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TIME, SPACE AND THE SHAPE OF WORK: KNOWLEDGE MANAGEMENT IN 'NEW OFFICE' SPACES

Theme: The Social Processes of OL and KM

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Abstract

The paper presents findings from a recently completed study (1998 – 2002) of knowledge management and organizational learning in the 'new office' environment. The study addressed the following question: in what ways do new office spaces affect organizational learning and the practice of collective knowing ('phronesis')? The approach was ethnographic, and informants were observed and interviewed in six case study sites. The study suggests that new office spaces do affect organisational learning, but that the effects are more complex and subtle than those that are anticipated in company mission statements. The authors account for this by invoking the concept of the 'shape of work'. This concept and its derivation are explained, and the authors suggest that a method employed in the study that elicited visualizations of the shape of work by means of time-space diagrams for specific innovations in process, may be a usable tool for managers who wish to understand this aspect of knowledge management.

Introduction

How do offices accommodate innovation? We describe a four year project that addressed this question in the context of 'new office' spaces, specifically created to foster knowledge sharing and innovation. The study offered an opportunity to explore ways in which physical architecture (a controlled space that is configured to achieve certain effects by modulating flows and points of view) affects knowledge architecture, or the flows and viewpoints that support innovative collective problem solving, and ways in which physical architecture, or structured space, interacts with other elements of infrastructure to both consolidate knowledge and allow knowledge to be diffused. Many 'office of the future' projects are driven by a perception that dislocated enterprise and fragmented physical space will force employees to make new connections, and thus contribute to innovation, a view that is not always well founded.

Background

The background to the study was the first author's professional experience as a manager in Scottish Enterprise in charge of a major new office initiative. Three design principles were adopted: physical visibility must be supported by the new space, physical connectivity must be obvious, and an affordable ICT infrastructure must be put in place to support distributed activity. Before embarking on the new building, a three year pilot exercise was undertaken involving 70 staff. This was in effect an exercise to determine user requirements *in situ*, capturing details of existing practice, and observing groups working with scenarios and role-play in designated spatial areas.

In the final stages of the pilot, the emphasis of inquiry shifted from usability and acceptability, to sense-making, and ways in which an amplified range of work settings might affect employees' choices about how and where and when work is done. Staff were encouraged to think about:

Degree of team working, interaction and autonomy in their work;
Supporting technology;
Communicating with customers;
Storage and filing provision;
Extent of home working;
Extent of time spent in the office and at desk in the office doing work;
The pace and variety of work when in the office;
The importance of meetings in work; and
Changes in the way work could be undertaken.

It was hoped that these questions would lead staff to think about the shape of their work, and encourage the formation of personal and group 'models' of work that aligned work planning with their sense of the workplace, or, in the language of the introduction, the 'cognitive' and 'spatial' architectures that support activities.

Initial analysis of activity in the first six months of occupancy (Davenport & Bruce, 2002) indicated that high-level assumptions that lie behind investment in new space are sometimes misplaced. In itself, providing for co-location does not foster exchange of ideas, and, *per se*,

specialised spaces for relaxation, play and so on do not evoke the intended activity. There is a potential tension between spaces which offer enough affordance for actors to know how to comport themselves, and spaces which are too familiar and thus inhibit the innovative practice that re-design seeks to achieve. Providing 'café' areas, for example, on every floor may not lead directly to the transfer of work expertise, but to the exchange of do-it-yourself, gardening and other hobbyist tips, conducive to bonding rather than knowledge transfer. The covert exchange of tacit knowledge, work gossip and personal expertise continues to be conducted, as it always has been, off the premises.

The pilot project in Scottish Enterprise and evaluation experiences in the early months of occupancy raised a number of questions. New office space appears to be as complex in its effects as any other new technology. A more extensive and substantial project started in 1998, involving six new organisations in an investigation that focused more on knowledge management than design issues. These included:

What kinds of innovation (routine? radical?) arise in new office spaces?
How does knowledge sharing happen?
Where 'space' is temporary and spatial configuration is ad hoc, what kinds of spatial cues may shape activities?
How do people 'see' their work in new office spaces?

Developing a Framework of Inquiry

Three academic domains (planning, workplace studies and knowledge management) contributed to the conceptual framework of the investigation. Each is concerned to a greater or lesser extent with material space and innovation. The dangers of separating 'designer' and 'user' or 'developer' and 'occupier' are amply documented (e.g. Worthington, 1997) in planning literature. Vischer (1989) suggests that to define quality in building environment, the physical environment and the users who occupy it must be considered as a whole or a system, and not conceptually separated into a subject (a user with needs) and object (a building with standards). Aronoff & Kaplan (1995) emphasise the importance of variety of furnishings, layouts and tasks if new offices are to foster innovation, and a number of typologies have been proposed (e.g. Duffy, 1997) to guide facilities managers: single-minded versus open-minded; hi-touch versus high-tech; nomadic versus nester. According to Brand (1994) a new office building is initially designed as an empty shell, probably with a notional configuration of cellular and open plan offices, and meeting rooms. From the very day the offices open there will then be a continual process of adjusting and modifying layouts in the light of experience. He suggests that such ongoing adjustments may eventually be of greater impact than the original design.

Many accounts of new office spaces written from a planning perspective are anecdotal and prescriptive. Thompson & McHugh (1995) in a review of articles on office space, describe 'evidence' that draws uncritically on a number of genres such as:

interviews with top management, who tested the culture by conversing with the receptionist;
profiles based on company documents;
use of formal statements of objectives and philosophy;
biographies and speeches; and

questionnaires filled in by Chairmen which ranked their firm according to excellence criteria.

There are, in contrast, a number of examples of detailed accounts of the interplay of the material environment and activities in the literature of workplace studies (Hindmarsh & Heath,2000; Luff et al., 2000). These exhibit a characteristic approach to empirical work (ethnographic) and a characteristic focus on artefacts at work in collective activity. Kraut et al. (1990), for example, in a study of R&D workers, describe three common interaction types – the call, the vending machine and the short stop captured in the notion of 'browsing the social environment while on other business' that 'provides people with a substantial amount of information about the world in which they live'. They conclude that: "None of these brief episodes of informal communication was especially significant in their own right. We believe that in the aggregate, they are fundamental methods that organisations use to get their work done, transmit organisational culture and firm-specific knowledge, and maintain the loyalty and goodwill of their members."

