

**Learning in projects,
remembering in networks?
Communality, sociality,
and connectivity in
project ecologies**

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Project ecologies: knowledge production at the point of application¹

Knowledge, it seems, has become magic. The view of knowledge as most powerful engine of economic progress and competitive advantage practically is „the historical *a priori* of the age“ (Scarborough 2001: 204; see also Lindkvist 2003: 2). A polyphony of voices from different disciplines has grown to reiterate that our economy is shifting from primary and secondary production to an increasingly knowledge-intense service economy, pointedly dubbed the quaternary sector.

By moving away from this sectoral understanding of economic and societal transformation, Gibbons et al. (1994) stroke a different epistemological chord by focusing instead on the *mode* of knowledge production. The current transformation, from their point of view, appears as an increasing shift of the locus of knowledge production from the traditional (science-pushed) institutional framework to knowledge production in the *context of its application*. Each particular context of application implies its particular set of theories, analytical strategies and learning practices which can not easily be located onto the established disciplinary map. Trans-disciplinarity, heterogeneity and transience are quintessential organisational features associated with this mode of knowledge production (Gibbons et al. 1994: 6): „[P]eople come together in temporary work teams and networks which dissolve when a problem is solved or redefined. Members may then reassemble in different groups involving different people, often in different loci, around different problems.“ Welcome to the ephemeral world of projects.

Although this scenario shares some of the prophetic verve that echoes through the current heated debate on the different (semantic) variants of knowledge-based capitalism, projects indeed appear as an emblematic form of this mode of knowledge production (see also Boltanski and Chiapello 1999). Projects constitute a temporary organisational arena in which knowledge is combined from a variety of sources to accomplish a specific task (for the paradigmatic definitions, see Gaddis 1959: 89;

¹ I am indebted to Oliver Ibert for his reflections in the course of our joint field work in the Munich software cluster. I also owe sincere thanks to the participants in the Sub-theme 'Project Organizations, Embeddedness and Repositories of Knowledge' of the EGOS Colloquium in Copenhagen, 3-5 July 2003 for an exciting discussion of an earlier version of this paper.

Goodman and Goodman 1976: 89). The claim here is *not*, of course, that the spectrum of organisational forms just recently has been expanded with 'temporary systems' (Lundin and Söderholm 1995). Projects, in fact, are long-established routine in industries organised around 'one-off' ventures such as architecture, construction, engineering, shipbuilding or movie production (see, for example, Winch 1986; Faulkner and Anderson 1987; Lundin and Midler 1998). More recently, 'projectification' (Midler 1995), though, seems to have taken hold in a range of traditional industries in which it has not previously been part of the canonical repertoire of organisational forms like automobiles or chemicals (see, for example, Ekstedt et al. 1999; Lundin and Hartman 2000; Grabher 2002a; Bragd 2003); moreover, new industries like software, new media or business consulting *are* genuine project industries (see, for example, Perlow 1999; Grabher 2002c; Siedersleben 2003).

The practice of project-based organising is only captured insufficiently in the notion of the temporary system with 'institutionalised termination' (Lundin and Söderholm 1995). Projects, in fact, hinge on a dense fabric of lasting ties and networks that provide key resources of expertise, reputation and legitimisation (see Ekstedt *et al.*, 1999; Sydow and Windeler, 1999; Gann and Salter, 2000; Grabher, 2002a, b; Sydow and Staber 2002; Engwall 2003; DeFillippi, Arthur and Lindsay 2003; Scarbrough et al. 2003). The practice of temporary and episodic collaboration, phrased differently, relies on an intricate *project ecology* (Grabher 2002b; 2003; 2004) of enduring ties and institutions. The relationship between 'project' and 'project ecology', however, is not equivalent with the interrelation between 'organisation' and 'context'. In a similar way as with the image of the Greek vase (as in trivial perception tests in psychology), foreground and background can not be distinguished in an unequivocal fashion but rather switch back and forth.

The notion of the project ecology, in other words, signifies not just a passive institutional environment but denotes the networks and institutions that constitute integral ingredients in the practice of temporary collaboration (see also Scarbrough et al 2003). The intricate interdependencies between temporary projects and permanent ties and institutions, moreover, can hardly be conceived in terms of neat complementarities or mutual support (on 'critical' project management, see for

example, Bresnen 2003). Actors, networks and institutions within project ecologies rather adhere to diverse loyalties and logics that, symptomatically, beget conflicts of organisational imperatives and cultures and professional identities and ethos' (see Alvesson 2000; Swart, Kinnie and Purcell 2003). Project ecologies, in other words, do not only represent a particular ensemble of organisations and institutions temporarily tied together for the completion of a particular task. Moreover, the notion of the project ecology denotes also an ecology of organisational logics and individual identities, values and loyalties.

The challenge of project ecologies

The inherently complex and ambiguous nature of project ecologies thus incites a problematisation of some of the concepts and assumptions that, implicitly at least, seem to underpin current reasoning in economic geography. The paper aims to embrace the multiplicity (not to say hybridity) of logics and identities and thus seeks to dehomogenise conceptions of firms and networks in particular and to challenge assumptions on spatial scales and learning. In doing so, the paper wishes to follow the pleas for a decidedly non-essentialist perspective of geographic inquiry (Lee 2002: 340-341; Ettliger 2003; see also Massey 1997; Whatmore 1997; Dicken et al. 2001; Amin and Cohendet 2003). Such relational thinking recognises the multiplicity of logics and perseveres that identities are not pre-given essentials but constantly reshaped through a variety of internal and external influences.

Firms

In economic geographic analysis, the firm stills enjoys an ontological and epistemological privilege. Despite the invocation of districts, milieux, clusters and other meso-level socio-spatial aggregations, the firm epitomises the basic analytical building block. The integrity of this corner stone of inquiry remains largely untouched, the firm is rather universally invoked as an atomic crystallisation of commercial agency, universalised as a 'stylised fact' (Maskell 2001; Taylor and Asheim 2001). Resonating with classical accounts in economics and business studies (for example, Chandler 1990), the firm, in short, remains unproblematised as unitary and coherent actor (see also Schoenberger 1997).

Practices of knowledge creation, distribution and sedimentation in project ecologies perforate and entangle organisational boundaries in multiple ways. In the course of projects, the actual sites of learning cyclically shift between various organisations involved. Temporary collaboration thus undercuts the coherence and integrity of the firm as the basic analytical building block. The radical single-task focus together with the temporal limitation of projects privileges a *situative pragmatism* that blurs organisational boundaries within firms. Knowledge, in principle at least, is valued according to its usefulness to achieve the project task rather than to the authority of its departmental origin. Between firms, organisational boundaries of projects operating across different firms, in fact, are often more decisive as boundaries of the respective firms. The task orientation of knowledge-integration and production, as the paper seeks to elucidate, is reflected in the location of projects, literally, at the point of application: projects are placed *within* client-organisations or *at* the boundaries of co-operating organisations to afford a re-adjustment and collaborative accomplishment of the project goal *in situ* (Gann and Salter 2000: 957); conversely, projects are located off-site to maximise cultural and cognitive distance from the organisational 'home base' by means of geographical isolation to allow projects to unfold task-specific approaches (see, for example, Schoenberger 1999; 216; Zeller 2002; see also Bengtsson and Söderholm 2002).

