

Remembrance of Designs Past: Legacy Data, Organisational Memory and Distributed Design.

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Introduction: Legacy Data and the Virtual Organisation.

This chapter reports on an ethnographic study of a manufacturing design team in order to understand some features of how distributed, legacy product data is managed and accessed in everyday work. It describes the routine activity of design work and documents how issues of 'legacy' and 'organisational memory' are instantiated in routine work. The general motivation for the study derived from an interest in understanding the impact of legacy systems and legacy data as organisations confront a number of major and connected transformations in the social, economic and technological environment in which they operate. While there are various diagnoses and explanations of these transformations (Lash and Urry, 1987) (Hammer and Champy, 1993); most stress the role of IT in responding to manifest organisational needs. These include a greater reliance on knowledge creation and conversion, the growing importance of the consumer, the growth of distributed organisational structures, and the creation of more flexible patterns of organisational relationships. IT may be viewed as the crucial element in facilitating these changes, through the development of systems that can facilitate coordination and communication, and support skill and knowledge (Zuboff, 1988; Scott-Morton 1991). Paradoxically, and at the same time IT is also commonly regarded as holding back organisational change as legacy problems, problems of integrating, evolving or replacing ageing systems, proliferate.

Within manufacturing industry one response to these increasing competitive pressures and customer demands has been to introduce new processes to support new product development by reducing product development cycles. Global, concurrent engineering is now being widely applied in large manufacturing enterprises to develop, from the outset, new products/services in partnership with customers, contractors and suppliers. In this context one of the organisational concepts which is receiving considerable attention is that of the 'virtual organisation' (Zimmerman 1997; Sieber and Griese 1998). As business process changes have increased and become increasingly distributed so, it is suggested, has the widespread adoption of virtual team working practice in extended (virtual) enterprises. Such virtual enterprises are characterised by the development of new forms of 'virtual' teamwork, "in which people share knowledge, skills and resources and work cooperatively in the manufacture of their products". (Casey 1995: 109). Networks of workers and organisational units, linked by information and communication technologies, flexibly co-ordinate their activities, combine their skills and resources in order to achieve common goals. Such arrangements form and reform as problems arise so providing a flexibility of response to changing circumstances and organisational needs.

It is widely recognised that computer-mediated support has an important role to play in this process change but introducing such support is complicated by the difficulties of

providing timely access to design and manufacturing data. It can no longer be assumed that all members of a product development team share a "physical work space", have access to the same knowledge, communicate on a daily basis and use the same support software. Rather, than a product development team being relatively stable and co-located, new product development teams are likely to be distributed and dynamic. Consequently, team members may rely on different software tools and support systems and may need access to large volumes of legacy data. Of particular concern are the problems of managing legacy data that may be required by distributed teams in different organisations. Such issues suggest that this data as well as the experiences of design engineers in new product development teams needs to be captured and made available to future team members through some kind of organisational memory which can retain and 'remember' crucial elements of an organisation's past.

'Organisational memory' has become a popular concept in recent years, proposing a solution to a series of organisational problems arising from new commercial circumstances (Ackerman 1994; Bannon and Kuutti 1994; Randall et al 1996). In terms of computer systems 'organisational memory' is perceived as a comprehensive computer system that somehow 'captures' accumulated organisational knowledge and deploys it when required to enhance the efficiency and effectiveness of various forms of knowledge-intensive work. Increasingly, systems based on some conception of 'organisational memory' are evolving to support management, professional and other needs in the task of recording organisational knowledge. There are then some interesting, if paradoxical, similarities and differences between the notions of 'organisational memory' and legacy since both are concerned with the character of the information and data about the organisation and its processes. Organisational memory typically focuses on the capture, retention and production of knowledge of how the organisation works, the various plans, procedures and rationales for work within the organisation; 'legacy' is preoccupied with the adequate documentation, use and evolution of ageing systems and data. The interest in legacy systems arises because commercial organisations, facing increasing competition, need to develop new business processes that may not be adequately supported by existing systems. The interest in organisational memory arises because organisational change, in particular rapid 'downsizing' and the move to a more flexible workforce, creates anxieties within organisations about the skill and knowledge they are losing. The interest in legacy data is, in some sense, an amalgam of these concerns since new business processes often continue to rely on large amounts of legacy data accessed through existing legacy systems.

