenfield sites in China and one in Spain.

[10] We were two researchers who collaborated in collecting data for this study.

Phoenix is an international leading producer of light metal products, serving a worldwide network of customers within a variety of industries with casting alloys and extrusion products. Establishing new plants in emerging markets is a frequently occurring activity for Phoenix with respect to the ambitions of further strategic growth; not only have they completed similar experiences throughout Europe and North America, but now more recently in China. When evaluating a greenfield prospect at a new location, a Phoenix business unit will conduct feasibility studies, estimate market potential, and determine appropriate products. When a decision to proceed to the next phase is made, Phoenix has its own project development unit (PDU) which—when given the task—is responsible for developing the detailed design basis and budget for the construction of the new plant. This unit consists of experienced project managers and experts in engineering, and is renowned outside the organisation for their track record of completing projects on time and within budget[11]. The PDU prepares the tender documentation as well as evaluates and negotiates contracts. Experts in this unit often take the role of project manager when the corporate management team approves a project. A project handbook provides guidelines and policies for how the project should be organised and what roles to be filled. The actual organising of the project and the project's management model are, however, to some extent decided by the local project team and the steering committee for the project. A profile of the three greenfield projects studied is given in Table 5.

[11] In a bulletin published by a confederation of employers in 2005, Phoenix was used as an example of an extraordinarily high performer in accomplishing projects on budget and time.

	Greenfield site characteristics	Project methodology	Project core team	Technology and market	Number of interviews	Time period of main data collection	Timing of study	Length of studies in the field
Mancha (Spain)	Located in a well developed industrial area with low unemployment and strong unions. Budget NOK 200 millions.	Corporate report procedures were introduced. No formal PDU project management model was implemented.	A selected "dream team" of six persons with background from operation, management and finance. Two out of these were locals with less previous project experience.	Industry-standard technology with few competitive advantages. Well developed market access for sourcing and sales.	40	May 2001 - November 2001	Real time	Four fieldtrips of one week. A final visit was made in June 2006
Shaanxi (China)	Located in an industrial park established by the Chinese authorities. Favourable conditions in terms of less and simpler bureaucracy and lower tax rate first years of operation. Due to the clustering of Western companies the competition for skilled workers leads to high turnover rate and pressure on salaries. Budget: Shaanxi NOK 40 millions and Jiangsu NOK 200 millions.	Corporate report procedures were introduced. An ad-hoc version of PDU project management model was developed by project manager. Project manager was also hired from PDU to the responsible business unit.	Experienced senior project manager (spent most of his time at the home base) and two project deputies with both Phoenix project experience and strong cultural knowledge about China.	Competitive technology but not state-of-the-art in the industry. However, in local market compared to competitors it is regarded as cutting-edge. Access to market needed to be developed further.	54	September 2002 - May 2005	Retrospective	Three fieldtrips of 14 days (includes trips to most offices/sites Phoenix has in China)
Jiangsu (China)		Corporate report procedures were introduced. Deputy project manager from Shaanxi-project was hired as project manager. Similar project management model as in Shaanxi (even more ad-hoc).	Project manager with experience from Shaanxi as main resource. Supported by dedicated personell from the European network including mother plant (i.e. "blue print" plant).	Industry state-of-the-art technology. A blue-print of an existing European plant. Equipment delivered from European suppliers. Huge market potential but strong competition.	39	November 2003 - May 2005	Real time	

Table 5. Profile of greenfield projects studied

Data Gathering

We followed two of the start-up projects in real-time, visiting the sites regularly during the time period. The third start-up was studied retrospectively immediately after the project ended. The interviews were effectuated in a semi-structured way, starting with the interviewee's chronological biography with the project, continuing with what tasks s/he is involved in at that moment: challenges, communication flows, availability of resources (personnel, structures, artefacts), and the composition and functioning of the social network they were part of. About 40 interviews were made per greenfield project (see Table 5 for details) and key personnel such as business developers, project owners, project managers, and senior project staff were interviewed several times (approximately 6-8 persons for each project). We also had access to documents such as reports (e.g. feasibility studies, design basis), minutes of meetings, presentations, and e-mails from all projects. Our main fieldtrips to the various sites lasted between one and two weeks; during these stays, we spent almost all our time together with the project team observing meetings and discussing project issues on a more informal basis. This helped us to develop a better understanding of the particularities of the projects, and also the light metal business in general.

All interviews were transcribed verbatim and qualitative techniques were used to analyse the material (Strauss & Corbin, 1998; Eisenhardt, 1989), including multiple readings of transcripts, codification, and categorisations into a set of themes with a subsequent deduction of organisational practices. The process was inspired by the extended case method and reflexive science, where empirical accounts are used to extract the general from the unique and to move from micro-activities to meso-practices by means of aggregation of situated knowledge into social processes (Burawoy, 1998). The analysis started with the Mancha case, which was the first leg of the study. The other cases, Shaanxi and Jiangsu, were conducted some time afterwards and analysed correspondingly. All three cases were then compared against each other; during an analysis, which included several iterations and modifications, a set of cross-case compatible organisational practices were obtained.

Results

The analysis provided four distinct and recurrent practices present in all the greenfield projects studied. It should be noted that the organisational practices are interdependent and overlapping; another level of granularity in the description could provide a somewhat different set and corresponding boundaries between them. The level of description provided here is similar to that used by Orlikowski (2002) in her study of globalisation practices in an international ICT firm. The set of organisational practices described here has also been presented and discussed with senior personnel in Phoenix. They found the analysis and set of organisational practices to capture important aspects of the social dynamics in a greenfield project with a high degree of accuracy. The identified practices which will be described more in detail below are as follows: 1) Configuring interfaces and "intrafaces", 2) Enabling coherent action domain, 3) Constructing "the grid", and 4) Collaborative and co-constructed operations. In Table 6, I have summarized some of the main characteristics for these practices.

Practice	Activities constituting practice	Purpose and functioning
Configuring interfaces and intrafaces	Project meetings and workshops. Developing a shared understanding of what is going to be accomplished, social gatherings.	To define boundaries and responsibilities, establish measures and ways of communicating in the project. Interfaces prescribed (to some extent) by formal project guidelines while intrafaces (i.e. internal project boundaries) are managed by project team.
Enabling coherent action domain	Developing a road map and shared target scheme for the project, information meetings, definition of milestones, enrolment of actors.	Create an atmosphere of enabling through co-generative imagining of what is going to be accomplished. Project team initiated but guided by corporate management expectations.
Constructing the "grid"	Translation and revision of plans. Breaking down and scheduling "issues" into activitites and work packages giving responsibility to dedicated persons.	Balancing day-to-day challenges (and activities) and plans to ensure necessary progress. Followed up by project manager and steering committee.
Collaborative and co-constructed operations	Hands-on training of personell at local site and sister sites by expat experts. Strong expat support in start-up phase of production.	To recruit and train new organisation by mobilising resources from the Phoenix network. Often inititated by key personnel in Phoenix with strong experience in operation but the detailed planning and scheduling is for the project team to decide.

Table 6. Distinct practices in a greenfield project

Configuring interfaces and intrafaces

To establish a new plant involves a collective endeavour of vast complexity. Each greenfield project represents a novel combination of physical and technological factors regarding the construction of the plant, as well as unique social and cultural conditions. The decision process to proceed with a business case is a rigorous, highly structured, and formally described process that is similar for all investment projects of this kind.

The project managers in the greenfield cases under study have all extensive experience working on Phoenix projects. All projects are organised according to a project organisation model where the business unit is the "owner", and the project manager is a "client's representative" reporting to an appointed "steering committee" composed of key stakeholders responsible for following up with the project and communicating with corporate management.

	Activities	Mancha	Shaanxi	Jiangsu
Configuring interfaces and "intrafaces"	Deciding upon project management model and adaptation to local circumstances	PDU's project management model was introduced in the construction project	Project manager hired from PDU. The PDU model was not formally introduced but some of the main principles were operative. Some support from PDU was provided	Project manager was formerly deputy project manager in Shaanxi project and some aspects of PDU's model was applied. No support from PDU was provided
	Allocation of resources and provision of structures and principles for meetings and communication	Model for evaluation of progress, how to handle deviations and reporting was approved by responsible business unit and in accordance with corporate procedures		
	Defining boundaries between construction project, start-up project (building up new organisation) and IT/IS project	Separated projects coordinated by steering committee	Separated projects coordinated by project team	Integrated projects coordinated by project team

Table 7. Configuring interfaces and intrafaces

While all projects contain a strong emphasis on health, safety, and environmental issues, the detailed local structuring and organising of the projects on site is to a less extent governed by corporate policies and systems (see Table 7 for an overview). In the Mancha project, the greenfield project was split into a building project, a start-up project to establish the new organisation, and an IS/IT project to avoid using too much time on discussions around technicalities which would be of little use for the overall progress. Instead, weekly coordination meetings were held to solve issues on the interfaces between the projects. The project team for the Shaanxi project consisted of a

small core group of no more than three members: two native Chinese with previous experience from projects in Phoenix, and a project manager with international experience. Support staff and managers were recruited during the project to help build the new organisation. Immediately after the Shaanxi project was complete, the Jiangsu project was initiated with the Shaanxi deputy project manager promoted to primary project manager. The owner of this project was in another business unit than in Shaanxi, and the main transfer of experiences between the two projects occurred through the project manager. While his effort and capabilities was highly appreciated in the Shaanxi project, it took some time for the project manager to arrive at the same status in this project. The business unit did not want to use the methods and systems for following up with the project as in the Shaanxi project; his wish to use resources from the PDU unit was not approved, as they perceived the project as setting up a "blueprint" of an already existing plant in Europe—with the feeling that there was no need for additional support beyond regular visits from overseas experts.