Networks

The meso-level in economic geographic inquiry typically is conceived as a set of firms (and 'institutions') variably tied together through networks. Despite the prolific categorisation of different network patterns in economic sociology (for overviews, see Powell 1990; Smith-Doerr and Powell, 2003), networks in economic geography have remained somewhat under-theorised (see Ettliger 2003: 160-161). Elaborations of networks generally tend to stick with Granovetter's (1973; 1974) paradigmatic distinction between 'weak' and 'strong' ties – if networks are explicitly differentiated at all. Perhaps apart from productive explorations of actor-network theory that acknowledge the multidimensionality of actors and the multiplicity of network logics (see, for example, Bingham and Thrift 2000; Murdoch 1999; Thrift 1996; 1997; Whatmore 1997; see also Dicken et al 2001), economic geographic reasoning on

networks remains largely focused to the inter-organisational level. Thereby different social logics of networks of individual actors, groups and organisations are either systematically ignored or lower-level networks are unproblematically subsumed under higher level networks; inter-personal trust, for instance, is confounded with inter-organisational trust: 'the ecological fallacy' (Ettlinger 2003: 156).

Project-based organising involves a multiplicity of organisational and personal networks. *Networking*, in fact, signifies the emblematic mantra of project ecologies (Wittel 2001: 63; see also Sennett 1998). Personal networks symptomatically efface the distinction between private and business (Ekinsmyth 2002: 234; Heydebrand and Miron 2002: 1967), between the communicative logic in the 'life world' and the strategic rationality in the 'systems world' (Habermas 1981). In the fluid and transient world of projects, they fulfill multiple roles; they provide arenas of professional socialisation and enculturation (see, for example, Brown and Duguid 1996: 68-70); open up access to and careers in project labour markets (see, for example, Faulkner and Anderson 1987; Jones 1996; DeFillippi and Arthur 1998; Thompson and Heron 2003; Swart, Kinnie and Purcell 2003); and, more generally, rather than as 'pipes' function as 'prisms' (Podolny 2001) through which reputation of potential clients, collaborators and suppliers is inferred from their ties with third project partners (Sydow and Staber 2002; see also Uzzi and Gillespie 2002 on 'network transitivity'). These networks involve a variety of social and communicative logics, different time scales, and various modes of interaction. By exposing overlaps, conflicts and tensions between diverse networking practices, the paper seeks to move beyond somewhat schematic assumptions on the complementarity between 'weak' and 'strong ties'.

Scales

Economic geographic attempts to map the strong/weak-tie dichotomy onto spatial scales regularly results in an ascription of strong ties and social coherence to the local level while sparse networks rather are associated with the non-local realm (see Ettlinger 2003: 160). This socio-spatial duality explicitly or implicitly underpins the elementary anatomy of the 'territorial innovation models' (Lagendijk 2001) varyingly discussed as industrial districts, innovative milieux, clusters or learning regions that

are perceived as spatial manifestations of strong ties, linked to the global level through weak connections. This scalar nesting of social relations also provides the template for the geography of knowledge creation and transfer. Particularly in the learning region-debate, dense local patterns of local interaction reinforced through trust, social familiarity, institutional coherence and sense of local belonging were read as the vital economic assets for 'tacit' knowledge exchange while the sparse global networks were conceived as the pipes that convey 'codified' knowledge (see, for example, Lawson and Lorenz 1999).

More recently, this makeshift translation of the local/weak vs. global/strong-tie dichotomy into a local/tacit vs. global/explicit knowledge-duality, reified in the ceaseless piling up of case-studies on 'islands of innovation' (Amin and Cohendet 2003: 144) provoked severe objections that deny a *causality* between spatial scale and density of ties (see, for example, Harris 1998; Allen 2000; Oinas 2000; Ettlinger 2003: 161; Gertler 2003: 84-86). Profound dissent above all crystallised around implications of this geography of scalar nesting on knowledge creation and transfer.

By taking on the profound dissent on the 'self-evident truths' of the learning debate, the analysis of project ecologies eschews any simplistic scalar nesting of network density and knowledge types. It rather is sensitive to 'distanciated' ties that do not adhere to a spatial metric (Allen 2000: 28): "The translation of ideas and practices, as opposed to their transmission, are likely to involve people moving to and through 'local' contexts, to which they bring their own blend of tacit and codified knowledges, ways of doing and ways of judging things. There is no one spatial template through which associational understanding or active comprehension takes place. Rather, knowledge translation involves mobile, distanciated forms of information as much as it does proximate relationships." The paper thus seeks to follow the proposition for thinking about knowledge spaces *topologically* (Amin and Cohendet 2003: 154): "... where the folds and undulations of lines drawn as contours bring into close proximity sites that might appear distant and unconnected on a linear plane, and which allow the possibility of no relational links between co-located sites ... thus allowing an understanding of individual sites as a node of multiple knowledge connections of varying intensity and spatial distance, as a place of trans-scalar and non-linear

connections, and as a relay point of circulating knowledges that cannot be territorially attributed with any measure of certainty or fixity.”

Learning

Against the fixation with learning in and through dense local networks, a persistent stream of accounts insists in the role of sparse networks and indirect ties on the local level (see, for example Storper 1997; Oinas 2000; Malmberg and Maskell 2002; Grabher 2002b; see also Burt 1992). Nevertheless, however, the more recent turn to the ideas of learning in and through ‘communities’ (see, for example Gertler 2003; Amin and Cohendet 2003) that imply a strong sense of coherence, familiarity and stability might privilege, although entirely unintended, yet again a privilege of the long-term over the serendipitous and accidental in the learning debate. The paper seeks to follow on from the accounts that insist in the crucial role of sparse and indirect ties for learning processes and, in a sense, radicalise this perspective.

More specifically, the paper seeks to contrast two project ecologies which are driven by opposing logics of creating and exploiting knowledge. The key imperatives in the first ecology are *accumulation* and *modularisation* of knowledge. Knowledge practices in this ecology are rooted in the fundamental association between learning and repetition: repeated cycles of interaction within the organisation and between the organisation and the environment form a central base of learning (see also Hedberg and Wolff 2001). Project-organising in this ecology is geared towards moving from the singular one-off venture to repeatable solutions (see also Davis and Brady 2000, 2003). The cumulative logic of this ecology will be exemplified with software production in Munich that has evolved as a pre-eminent (continental) European cluster in the production of business software (enterprise resource planning, customer relationship management, Internet-related business tools, software engineering tools and document management) (Lehrer 2000: 591; Tamasy and Sternberg 2000; Bain & Company 2001; Casper and Glimstedt 2001; Casper and Whitley 2002).