Many of these studies emphasise on routine micro-level change. Suchman (2000), for example, has analysed changes in work practice in a legal documentation unit, and Ackerman and Halverson (1998), have described changes in call-centre routines that improved response to customers. As we note above, these studies share a common approach – productive accounts of workspace activity based on direct observation. They provide a means of understanding complex infrastructure that relies on narratives of what happened with what tools at what point in a recognised activity, and this approach informed the design of protocols for our case studies. The second author has drawn on this material to explore what she calls 'mundane knowledge management' (Davenport, 2002) in a number of contexts. This work highlights the importance of environmental cues in routine organisational learning and draws on genre theory to explain the tacit transmission of knowledge of appropriate conduct. The spaces discussed in that study are localised and bounded – the reference desk, for example, or the help desk – and generate insights at a level of detail that we considered to be inappropriate in analysis of more extensive spaces like the new offices of our six studies. We thus turned to a model of knowledge creation that is explicitly concerned with space – the 'ba' model developed by Nonaka and his colleagues (1998). The basic version is simple: different configurations of four attributes (individual/collective; explicit/implicit) are used to support descriptions of different conceptual spaces that are themselves elements of organisational learning. Other attributes are implicated in these conceptual spaces such as proximity/distance, collocation and separation, captured with the word 'ma' by Hall (1986). (We have used both 'ma' and 'ba' in our conceptual framework).

Though Nonaka's work has been heavily invoked in prescriptions for knowledge managers, few analysts have attempted to instantiate 'ba' in empirical studies. Baumard (1999) however has used the 'ba' model in an extensive and detailed study of three organisations in crisis. He maps time-lines of events in these three companies across the four quadrants of the basic 'ba' model, and uses the resulting diagrams to reflect on crisis management in each of the organisations. One of his aims is to demonstrate the workings of two forms of tacit knowledge, phronesis and metis. The former is described as 'a certain wisdom that is acquired through social practice.' (p. 66) We adapted Baumard's visualisation technique in both our interview protocol, and in a mapping technique for data analysis.

Each of the domains reviewed above contributed to a conceptual framework that supports 'middle range' accounts of new office space and innovation. In order to do this, it had to:

accommodate different points of view (the 'micro- ecology' of innovation);
recognise the complexity of technological change;
address innovation at a number of different levels; and
focus on geography as much as history.

The Method

Data in our study were gathered in six case study companies. The selection of companies for the case studies, and of people for interview was based on the first author's prior knowledge of and position in the relevant professional network. The primary sources are loosely structured interviews using a protocol was based on the conceptual framework that is described in an earlier section. Two slightly different interview protocols were devised, each relating to different types of interviewee. Interaction with designers took the form of an on-site visit and explanation of the 'new' workspace followed by a short interview. Other informants took part in a fuller interview in situ. Observations were made at each location, both through site 'reconnoitre' visits, and interviews with designers and facilities managers that complemented the semi-structured interviewees with those working in the space. In addition to the recording of conversations that were transcribed, a number of artefacts were generated in the interviews: summary post-it notes written during the interviews for immediate verification by the interviewees, photographs of the sites, sketches provided by the interviewees during the interview sessions. The interviews themselves included probes (these were designed to invite, but not drive input on specific topics) and allowed the respondents to discuss and sketch their answers and contributions.

Before interacting with key informants in each company, the researcher visited the premises with the 'designer' of the space, and had an in situ discussion of the environment, and took photographs. Interviews with both designers and participants or 'occupants' at varying levels of seniority in the organisation were then carried out. Out of those initially contacted, 24 finally participated. All but one of the interviews was conducted on a one-to-one basis by the first author. Each interviewee was introduced initially during the reconnoitre tour, when he or she was observed in his or her working habitat. To stimulate exploration of real-life experience, the dialogues focused on naturally occurring ordinary events.

Two areas were covered; 'a day in the life' of the interviewee, and 'an innovation process'. These provided a rich archive for analysis, but posed a problem in terms of coding. What would be an appropriate unit of analysis? We settled for 'middle range' entities, the activities and stages of innovation that were captured in the sketches drawn by the participants. The visualisations proved to be powerful artefacts, serving as scaffolds for the interview dialogues, and also acting as a from of 'rapid coding' by the informants themselves, as they allowed significant events and activities to be identified as the interviews unfolded. Though overtly focused on events and timelines (history) they stimulated insights about place and space and proximity (geography) which were the basis of our own analytic visualisations.

Everyday Life in the New Office

Each interviewee was asked to sketch, either verbally or in graphic form, a typical day in their working life. To give a flavour of what was involved, we provide samples of the responses of participants ('MM2' and 'MM3') in one of the six companies, a major media corporation ('MM').

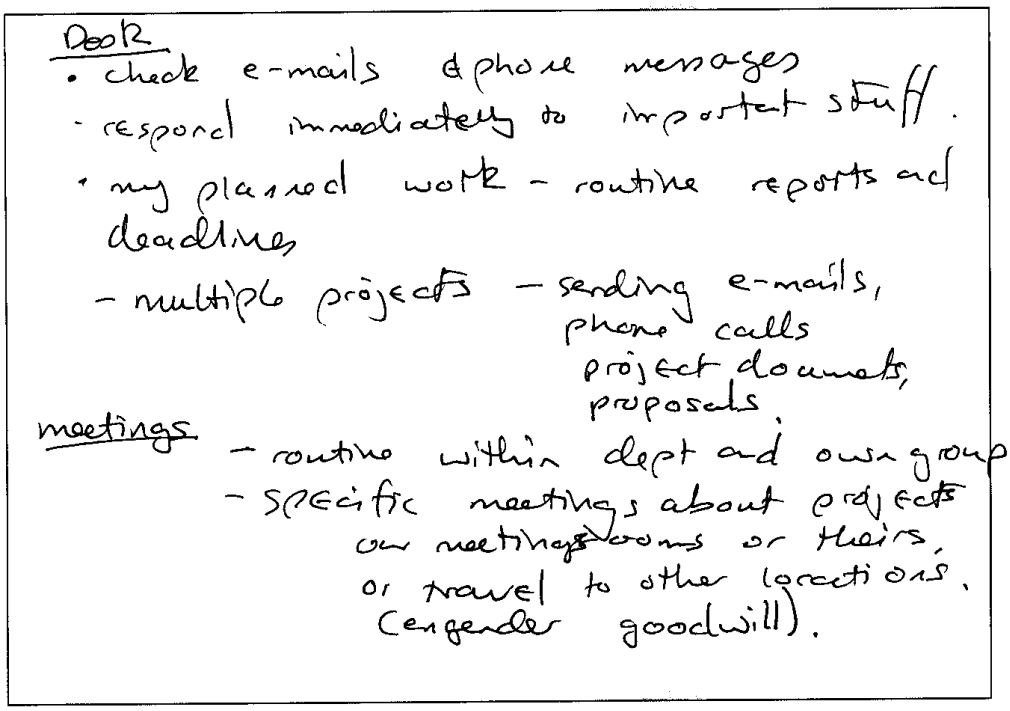


Figure 1. A sample activity sketch

When MM3 is working in the London office and not travelling throughout the regions, she works from 10.00am to 6.30pm. Her first action on arriving at the office is to power the computer on, check her voicemail while the computer is powering up and check out any things that require urgent attention. She will then respond to important requests, following which she "will be free to get on with my planned work for the day". She has certain routine deadlines in the department's monthly reporting cycle, so she prepares routine reports on the various multiple projects that she is currently working on. This work will include sending e-mails, making phone calls, developing project plans and preparing project documentation reports and proposals. All of this work will be done at her desk.