In the initial phase, much emphasis is placed on obtaining an overview of upcoming achievements by articulating common ground and concretising goals. The focus is on ensuring that the project team covers all areas and activities, and establishes structures that make the project transparent by connecting the parts to the whole:

> "The main challenge has been to find the right way of how we should work together. First to get the group together, and then make it work together. But also to see how we should structure it, what kind of issues we have to take care of in the steering committee meetings and in the workshops. I think that in the beginning we were mixing those two together and now we have learned that we have to have a clear idea of what we do and how to get things in progress." (Project manager for start-up project, Mancha)

By starting out from "small" structures, the core project teams build upon and extend the structuration by allocating resources, delegating responsibilities, and establishing arenas for meetings and communication. Through frequent meetings and social gatherings, ambiguities are resolved and a shared understanding of what is at stake

emerges. Understanding objectives and shared ownership are crucial for the ability to act, motivate, reduce risk, and increase flexibility when "things go off". Despite all the efforts of working systematically and gaining collective acceptance for how to structure and organise the project, managers emphasise the importance of selecting the "right" people for the project—in terms of experience, attitude, openness, modesty, and social orientation—as a key success factor for creating a climate for cooperation and communication. In the core project team, there is also at least one person who is either a "local" or who knows the socio-cultural codes very well.

A striking similarity for all the projects is a residual in the planning regarding the organisation and execution of project activities which the project team needs to configure and structure in a manner they find appropriate. Sometimes the local solutions do not fully harmonise with Phoenix's "best available practices" that are described in corporate policies or the project handbook. This self-organising feature provided some slack in planning, which resulted in slightly different models for how work was organised and accomplished, but there are still similarities in the way control is achieved through both definition of boundaries and hands-on following-up, and how the project work is made transparent for both internal and external purposes.

Enabling coherent action domain

One of the main challenges in a start-up project is the process of figuring out the right ways of working together. To get people with different backgrounds, experiences, and competencies to align efforts is a necessity for the project to take off (see Table 8 for an overview of the activities of enabling aligned effort in the various projects). One project manager emphasised that every individual is part of a collective and has a responsibility that extends beyond themselves:

> "In a project you have to be loyal to the project. If there are any decisions made they have to be followed up, and you can't go against them. When you are asked to do something, within a given period of time then it could happen that this is not done on time, but it is not up to each individual to decide—because it has

consequences for others. If one ends up using time and energy on this kind of internal issues one cannot function very well."

	Activities	Mancha	Shaanxi	Jiangsu
Enabling coherent action domain	Recruiting experienced project people and disciplinary experts to participate and support the project	Experts and project participants were recruited throughout the Phoenix network	Most of the experts and project participants were recruited from another plant	
	Developing relationships within and across project boundaries internally as well as externally with suppliers and contractors	Across projects and with main contractors	Mostly internal. External relationships were more formally managed	
	Motivate newly hired workers to engage in the making of the new plant	Introduction to Phoenix' history, locations around the world, products, processes, and visions for the plant. Strong emphasis on health, environment and safety issues.		
	Delegation of tasks and responsibilities outside project core team	Delegation of tasks to experts and expatriates without any strict following up.	Project teams were reluctant to give any responsibility away. All important tasks accomplished by (sub-)contractors or suppliers were closely followed up and checked.	

Table 8. The practice of enabling coherent action domain

The aim of the project is not only to set up a new plant, but also to ensure that the new organisation will manage on its own after project termination. A common denominator in the three projects that made them self-contained was integrating key personnel recruited for operating the new plant into the project teams, and allowing them to work on project activities fundamental for establishing the new local organisation. The aim is to provide them with as much of the foundational bases, judgments, and considerations that were made at an earlier stage in order to make them competent and confident when making their own decisions once they are in charge. The project manager of the Mancha building project told us:

> "Our priority is to delegate. We have to get the organisation to work well, and that is not by doing the things ourselves. It is rather by bringing knowledge from Phoenix into the organisation, and doing it from the operational and start-up side. We are only two persons here; they should not believe that we are here to actually do the job. We are just facilitators."

In the initial phase of the project, gathering the team is not just about creating motivation and engagement among participants, newcomers (as they are recruited), and other stakeholders. When the project advances and leaves the ground, the core project team will no longer be able to supervise and control everything that happens. They have

to let go of many details and focus on the larger pieces and overall progress. We found that the way of dealing with this issue was common in all the projects studied. The practice implies building a strong collective orientation in the project by means of intense and dense interactions. When the project was properly framed, formal and informal social encounters—meetings, discussions, and workshops—comprised the basis for resolving potential uncertainties and possible future problems. Central to these coordination efforts were stories and negotiations of what were to be achieved, how it should be accomplished, who should be involved, etc. Through ongoing discussions and dialogues, mutual trust based on dedication and sincerity emerged; this "capital" turned out to be an asset when more and more people became involved and the complexity of coordinating and managing all the activities grew. A senior operations engineer in the project team told us:

> "We were two persons sitting here following the project daily, and then we grew. Now we are thirty persons so the number of persons taking actions and responsibilities is expanding. Now I know a lot more about the complexities of a start-up! I do not feel more nervous now that we are losing control or things like that. But, it is just that I realise more and more that there is a lot of details that have to be taken care of...But everything is now starting and it is getting faster and faster, and we can't just start to think, 'oh, we are losing control' or 'we don't have the overview'. We just have to believe that we are doing an honest job, that we are on the right track, and still try to contact the right people, and do quality checks, and in a way we can't stop now. I don't know what kind of feeling I have, it is just that this has to run now until the plant is starting going."

There are many issues regarding land, infrastructure, local bureaucracy, contracts, contractors, suppliers, etc. in China that are different from what is common in Western countries. Chinese greenfield projects thus represent a somewhat different set of challenges than in more familiar socio-cultural settings. For instance, the issue of delegating work tasks was frequently discussed:

> "Delegation of responsibilities that we are used to from modern organisations in the West, they don't work in China. Delegating something in China means: do as you like. You may say that people, the personnel, are the greatest challenge in China. I would like to call it the No. 1 issue. That is where the great difficulties lie." (European expatriate manager)

Greenfield projects viewed as tabula rasa—where no prior experiences, systems, or structures are available—easily generate uncertainties and feelings of not being in control. In the studied projects, we found that despite differences in delegation, control was approached and managed in an ongoing manner by the core project team and their close associates. In Mancha, growing complexity was handled by distributing responsibility to those who actually did the work, and control was maintained through a combination of project team supervision and regular onsite inspections. There were more complexities and uncertainties in the Chinese projects, but there was no delegation of responsibility outside the project team. Everything a contractor did or delivered was thoroughly checked either by the project core group or expatriates. A Chinese company was actually hired to supervise the contractors, but the project core group controlled even this company. According to those involved, this was both a necessary and successful approach. The project manager commented later that if they have had more resources (i.e. people and money) available, more uncertainties could have been resolved and they could have substantially improved the quality of their work. But still the project turned out to be a success and according to the people involved (expatriates, visiting experts, and the project manager), this was mostly due to the two Chinese "cultural brokers" in the project team—and their capacity to deal on-the-spot in real time with what could have turned into serious obstacles.

Constructing "the Grid"

Planning is an essential part of all start-up projects; like most organisations working with projects, there is no lack of formal systems and procedures in Phoenix for preparing for action. For the physical construction of a new plant (including infrastructure and installation of equipment), a detailed design basis is prepared and

finalised in the initial project phase. Deviations from the design basis at subsequent stages need formal approval from the responsible business unit; permission to make changes are not easily obtained, especially when they imply an increase in the budget or revision of risk assessments. For "soft issues", i.e. recruitment and training of new employees, there are no prerequisites to have a similarly detailed "master plan". Our informants emphasised that too much planning could just as well be an obstacle as a guidance in daily work. One project manager told us that the challenge with planning is to find the right balance between planning for the "right things" versus planning for "everything":

> "Phoenix has, over time, developed systems for systematisation, documentation, and steering of work efforts. Parts of it have come from the offshore industry, maybe also from the power industry and the nuclear-power industry, but one cannot uncritically use these methods both in large and small projects. You have to be careful and not do things too complicated or build up systems you perfectly well can live without: either you have control, or you don't. You have to stop when you have the necessary control and not take into use more systems, because it is resource demanding to build up and maintain. One should think of what is necessary to do and not to do in the administrative planning and start-up of a project. That is always the key. Search for simple solutions if they are good enough. And it is for sure a matter of training to do something simple."