The logic of accumulation and continuity in this cluster will be juxtaposed with an ecology that is organised around the imperatives of *originality* and *rupture*. Although,

of course, learning by repetition also plays an important role in this ecology, 'learning by switching ties' both within and across organisations (see Dornisch 2002) provides the emblematic knowledge practice in this ecology. Whereas the first ecology economises on the benefits of recurring ties, the latter thrives on reconfiguring relationships. The overarching demand for originality minimises the scope for repeatable solutions. Convention defying is encouraged, as a convention (Nov and Jones 2003: 9). The London advertising cluster epitomises the workings of such a one-off project ecology. London during the late 1980s had emancipated itself from the hegemonic US American industry through a new style of organising production which made London a prime cluster in creative advertising (Lash and Urry 1994, pp. 138-142; Grabher 2001a, 2002b).

By way of contrast, the paper subsequently not only unfolds an ecology of organisations, networks, and communities but also an ecology of social and communicative logics, organisational identities and professional ethos'. Both project ecologies intricately interweave two social layers. The first layer comprises the *core team*, the *firm* and the *epistemic community*, it is primarily concerned with more deliberate knowledge creation focused on the particular project task; in the second layer of the *awareness space* which evolves through various networking practices learning in contrast is more accidental and less centred on the specific project. In elucidating the interrelations within and between these layers the paper seeks to avoid the functionalist perspective inherent in the normative project management literature (see Hodgson 2002). Instead of portraying the interdependencies between the constitutive realms of the ecologies in terms of neat complementarities, the discussion will also explore tensions, conflicts and paradoxes.²

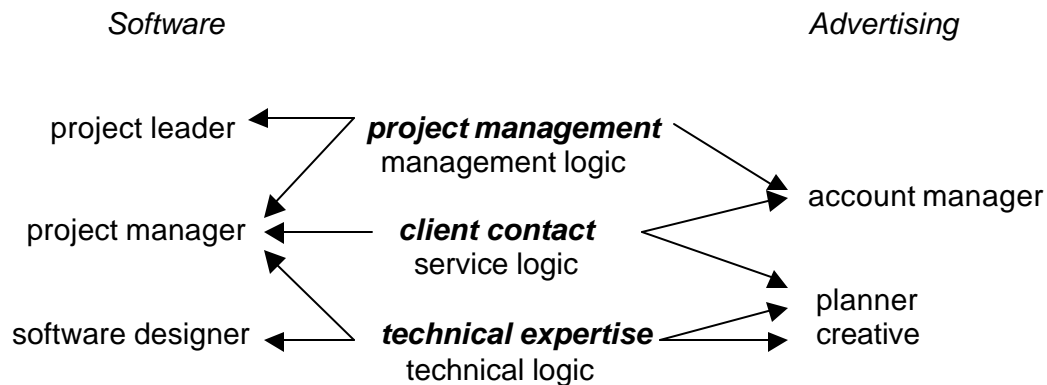
² In methodological terms, the paper draws on the findings of two qualitative research projects on project-based organising. The account on the advertising ecology is derived from 78 semi-structured interviews in advertising agencies and collaborating film- and post-production companies which have been conducted in Spring 1998, Summer 2000 and Summer 2002 in central London. Information was supplemented by a variety of secondary sources including interviews with representatives of the Institute of Practitioners in Advertising (IPG) and the Account Planning Group (APG) and data from industry reports, trade press, business reports, and press releases. The portrayal of the software ecology draws on data gathered in 24 semi-structured interviews in Munich software firms that were conducted by Gernot Grabher and Oliver Ibert between Spring 2003 and Summer 2003 in the context of the project 'Production in Projects' funded by the German Research Foundation (DFG). The somewhat asymmetric empirical base of the paper inflicts two substantive caveats. Firstly, whereas the material on the software ecology reflects a first and

The core team

Abstracting from the idiosyncracies of the production process, projects both in the London advertising and the Munich software ecology are evolving around a 'core team' (see also Dubé 1998; DeFillippi and Arthur 1998). Each of the team members not only contributes a different set of skills to the project but also embodies a specific professional ethos and project logic. The practice of project organising involves an ongoing recombination of these skills within project parameters and in both clusters shares some generic features.

The service logic of solving a specific problem of the client is, or at least ought to be, the prime logic of a project. This client-specific task, regardless if this involves the improvement of the billing system or the promotion of a product re-launch, marks the point of departure of the project. The latter has to be taken literally since in the course of the project, symptomatically, problems get redefined and tasks renegotiated. This 'scope creep' (Jurison 1999: 33; Lannes 2003: 337; see also Girard and Stark, 2002: 1940) has to be balanced against the management logic of the project which aims at keeping the project within key parameters such as time and budget. The fragile balance between the service logic (of solving the client's business problem) and the management logic (of keeping the project on track), in a sense, provides the organisational co-ordinates within which the logic of the 'technical' expertise can unfold.

most recent snap-shot, the account on the advertising ecology is distilled from research stretching over several years. Secondly, the comparison of both *sectoral* ecologies reverberates, to some extent, differences in *national* practices and institutions. While the latter issue in particular has to be addressed in subsequent papers, the chief aim of this paper is *not* to provide an idiographic historical-geographical account of the Munich and the London cluster. At issue in this paper are rather the systematic differences between the stylised versions of disruptive and cumulative modes of project-based learning which are illustrated against the background of both ecologies.

Table 1: project roles and occupations

These generic imperatives of project organising, of course, are embodied in and balanced by different trade-specific professional profiles and occupations (see table 1; on software, see Ibert 2003a; Beer 2003: 31; Scheidle and Teubner 2003: 7-8; on advertising, see Grabher 2002b: 248; Nov and Jones 2003). Each professional profile epitomises a specific work ethos which implies a certain ‘cognitive distance’ between these professions (see Noteboom 2000). Meaningful interaction and fruitful collaboration across cognitive distance, of course, is possible as long as the participants can make sense of each others perspectives. In both project ecologies, however, cognitive distance is enacted in fundamentally different ways (on enactment, see Weick 1995). Whereas the interactions and practices of the core team in the software ecology are geared towards *reducing* this cognitive distance, project organising in advertising rather is aimed at reproducing and temporarily *bridging* cognitive distance.

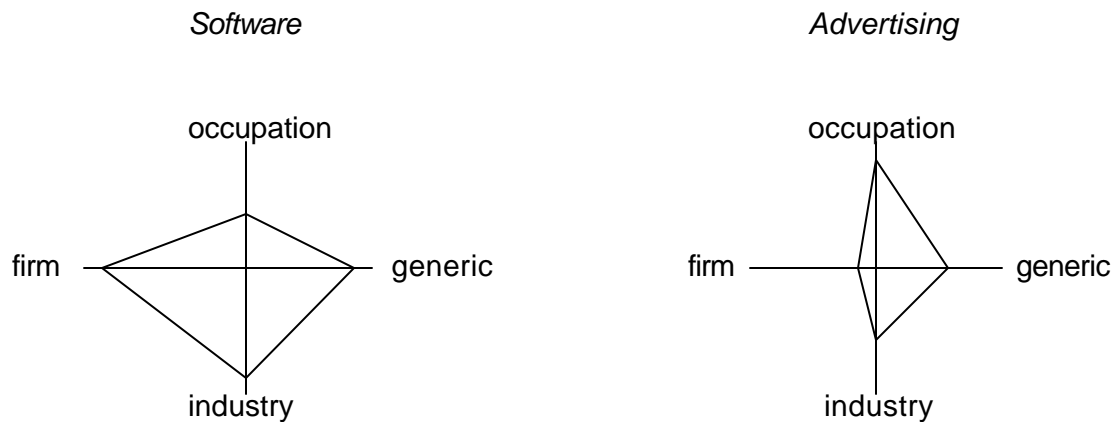
The organisational repertoire to reduce cognitive distance in the software ecology comprises a range of organisational practices and conventions. Firstly, professionals in the course of their careers, sometimes even in the course of a project switch roles. “There are no clear-cut categories of software workers, such as designers, coders, and testers. Designations do not provide job descriptions in the organizational structure ... job description is ambiguous” (Ilvarasan and Sharma 2003: 3). The practice of switching roles is also facilitated by non-discriminating training: candidates with graduate degrees in engineering and technology (in a broad range of disciplines) or post-graduate degrees in informatics, mathematics and statistics typically are