She will then have meetings of which usually there will be several a day. They will involve some of her team, either within the wider department or within her more immediate group. These meetings range from a consideration of administration matters, checking information, and specific discussions about her projects. These meetings would be held in meeting rooms either on or off-site (to engender good will) as "I've got three people in front of me and two behind me, I couldn't disturb them". According to MM3 (a technical equipment adviser) , the new office space comprises permanent desks for staff members within an open plan layout, study booths for "peace and quiet or…working on confidential material", small meeting rooms that are bookable, and for informal business conversations, there is the Hub.

Unexpectedly for MM3, the hot desks for visiting people from the regions "have been fabulously well used". However, she continued that the study booths are not being used as they should, but rather provide storage for spare PCs. (MM1, the space manager, confirmed that he had received requests to have study booths removed from several floors, but he did not know why. He wanted this discussed in the post occupancy evaluation).

In her previous traditional office, MM3 had no communal area, so if you wanted a cup of tea you had it at your desk and continued working. In the new office environment, there is a Hub, where she "hears things and things spontaneously happen in the Hub. Because you are getting a cup of coffee for someone and you hear people talking and you join in the conversation and you will find out what is happening that way". MM3 also confirmed that informal collaboration within the team would possibly not have happened in the previous office as they "were all sitting with our backs to one another then in different parts of the office". That communication is much better in the new office, the atmosphere is much better, "we don't have walls metaphorically or virtually that we used to have". She would not go back to the previous space — "I would feel too isolated and too out of the loop and it makes things too formal".

MM3 continues that while her role has not changed, within the new office space, the way she performs it has, in that it involves much more face-to-face communication. Sharing knowledge is made much easier. She explains that if an immediate team member is on the phone and if she hears somebody saying "oh, I know we've got information somewhere", then if she has it to hand, she would pass it over. MM3 explains that she can work either at her desk or book a meeting room, or, if there is a very large and substantial project, then an entire big room would be allocated and be for use by the project team. "What we've got now is all that we are hearing, and communication flow, and the seeing, and the interruptibility of people". Such relationships and interaction have allowed the flow of ideas, something that would never have happened in the previous office.

A typical day for MM2 is to say 'Hello' to her team individually, to make sure that there are no outstanding matters or issues. Normally because she is the last person to arrive in the morning, her team is already in the office. Then she goes straight to her PC, checks her calendar and roughly checks her e-mail. Following this, she usually has a meeting in either the main meeting room, or one of the smaller meeting rooms. After the meeting, she would give consideration to resolution of immediate issues. At this point in the interview MM2 commented that by having to sketch her typical day on paper, "you get to see how you don't have any creative time and you don't really come up with any ideas".

She then considers her immediate issues based on the planned activities for later that day, and the consequential preparation time. For example, for another meeting or something specific she has to do could involve thinking about, or reading, before she goes to that meeting. There are also more routine matters such as clearing out her e-mail, or "what other things do I do?" Because of this she commented that "There is no way I ever come in at my desk and think up ideas or think about creativity". For her the stimulus to innovation can be reading something in the newspapers, travelling, or when at social activities. A lot of her friends and contacts "are people in music, so in having a conversation with them I will have an idea." While not all of this happens in the office, "obviously if I'm having a good conversation with someone in a meeting room, it might spark an idea off. But it tends to be the less free form wild

ideas". Her idea for the mix might have been in the office when she was thinking through "what a New Room should have, what a new area for new music should have". However that particular office space was more like an attic room, it had some atmosphere and it was not clinical. There, she was allowed to bring her atmosphere to it: "….because I was allowed to put things up on the walls because it was all my own space. It's like when you're an adolescent and you know, you're doing creative things, you are making something…It's that sort of childish activity, quite young activity which I find a bit more stimulating than sitting down and writing a report about something. That's not to say I haven't had ideas or developed ideas when I have sat down to write a report about something."

Currently MM2 tends to find that the first thing she needs to do in the new office when writing something up is go to the café and think. So she tends to make some notes, have a think about it and use her laptop. That provides her with: "the ultimate freedom, just being anywhere you like, and I'd go to the café and think first. I'd literally only want to come to my work desk to type things up. Now in the process of typing things up the ideas get developed. The ideas develop while I'm writing". However for MM2, there are some days when she has so many meetings that she feels "I don't even really have a day". Normally therefore she gets a second wind towards the end of the day. Her second phase of productivity takes place after 6.00pm. By then office noise has died down. She puts Radio 4 on and "then I'm very happy to just sit and mull over work, get work done, think about some ideas. I feel that all the chaos has left and I have got some chance to just be on my own." And for her that is a totally personal thing, as she finds that the 10.00am - 6.00pm period is the hardest part of the day for her to work.

MM2 explained that the intention within her organisation is to provide open space with a sense of space, clarity and less clutter. In order to facilitate a better chance of communication between teams, an open plan environment was created which removed "box offices full of papers and tapes with no space for people to think or have a clear head. Space...crammed with an 'old school style' that they wanted to get rid of because they didn't think it helped people work clearly." MM2 confirms that the meeting rooms are "wonderful but these are under pressure a lot, because they're actually very useful for meeting rooms and there is a lot a people having a lot of meetings all the time". While she advises that the Hub is a relaxing space, she never uses it as such, but rather uses it for meetings - "this is when we want to have a more relaxed meeting in a nicer environment and it's wonderful for that". This tends to be supported by her colleague MM3 who advises that she uses the small bookable meeting rooms for discussions such as the research interview, but that for informal business conversations, she would use the Hub.

There are also spaces for quiet, informal and relaxing work. For example, MM2 chooses to relax and have a second phase of productivity after 6.00pm. Once the office noise has died down, she puts on Radio 4 on and is very happy to just sit and mull over work, get work done, think about some ideas. She feels that all the chaos has left and she has the chance to be on her own. It is really important to MM3 to have somewhere that she can go and have a quick five minute chat with somebody, either personally or informally about work, and to know that you are not disturbing you colleagues. The new office space supports such needs.