	Activities	Mancha	Shaanxi	Jiangsu
Constructing "the grid"	Using the design basis for the plant as a point of departure for further detailed planning and scheduling of work.	Similar process in all projects. Construction project determines progress and milestones for the project as a whole. The more "soft issues" adapts to the time schedule provided by construction project.		
	Provide flexibility and enable exploration of possibilities to obtain adequate solutions through discussions and communication flows	Ongoing revisions of plans and time schedule. Day-to-day following up on activities at site	Day-to-day following up on activities at site. Issues dealt with on the spot by the project team. The most critical risk elements are identified and made transparent.	
	Mobilise, articulate and concretise plans into actions	Tasks are imaginatively constructed and driven by a risk/reward scheme by which the project team is held accountable. Facilitation of a holistic understanding connecting parts and the whole and involvement through engagement		

Table 9. Constructing the "grid"

As in most large companies that organise development activities in projects, Phoenix has readily-available tools and templates for proper planning of work tasks. Some of the reluctance of planning in too much detail is related to moments when possible deviations generate extra work clarifying and explaining what happened and what caused it. By not planning in too much detail, fewer deviations occur. The prevailing approach in greenfield projects—which often occur under volatile and changing circumstances—is to adopt a view of planning as an ongoing dialogue of justifications, coordination, and adaptations across disciplines as they emerge (see Table 9). Proper planning implies establishing conditions to cultivate emergent, informal networks, a robust and dynamic project-realisation culture, and practices prepared for improvising when necessary. This approach shares some similarities with Pitsis et al.'s (2003) study of managing a project as "future perfect"—that is, by what means can a project that is too unique and complex to be strategically planned in advance still be managed. The timeline, with its milestones and overall progress, is determined by physical construction work; in this respect, planning is a tool to structure, simplify, and prioritise effective coordination of activities. As a consequence the "soft issues", i.e. recruitment and training within the new organisation, need to adapt to the progress of the construction work, making it challenging to plan—let alone manage.

This approach to planning is first and foremost brought forth by senior experts who are used to handling minor delays and deviations on a day-to-day basis below the radar to the formal control apparatus—which, by some are claimed to reinforce rather than resolve problems. These problems can range from delays of deliveries, quality issues regarding construction work or installation, small budget overruns on activities or deliveries, minor changes to production layout, to a change of sub-contractors—all of which are common in these kind of projects. Dealing properly with these encounters often requires a great amount of expertise, and are well suited for the less experienced to obtain new insights and to learn about "management of issues".

As the project develops and expands, it is not possible for a project manager to be updated on all details. For areas such as engineering, logistics, metallurgy, process technology, ICT, and human resources, experienced Phoenix managers are in charge;

the project manager has to see to that all fields are covered. This implies obtaining feedback on status updates, follow up on urgent matters and make changes in the priorities made. As the project matures, increasing responsibilities are transferred to the local organisation and the core project team (and possibly other disciplinary experts) gradually takes more distant roles as supervisors and advisors—thus giving the emerging organisation the opportunity to become autonomous and self-contained.

Collaborative and co-constructed operations

Just before the Mancha project was initiated, Phoenix was working with ramping up production in a greenfield plant in North-America. This was a project that failed to reach its design capacity within the designated timeframe, and needed additional support from other plants for an extra year. The increased costs due to this failure were substantial, which generated pressure for upcoming new projects to do better. The evaluation of this start-up showed (among other things) that the operator training was not satisfying. One of the project managers had some knowledge about this start-up:

> ”They had training, lots of training actually. Too much, maybe. And a lot of training was done in the classroom, but not so much in practice. And if there are people who have no experience from production, you will get an overload of information and cannot absorb it all. And it gets difficult to use it in practice. Then there has been a lot of people coming from the European system to support them, but in a way it has been on an ad-hoc basis. So when some problem occurred, somebody was sent over and stayed there one or two weeks to try to solve the problem.”

The lesson learned for Phoenix was that the importance of the practice part of the training hardly could be overestimated. All projects since have subscribed to a “learning-by-doing” philosophy for training and support of production ramp-up, where experts from other production sites have been brought in to demonstrate and supervise (see Table 10 for details). This model for organising “soft” start-up activities was

similar for all the projects studied, but only in the Mancha project was this labelled and referred to as the "dream team model".

	Activities	Mancha	Shaanxi	Jiangsu
Collaborative and co-constructed operations	Investment of necessary time and resources to make sure all operations (training activities and standard operation procedures) are according to safety standards	Safety imperative is present in all projects. For newcomers introduction to safety is given at day one, and everyone is equipped with the right clothing and safety equipment before entering the production area. Management serves as an example in their behaviour and do not accept any deviations.		
	Organisation of training by means of a learning-by-doing approach	Training of the local organisation is a combination of theoretical lessons and practical operations. Gradually it becomes more practical and collective – learning-in-action as a group.		
	Composition of learning paths covering all relevant aspects for the various organisational levels	For all organisational levels tailor made "training trails" are specified. The training follows the installations and progress of the building project. Managed by project teams and expatriates.		
	Training of all organisational levels (also) at other sites	All levels sent to other plants. Managers to several plamts while operators where sent to a plant co-localised with a R&D center	Due to the costs of sending workers to Europe, experts travelled to China instead (some exceptions)	

Table 10. Collaborative and co-constructed operations

Some of the essential aspects of this model include configuring learning paths for the various organisational levels. Specifiying such paths consisted of aligning a set of elements starting with recruitment and pooling of training resources from the Phoenix network in order to develop a coherent and agreed upon training scheme covering all necessary topics. Recruiting for a new local organisation starts from upper level management and continues down to the level of operators. This top-down strategy makes it possible to include teaching at lower organisational levels in management training. An integral part of training (and building the new organisation) is visiting sister plants to partake in daily work tasks, with a goal of learning how production and support systems are organised and managed in similar plants. Sister sites are also important for adopting standard operating procedures that detail how various operations in a plant should be executed. In the Chinese projects, only some of the managers were sent to European plants; however, this was compensated by more frequent and extensive visits of experts coming to the greenfield sites who taught larger groups of employees. Phoenix adopted a "best-practice" system, where the network of plants exchange and transfer "best available practices". "Best practice" sharing is a controversial topic in literature on distributed organising (e.g. Orlikowski, 2002). However, our study shows that what is actually meant by "best practice" could, for instance, be optimisation of production system parameters or revisions of descriptions

of standard operating procedures in production—i.e. it has little to do with a transfer and replication of work *practices* as such.

No plants are equal; they all have their own specific layout, equipment, and other characteristics—in some sense, making them unique. This implies that there are always some local idiosyncrasies of how a plant is operated, and these particularities are constructed through the installation (cold training), commissioning, and ramp-up phase of production. These efforts unfold in subsequent (and partly iterative) phases as various learning modes, dominated by imitation, instruction, and collaboration, respectively, taking place between supervisors, managers, and operators to bring forth co-constructed collective practices from a shared background of understanding. As such, this process represents a formation of a distinct plant identity.

Discussion and Implications

In this paper, I bring forth an understanding of organisational routines as isomorphic and functionally similar patterns of enactments building upon an enactive view in cognitive science and theories of social becoming. The results from the empirical analysis suggest that the constitution and performance of the identified organisational practices—when going beyond the nitty-gritty particularities for each case—display similar interaction patterns across the three greenfield projects studied.

In contrast to a perspective of organisational routines viewing individuals' actions as more or less automated or pre-programmed with absence of reflexivity, an enactive approach highlights the situational constitution of viable actions by a reflective and knowledgeable agency. Although individuals and their capacities for knowing, reflecting, and creating intersubjectively coordinated and integrated actions is core, a fundamental tenet in the enactive approach is that *social activity* is the ultimate foundation of intelligibility (e.g. Winograd & Flores, 1986). Agency represents a fusion of agents and structures in action; it is the agentic adaptive enactment, providing both flexibility and robustness for a variety of dynamic situations, which seem to enable similar patterns across the greenfield projects. The question that arises is how do such

similar patterns emerge when the opportunity space—even though it is constrained by experienced agents and unfolded structures—is still so large?

As the previous analysis has shown, the overall pattern across the various greenfield projects emerges from a set of similar organisational practices composed of isomorphic sequences, steps, and actions that are situationally justified and enabled. We have separated these practices for analytical purposes; however, as the empirical description indicates, they are more or less interdependent, mixed, and ongoing throughout the project period and have no clear or definite boundaries. Even though they are essential for successful project completion, they are of a more emerging nature than a set of "ready-made" practices waiting to be executed. Problems, challenges, and work tasks are not given, but brought forth and specified through social interactions and mutual co-construction of components connecting to patterns.

The *configuring interfaces and intrafaces* practice enables the creation of a project body that people can enrol in that configures work tasks and responsibilities, and establishes robust project boundaries internal to the project as well as in relation to external stakeholders. A project management model is agreed upon, and the main reporting and communication lines are set up to help create an open atmosphere and work climate across interfaces. As long as the formal structures are in accord with corporate procedures, decisions and responsibilities that need to be agreed upon for an efficient manner of working are entrusted to the local task force's systematic efforts of finding the "right" people to elaborate and develop the initial "small" structures and fill the gaps.

The practice of *enabling coherent action domain* deals with the challenges of enabling people with different backgrounds, experiences, and competencies to keep the project on track by discussing, delegating, and daily hands-on following up with relevant tasks and issues—all while sustaining a "culture of co-operation" and good relationships as the project proceeds. The strong collective orientation present in all the studied greenfield projects is obtained by means of extensive and dense interactions, to clarify uncertainties and build trust for when the project expands and everything cannot be

controlled. Even though it is a distinct trait most easily observed in the early phase, it is an ongoing accomplishment of integrating newcomers throughout the project period.