selected by firms for a broad array of jobs and roles. Further training and learning within the firm, likewise, is practically non-discriminating between the various roles. Consequently, professional identities in the software ecology overlap and interpenetrate each other (Solingen et al. 2000: 969).

Secondly, the composition of core teams characteristically remains stable over several project cycles. Collaboration within the team, over time, thus evolves from an interaction between professional roles to relationships between individuals. Collaboration in the project, generally, seems more strongly moulded by the service-logic of *joint* problem solving than by the particular professional ethos'. The collaborative ethos that harshly clashes with the cliché of the red-eyed, antisocial coder hidden in a silent cubicle is, quite literally, taken to its extreme by the new approach of 'extreme programming' (XP). The '12 commandments of XP' (Baer 2003: 124-127; Lannes 2003: 329) request, amongst others, to "meet with coders, managers, and the customer each week to schedule the next phase" and to exclusively "write all code with two programmers at one machine".

In the advertising ecology, in contrast, professional identities crystallise into 'creeds' whose distinctiveness is reiterated through organisational practice and professional styles (Bilton and Leary 2002: 56-57; Grabher 2002b: 248; see also Nov and Jones 2003). Professionals hardly change roles within the core team (if they change role it is rather switching from the agency to the client side of the business; see also Blyler and Coff 2003: 681). Although professionals are recruited from a broad range of educational and biographical backgrounds, further training appears more discriminating between different roles and occupations since it is rather provided by professional associations (like the Account Planning Group) than by individual agencies. More generally, the occupation-centred knowledge accumulation on the individual level in the advertising ecology thus contrasts with a more firm- and industry-oriented knowledge formation in the software ecology (see figure 1). The comparatively sharp crystallisation of activities into professional profiles, paradoxically, provides the context for fluid practices of productive improvisation since it affords (on the idea of 'affordance', see Gaver 1996) structuring and re-structuring on a moment-to-moment basis (see Bigley and Roberts 2001: 1282).

Figure 1: Knowledge formation



Inspired by Scott Snell's intervention at the Academy of Management Meeting (Seattle, 2003).

Moreover, the personal composition of teams is deliberately altered from time to time to trigger novel and unexpected confrontations of different perspectives, in other words, to maintain cognitive distance. Since interactions within the team are, comparatively speaking, more strongly shaped by professional identities and roles than by individual identities and the project aims, the drift towards a hegemonic perspective is kept in bounds. In this sense, the overarching imperative of freshness (see, for example, Wells et al. 1998: 381) conflict with normative project management that demands to sacrifice professional identities for the project goal. The creative success of projects thus, paradoxically, entails a deliberate violation of key principles of project management.

The firm

Economies of repetition

In both ecologies, firms experiment with, develop and adopt routines that are aimed to enhance and accumulate 'project capabilities' (Davies and Brady 2000; Brady and Davies 2003; see also Prencipe and Tell 2001; Scarbrough et al. 2003). On a more tactical level, firms seek to transfer knowledge and experience gained in a particular

project to subsequent and related bids and ventures. This type of *project-to-project* ranges from rather unsystematic and ad-hoc transfer of 'front-line' knowledge to other projects to more routinised practices such as meetings, documentation, and 'knowledge brokers' (Hargadon 1998). On a more strategic level, firms in both ecologies also seek to transfer and sediment knowledge through *project-to-business* learning. These attempts resemble efforts to increase organisational reflexivity by complementing 'single-loop learning' (Argyris and Schön 1978) around individual projects with 'double-loop learning' related to processes, routines and practices more generally. The shift from project-to-project to project-to-business learning also marks the move from the *project* to the *account* and, in other words, from the one-off to the client *relation*.

In both ecologies firm-specific best practice is codified in *tools* which provide menus for risk assessment, costing, project-design, scheduling and contractual agreements.³ Moreover, firms aim at reinforcing and extending the reach of codified tools with (less codified) *culture*. While tools represent a kind of 'blackboard memory'⁴ (Lundkvist 2003: 16), culture embodies a distributed 'network memory' (see also Mintzberg 1979; Girard and Stark 2002: 1934-1936). Corporate culture in both trades is coloured by idiosyncratic personal constellations, though less visible around the founders in the software ecology but much more palpable in the advertising ecology around the 'stars' and their particular style.⁵ Whereas cultures in the software environment are moulded by the culture of client industries (software providers of media firms, for example, organise differently than suppliers to engineering companies), the cultures in advertising are reflecting agency-specific priorities of different professions and their respective ethos' (for example, 'emotional' Ogilvy & Mather vs. 'scientific' J Walter Thompson). Finally, *stories* about both, the firm's own identity-forming 'historical' projects as well as seminal external success (or flop)

³ Although the actual practice of projects symptomatically seems to deviate from these best-practice procedures, they play an important role in acquiring new projects in signalling method and transparency to the client (Lundkvist 2003).

⁴ Vast 'blackboards' indeed: These manuals on firm-specific best practice might, as in one of the interviewed large software firms, pile up to 14 massive volumes of documentation.

⁵ A most blatant manifestation of this highly personalised understanding of the firm are agency names that typically combine the founders' names like, for example, Bogle, Bartle, Hegarty.

stories shape project practices since their circulation is driven by a certain 'moral' (Lampel and Jha 2003: 9). This moral often translates into prescriptions or principles of project organising.

Economies of recombination

While in both ecologies project-to-project and project-to-business learning allows firms to reap 'economies of repetition' (Davies and Brady 2000), only the software ecology benefits from *economies of recombination*. These economies emanate from the ability to balance the contradictory demands of offering a problem-specific solution to the client and yet, at the same time, to reuse and sediment project knowledge into 'modules' that can be recombined in subsequent or related projects. Modules epitomise the proverbial 'black box', a component that produces a particular output from a certain input whilst the internal functioning remains largely irrelevant (see, for example, Brusoni and Prencipe 2001). "Even service-oriented producers of customized software have an enormous incentive to specialize on a particular kind of customer application that will enable them to reproduce their previously accumulated know-how, algorithms, and even sections of their computer code" (Lehrer 2000: 594; Stützle 2003).