These analyses of organisational change and the proposed solutions to them require close empirical examination given that other views are considerably less optimistic about the consequences of technological change and more sceptical about the likelihood of such changes in improving teamwork, skill, and empowerment (Kunda 1992). As Ackerman (1994) notes there is a pressing need for empirical research on memory, remembering and forgetting in everyday organisational life - both for a better understanding of the problem of organisational 'remembering' and for the informed design of organisational memory systems. At the very least any attempt to develop an organisational memory system needs to be based on an understanding of how the organisation works. This chapter therefore

presents some fieldwork observations of a distributed industrial design team, documenting aspects of the problems of creating, accessing and managing legacy data. The rationale for the ethnographic fieldwork method employed in this research into the activities of a design team resides in providing detailed descriptions of the everyday, practical accomplishment of design work. Attention is focused upon studying the actual *doing the work of design*, with work as it is done in *actual practice*. It describes some of the routine activity of design work and the issues of 'legacy' and 'organisational memory' as they appear in everyday work.

Background to the Design Work:

For a variety of historical and organisational reasons, the design team that was the focus for the ethnographic observations do most of their design work for XXCO who are currently involved in designing and building a 'generic' 'Eurotram' - that can be modified according to particular local, geographical circumstances. So, for example, the new project 'PORTUGAL' tram' is a modification of the 'ITALY' tram' which in turn is a modification of the 'GERMANY' tram' and so on. XXCO are trying to produce a generic platform of trams - a basic design that will suit a multitude of varieties where the basic engineering design is the same but adapted for different requirements. Current discussions on modifications to the design include a different auto-coupler which further involves raising the floor in the driver's cab, modifications to have sloping floors near the doors which in turn involves designing new supports for the solebar. There are further modifications concerning the weight and waterproofing and more, all alterations which in turn have to be subjected to stress analysis;

"we've been asked to optimise the design - reduce weight, cost, manufacturing time and produce a cheaper product"

The development of the 'generic' tram has created a number of design problems in that it is suggested that the design is carrying a lot of redundant material and the design is effectively 'over-engineered'. This is because a lot of the tram design has been borrowed from a previous - much larger - vehicle, for example it uses body side pillars borrowed from rail vehicle but this tram is much smaller -and has smaller loads. While the design is 'engineeringly sound' however, little attention is paid to optimising design. In this sense it can be argued that legacy data is intrinsic to the new designs and yet, at the same time, can prove problematic.

The designs for the trams, drawn on CAD packages Intergraphics EMS (or MicroStation) are held by XXCO in a system called DRAMS (Drawing Registry And Management System). The technical drawings are used and modified in a carefully regulated fashion. DRAMS is effectively the organisational memory system containing details of every modification (addition and subtraction) to the original drawings. The computer terminals in the design office are connected to the XXCO - DRAM system which gives out drawing numbers and stores issues of drawings. Whenever the design team got a job they needed to connect to XXCO to book the particular drawings out, do the required modifications and then book the drawing back into the system. There are, however, a number of problems with this drawing management system - in the form of 'legacy' problems which are largely a product of responding to customer demand in terms of the CAD system the designs will be delivered on. So, for example, the existing tram

drawings in the electronic DRAM system are 'Intergraph EMS' files. However, the new tram work is likely to be on 'Pro-Engineer'. The conceptual work which was being done ahead of final agreement was on 'Solid Edge' and the problem was to get this conceptual work on Pro-Engineer to reduce translation problems. At the same time there was some suggestion that the design group's main customer, and manufacturer of the tram, XXCO were moving toward a different CAD system - CATIA. However, the end customer, Porto tram, use 'Pro-Engineer' (but may eventually transfer to CATIA). This uncertainty - in terms of the likelihood and timing of the work and the system it would be produced on - created tremendous problems connected to the buying of equipment and the training and retraining of staff.