The *constructing "the grid"* practice is essentially about planning and executing activities. Planning in the greenfields can be conceived as both a tool for organising, highlighting, and prioritising tasks and to communicate and coordinate activities between interfaces in a structured and non-redundant way—thus, offloading peripheral un-necessaries when environmental complexities are high. Proper planning is about finding both the right detailed level of prescription without interfering in the cultivation of emergent, informal networks and a "robust" project-realization culture that fosters practices of work execution, leaving a residual for improvisation and creativity to the performing agents.

The *collaborative and co-constructed operations* practice concerns the development of a local competent organisation that operates the new plant. It is of an utmost importance to succeed with this endeavour because a delay in the production ramp-up will incur a substantial cost increase, which in the worst case could cause the plant not to be profitable for years (if at all). The emphasis on issues regarding safety and acquiring the right attitude and behaviour when working with liquid metal are strong in all Phoenix's new operations. The actual operation of the plant and development of skills and routines is a locally enacted practice based on support and on-site assistance from Phoenix expatriates and visits to other plants. A hands-on approach of training-by-doing is the preferred way in all projects of developing skills and capacities by means of specified learning paths tailored to the various groups of employees.

What does the patterning of practices across greenfield projects imply for our understanding of organisational routines? Many empirical studies describe routines as collective phenomena (e.g. Becker, 2004) beyond individuals' comprehension and control because of only the partial overlap of the many individual's knowledge comprising the routine (Cohen & Bacdayan, 1994). They are conceptualized as multi-actor effortful accomplishments (Pentland & Rueter, 1994) of interdependent actions, where actions are triggered or primed by other's actions (Cohen & Bacdayan, 1994).

There are, however, few attempts in the literature to explain how this interdependency and processes of priming contribute to the constitution of collective action. Based on findings in neurophysiology, Gallese (2003) proposes that the capacity to interpret others' behaviour in a meaningful way is conceived as the result of a *simulation routine* by means of which we can *purposefully pretend* to be in the other's "mental shoes", and use our own mind as a model for the mind of others. The fundamental mechanism enabling this capacity of experiential understanding of other's action is the activation of the mirror neuron system. The function of the mirror neuron system is such that the activity pattern of the neuron system of an observer resembles that of the actual performer. Gallese (2003) proposes that it is by means of a shared meaningful intersubjective space—relying on embodied simulation—that communication, social imitation, and the ascription of intentions critical for collective action is possible. Through articulation, agents make themselves known with their background, assumptions, beliefs, and concerns helping them to negotiate their way through a world that is not fixed and pre-given, but continually shaped by the types of actions in which they engage (Varela et al., 1993, p. 144). From an enactive point of view, interactions between agents can be perceived as a mutual tuning process in which individuals continually adjust and calibrate their own conduct with respect to each other. Agents do not act independently; they do so in the context and situatedness of other agents and artefacts, aiming at providing viable and functional—and not necessarily optimal—solutions. In greenfield projects, the encounters, even if they are asymmetrical between experienced project seniors and less experienced team members, give rise to transactive[12] discussions and elicitation of organisational memory, which transcends any individual comprehension through a process of co-construction (Walsh & Ungson, 1991). Organisational routine can thus be perceived as a nexus of intersubjectively generated and shared dispositions that emerge and are maintained through articulation, stories, negotiations, and everyday social interactions. As intersubjective interpretation systems, routines in part transcend the individual level of knowing by enabling a transactive process of mutual tuning where experiences, insights and expectations from accomplishing previous episodes are elicited and shared in order to shape future

[12] That is, discussions which are more comprehensive and potentially more effective than that of any of the individuals partaking in it.

conduct. Such a tuning-in process extends over time, and can be perceived as an emergence of collective knowing arising from regular events and day-to-day encounters between people. This collective co-orientation is of a patterning nature in which individuals adjust their behaviour in relation to each other while embellishing small structures, artefacts, agents' procedural memories, systems, and practices located in and between organisational nodes. The "ordering-process" also indicates that change is an inherent and fundamental part of organisational routines. Change can be of either an exogenous or endogenous character: exogenous because of the natural fluctuation of its surrounding environment from which follows a belief that each performance will be different (Birnholtz et al., 2007), and endogenous because they also "…entail self-reflective and other-reflective behavior" (Feldman & Pentland, 2003, p. 95). This is also in line with Weick's suggestion that there is a possibility that "order/patterns can be accomplished by means of ongoing ambivalent mixtures of variation and retention that permit adaptation to dynamic situations" (1998, p. 551). A possible implication for conceiving and studying organisational routines is thus that the nature of intra-organisational conduct sharing isomorphic practice characteristics – as for instance greenfield projects – is such that it display similar functional patterns as a consequence of the continuous enactment of social systems for maintaining and sustaining a steady-state equilibrium by performing balancing acts.

Organisational memory is commonly perceived as consisting of mental and structural artefacts distributed as nodes in networks resembling the organisation, and is "stored" and activated through the connections between the nodes (Walsh & Ungson, 1991; Smolensky, 1988). For standard and recurring situations, these networks develop over time into experiential structures and relational networks made up by scripts, "bracketed" networks, and systems enabling organisations to develop effective practices (Bloch, 1991). Organisational routines can in this respect help utilise and economise cognitive resources (Becker, 2004) by offloading the need for mental computing through epistemic actions (Kirsch & Maglio, 1994), providing guidance, templates, and support for how to solve tasks. They can also contribute to obtaining synergetic effects when doing complex tasks involving many experts with specialised knowledge and advanced technology. For instance, when building a jumbo jet they do so "only indirectly—by

creating larger external structures, both physical and social, which can then prompt and coordinate a long sequence of individually tractable episodes of problem solving, preserving and transmitting partial solution along the way" (Clark, 1998, p. 186). These structures or "scaffolds" include language (especially written) (Anderson, 2003). In the case of greenfield projects, project management models, technical design basis, corporate policies, ethical guidelines, and templates for organisational design are important means for making tasks manageable by providing guidance and reducing uncertainty. For the individuals' part of an organisational routine, "'Procedural' memory appears to be the form that stores the components of individual skilled actions—for both motor *and cognitive skills*... Procedural knowledge is less subject to decay, less explicitly accessible, and less easy to transfer to novel circumstances... The properties of organisational routines are proposed to arise from the way individuals store and enact their parts in those routines" (Cohen & Bacdayan, 1994, p. 557, italics in original). While individuals' memory indeed is important this study implies that the importance of transactive memory (Wegner, 1986) is an underestimated component of the enactment of organisational routine. Transactive memory represents not simply the aggregate of the individuals' memory but also consists of a metamemory distributed among the "nodes" (i.e. individuals) comprising of traces where knowledge can be found. That is, among the people involved there is a shared understanding of who knows what and where to go to get assistance when needed. Transactive memory develops through social interactions and in all the greenfield projects studied there were already from the beginning extensive social activity of assembling the project team and configuring the "cathedral". Systems of transactive memory are highly efficient and the need for explicit coordination and formal structures are thus limited. This last remark also implies that the concept should be of great interest outside the academic community: Most managers would certainly appreciate insight into how to reap the benefits from cultivating and sustaining dynamic metamemory systems facilitating robust, reccurent and adaptive social work practices throughout an organisation.

Conclusion

In this article I have examined why apparently independent and locally enacted practices of accomplishing greenfield projects display patterns resembling the same organisational routine. Organisational routines are in the literature currently understood as repetitive and recognisable patterns of interdependent actions involving multiple actors (Feldman and Pentland, 2003). As the empirics show constructing a greenfield plant and building a new organisation is mainly a social effort conducted by experienced as well as newly recruited personell with diverse backgrounds. In order to succeed it is crucial to establish and maintain well performing social communities throughout the project period. To provide a possible explanation of the observed non-routine/routine-paradox, insights from theories of the functioning of cognitive systems and constitution of social actions provided an analysis suggesting that on a fundamental level all actions are basically social, and embodied simulation is essential for the enactment of coherent collective co-generated actions. The nature of social systems are thus of a patterning nature performing balancing acts to maintain steady-state and avoid disintegration and collapse. Still, for independent projects to display interaction patterns resembling organisational routine a similar set of coherent dispositions need to be present in each case. Typical sources of such dispositions includes; project internal experts offering slices of experience and heuristics, transactive discussions and memory which brings forth previous knowledge structures for solving similar problems, and exogenuous imposed prescriptions such as project methodologies, corporate policies, norms, values, expectations etc. As brought forth here organisational routines are important means for effectiveness but their true value seem to be their offerings of the affordances of the connectivity of the parts that comprise the whole.

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4.

Knowledge Hyperstories and Context-sensitive Knowledge Enabling[13]

Abstract

This paper investigates the question and challenge of knowledge enabling and sharing in distributed organisational environments. On the basis of broad empirical material from action research projects in two Norwegian companies, we describe and reflect on the development and use of ICT enhanced storytelling as a means to address the challenges above. As a point of departure we use the Learning Histories methodology, and extend this approach by means of ICT into the realm of purposeful digital storytelling for the support of organisational development. On this background we develop the notions of "situated support systems" and "knowledge hyperstories", located at the intersection of Learning Histories proper, cybertext, hyptertext and the web medium.