Economies of recombination, phrased differently, accrue from *not* offering one-off solutions in the strict sense of the word. On an ad-hoc project-to-project level, they flow from bricolage, that is the creation of novel combinations of familiar elements and by-products from previous projects. Such tinkering involves processes that range from serendipity of accidental discovery to imitation and the painstaking efforts of trial and error (see also Heydebrand and Mirón, 2002: 1962-1965). On a more strategic level, firms realise economies of recombination by engaging in a process of moving from first-of-its-kind projects to the execution of portfolios of related projects (see also Davies and Brady 2000: 952). This move widens the scope for reuse in the sense of increasing the 'utility' (by enhancing intelligibility, availability and ease for modification) and/or 'variability' of code (by boosting adaptability and portability to different application contexts) (Stützle 2003: 191-194).

In the Munich ecology, organisational routines and processes to systematically reuse components are basically confined to a 'library model' (in which centralised libraries of components are managed by reuse specialists; see Fichman and Kemerer 2001). Basically only large corporations offer their repository in a, so to speak, crystallised version of a *product*, that is a standardised software programme. However, even for firms who specialise in products (that is who embark on the business route of shifting 'boxes'), projects remain of vital importance. Projects provide crucial learning opportunities to refine products (i.e. simplify them for the user) or to broaden the domain of their applicability (see Fichman and Kemerer 2001). Projects, in other words, are the R&D-labs of firms who specialise in products (see also Crnkovic and Larsson 2002: 208).

This logic of reuse and sedimenting knowledge into modules in the software ecology is diametrically opposed to the overarching imperative of freshness in the advertising ecology (Nov and Jones 2003). The quintessential demand for originality limits the scope for reuse and modularity on the level of the creative product to an absolute minimum, at least in principle. Although agencies seek to differentiate themselves from their main competitors through a particular aesthetic and a specific 'way of doing things', they somewhat paradoxically also desperately endeavour to avoid a particular 'house-style'. The aim is to be distinct and yet not to be predictable since this would limit the market to exactly a single customer.

The epistemic community

The actual locus of knowledge production, of course, extends beyond the boundaries of the firm and involves communities "[w]ho are in contact with the environment and involved in interpretive sense making, congruence finding and adapting. It is from any site of such interactions that new insights can be coproduced" (Brown and Duguid 1991: 53). Deliberate knowledge creation more specifically ensues in 'epistemic communities' (Knorr Cetina 1981, 1999). Epistemic communities are organised around the specific project task and a mutually recognized subset of knowledge issues. They are governed by a procedural authority endowed internally or externally to fulfill the goal (see Cowan, David and Foray 2000). Within an epistemic community, agents are bound together by their commitment to enhance a particular

set of knowledge. Individuals accumulate knowledge according to their own experience and validation is made according to the procedural authority: what is evaluated is the contribution of the agent to the cognitive goal with regard to the criteria set by the procedural authority (Amin and Cohendet 2003: 123).

This understanding of epistemic communities might, indeed, more aptly depict organisational practices in the cumulative learning regime of the software ecology in which committed, enduring and close ties prevail. The very notion of 'community' however, connotes with a level of persistence, familiarity and intimacy that appears rather alien to the relentlessly shifting advertising ecology (see Lindkvist 2003; see also Swan, Scarbrough and Robertson (2002: 482-484) on 'communities of practice'). The concept of the epistemic community evokes a sense of order and coherence that not only seems absent but even not desired in the originality-fixated advertising ecology. The 'staged' antagonism and transience of ties in the disruptive learning regime more appropriately might be phrased in terms of an *epistemic collective* (analogous to Lindkvist's (2003) idea of the knowledge collectivity).

Although, of course, organisational knowledge and routines inform the division of labour in the epistemic collectives of the advertising ecology as well, *individual* expertise and creativity enjoy, or at least strive for, unchallenged primacy. The distributed knowledge and learning within epistemic collectives resembles an 'undeveloped group with developed mind' (Weick and Roberts 1993): although the short-project cycles prevent epistemic collectives from evolving into coherent communities with shared values, they nevertheless are sufficiently connected through extended indirect and latent ties to behave 'as if' they were a group (Weick and Roberts 1998: 118). While learning in the epistemic community is embodied in a continuous process of organisational socialisation, individual learning in the epistemic collectives is rather driven by goal-oriented problem solving. However, despite their different social logics and temporal scales, epistemic communities as well as collectives extend beyond the firm to involve the same set of actors, that is clients, suppliers, and corporate groups (see figure 2).

Clients

In both ecologies, clients of course play a central role in knowledge production that is not confined to initiating and sponsoring the entire venture. Both ecologies are intrinsically driven by the strategic goal to transform a *single project* into a *lasting relationship* that is into an account (note, it's the *account* and not the *project manager* in advertising). In both contexts, projects thus are strongly conceived as strategic pivots from where to leverage a continuous stream of business. As a consequence, the calculation of projects follows firm-specific rules of cost coverage in a less rigorous fashion if they, potentially at least, open the door to a lasting client relation. Apart from sharing the interest in transforming projects into relationships, however, both ecologies rely on practices to 'lock in' clients that differ in kind and in intensity.

Although profound client involvement is a key feature of project ecologies more generally (see also Iansiti and Clark 1994), in the Munich software ecology user participation appears particularly deep (see Lehrer 2000: 592). In fact, the extent of user or client involvement ranks on top of the determinants of successful project completion (see, for example, Beer 2003: 22).⁶ Software projects frequently are carried out on-site in ongoing conversation with the IT units as well as the end-users in the client's organisation (Beer 2003). Again, the approach of 'extreme programming (XP)' is pushing client involvement to its limits by involving an 'onsite customer' (Baer 2003: 129) by demanding to "include a real, live user on the team, available full-time to answer questions." By embracing the client into the simultaneous engineering of different project teams, the discursive pragmatics of 'collaborative engineering' unfolds (Neff and Stark, 2003; see also Heydebrand and Miron 2002: 1963; Jeppesen 2002).

The intensity of client involvement is propelled by the inherently systemic character of software. The client's expectations and ideas, although specified in the brief, typically crystallise into more concrete specifications not before the project process has yielded some interim variants (Beer 2003: 29). And as the software becomes more complex in the course of the project, so do the implications of even seemingly simple changes that ramify throughout the entire client organisation and its 'legacy system'

⁶ SAP, for example, currently is restructuring its R&D of 8400 staff from an organisation along product lines to one based on key client groups (*Süddeutsche Zeitung*, 29 July 2003).

operating on older platforms of controlling production, purchasing, billing or data storage (see Keipinger 2003).

Even within shorter project cycles and despite elaborate 'change request'- and 'change control'-tools (Lannes 2003: 336-337) project specifications as a consequence are 'racketing up' (Jurison 1999: 33; see also Girard and Stark, 2002: 1940). Such 'scope creep' notoriously puts pre-calculated plans of resource allocation at risk. Nevertheless "[m]ost software engineers understand that freezing is an undesirable action because it means commitments to a set of requirements which are obsolete upon delivery of the system" (Bourque et al. 2002: 67). Viewed from a more strategic point of view, however, scope creep might not only benefit the usefulness of the software (see also MacCormack 2001). It also could open up prospects for turning the single project into a lasting tie (Casper and Whitley 2002: 24). The repertoire for this sort of *strategic scope creep* (that is to *deliberately* 'lock in' clients by increasing interdependencies) in software is wide and ranges from training of the client's staff, stand-by advice through a hot-line to technical maintenance, including regular up-dates and de-bugging.