In the case of MM2, the new office concepts were still very new to the interviewee who found it difficult to come to terms with the change. However, at the end of the interview she

revealed that she had pressed management to provide her with a new space with a similar layout, but one that she had chosen. She was of the opinion that this would work better for her and her team. The principle of ownership is important to her.

Innovation Process Sketches

All respondents were asked to describe an innovation process – what the issue or idea was that set the process rolling, and what the details of the process to resolution were in terms of space and time. The concept of an 'innovation process' posed no significant challenges for the participants in the research. In discussion, the concept of innovation emerged as a component of everyone's work activities that is not restricted to either an hierarchical level or job-specific role. We describe this as the 'naturalisation' of innovation. In the section that follows, we return to MM2 and MM3 to show how the technique worked, and, in addition, discuss innovation at a second company, WT.

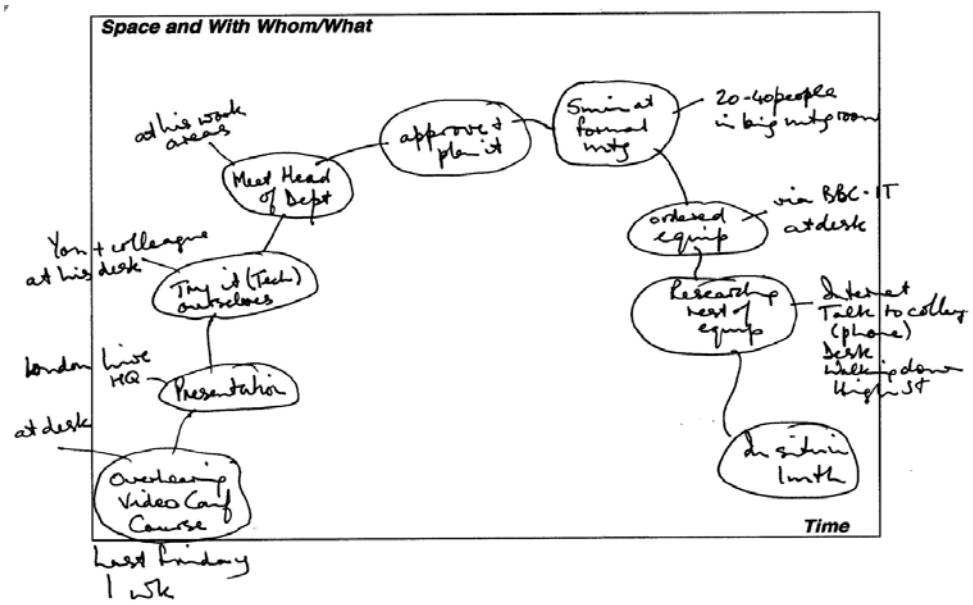


Figure 2: An innovation process sketch (MM3)

The first sketch relates to MM3 and an innovation process that developed as a consequence of participant MM3 sitting at her open plan desk overhearing another team organising work which lay within her team remit. As a consequence of this, she went to a management guru's presentation in the company's High Street offices – this had been the subject under discussion. On her return she shared the information with a colleague at her desk. She explained: "…the ideas that they are coming up with…wouldn't it be great if we had a little space here where we could try new technologies. Not wait to be introduced in the great fullness of time…usually very slowly." She and the colleague then sought approval from their manager at his desk: "I just wandered over and talked to him". The idea was then discussed with the Head of Department – "in about several seconds time…at his working desk". Both these interactions were possible because of physical proximity. The meetings were informal, not the usual "let's-have-an-agenda-three-weeks-in-advance sort of meeting"

because the interviewee does not think that innovative ideas come up at those sort. The plan was approved subject to satisfactory costings.

Her manager then asked her to take the plan to the formal departmental meeting that afternoon. "…do five minutes this afternoon on why you are so enthusiastic about this and what you want people in the department to do, because they have to be involved, we can't just do it and not tell them."

She presented to between 20 and 40 colleagues in one of the big meeting rooms. The idea was approved and the equipment procured from her desk via the Internet, talking to other colleagues, and by phone; and by walking down the High Street. The entire innovation process, from starting point to implementation, took one month.

MM2's innovation sketch follows an idea to provide a Web-site for the public from conception to implementation. The Web-site sampled different music and to have at least one part of the site where they could listen to "big chunks of music" which usually cannot be achieved for reasons of copyright. This involved several steps. Initially a project definition which developed from her thinking "in isolation" in her former personal office. She then developed a delivery plan with a music consultant in a meeting room in the office. Later, she added to the idea so that the public could "listen to music and look at visuals… So another idea that I had had began then to influence this idea." A consultant artist was then added to the team. These meetings and discussions took place in a meeting room in the office.

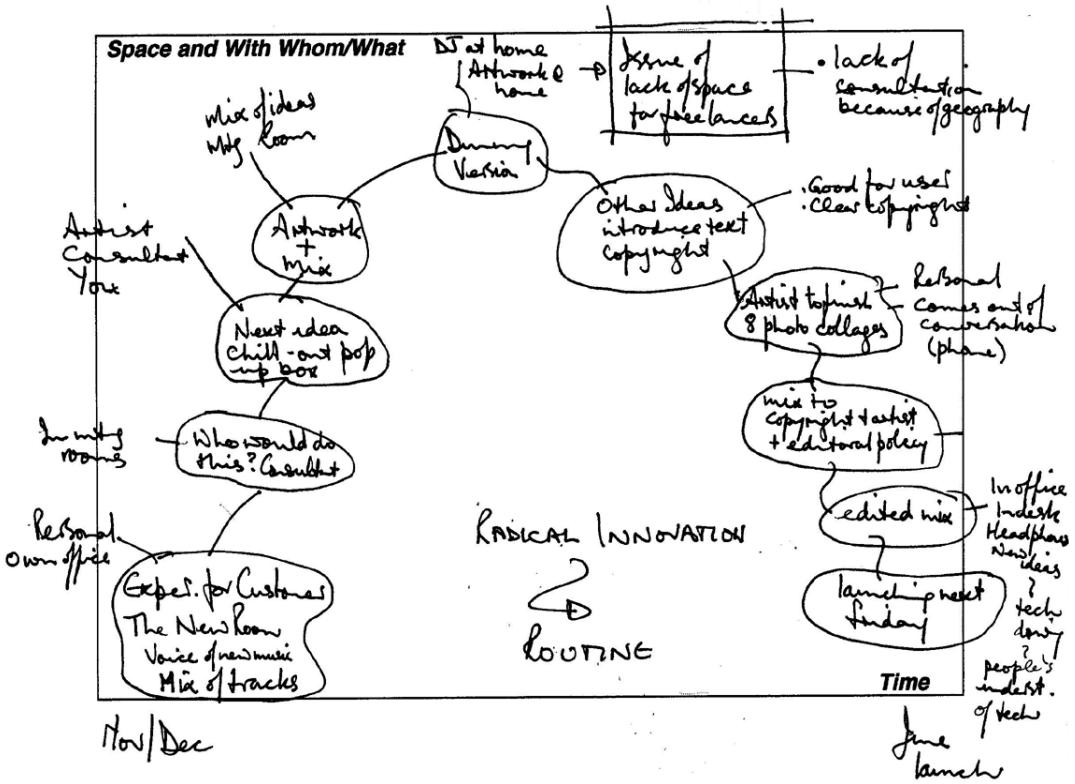


Figure 3. An innovation process sketch (MM2)