The bulk of the observed work in the design team consisted of modifications to existing drawings. As one of the designers commented, *"although we're a design company we don't do much design"*. The way the system worked was that if XXCO want to make a design change they'll raise a DQP (Design Query Proposal) which contains instructions for engineering drawing modifications. It's from that DQP and the drawings it highlights that the design team work. The design team alter CAD data issued by XXCO through the DRAM system, working to drawing numbers allocated by XXCO. However, there are problems putting drawings back into XXCO DRAM System since it won't accept Pro-Engineer files. Whilst the DRAM system, as part of the management process, allocates numbers to drawings and revisions of drawings - and has a carefully constructed authorisation system - with Pro-Engineer files it will record that drawing is at Issue A but the file will not be stored. The problems of legacy systems and legacy data are then manifest and consequently part of the task of the design team scope was to produce a useable data management or organisational memory system.

Developing the Organisational Memory

There are a number of reasons why OM systems might be introduced into an organisation. Issues to do with legacy data and systems, the need to provide an organisational record that is accurate, available and effective compete with other organisational and political priorities such as the growth of organisational accountability as expressed in the idea of an 'audit culture' (Strathern 2000). Orlikowski (1997) and Brown (1998) for example, document the various ways Lotus Notes come to be used as an effective OM system: *"In use, Notes was a different 'device' in different situations, woven into the fabric of the work. ... something ... actively and creatively incorporated into the work in different ways...(helping) staff to get their jobs done, be it by getting sales people off the phone, or convincing financial auditors of the orderliness of a process"*. They suggest that over time Lotus Notes, as an OM system, became a resource for structuring and coordinating action and producing an ordered account of work. Personnel would effectively use their entries into the database as a means of coordinating work in a distributed organisation and as a visible reminder to others that they were 'doing their job'.

When OM systems are used in this way for coordinating work they move beyond the notion of data management and OM systems as mere storage (as in Walsh and Ungson (1991)) towards their use in the coordination, planning and awareness of work.

Distributed coordination requires the coordination of people and tasks as a routine feature of 'real world, real time' work. Notable coordination features include the ability to monitor the activities of others and access to shared and readily available information. Given the importance of this coordination within highly distributed cooperative work identifying of the features of work that facilitate coordination is clearly important. Although explicit forms of coordination work can be documented within the design team, coordination does not consist in any one feature of the work but is deeply, and inseparably, implicated in the procedural details of *all* work. This is manifestly the case in the design team by virtue of their position vis-a-vis both the various sections of their manufacturer (XXCO), and their eventual end customer. Coordination is built into the team's everyday work through, for example, the routines involved in modifying and authorising drawings through the drawing management system (DRAMS) and is instantiated in the use of the drawings themselves as everyday resources.

Observation detailed the various ways in which drawings, and their associated paper work, were used both as coordinating devices and as components in the individual worker's 'sense of organisation'. Such artefacts enabled designers to quickly the 'history' and progress of a design - not only of 'what had happened' and 'what to do next' but also 'who had done what'. Their explicit point is to co-ordinate the work of numbers of people - in the design team and in the various divisions of XXCO with whom they dealt - (Bogeys; Bodysells and Projects) - in order that separate work activities and tasks come to have a coherence. In this respect they are solutions to the problem of the assembly of information in organisations identified by Garfinkel (1967); that is, what information is needed and its 'value'; the worth of collecting the information with reference to the effort involved in its collection. One of the more obvious ways in OM systems assist in distributed coordination is through the everyday use of formal procedures - commonly available in the form of 'idiot guides'. For the design team this would include, for example, 'how to get a drawing modification checked and authorised' - a system known as PROTOS. The following fieldwork extract outlines some features of an everyday process of getting a drawing checked and signed off. It illustrates how the various forms in use in the Design Office are designed to assist in the updating and control of legacy data, to collect standard information, to make the information comparable and to control the information that is provided.