The less intense client involvement in advertising is interrelated with lower degrees of technical and organisational interdependencies of the project output with the existing business of the client. Of course, campaigns and 'brands' developed by advertising agencies have to correspond with key features of the client's organisation and culture. Such interdependencies, however, are more an issue of interpretive plausibility than of technical compatibility. The leeway for strategic scope creep, consequently, in advertising is much more limited in general and confined to establishing personal trustful relationships. In a context in which interaction resembles less the 'facts-and-figures'-exchange of business parlance but is strongly coloured (quite literally) by individual taste and aesthetic preferences, trust in the (style-) 'expert's judgement and advice is of considerable value.

Trust does not equal involvement, however. Rather to the contrary, high levels of trust afford lower degrees of channelling and controlling the creative process. Trust, amongst others, is nurtured through a practice that in advertising is referred to as 'educating clients' (see also Quinn 1999: 33). This practice encompasses, besides

defining basic standards for the aesthetic dimensions of the project task, clarifying the division of labour that is rooted in mutual respect for professional competencies. Whereas client involvement in software is strongly driven by the necessities and (leveraged opportunities) to integrate the project output into organisational and technical 'legacy systems' or 'neighbourhood systems', client participation in advertising is limited by the creative ethos that demands, at least temporary, autonomy and independence from the interference of clients who symptomatically associate creativity with risk (see also Bullmore 1999).

Suppliers

The different degrees of client involvement, in a sense, correspond with inverted roles of suppliers, i.e. the higher degree of client involvement corresponds with a relatively smaller scope and lower intensity of ties with collaborators in the software ecology. While larger product-oriented corporations rely on supplier networks for recurring cycles of client-specific adaptation and implementation, smaller projects-only-specialists seem to prefer in-house solutions vis-a-vis extended supplier networks. In fact, free-lancing typically is derogated as 'body-leasing' and the renunciation of external suppliers is integral part of the corporate culture, as unequivocally stated in the company profile of a medium-sized project specialist: "Corporate policy was and is not to pursue body-leasing ... [this firm] exclusively relies on permanent staff since only they fully identify themselves with the company. Freelancers in contrast are first of all companies of their own". The consequent low supplier involvement seems strongly driven by the seize of projects. Although the average seize of software projects in the Munich ecology varies considerably, projects like the development of a global ordering system for DaimlerChrysler can demand of up to 200 and more staff years.

The modularisation of projects as well as the analytical professional ethos favour a partition of jobs and responsibilities among project collaborators that resembles orchestration in the sense of a comparatively clear assignment of jobs and responsibilities and exact timing. Due to the seize and technical complexities of projects (see also Fichman and Kemerer 2001: 58), a high premium is put again on continuity. Long-term collaboration with a relative stable set of suppliers in addition,

of course, not only lowers transaction costs but also afford interactive learning processes that benefit the subsequent maintenance and up-grading of software which has a lifespan of up to 10-15 years (Siedersleben 2003: 1).

In contrast, the evolution of extended supplier networks in the advertising ecology are not driven by the mere seize of projects but rather by the diversity of skills involved. Whereas the participation of *technical* specialists follow similar principles of hierarchical synchronisation and modularisation of tasks, collaboration with *creative* professionals involves turbulence, ambiguity and ongoing 'redistribution of improvisation rights' (Weick 1998: 549). The analytical and methodological ethos in the software ecology stands out against a creative culture epitomised in the morale of "as long as the show was on time, it was not important how it was achieved" (Hartmann et al., 1998: 272).

Collaboration with creative suppliers thus, rather than orchestration, mimics features of (jazz) improvisation, a 'prototype organisation' designed to maximise innovation (see Hatch 1999; Grabher 2001: 367-369). Improvisation, essentially, implies a deliberate interruption of habit patterns and resistance to the temptation to become locked in to routines of past success, thereby squelching experimentation. One of the most widespread practices in improvisation is 'taking turns' that is swapping back and forth the roles of soloing and supporting other soloists thereby rotating 'leadership'. Like jazz bands vary their composition of instruments and players, ties with suppliers are reconfigured from project to project around a relatively stable set of core relationships. This variance in composition reflects, on the one hand, obvious particularities of a specific project. On the other hand, collaborative ties with suppliers are deliberately interrupted or terminated for the sake of the overarching imperative of freshness (see also Usai, Delmestri and Montanari 2001). The contrasting logics of learning in both ecologies here play out as the opposition between the common-sense '*never change a winning team*' and the challenge to '*a/ways change a winning team*' (see Mayer 2002) to enhance 'learning by switching' (Dornisch 2002).

Corporate groups

The knowledge practices, more and more, are moulded by the corporate groups to which both ecologies increasingly become tied into. The role of large corporate groups in both ecologies defies any straightforward mapping onto a 'global' versus 'local' geography since the groups embody and signify both, indigenous ties as well as exogenous connections (see also Amin and Cohendet 2003: 163). The prime concern here, rather than on the disentangling of geographical scales, lies with the different modes of corporate affiliation and their bearing on knowledge practices in both ecologies.

In the software ecology the importance of corporate groups is immediately obvious through the presence of truly global software brand names like SAP, Oracle, and first and foremost, Siemens, *the* incubator of the Munich high-tech agglomeration. Their role in the Munich ecology is not only based on ownership or financial control but also on the Archemidian pivots of the software business more generally, that is compatibility and standards (see also Casper and Glimstedt 2001). Beyond direct ownership, smaller firms are often tied to corporate groups through licence agreements. These arrangements, in their more visible dimension, primarily refer to the distribution and client-specific adaptation (of a certain range) of the product portfolio of the large corporations in the context of recurrent projects.

Licence agreements thus generate cycles of learning, or at least sporadic feedback, from the frontline of application projects to the sedimentation of process knowledge and the refinement of corporate tools and of substance knowledge through the evolution of the product portfolio. This continuous inflow of corporate methods, standards and tools yields some positive reputation effects in the software ecology, in which the label 'Oracle approved / Oracle authorised', for example, facilitates access to clients. In a similar vein, ownership ties to large corporate brands in the consulting or financial sector are perceived as beneficial for the esteem and standing of software firm.

The significance of the large corporate domain in the advertising ecology is far less perceptible (and deliberately so), albeit it impacts likewise in fundamental ways on the knowledge practices. More and more agencies in the Soho ecology are tied in more or less direct forms of ownership control into the global corporate networks of

the three leading communication groups, Interpublic, WPP, and Omnicom (see also Nachum and Keeble 1999; 2000). Since corporate affiliation often is limited to financial control, they provide only comparatively narrow channels through which corporate tools and cultures diffuse into the ecology and project experience is fed back into the corporate network. Although corporate groups, like WPP for example, set up 'knowledge communities' which share non-confidential insights and case-study evidence (WPP Group Navigator 2002; WPP Annual Reports 2001, 2002), the scope for post- and cross-project learning within the corporate network is considerably smaller, not least due to the pronounced variety of (agency-)cultures and styles within these groups.