The next step was the preparation of a pilot version. The music DJ did that at home and not in one of the company's recording studios for technical reasons. Most radio stations do not use record players and to do a mix properly you need record players. The artwork was also being done at home. One of the problems for the interviewee was that there was not enough space in the office for freelancers and she has to encourage them to work at home. For her that is a good thing and a bad thing: "Sometimes it means creativity for a person if they prefer to be on their own environment and they have all their tools around them, they have everything they need…However there are some problems we could have solved or saved ourselves going through if he had done his work here. Like for instance, he could have consulted with our Project Manager to find out if the images he was working on were too heavy for an Internet page…Issues like that can be gotten over if everyone is working together".

Other ideas were then introduced as a result of the pilot – the addition of text to the music and artwork. This also helped the team to clear the copyright for each track as they provided details which would help more copies of the music to be sold. This idea was just "one of those things where…someone said, "oh maybe we could put in a few lines about the record". The artist then had to complete the montages which were increased to eight from five. This idea came out of conversations and interaction usually by phone. At this stage the mix was ready for approval and was sent to the copyright department, to the artist and to the editorial policies department. The music consultant then creatively brought it together and in doing so had a new idea. He developed a cloud picture concept which meant it did not take so long to download. This meant that technology was driving this new idea. He did that in the office, at his desk with his headphones on.

The idea would be going live and be available to the public within a few days of the interview. The innovation process, from starting point to innovation, had taken around six months – "I'd say November/December….that the idea came up….through to June launch This interviewee seems to like to be alone in the office when she does her thinking, but correspondingly can have points of quickening when surrounded by other people in a non-work environment. She expands: "Now it's funny because when I was writing or wanting to play around with an idea in my head, I'm quite willing to sit in the café and do that sometimes. It's that sort of Ernest Hemingway 'let's sit in a little wine bar and drink wine while I write'. There is something about being, not really that noticeable but allowing your mind to wander as you watch life go by."

The two sketches that follow describe activity in a second company, a world travel company (WT). The first represents a process described by respondent WT4, a procurement manager. Was was required to reduce the number of suppliers to the company. There were five steps to this innovation which are sketched below.

The first step involved establishing a project team of stakeholders and although it was a permanent team, because it was virtual, it could meet anywhere but usually within the new office at HQ. The team had brainstorming sessions to agree what and how to deliver an outcome. These sessions were held in the bookable meeting rooms. The team then developed options and some of the team prioritised the options at the interviewee's desk. The findings and recommendations were presented to the Core Team in a meeting room. The recommendations were approved subject to team review and open research, this being undertaken by the interviewee at his desk. The timescale for this innovation process was six

months - it was implemented in February 2001 and the process commenced in September 2000.

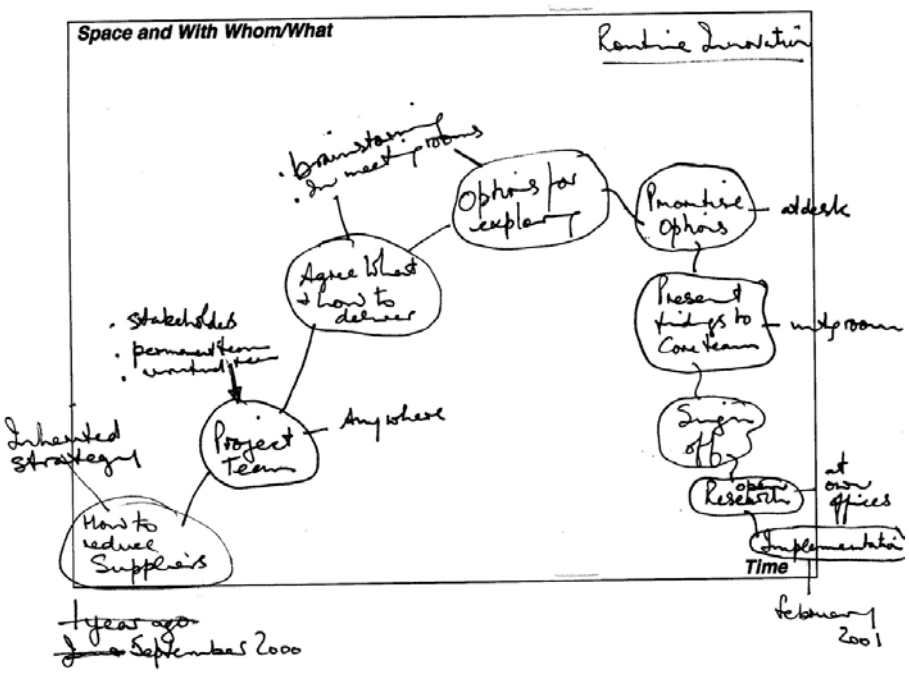


Figure 4: An innovation process sketch (WT4)

In summary, the respondent (WT4) worked individually only to research the process once implemented at his desk, and in collaboration with colleagues by brainstorming, prioritising and presenting; virtually, at desks and in meeting rooms.

The next example is WT3, who described a process of restructuring her six teams. The process took place within the office, and in a variety of formal and informal spaces. However, the point of quickening or direction for her innovation happened within the more social environment of working in the garden with her partner. Essentially she had come back from annual leave to find that a number of vacant posts in her teams had been filled, and at the time of interview, the organization was still in the process of considering changes to its structure. There was a review of all contractors and of the way in which the business was operating, She has been discussing such matters in her role of manager within the operational services. There are six steps to this innovation process.