[13] This paper has been published in *International Journal of Internet and Enterprise Management*, 2003, 1(4), p. 389 – 403.

Introduction

The use of stories in firms as a means for identification, collection and sharing of knowledge has received much attention over the last decade among both practitioners and academics. Research on "organisational story and storytelling" has been a part of the agenda in organisation studies since the 1970s with Clark (1972) using it mainly as a medium of reporting "from the field", and Mitroff and Kilmann (1975) as an approach to problem solving and action research. It was not, however, until the mid-1980s that storytelling started to enter highly ranked journals and mainstream theory (for example, Martin, 1982; Martin, Hatch and Sitkin, 1983), thus being realised as a legitimate topic in organisation studies. The "narrative turn" in social science has changed and partly created several different fields and themes of research and practice, such as the focus on *organisational symbolism* (Pondy, Frost, & Morgan, 1983; Morgan, 1986) and the "*metaphorical basis of knowledge*" (McClosky, 1986). Other fields of narrative and storytelling used in organisations have been the *socialising of new employees*, as a tool for *collective orientation*, of "*sense-making*" (Weick, 1995; Boje, 1991), *organisational learning* (Kleiner and Roth, 1997; Roth and Kleiner, 1998), and as an approach to *innovation and product development* (Shaw, Brown, & Bromiley, 1998), *strategic thinking and practice* (Barry & Elmes, 1997), for example, through story-scenarios (Davies-Floyd 1998). For good overviews see Boyce (1996) and Czarniawska (1998).

Our approach to storytelling is that stories always have been a natural and essential part of knowledge sharing and organisational learning, but have still not received authoritative acclaim in the legitimising "foilware" discourse of management and leadership. Thus the potential for nurturing and harvesting the natural human ability and social capacity and preference for communicating with stories is profound.

In this paper we use the approach of Learning Histories (Roth & Kleiner, 1998; 1999) as a point of departure, and will, from there, explore an extended concept and practice in the same spirit—what we label *knowledge hyperstories*, focusing on the use of Information and Communication Technology (ICT) as a mediator and facilitator for a new type of purposeful, non-linear storytelling for knowledge enabling and sharing in

organisations. By arguing for an activity based view on knowledge, focusing on the relational, communicative interaction processes, our claim is that knowledge hyperstories form a ”rich” identification and representation of the knowledge dynamics of practice in the organisation. Knowledge hyperstories position themselves in this respect as a link between mobilisation and allocation of knowledge resources and practice.

The paper utilises broad empirical material from action research (Greenwood & Levin, 1998) projects in a large diversified international company and a medium-sized, project-based IT consultancy company located in Norway.

From Learning Histories to Knowledge Hyperstories

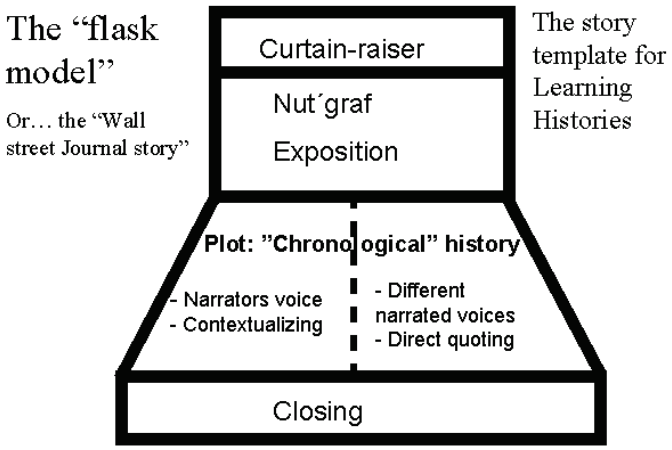
Learning histories

The storytelling approach conveyed here is a development of the Learning Histories methodology developed at Massachusetts Institute of Technology (MIT)[14] and re-used and redesigned at SINTEF (Hatling, 2001). The specific form exemplified here is that of ”extended” learning histories. Basically the expansion of the learning history “generic form”, is by means of ICT moving the learning history into the realm of “digital storytelling”; with the ideas and tools of *cybertext* (or cybermedia) derived from the works of Norbert Wiener (1948), of *hypertext* as coined by Nelson (1987; 1990), and the *web* interface and communication channel, as originally designed by Berners-Lee (with Fischetti, 1999). Let us first have a quick peak at the Learning History point of departure.

The Learning Histories methodology is described elsewhere, both in its original MIT form, and its SINTEF derivates and variants. Briefly, Learning Histories is a formalised approach for collecting and presenting learning efforts in organisations. It is a method for sharing knowledge with a focus on giving voice to a multiplicity of perspectives on

[14] See Roth and Kleiner (1998, 1999) and Kleiner and Roth (1997).

important events, told by the participants themselves and the researchers in a "jointly-told tale". The aim is to stimulate communicative interaction to support developmental processes. The Learning Histories are produced by a Learning History group of insiders (members of the organisation) and outsiders (researchers) to illuminate the how, when and why learning takes place in practice in organisational work contexts. The format of the Learning History is schematically illustrated in Figure 4.



The story starts off with the '*curtain-raiser*', analogous to the opening sequences of the 'Hollywood-film'. Then the *nut'graf*, journalist jargon of the kernel paragraph, and *exposition*, containing the 'main points' of the story, and the when and where. Then comes the main story, the *jointly told tale*, with the *two-coloumn* format, narrators voice and direct quotes. In-between are thematic chapters with their own nut'graf and exposition. At the end, the *closing up* while connecting to the curtain-raiser.

Figure 4. The story template for the "generic" Learning Histories format

SINTEF have conducted about a dozen Learning Histories projects, with a "Scandinavian" form and format, documented in "Fortellingens Fortrylling" (The Enchantment of Storytelling) (Hatling, 2001). As at MIT, all of these "first generation" learning histories were solely using the technologies of text (word processing) and paper as mediums of production and presentation. As a distinguishing feature of the second generation Learning Histories presented here, they are now moving into the area of digital storytelling, taking full advantage of the tools made available through the microelectronic-based revolution of ICT.

Digital Storytelling and Knowledge Hyperstories

Broadly, we can position our concept of Knowledge Hyperstories within what is commonly referred to as "digital storytelling"[15]. Digital storytelling is the attempt of a human-centred and historically based "take" on stories and storytelling, combined with competence and creative use of the digital tools made available through the invention of the computer. More specifically, digital storytelling is a multi-faceted endeavour with a lot of different stakeholders, forms, mediums and purposes; from multimedia presentations, small video-clips made in software programs to CD-ROMs with fairytales or 3D games, to web-based novels, diaries, soaps and multi-user dungeons—or advanced virtual reality environments.

The roots of digital storytelling should be traced back to the work of Wiener (1948) who laid important foundations for the development of the computer, and especially through his ideas on information feedback loops, the concept of *cybertext* can be derived (Aarseth, 1997). The contribution of cybertext, conceived by Aarseth (1997) as "a machine for the production of a variety of expression", is twofold; first it highlights the mechanical organisation of the text by posing the medium as an integral part of the literary exchange, and second, it draws stronger attention than response-theorists to the reader or "user" of the "text" as being an important co-creator of the meaning that arises through the interaction with the "text/medium". In cybertext the user will physically (as well as mentally) interact with the text/medium, and therefore be engaged in *performative acts* (in an extranoematic sense) of physical construction not accounted for in different notions of "reading". This latter phenomenon Aarseth refers to as *ergodic*, a term he draws from physics, with its etymological roots in the Greek words *ergon*, meaning "work", and *hodos*, meaning "path". Aarseth's point is that through the active, also physical, involvement (work) of traversing texts (path), ergodic literature is about "making sense".

[15] Lambert, J. and Mullen, N. *Memory's Voices. A Guide to Digital Storytelling. Center for Digital Storytelling.* http://www.storycenter.org/cookbook.html

From the 1960 research began on *hypertext*, a word coined by Nelson (1987), referring to the strategy of organising text in an "informal" and intuitive way using "links" between parts of text, and later also multi-media. It started out as research on citation and references, but led to the development of World Wide Web (www), a concept originally outlined by Berners-Lee (with Fischetti, 1999). And today the hypertext and www are used in a variety of digital storytelling efforts. Both our cases here use the forms of cybertext, hypertext and the intranet (web) as mediums of expression.

Janet Murray (1998) lists four characteristics that make digital environments unique in this respect: they are procedural, spatial, encyclopaedic and participatory. The user/producer of interactive texts gives the user/producer the possibility to recombine and change the plot and presentations. This dramatically changes the relationship between "teller" and the "audience". The reader or "user" becomes more of a "producer" with power over the story and, according to Murray, this creates more emotional engagement in the users. And emotional engagement spurs learning.