Whereas the corporate groups in software crystallise primarily around products, they evolve rather around clients in the advertising ecology. The key rationale of corporate groups in advertising is to enhance the ability to provide clients with services on a global scale and in a cross-disciplinary fashion including the entire spectrum of communication services (Leslie 1995; Grabher 2002b: 256). While involvement with a group extends both the range of modules and the portfolio of skills for software firms, it merely expands the portfolio of skills and professions from which advertising agencies can compose core teams.

Although the organisational backing of one of the major corporate groups enhances the business reputation and hence facilitates the transformation of projects into lasting client ties, the association of an agency with one of the 'Wall Street behemoths' impacts negatively on the creative reputation. For creatives, the efficiency-driven manuals and standardised corporate tool-kits for project organisation inevitably thwart the creative process which not only demands distance from client interference but also from uniform corporate organisational principles (see, for example, Shelbourne and Baskin 1998).

The awareness space

Epistemic communities and collectivities are built around actual production networks that, in a sense, embody the 'plumbing' of the project ecologies (see also Podolny 2001, Owen-Smith and Powell 2002). Each project prompts a reconfiguration (in

software a minor, in advertising a more significant one) of the 'pipes' through which resources are conveyed to achieve the specific project aim. Project ecologies, however, also enact an awareness space that extends beneath and beyond the manifest pattern of the actual production networks. Project ecologies thereby co-produce their knowledge environment (see Weick 1995: 30). Whereas the core teams, firms, and epistemic communities have organisational boundaries and a perceptible inside and outside, awareness space does not; it is an open environment.

Although the awareness space unfolds its distinct geography, the paper once more aims to eschew a straightforward local-global dichotomy (see also Amin and Cohendet 2003). The attempt to explore the awareness space, consequently, is not intended to evoke a *geographical* scaling of knowledge practices but essentially seeks to identify different social logics of diffuse learning that rather epitomise different degrees of embeddedness and varying combinations of strategic and communicative rationality. The proposed social and communicative logics, of course, do not epitomise arithmomorphic concepts, nor are they mutually exclusive but rather interpenetrate each other. Nevertheless, diffuse learning in both project ecologies seems to adhere to qualitatively different principles that, in a first approach, resonate with Tönnies' (1979) paradigmatic distinction between *Gesellschaft* and *Gemeinschaft* (see Wittel 2001; see table 2).

Communality

The notion of communality signifies networking that involves long-lasting, intense and thick ties, in which the private is at least as strong as the professional dimension. Relations are based on mutual experience, common history or narratives. Communality typically originates through shared experience at school or university and evolves into enduring bonds that embrace mutual acquaintance with families and friends of particular network members. Most importantly, the social realm of communality affords a key condition for the evolution of trust, that is the duration of 'linear time' (Sennett 1998, see also Bauman 1996:51).

Table 2: Stylised features of the awareness space

	Communality	Sociality	Connectivity
	<i>software</i>	<i>advertising</i>	<i>software</i>
Nature of ties	lasting, intense	ephemeral, intense	ephemeral, weak
Character of Communication	private <i>cum</i> professional	professional <i>cum</i> private	professional
Embeddedness	high	moderate	low
Substance	narration	knowledge	information
Governance	trust	swift trust	peer recognition
Focus	relationship-oriented	career-oriented	task-oriented
Socio-spatial Metaphor	'neighbourhood'	'city'	'(virtual) club'
Medium	face-to-face	face-to-face	virtual
Social practice	'staying in'	'hanging out'	'logging on'

Although communality, of course, is present in both ecologies, it appears of higher relevance in the software ecology. The cumulative learning regime in software translates into comparatively long affiliations with firms which in turn reduce the likelihood that network ties with former colleagues from university days, current work-mates or long-term clients are disrupted by inter-firm and inter-regional mobility. Communality in the software cluster epitomises the coherence of a *neighbourhood*,⁷ and socialising typically is confined to *staying in*.

Network communality is strongly moulded by the private dimension and 'communicative rationality' and yet it is also instrumental in the project ecology. Its functions relate less to enculturation and (project-)skill formation (this is afforded

⁷ I owe the idea of neighborhood to Oliver Ibert.

primarily by the epistemic community) nor to the acquisition and juggling of projects (this is mainly achieved within the firm). Network communality rather provides a sounding board for contemplating career decisions, discussing conflicts within the core team, exchanging experience with specific tools and methods and reflecting on technical and organisational issues beyond the day-to-day project frenzy.

Sociality

In contrast to the thick and lasting relations in communality, the notion of sociality emphasises *ephemeral, yet intense* networking (Wittel 2001: 51). In sociality, social relations are less 'narrational', that is they are less based on mutual experience or a common history but primarily on an exchange of knowledge and on 'catching up' (see also Kotamraju 2002). Linear time in sociality is partitioned into 'serial time' defined by cycles of (comparatively short) projects, contracts and firm affiliations. The shorter project cycles hardly leave time to develop personalised trust based on shared experience, familiarity or social coherence. Instead, sociality involves 'swift trust' (Meyerson, Weick and Kramer 1996) which, most importantly, is category-driven trust; network members deal with one another more as roles than as individuals.

Although sociality, very much like communality, pervades both ecologies, it is the archetypal form of networking in the advertising ecology. The disruptive knowledge practice of learning by switching (teams, agencies, suppliers, clients) here renders an ongoing re-wiring of relationships and swapping of jobs and projects. Sociality signifies an immediate intersubjectivity (Wittel 2001: 51) that is integral to Koolhaas' concept of the 'generic city' (OMA et al., 1995). The socio-spatial metaphor of the neighbourhood in communality contrasts with urbanity in sociality; diversity of contacts, serendipity of encounters, accidental interaction, 'noise' (Grabher 2002b) and exposure to strangeness (Simmel 1950; see also Ibert 2003b) take the place of social coherence; the social practice of *staying in* in communality contrasts with the convention of *hanging out* in sociality; whereas hanging out in the city stimulates *creation*, staying in the neighborhood benefits *re-creation*.

Even though sociality also intricately blends communicative and strategic rationality, the instrumental dimension seems to prevail. In fact, networks are to some extent

commodified (Wittel 2001: 56): contacts with blue-chip clients or in-vogue creatives are 'stored', 'exchanged' and - as trade parlance reveals - even 'stolen'⁸. Sociality, indeed, fulfils indispensable functions in the advertising ecology. Firstly, hanging out is an essential practice for enculturation and for acquiring the codes and 'habitus' (Bordieu 1977) of the trade (which is less afforded here by the firm). Secondly, sociality provides critical information of job opportunities for the nomadic project worker as well as on pending accounts and thus on potentially up-coming projects (see also DeFillippi and Arthur 1998; Ekinsmyth 2002; Blyler and Coff 2003).