The issue for her arose three weeks prior the interview, when she returned for annual leave to find that while she had been absent, all the vacancies in her team had been filled. She considered that such a restructuring exercise was a target for her and that it should not have happened in her absence. This matter was relayed to her by her boss at her desk, and "it was affecting me and made me very subdued for I wanted to fill the vacancies myself." The first action she took was to think about it and did so by taking it away from the workplace - by taking it home to talk to her partner about what had happened in her absence from work. She then talked to her boss about it primarily to get reassurance that the people selected were appropriate. These conversations happened over a coffee in the Pavement café (in the Street) or sometimes just at our desks. She then "went into a longer period of talking and needing

reassurance with both my boss and with the teams". These were very casual informal conversations in meeting rooms or on the phone, either the mobile phone or work phones. She then reassessed the posts that had been filled recently, together with all the other staff that were already in place.

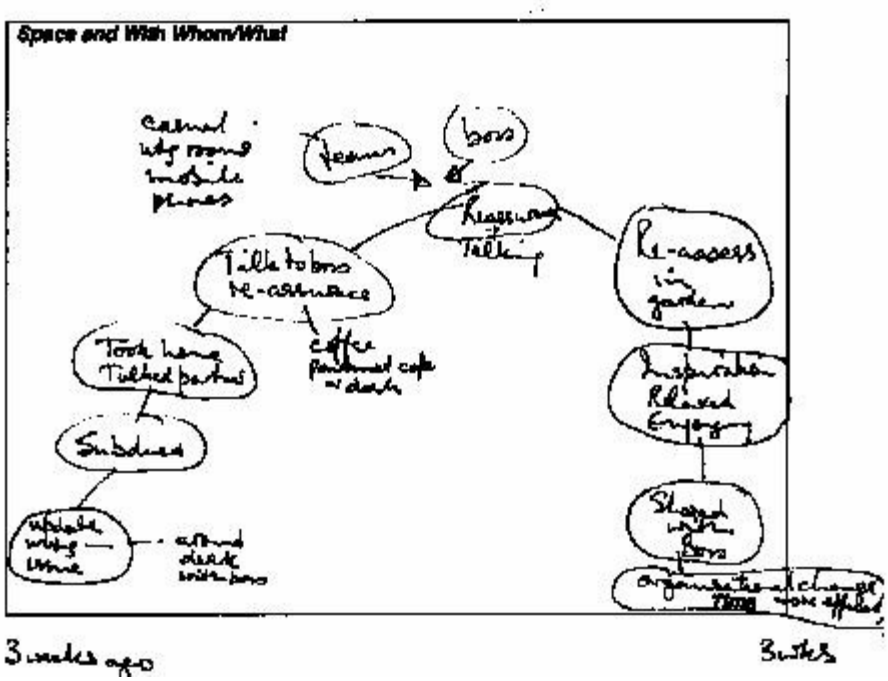


Figure 5. An innovation process sketch (WT3)

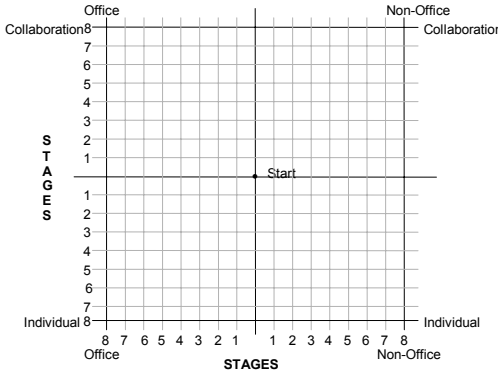
She then thought about this in the garden and "I suddenly came up with the inspiration of doing an organisational change across my teams using the existing and new people in such a way that they would deliver more efficiently and I had ownership of the whole process". WT3 considers that she turned her experience of needing reassurance into a positive thing and that the inspiration happened because "I was relaxed and enjoying myself with my partner". She returned to work after the weekend, shared the idea with her boss who approved the new team structure. The organisational change has now been made and she has "ownership of all the teams and we are now delivering more efficiently".

INTERACTION GEOGRAPHIES

What is clear from these and other interviews is that the relationship between space and innovation is complex. The concept of work is porous, as the office in the descriptions of our participants is not a closed system. .

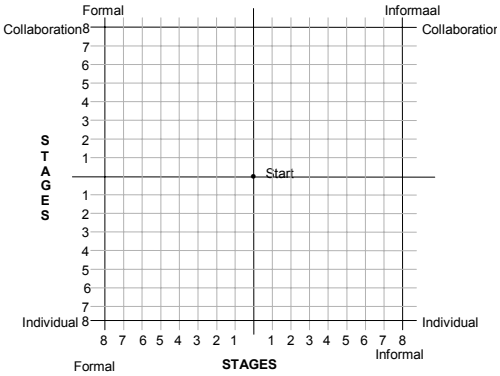
To help us reflect on the innovation sketches of participants, we designed a template to capture what we describe as 'interaction geographies', or sketches that capture various stages in the innovation. These were drawn on to a grid with each 'stage' in the process entered according to co-ordinates. These are not drawn to scale, and do not conform to a standard calibration, as the interview protocol did not include specific and finite questions that might capture the required numerical details.

Sketch 1



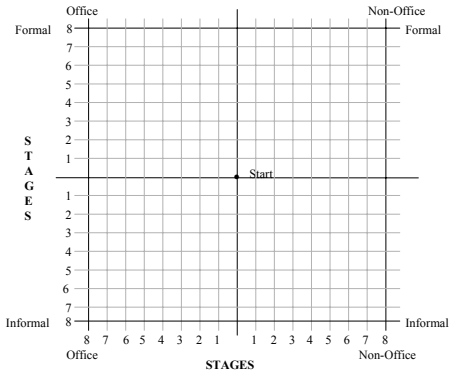
a) Collaborative and individual work within and outwith the office

Sketch 2



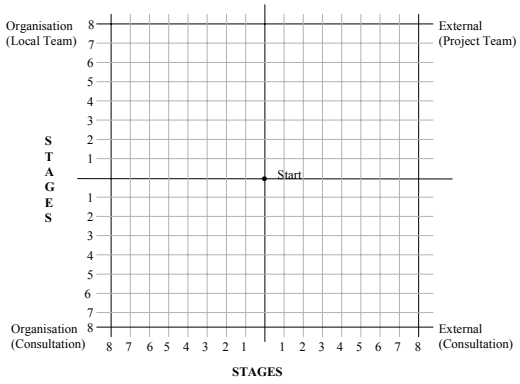
(b) Collaborative and individual work in formal and informal spaces (computer-based work being classed as 'formal', regardless of location)