It is in the continuation of these lines of thought we use the notion of knowledge hyperstories; the pursuit of getting and displaying multiple voices commenting on important issues, from different angels and perspectives, using different mediums like text, pictures and videos (a variety of expression in both senses), for the purpose of active involvement from the "user" side in an iterative movement of "organisational sensemaking". The iterative movement implying both "interiority" to the hyperstory (working out your paths *in* it) and "exteriority" to the story, that is, face-to-face or online workshops discussing its content and possible implications and actions to be taken. It is in these senses we refer to the hyperstory as "knowing". As tightly *fit symbolic interactions* (Blumer, 1969) for improved mutual understandings and potentials for possible alternative practices.

Thus, a preliminary and initiating summary of the *form* and *function* of the *knowledge hyperstories* is that it should be conceptualised as a development of the MIT Learning Histories methodology, by the means of ICT, being situated at the intersections of (some) aspects of the transformational ideas and realisations of *cybertext, hypertext* and

the *web* (intranet versions). Evidently, the knowledge hyperstories are in conjunction with Aarseth's (1997) conception of "ergodic literature"—highlighting the intricacies of the *medium* as a part of the meaning exchange, and the *performative* part played by the "user" or "consumer" of the text. That is, by *actively*, in a physical sense, both with their minds *and* bodies[16], being involved in the meaning creation. Knowledge hyperstories may thus be seen as a purposeful[17] form of, ergodic literature, with the aim of being a method for targeting the development and sustainment of enabling conditions and learning efforts, the mobilisation and allocation of knowledge resources, in the context of organisations.

Based on the insight that the formal and medium aspects of communication are an integral part of its *content*, we will now turn to the cases, the practices of ICT-enhanced storytelling. That is, the inside of our proposed conception of knowledge hyperstories.

Inside Knowledge Hyperstories

We have developed the knowledge hyperstories concept through projects with differing aims and goals in several organisations. Here we will go into more depth in two of our cases to show the development of the knowledge hyperstories concept. The first case, Phoenix, describes and reflects upon the development of an ICT-enhanced hyperstory for enabling of contextual- and situational-anchored "best practices" in a "glocal" (Robertson, 1995) organisation. In the second case we take the conception a bit further and look at knowledge hyperstories as a realisation of an expanding and emerging "situational support system" for enabling of contextual and situational knowledge support. We will also give some remarks of the stories in the organisations in each case.

[16] This goes beyond what the reader-response theorists focusing on reception and meaning construction by the receiver would claim: physically and bodily in the knowledge hyperstories, by choosing and clicking their own path through the story(ies).
[17] For a discussion of the concept "purposeful storytelling" see Snowden (1999).

The Phoenix hyperstory – establishing conditions

Phoenix is a growing international manufacturer of metal, which serves a worldwide network of suppliers with a variety of different casting alloys and extrusions products. Establishing new cast houses (at various times) are a natural activity for Phoenix with respect to the ambitions of further growth stated in the strategy. The organisation has experience from this all over Europe and North America and will also in the future establish new cast houses in strategically important regions.

Phoenix has developed a more or less formalised method for how this should be done, but it is still practically impossible to find out about experiences from earlier start-ups. The problem is that the carriers of the most valuable experiences are persons who are no longer with Phoenix, and that there is, at present, no organisational memory representing the broad picture of experiences from the different parties involved. The experiences are not captured in a way that make it possible for others who have not taken part in the projects to get access to the lessons learned, beyond formal documents as plans, budgets, minutes, checklists, presentations etc. in different versions. Of course, these kind of documents address relevant issues for future start-ups, but they provide relatively little insight in what actually happened during the project, how things were solved and the reasoning behind the priorities given to things. When there exist a report from a start-up it is often written by one author (usually the project manager) after the project is terminated. These kinds of reports often conclude with a bullet-item list indicating what one should do and not do. The problem is that there are significant differences between each start-up due to, for instance, cultural and social differences between countries, legislation, competence of work force available, market situation, production technology to be used, etc. The potential for learning from reports and the like, is limited to things like how to plan and budget a start-up, which, of course is important, but still account for only a minor part of what it is possible to get out of it.

Our, that is, SINTEF's, Learning History approach is developed as a method for identifying and representing experiences and subsequently facilitating collective reflections and discussions with the aim of stimulating collective learning. The stories

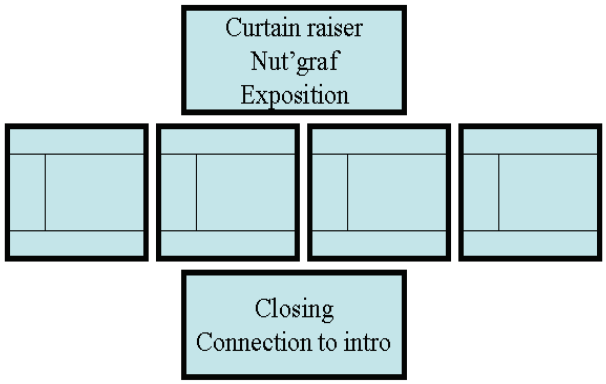
should not be normative in the sense that they give a description or "recipe" of how to establish a new cast house, but they represent a multi-faceted and sometimes contradictory message containing multiple views and perspectives from the different participants involved. The learning from such stories lies partly in the stories themselves, but maybe just as important is the learning and reflection processes it initiates in the user/producer of the story, both as an individual and in social settings.

When we got in touch with Phoenix they were planning a new start-up in central Europe and Phoenix had staffed a project team responsible for the start-up. This created an opportunity for us to develop a new layer on our Learning History methodology—the knowledge hyperstories—incorporating video-clips and pictures to the web-story. The intention and goal with our project was to capture, more than ever before, the insights and experiences gained during the accomplishment of the specific start-up in Europe and make them accessible and available for future start-ups.

Based on interviews, discussions, visits at the plant site, and reflections from the persons involved over the start-up project period, we created new learning stories, labelled knowledge hyperstories. In the Phoenix case this comprises a story composed of written text, video clips, pictures and presentations, structured and presented like a web. The story is meant to be read in an interactive way where the reader him/herself determines what issue to focus on and the level of details in the story by clicking on objects (for example hyper-links, pictures, video-clips, etc.). A part of the promise is that this also gives the opportunity to expand the story with experiences and insights from future start-ups, as these easily can be linked to the original story. In this way one gets a dynamic knowledge network of stories pointing to significant content both directly and indirectly, as it indicates persons, groups and units where the knowledge can be found. In addition, one also has the possibility to link the more formal descriptions and documents that were produced during the project. This has so far not been accomplished.

We departed from a "two-tiered" format developed in an earlier story-project and made the learning history format into a more "proper" hyptertext. The challenge was to tell a

continuous story, containing of five chapters, while at the same time the chapters was to "stand on their own feet" as autonomous stories. This was to allow for the more intuitive user way of "browsing" contents on the web. We suggested a path (hodos) through the story, linking every chapter and weaved everything together with in a "macro" introduction and closing. Each chapter had its "micro" introduction and closing as well. Schematically the knowledge hyperstories form now looked like the one in Figure 5 (keeping in mind the curtain raiser, the nut'graf, the two columns and the closing of the "generic Learning History form").



The Phoenix enabling hyperstory format. Introductory part, five 'semi-autonomous chapters (only four are shown in the Fig.) told in the jointly-told of two coloumns with their own opening and closing, and the 'macro' closing and connection to the introductory part.

Figure 5. The format of the Phoenix hyperstory

The added challenges in this project compared to the previous ones were numerable. Among them was the situation that the story "audience" is a group of highly specialised experts from different disciplines, having different roles and work tasks, and who are also distributed globally. Another big challenge was the development of the knowledge hyperstories form, such as the incorporation of video-clips into the story format. Apart form a vast number of technical difficulties, the question was: which clips functioned best in video rather than text—and vice versa? Furthermore, how could the videos be smoothly incorporated in the story? We are far from sure if the way we tackled these challenges worked; the story has yet to be evaluated by the corporation on a large scale.

So far it is only the start-up project group of the specific European location that has seen it.

The knowledge hyperstories is now going to be used in the preplanning for the next cast house; the purposes of the stories are manifold and have similar applications to those in other cases. They set an agenda for discussion of relevant issues and it will be used as initiators and facilitators for discussions on different levels; top-management, project management, etc. as the stories are appropriate for collective and individual reflections. The stories act as facilitators, not for doing things right but for *doing the right things*. They are, thus, a means to enable and sustain conditions fruitful for (collective) double-loop learning (Argyris & Schön, 1996), in distributed, "glocal" organisational environments. Put differently, they can be labelled the sharing of "glocal" situationally anchored best or first practices.

To make a multi-media learning history is a rather extensive and work-demanding task, it is, in many ways, a project in itself. Thus, it has its limitations as a knowledge-capturing tool, as it prerequisites projects of a certain size. Furthermore, a learning history has limited value for once-in-a-lifetime projects, as it is more like a subtle, active and dynamic variant of "lessons learned" than specific input to the process in question. Our experience is that stories could also be used as feedback to a single project, but the project should then be of some length. Finally, a learning history is not appropriate as a tool for evaluations of projects and individuals. It should be conceived as an opportunity for collective double-loop learning and making future practices better.

The making of the knowledge hyperstories and its further use is thus basically about focusing on and enhancing the attention and practice towards the "establishment of conditions to cultivate emergent, informal networks" (Seufart, Back, & von Krogh, 2002). Out of that may come the "design of intentional, formalised networks for knowledge creation and transfer" (Seufart, Back, & von Krogh, 2002) as we have seen is the situation in the Phoenix case: The establishment of proper ownership and legitimacy, at least in the European part of the Phoenix-network, lead to the development of an International Reference Centre for training and knowledge exchange.