Next:

1. from file - ready to be authorised going through PROTOS
2. writing and drawing on sheet "we need to make a record of everything we do - so that we can back track it.."
-
7. "I'm just checking all signatures off to make sure all PROTOS is done
8. assembling various bits of paper together - DQP and quote (the contract for the drawing)
9. explains how the system works - sign in red; have to do 7 copies; has to staple PROTOS to the back; fill a CADCH sheet in
10. Off to photocopy and find rubber stamp - stamping everything
11. gets drawings for photocopying - for every drawing they do they need: delivery note; drawing issue sheet; master drawing; on back stapled PROTOS info sheet; copy of signatures..
12. material duplicated 7 times and each copy has to put copy number, initial and date (different copy numbers go to different departments) because its in red they can't photocopy it - "that's how they do it in Bodysells, they're our customers.."
14. Assembling packages together

Organisational Memory and Awareness of Work.

Despite the obvious benefits of standardised processes and formats - such formats do not always, in themselves, convey an adequate 'sense of the work' and it is in these circumstances that local knowledge and a whole range of interactional skills are deployed to help 'make sense of' the work. This reiterates the point that building up a useful OM system involves rather more than simply building up a database, collection of plans or drawings. In this sense organisational memory should not be viewed merely as a static repository of experiences organised and structured in direct correspondence to a shared and unproblematic reality but a dynamic process in which definitions are continually renegotiated and understood. As Schmidt and Bannon (1992) argue, it *".... requires the active construction by the participants of a common information space where the meanings of shared objects are debated and resolved.. objects must be interpreted and assigned meaning, meanings that are achieved by specific actors on specific occasions of use."* (1992:27).

In the Design Office the various drawings and documents and the various screens of the CAD packages, were both the focus for work and a visible, a publicly available, record of work. They effectively put the work on display so that others might be aware of it. So, for example, modifying a drawing, preparing a quote, writing an instructional booklet, are organised to provide for the 'awareness of work', and done in ways which ensure their recognisability, their 'visibility' as the actions-that-they-are. This issue of 'awareness' of work manifested itself on a regular basis since the design team necessarily work with others - not merely others in the design team but particular sections in their manufacturing company XXCO (such as Bodyshells who built the trams), and sometimes organizations in different countries (Portugal Tram). In the following fieldwork extract a designer - 'John' - displays an awareness not only of another designer's work - 'Fred' - but also the work of those in Italy who have the task of assembling the tram and, in particular, applying sealant to the tram roof. This is in response to a problem of leakage that had emerged as a consequence of the inadequate application of sealant to the roof joints.

Next:

1. John - looking at sealing job - has to alter ITALY tram drawings - made up of 6 cars - 2 cabs and 4 saloons - concern about drainage - got to alter the drawings .. those dealing with the call up of sealant - because the sealant has not been adequately applied
"the problem with ITALY tram - joints of roof panels not fitted properly - had to put a lot of sealant but it wasn't very successful.."
2. Has to remove balloons from drawings because called up in more detail in Fred's document - only supposed to call things up once - and the details are in Fred's document on sealant. Therefore his modification to the drawings must make reference to Fred's document
3. *"I've removed the balloons .. now these notes (notes on drawing relating to sealant) - I've got to refer to that (pointing) (Fred's) document"*
4. *"Every time we up issue a drawing we have to keep track in this alteration column.. have to change these notes to reflect the DQP(drawing contract).."*
5. Calls up notes on drawing - removes note 3 - "note 4 can go as well" removes note 7 (refers to sealant) and note 8 (refers to cleaning of surface)
8. *"The tricky thing I've got to do know is to remember which notes I've changed and put it in this column - this alterations column"*
10. *"I think that's it - I'll just get a printout"* - goes to get drawing from printer

11. Writes 'Check Print 2' on drawing - *"that's so that we don't get hammered by the auditors .. they should only leave the office if they are proper authorised drawings"*
16. *"That's it ..it can go for checking now"*

The fieldwork extract shows one designer (John) modifying existing legacy data - the drawings of the roof panels - to incorporate the necessary information about the application of the sealant, guided by an awareness that another designer (Fred) is currently producing a document that contains extra and even more detailed information. The modification of the drawings is shaped by an 'awareness' of how others - those applying the sealant - will go about their job in using the drawings and applying the sealant. Both designers might then be regarded as attempting to build some form of 'awareness' into the OM system by providing further explication to legacy data - that is, they deal with the practical problem of communication as recipient designed by the provision of yet further detail.