Sketch 3



(c) Formal and informal working, within and outwith the office

Sketch 4

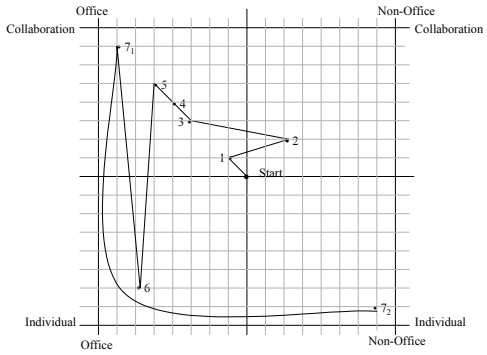


(d) Team working and other consultation within and external to the organisation. (Local team work is defined as being working locally where no project team exists and also working at local team level)

Figure 6: Sample interaction geography sketches

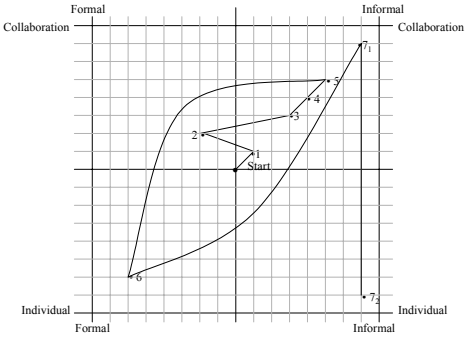
To illustrate how the interaction geographies are used, we return again to the media company and respondents MM2 and MM3.

Sketch 1



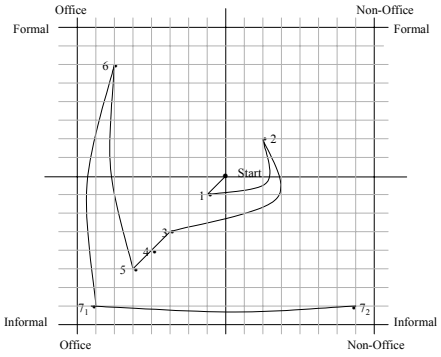
(a) Collaborative and individual working within and outwith the office

Sketch 2



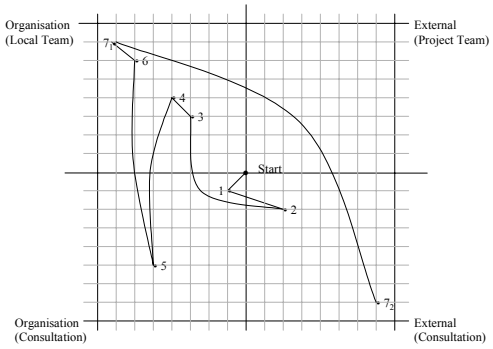
(b) Collaborative and individual working in formal and informal spaces

Sketch 3



(c) Formal and informal working within and outwith the office

Sketch 4



(d) Team working and other collaboration within and external to the organisation

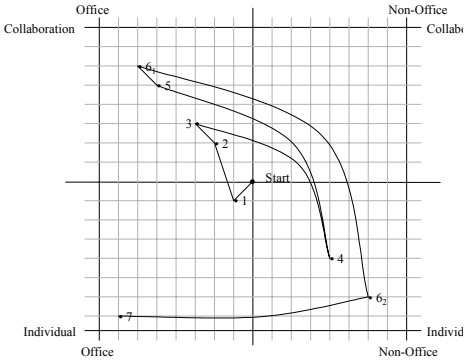
Figure 7. Interaction geographies (MM3)

Each sketch for MM3 captures different sets of coordinates such as individual/collective; formal/informal; office/non-office. These capture proximity and presence in a series of events that reflect seven composite stages. First, informal collaboration in the office at organisational consultation level; formal non-office collaboration at external consultation level; two elements of informal collaboration in the office at organisational local team level; informal collaboration in the office at organisational consultation level; individual formal work in the office within the organisational local team; and finally, informal collaboration in the office within the organisational local team followed by informal individual non-office work with external consultation. These seven combined stages are undertaken formally and informally, within and out of the office, and largely with colleagues internal to the

organisation. Because, as we note above, the 'new' office space enabled overhearing, prompt discussion with her manager, and prompt discussion and consultation within her wider team. There was a corresponding lack of delay in the legitimisation process as a consequence of the ease of responsiveness associated with the physical closeness of the staff.

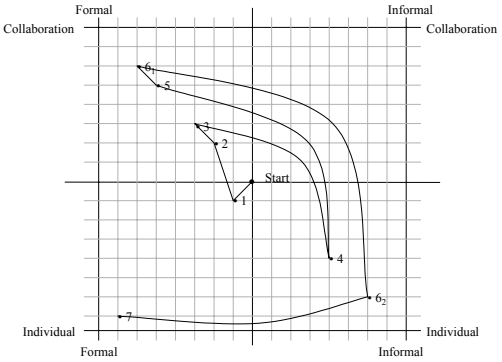
We can compare this process with that of MM2 which has a external team focus. In MM3's case, no specific project team is involved as MM3 herself develops and implements the innovation within her local team.

Sketch 1



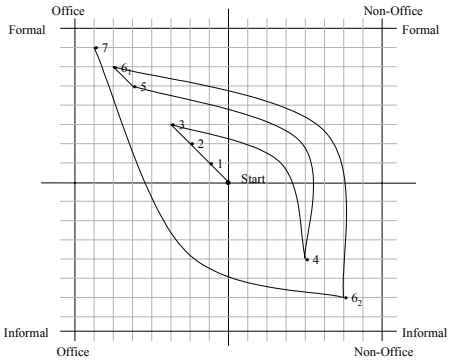
(a) Collaborative and individual working within and outwith the office

Sketch 2



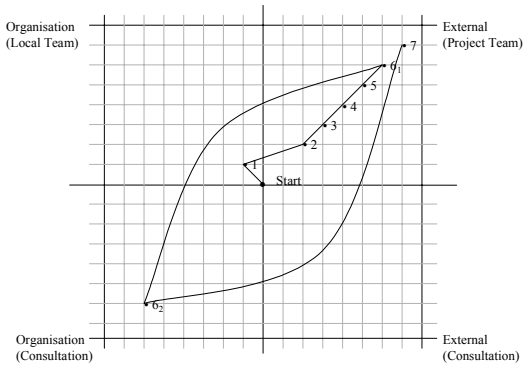
(b) Collaborative and individual working in formal and informal spaces

Sketch 3



(c) Formal and informal working within and outwith the office

Sketch 4



(d) Team working and other collaboration within and external to the organisation

Figure 8. Interaction geographies (MM2)

MM2's trajectories reflect her strong external focus. First, formal individual working in the office at organisational team level; two elements of formal office collaboration at external project team level; individual informal non-office working at external project team level; two elements of formal collaboration in the office at external project team level followed by

individual informal non-office working at organisation consultation level; and finally, individual formal work in the office at external project team level. The combined stages are undertaken formally and informally, within and out of the office, and largely with colleagues external to the organisation. This respondent operates within MM and has chosen to work within her own office while the rest of her team work within an open office environment. She took many of the decisions for this project herself following both organisational and external consultation and made no reference in her narrative to an organisational legitimisation process. There are strong working relationships with her external project team and much of the project detail was developed in non-office and formal environments.