How well the different functions will work out in the long-term remains to be seen. While the method and different steps in producing a learning history is straightforward and easy to describe, it is a rather complex and difficult task to do well. If one fails to carry out good interviews or does not do a good job of synthesizing and writing up, it will never be a good knowledge hyperstory.

Scheherezade's divan on pantomime – approaching Xanadu?

The "Pantomime-case" is drawn from the ICT-consultant company Computas, a firm of about 130 employees that SINTEF has had a relationship with since 1997. Computas is project based and organised in several processes (sale, deliverance, R&D, resource allocation, etc.) with process "owners" and is delivering custom-made knowledge support systems for knowledge-intensive enterprises in the private and public sectors. To this date, Computas has not been a deliverer of ready-made software. They use an interactive and iterative method of workflow analysis to map the needs and structure of work in customer organisations, and adhere to their own motto of "just in time knowledge support" (Dehli & Coll, 2000).

The focus on storytelling came up in a project in 1999, doing a Learning History on the development and use of the system *WoX* (Well of Experience), one of several integrated systems on the highly sophisticated and thoroughly used intranet *Mimesis*, allowing them to harness, represent, seek out and employ the collective knowledge resources of the organisation. The question that SINTEF arose in the project was whether Computas could "administer their own medicine" and as a consequence a storytelling portal named *Scheherezade's Divan*—after Scheherezade of the Arabian Nights, who told stories to stay alive—was developed (Barth & Bang, 2001).

Storytelling and making is introduced to the user/producer of the Divan as an invitation to content *exploration*, *organisation* and with guidelines for *production*, supported by Pantomime, allowing the user/producer to actively recombine the available information by the present *need* of the user/producer. By means of an *editor* function the user/producer can create: first, tags of their own choice, allowing users to recombine the

content of the Scheherezade's "pool of content" any way they may find useful for different purposes decided in real time; second, to allow a *situational* and *contextual* view of the distribution of competencies; and third, the stories may initiate employees to seek out colleagues for face-to-face discussions and co-operation.

The Divan is constructed within a frameset that looks at *story making* as preceding *story telling*. Story making is conceived of as evolving out of organisational practices, and not as some of the organisational storytelling literature seems to contend as some kind of a "more serious" form of "the whispering game" ("Chinese whispers"). Stories without resonance in practice may function in an opposite manner to that intended, producing barriers to knowledge sharing. Stories evolving from practice, on the contrary, could be used as powerful knowledge enablers.

The Divan is not yet not a fully integrated part of the Computas daily work life. It is rather in its "testing stage" to see if it can be a tool for tackling some of the challenges that a growing company is facing, such as the challenge of staying "flat and process-organised". And as is argued here, the process-knowledge carrier above all else is the narrative, especially when depicted as in the Divan, as a *learning process* were employees successfully pass from browsing passive content to organising and producing active content. The passage from a passive story browser portal to an active user/producer cybertext (cyber-media) portal is made possible by the collaborative technology Pantomime. Schematically, the way Pantomime works is shown in Figure 6.

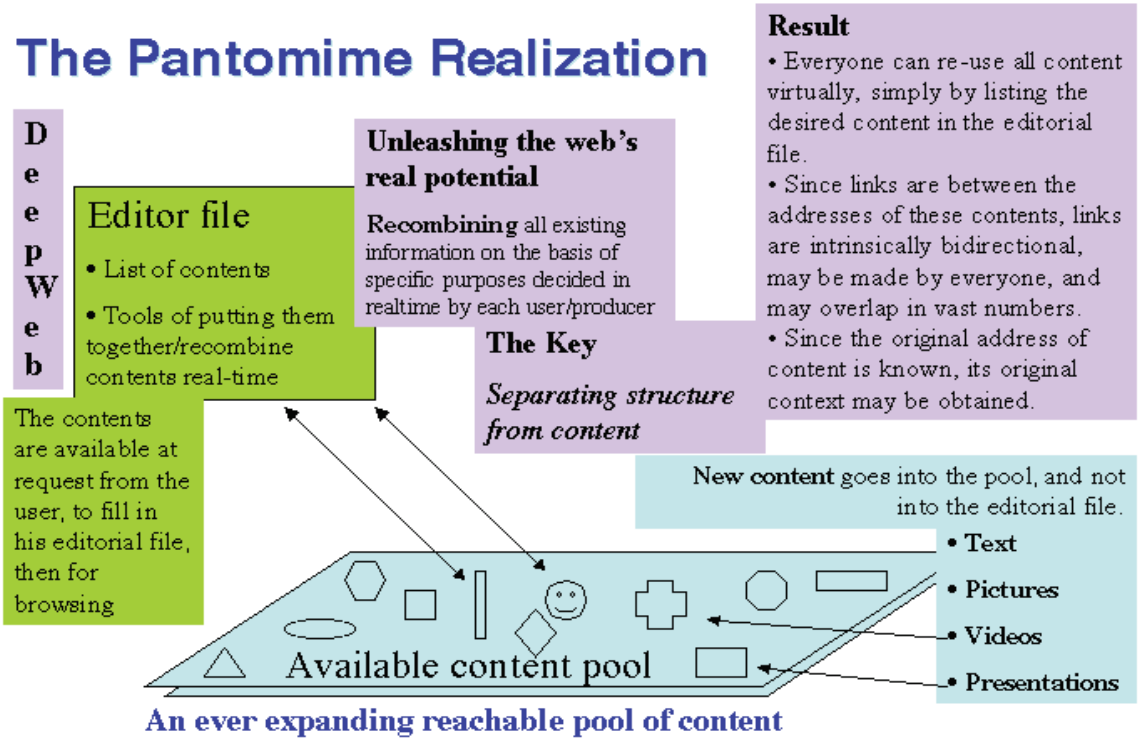


Figure 6. The Pantomime technology's simple principles makes active use possible

Let us now exemplify the workings of the Divan on Pantomime. One of the stories told, constructed and produced on the Computas Fable-forum[18] (Mæhle & Røyrvik, 2001) mountain trip, and later put on the Divan, is called "Broken coffee cup or golden prize". It is a non-linear story utilising the hypertext and web possibilities; with several different paths the user could choose to traverse the text and with different possible outcomes dependent on which path the reader chooses.

The content of the story comprises real project situations from Computas' work practice, while the characters are "fictionalised" and show archetypes or stereotypical displays of common roles and statuses in project work. The story contains different situations of *choice*, regarding, for example, a project delivery, the implementation of the system, as well as different kinds of *dialogues* with the customer. The project situations are thus knitted together by their common gallery of persons and with the dramaturgical technique different types of coffee cups showing up in all of the

[18] Fable-forum is a method developed within the project; a single-day event for exchange, between members, of experiences through verbal examples, and for developing and producing stories in dedicated teams, with different types of media, from cartoons, to web, video, and role-playing.

situations. In addition to the incorporated possible readings, the story allows unexpected interpretations depending on the readers' context, frame of reference and chosen path (hodos) of traversing (ergon) the text (and pictures). In sum, the story is a sophisticated utilisation of the possibilities given by cybertext (feedback), hypertext and the web medium. In addition, with its focus on choices and multiplicity of interpretations (hodos/ergon), it conforms to the standards of ergodic literature, as described in the introduction.

In complementary opposition to the "just in time knowledge support" principle and systems that Computas adheres to, a possible labelling principle of the Divan/Pantomime model and potential use could be "when time is just knowledge support". You can enter the Divan when the time is "right" and use/produce active contents and interpretations that are useful for some specific purpose, there and then or and some later juncture. The Divan will not provide you with clear-cut, yes or no, binary type of knowledge or guidelines, but rather support you with a repertoire of experience for future improvisation in new situations that you face. An example of this is one of the uses of the Divan/Pantomime that so far has been tried. One of the stories was used in a customer meeting during a project. At one point in the project, the joint (customer and Computas) project group was stuck on problems no one seemed to see the way out of. The situation reminded one of the Computas' employees about one of the stories available at the Divan. In the next meeting he showed/told the story as an illustration. Having an "external" analogous view of the situation they were stuck in provided a mediatory tool that negotiated and resolved the situation, and made it possible to move on.

As mentioned above, the Divan is so far still in a somewhat developmental stage and is far from being used throughout the organisation in everyday project work. But, also as a result of the Fable-forum, most employees know at least some of the stories presently available on the Divan. Today some forty stories in different forms and formats are available. An interesting trait of most of the finished stories told and produced on the Fable-forum is that they are all both "real" and "fictional". The procedure in most of the storymaking efforts has been to take real anecdotes from real project work situations

and mould and refine them with use of archetypes and dramaturgical tools into "fictional", or rather "factional" (Snowden, 1999), stories. Trough real-life story making, like the Fable-forum, and subsequent recombining through the Divan/Pantomime, and retelling in other social forums, the employees are activating and mobilising each other's experiences in ways that make other people than those with the primary experience able to take them *into possession*. Through the history identification, production, use, recombination and retelling, the employees makes their experiences *comparable*, and thereby *transferable* to the extent that they can be mobilised in each other's knowledge work.