The significance of such information is indicated by the contents of the leading British trade journal, *Campaign*, that prominently features the movements of key professionals within the ecology as well as speculations about expected splits between clients and agencies throughout the first pages of each issue. Instead of knowledge *in* firms, sociality helps to generate knowledge *about* firms and potential collaborators, their availability and reliability as well as other critical project skills (which are not certified in degrees) (see Brown and Duguid 2000: 20). Thirdly, sociality provides a sounding board for interpreting and de-ciphering the surrounding 'noise' of rumours, impressions, recommendations, trade folklore and strategic misinformation. And finally, the frenzied sociality seems imperative for keeping a certain work 'pace' and 'rhythm' in the pulsating advertising ecology (on the essential role of pace and rhythm in project work, see Bragd 2003: 9; English-Lueck, Darrah and Saveri 2002: 96).

Connectivity

The concept of connectivity denotes the socially thinnest and culturally most neutral, in a sense, the most weakly embedded mode of networking (phrased in the technoid

⁸The strategic dimension of networking is blatantly exposed in a statement from a co-organiser of networking events in new media (NetProZ): "A network is based on a key principle - the exchange of currency. We're not talking about money ... we're talking about information. Networks thrive on a complex arrangement of exchange rates and credit facilities. To me a phone number might be nothing, but to you having it could change your life and put you in my debt. Effective networkers understand this. They play to it, offering a titbit here and a bit of advice there, then calling in the slips when they need a favour" (www.garol.com/theview).

jargon of the software ecology, the social 'bandwidth' decreases from communality through sociality to connectivity.) Whereas communication in communality amalgamates friendship and professional issues, and sociality more strategically supports business agendas with private matters, communication in connectivity is relatively distant from the personal realm and most succinctly focuses on specific tasks (see also Alavi 2003). Social relations are almost purely informational. As much as caused by as resulting from the low level of social embeddedness, connectivity is confined to virtual forms of interaction while communality and sociality essentially are face-to-face modes of networking.

Connectivity plays only a minor role in the advertising ecology in which the convention of face-to-face interaction and a 'people business'-culture preponderates. Moreover, despite the availability of increasing bandwidth in virtual communication, the colour tone in the proofs, the quality of the paper for the brochure, the spatiality of the package design have to be checked through *physical* inspection. The software ecology in contrast, and hardly surprisingly, displays a strong affinity to virtual forms of interaction such as online forums⁹ or mailing lists: "Software professionals like e-mail's ability to be precise and culturally neutral, and they instinctively like its asynchronicity" (*Computerworld*, 8 December 1997). The social practice in connectivity is 'logging on', the socio-spatial metaphor of connectivity is the '(virtual) club' in which membership is bound to a certain expertise which allows to meaningfully interact with other club members. With communality connectivity shares some degree of coherence (both evolve and deepen around a certain profession); with sociality it has a degree of serendipity in common: although attending the club follows mostly a particular intention, it involves accidental interaction and unexpected knowledge encounters.

In these virtual and ephemeral forms of exchange the evolution of personalised trust seems extremely demanding, though not unfeasible in principle, of course (see Sarbaugh-Thompson and Feldman, 1998; Montoya-Weiss, Massey and Song 2001; English-Lueck, Darrah and Saveri 2002). Connectivity does not unfold the dynamics

⁹The widespread notion of 'online community' seems not entirely appropriate since the notion of the community epitomises, as already indicated, a degree of social coherence and proximity that symptomatically is absent in these forms of virtual exchange.

of category-driven 'swift trust' in which actors deal with one another more as roles or professions than as individuals. Nevertheless, online forums depend on a sort of reciprocity to elude the *tragedy of the (virtual) commons*. Virtual sources, in other words, have to be preserved from an imbalance of (little) nourishing and (high) utilisation that increasingly undermines the value of the source (see also Kollock 1999). Although hardly a functional equivalent to (swift) trust, *peer recognition* seems a potent social governance principle to elicit a continuous stream of inputs into the online forum "because the technology allows for optimal transparency" (Jeppesen 2002: 11).

In the software ecology, on-line forums and mailing lists fulfil two functions (see also Lee and Cole 2000; Kotamraju 2002: 16-18). Firstly and particularly in the context of open-source code like Linux, they provide virtual construction sites where code is updated, modified and repaired (that is, places where developers do the actual programming work). Secondly, they afford a virtual arena where information is exchanged and problems and their respective solutions are discussed (that is, places where developers talk about the work they do; see also Lanzara and Morner 2003: 24).

Conclusions

The aim of this paper was, firstly, to unfold project ecologies as both, as ensembles of organisations, communities and networks and also as ecologies of organisational logics, professional ethos' and individual identities and loyalties. By exploring project ecologies through a non-essentialist perspective of geographic inquiry that embraces the incoherence of actors and multiplexity of logics (Lee 2002: 340-341; Ettlinger 2003; see also Massey 1997; Whatmore 1997; Dicken et al. 2001; Amin and Cohendet 2003) the paper seeks to problematise and dehomogenise notions of firms, networks and learning that also underpin current reasoning in economic geography.

The paper, secondly, seeks to contrast two project ecologies which are driven by opposing logics of creating, using and sedimenting knowledge. The key imperatives in the first ecology are *accumulation* and *modularisation* of knowledge. This

cumulative learning logic is exemplified with the software ecology in Munich which is confronted with a learning regime that is driven by the maxims of originality and creativity. 'Learning by switching' here signifies the emblematic knowledge practice that is exemplified by the London advertising ecology. The paper explores these learning modes by analysing the anatomy of the 'plumbing' (Podolny 2001) of the productive networks within and between the core team, the firm, and the epistemic community tied together for the completion of a specific project. In addition, however, the paper also directs attention to more *diffuse* learning processes in an *awareness space* that extends beyond and beneath the actual production ties and that stretches around more lasting networks.

Instead of mapping the awareness space along a simplistic scalar nesting of network density and knowledge types (reduced to a global-vs.-local dichotomy), the paper, thirdly, proposes a differentiation that primarily involves social and communicative dynamics within the networks around which this social space unfolds. The analysis thus seeks to follow the proposition for thinking about knowledge spaces *topologically* that allows an understanding of individual sites as a node of multiple knowledge connections of varying intensity and spatial distance and as relay point of translating knowledges that can not be territorially attributed in a straightforward fashion (Amin and Cohendet 2003: 154; see also Allen 2000; Gertler 2003).

Network practices in the awareness space, symptomatically, efface the distinction between between the communicative logic in the 'life world' and the strategic rationality in the 'systems world' (Habermas 1981). *Communality* signifies lasting and intense ties, *sociality* denotes intense and yet ephemeral relations and *connectivity* indicates transient and weak networks. Communality epitomises the social coherence and stability of the 'neighbourhood' while sociality rather resembles the diversity, serendipity and exposure to strangeness of the 'city'. Connectivity, eventually, matches the relative exclusiveness of a '(virtual) club' in which membership requires a certain expertise. While the awareness space of the software ecology seems to involve primarily communality and connectivity, sociality appears as the central networking logic in the awareness space of the advertising ecology.

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