Analysing activities and innovation

As we note above, the shaping of activity and process in new office spaces is complex. As one participant puts it: "I'd love to be able to say 'you know, that programme which won an award or topped the ratings wouldn't have happened had this (new office space) not'. I just don't seem to find it." Work extends across multiple spaces, supported by a number of artefacts. This phenomenon (we describe it as 'work-life') is captured in the account of one of the designer-interviewees: "…the non traditional way of working does sort of blur the edges between what is work and what is home environment. In some ways people may see that as being a disadvantage but I think if you play it right then it can be quite a powerful advantage. But it means that people can bring their home into work and take their work into home as well. And as long as one doesn't dominate the other and you are careful how you balance the two, you can then be more productive. Because you are not only creative and everything else for work between 9 – 5 and everything is 'homely' after that. There are times in the evening when you feel you need to do 'a bit of work' and times during the day when you need to do 'a bit of home'. So if the person can manage that rather than being put into a box – 'now at work – now at home', then I think it can be very useful and improve productivity"

Though there is great variety in individual 'work-life' patterns, our initial application of interaction diagrams to anlayse innovation process has identified has identified four groupings of activities:

Group i) with three activities — discussion with colleagues and management; the legitimisation process; and procurement.

Group ii) with four activities — the identification of the problem; the thinking it through while undertaking non-work activities (this resulting in a point of quickening); the managerial approval; and implementation of the idea.

Group iii) with five activities — the identification of the problem; the establishment of a project team; brainstorming and developing options; legitimisation; and implementation.

Group iv) with five activities — the identification of the problem; the establishment of a project team; brainstorming and developing options; formal collaboration; and implementation

The Table below aligns these groups with roles and functions.

Roles & the Innovation Process

Role	Innovation	Duration	Number of Stages	Innovation Components
Manager				
	Web-site	6 months	7	Group iv) plus external project team
	Computer network for students	6 months	8	Group iv) plus external project team
	Managing customers	n/a	4	Group ii) and no project team and resolved by manager
	World-wide e-system	3-4 months	3	Group iv) plus co-location for internal project team and invisibly developing systems at world-wide level
	Managing staff	3 weeks	5	Group ii) and no project team and resolved by manager
Non-Managerial				
	ICT equipment	1 month	7	Group i) and no project team and resolved by non-manager
	ICT equipment	1 month	7	Group i) and no project team and resolved by non-manager
	Supplier information	6 months	5	Group iii)
	Financial information	1 month	4	Group iii)
	Cupboard	4 months	4	Group i) and no project team and resolved by non-manager
	Marketing brochure	1 day	1	Collaboration components only

Table 1. Roles, activities and innovation.

In addition, the activity sketches of participants have allowed us to identify two broad sets of activities that contribute to collective innovation in new office spaces. We describe these as opportunism and mimesis. Opportunism takes different forms. The first is tied to the ability to overhear. The unexpected benefit of the new office environment for MM3 is how much more she knows about what her colleagues are doing. To her, overhearing and being aware of what colleagues are doing is the biggest benefit of the new space. A participant in another company also remarks on this benefit of the open plan office where you hear what other

people are doing and "you get that extra bit of communication which is always the accidental communication as it were - there is always the benefit of that in an office". Another informant describes "bumping into people at the coffee machines and you can overhear conversations, you naturally knowledge share, which is a wonderful way to do knowledge sharing because sometimes you can just overhear somebody and you can go up to them and say "hey, I didn't know you were working on that". And whatever that is, that's the most powerful knowledge sharing of all." Opportunism also takes the form of critical intervention: MM3 believes that when you hear people talking and you are talking informally at the photocopier or the coffee machine, you are catching them when they are "still scratching their heads and thinking about things and wondering if something can be done, wondering if something is a good idea".

Opportunism also takes the form of rapid access, an important factor in the legitimisation process that subordinates have to go through before innovative ideas can be actioned. As MM2 explains "…it is very nice that your boss doesn't sit in a separate office, you've got a free access to them… you can just wander up to them". This ease of communication linked to quick decision making is also supported by other informants. Timing according to MM3 is critical to the collective knowing process within and across teams, as has been discussed with respect to her innovation sketch. Matters often get presented at meetings:

"Well a) it's chance that it's at the right meeting or not; and b) by the time it's been presented at a meeting, people have gone quite far down the decision making process and are less receptive."

It must be noted that although many of the respondents described their new office space as a 'leveller', that makes colleagues more accessible to each other at every level, the interaction geography analysis indicate that there are differences in the mobility and flexibility of managers and non-managers. 'Levelling' appears to be a social phenomenon more than a structural phenomenon.

Discussion

The study has some obvious limitations. The sample of participants is very narrow – we worked with whomever was available in the six case study organisations. The informant group thus comprises those whom the organisations considered appropriate respondents, and, within that group, those who were willing to take part. The result is a group that (with two exceptions in the form of 'concierges') is an organisational elite, supported by invisible others. These 'others' are facilities management and technology staff; in most of the case companies, these functions were seen as utilities and outsourced. Technology is discussed as a 'given' by the participants, who volunteered no information on how data is structured, how objects and entities are classified, or who makes decisions on such matters and maintains and manages such infrastructure. A further constraint on our findings is the level of detail at which data were gathered on timelines. In making 'space' the primary focus of the interviews, we failed to provide questions in the protocol on the timing of events and transitions across different spaces, and thus limited our ability to use the interaction geographies for comparative purposes. The protocol for eliciting process sketches needs to be further developed, as does the visualisation of interaction geography.

The study, however, has identified an approach (micro-geography) to capturing and analysing data about knowledge sharing and innovation and material space that may serve as a stimulus to reflective practice at both individual and group level. The material spaces of knowledge management have not been adequately explored (notable exceptions are the studies by Holtham & Tiwari (1998); Holtham & Ward, 2000), though a number of studies exist of KM and cyberspace. These range from the early work of Laurel (1991) to more recent descriptions of architecture for social navigation (Chalmers, 1999; Munro et al., 1999). Visualisation of interaction is an important of much of this work (see the recent review article by Donath, 2002). Erickson (2000) suggests that pattern languages may act as a bridge across analysis of cyberspace (in the form of online conversation) and analysis of office space. His 'pattern' of the 'secretary as hub' fits with the approach described here.

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