A possible interpretation of the use of the Divan/Pantomime up to now, as well as future Divan/Pantomime, is that the merging stories are becoming a part of the organisational collective memory, and thus background and potential for possible improvisations in practice. They are becoming a part of the *cultural* heritage, transformed from being only in possession by some individual's private possession. Experiences that support this interpretation include Computas' recent use of the stories in different "organised settings"; they used four of the stories in a gathering for new employees, with the purpose of drawing attention to, and reflecting on the Computas corporate culture. Also, they used two histories from the Divan/Pantomime, and one "live-story" in a course on methodology in February 2002.

Introducing new stories to the Divan/Pantomime is crucial for Scheherezade's Divan and the collective purposeful storytelling initiatives to stay alive. Many employees may see producing stories as a barrier to overcome. This is understandable. However, if one takes the view of stories as evolving from organisational practice, one does not have to be Stephen King to make a contribution to these stories. Employees are already doing that every day. What the support environment of the Divan/Pantomime is purporting to do is to help see and enable the interconnectedness of narrative and practice, use and production in the dispersed everyday project (and process) work life of Computas; and that is working to some extent. Stories have been submitted to the Divan/Pantomime after the Fable-Forum. The latter was an important initiating experience to put "narrative knowledge" on the corporate agenda, thereby lowering the threshold of

entering the field of "storytelling", which unfortunately has a too strong aura of "Hollywoodesque" attached to it. Another major point, concerning "the well being of Scheherezade" but, more importantly, to the success of storytelling initiatives, is the active real-life use of the stories for certain purposes. At Computas this is being done or is planned in several "fields of use": as part of the introducing of new employees to the process organisation and to different project practices stories are being used, and as a basis for discussions in methodology courses, for example, on issues concerning customer contact. A future concrete intended use is an integration of practice story archetypes with the present (hard) skills manager, to allow for better resource allocation, supporting also "soft skills". In addition the Divan has caused considerable discussions of identity issues, of "who we are". Whether this is constructive or not, is another issue, but from the point of view that present practice, identity issues and strategic development ideally should be tightly integrated, these discussions may have strategic implications.

Knowledge Hyperstories Revisited

Catching on to the introductory discussion in section two, and because it is the most fully realised conception of knowledge hyperstories, let us start out by fitting the Divan/Pantomime realisation into the broader picture of the "information age" (Castells, 2000) and the microelectronic-based revolution. According to Castells (2001) the new information technological paradigm have a strong historical influence based on three major, distinctive features:

1. their self-expanding processing capacities in terms of volume, complexity, and speed;
2. their recombining ability; and
3. their distributional flexibility.

Especially concerning the first two points, the Divan/Pantomime system tackles head on the original design of hypertext and the World Wide Web, as it was conceived of by Nelson's (1990) Xanadu model through Berners-Lee "www" design (with Fischetti,

1999)—the ability to recombine information in any possible way. According to Castells' (2001) discussion of Berners-Lee, the real value of the web will, however, first be realised when Berners-Lee's original idea of the web with *two* functions, as a browser *and* an editor, is restored. As we all know, today only one half of the web-design is realised; the browser with attachments including different other tools such as e-mail applications. In the Divan/Pantomime, the editor function is already restored, although, at the moment, only in the intranet versions and a password-protected prototype "Internet". As described above, the development of the Divan/Pantomime system is, in some important aspects, an actual realisation of Berners-Lee additional editorial function. Also, to some extent, it is realising Nelson's visionary (by many regarded as utopian), Xanandu model. The Divan/Pantomime separates structure/interface from contents, it utilises the editor (or editor file), the list of contents, as an enabler for recombining all the existing informational and communicational material in the pool of contents—on the basis of specific purposes decided in real-time situations of need, by each user/producer of the hypertext.

Now compare this to how Nelson, the man who coined the word "hypertext", describes the idea behind his Xanadu model:

> "The Xanadu model has always been very simple: make content available with certain permissions; then distribute and maintain documents simply as lists of these contents, to be filled in by the browser (...) This permits many structural variations on the same particular documents and their contents—variations whose cross-connections may in turn be viewed. If the list of content is made the fundamental unit, many things become possible and principled: nondestructive, additive editing; branching versions, all accessible and re-branchable; profuse unbreaking links; principled and visible re-use (transclusion); deep intercomparison along both links and transclusions; and transpublishing under transcopyright[19]".

[19] See http://www.xanadu.com/index.html

Thus, in Computas many of the visions of Nelson, and clearly some of the ideas of the original design of Berners-Lee's World Wide Web, with the two functions of browser *and* editor are being restored and realised. The Divan/Pantomime may thus be considered a "deep web", with the possibility of active recombination in real-time of information needed for specific purposes. That is, the use of the editor function (*form*) for the construction, through recombination, of situational tailored information (*content*), for achieving certain desired needs or goals (*function*). It is in the advent of this interweaving and integrative approach to medium, contents on story form and functions of practical use we propose the full realisation of the concept of the knowledge hyperstories.

Implications and Conclusions

As we have seen, the functions of the knowledge hyperstories are manifold; ranging from intra-project feedback on collective actions, for the aid of collective understandings in a distributed project group, as well as facilitating the establishment of conditions to cultivate emergent, informal and formal "glocal" networks; to the realisation of the potential of the knowledge hyperstories as an expanding and ever-emerging, *situational support environment* provided by the Divan/Pantomime framework, facilitating storytelling practices and practical storytelling.

Both cases illustrate the processes of "harvesting" and displaying multiple voices commenting on important issues in narrative forms, from different angels, perspectives and positions, and using different and intersected mediums like text, pictures and videos. Both cases show the use of digital storytelling practices, and recalling Janet Murray's (1998) list of four characteristics that make digital environments unique in this respect, they are procedural, spatial, encyclopaedic and participatory, it should be fair to say that it is first and foremost the spatial and participatory dimensions that are highlighted in the company cases. While the procedural and encyclopaedic aspects are less present, both cases display extensive use of cybertext and hypertext. As Aarseth (1997) conceived the contribution of the conception of cybertext as a "machine for the production of a variety of expression", the knowledge hyperstories must also be

understood along the same lines. As mentioned earlier the cybertext contribution is twofold: first the posing of the medium as an integral part of the literary exchange; and second, that it draws strong attention to the reader or "user" of the text/medium as being an important co-creator of the meaning that arises through the interaction with the text/medium. The user/producer are thus physically and mentally engaged in *performative acts*, what Aarseth (1997) refers to as *ergodic*. And because of this concrete, bodily active involvement ergodic literature is about "making sense".

With its much more elaborate emphasis on the physical and social arenas that makes up the contexts of the story mediums, the notion of knowledge hyperstories is, thus, in some ways an expansion of "the ergodic". Knowledge hyperstories are more mediators for the practical and active involvement of people discussing important issues for improving practices, broadening understandings and enabling knowledge sharing. This involvement should be an iterative movement implying both "interiority" to the hyperstory (working out your paths in it) and "exteriority" to the story, that is, in face-to-face or online workshops discussing its content and possible implications and actions to be taken. It is in these senses we refer to the hyperstory as "knowing". Knowledge hyperstories may be thus depicted as rather "a machine for the production of a variety of organizational reflection". The knowledge hyperstories may thus be seen as an attempt to squeeze in-between and bridge Suchman's (1987) dichotomy between situated action and abstract representations. Knowledge hyperstories are, to a large extent, about organisational sensemaking (Weick, 1995). And it seems to be useful in the companies.

One of the weaknesses of our approach is, of course, that many of its features could only be interpretatively validated. That is, it is difficult or sometimes impossible to measure the effects of the initiatives, beyond the (inter)subjective accounts from the participants in the organisations. Following anthropological methodological practices, the most important source of validation is, apart from the research community, not the mapping towards a supposedly objective external environment, but the feedback given by the members of the organisations that have taken part, both in the projects themselves and employees outside the project groups.

Thus, we argue on behalf of the material exposed above, that knowledge hyperstories offers *situated* and "long-term" knowledge support and enabling—through ICT enhanced knowledge narratives (or practical storytelling/storytelling practice). As by now quite firmly established, you cannot *manage* knowledge resources (von Krogh, Ichijo, & Nonaka, 2000) in the sense you manage other kinds of resources. What you can do, however, is supporting and facilitating enabling conditions for knowledge sharing and creation. As argued by SINTEF, among others, storytelling as a natural human and social capacity and practice, offers powerful means of context-sensitive knowledge enabling in organisation, both with regards to tearing down barriers and triggering enabling factors. On the other hand, the impact of the ICT integration into more and more aspects of work life is beyond dispute. In several projects, some of them documented here, we have over time tried to focus on the potentiality of a powerful amalgamation between ICT and storytelling, for purposes of organisational development. We have thus displayed examples of such efforts, tried to show some of the challenges concerning *contents*, *forms* and *functions*, and argued for the possible constructive uses of ICT-enhanced storytelling for knowledge enabling—what we have conceptualised as knowledge hyperstories. Knowledge hyperstories, thus, comprise the focus on the use of ICT as a mediator and facilitator for a new type of purposeful, non-linear storytelling in organisations—coinciding the way natural human storytelling take place in practical work situations.

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