Accomplishing Organisational Memory: remembering as a practical activity.

As we have already suggested 'organisational memory' as popularly conceptualised appears based on the view that 'storage' models of human 'memory' constitute valid metaphors for various organisational activities (Walsh and Ungson 1994). As a number of people (Ackerman 1994; Hughes et al 1995) have suggested, the notion presents us with an essentially anthropomorphised conception of organisations that trades upon a psychological, predominantly cognitive view of memory. Such a view, we believe, attributes *human* properties to organisations on the basis of ill-founded conceptions of these properties and consequently acts as a distraction from understanding the difficult issues involved in developing systems to support the record keeping, accounting, auditing and training.. activities of organisations. As Ackerman (1994) argues, *"using human memory as an analogy results in an easily understood metaphor, one offering promise. When it becomes idealized, however, systems based on this metaphor may be oblivious to serious organizational and technical issues."*

Our approach to the issues of 'organisational memory' draws on ethnomethodology and Wittgensteinian sociology and specifically Coulter's critique that cognition is better conceived of as a social and grammatical phenomenon rather than a 'mental' one (Coulter 1979, 1983). (In a similar fashion discursive psychology (e.g. Middleton & Edwards, 1990; Edwards & Potter, 1992;) suggests that psychological phenomena such as memory are best understood as accomplishments that occur in the course of communicative action). Our interest lies in the way in which 'knowledge', 'memory' and other related concepts that carry a cognitive baggage can be treated as culturally accomplished phenomena. Memory and remembering is something that speakers accomplish rather than simply possess. By identifying knowledge and memory as contextually arrived at in and through the practical work of members, we can provide, conceptually and empirically, some more rigorous underpinnings for the investigation and understanding of organisational memory. Understanding 'knowing and remembering' as contextual requires understanding context as the *accomplishment* of members where work has to be done to identify 'how to remember' rather than reaching, metaphorically and unproblematically, into some unspecified mental 'bin'. The problem, then, is not so much what people know and remember as how do they decide, or accomplish, what it is that they need to know

and remember and for what purposes. *"Remembering is a social act, informed by cultural understandings of what is to be counted as adequate and felicitous recall, a way of accomplishing some activity in the present through invoking the past in an appropriate and skilled manner"*. (Brown 2000)

Given ethnomethodology's emphasis on the 'accomplished' nature of human activity, problems of 'remembering' can be understood as problems of *providing instructions for what to remember*. In such a circumstance our fieldwork studies, both in the past (Hughes et al 1996: Randall et al 1996) and in the Design Studio, suggest that the storage metaphor of 'organisational memory' provides a solution to problems which organisations simply do not have. We believe that systems such as OM systems, should seek to support work as it is *practically accomplished* rather than be designed to support *idealised* versions of work. Our observations suggest that such idealisations are likely to have only a weak relationship to the practicalities of situated work. Our studies of organisations reveal few examples of 'remembering' problems that can be conveniently and unproblematically understood in terms of the standard 'organisational memory' metaphor since it fails to distinguish the kinds of socially situated 'remembering' that actually take place in organisational life.

Remembering as a practical activity: remembering plans.

When remembering is thought of as socially situated, then questions arise concerning what practical problems of remembering are to be found in organisational life. Developing the notion of remembering and memory as social and grammatical phenomenon, and using Ryle's and Coulter's (1993) division of 'knowledge types', our fieldwork observations in the Design Office suggest that we can distinguish between various 'types' of remembering as practical problems and practical accomplishments. Thus we might distinguish between 'remembering how' (how to perform a process), 'remembering who' (who might possess or have access to requisite information), and 'remembering that' (the rationale for any particular approach)(Randall et al 2000). Such a distinction is not just conceptual but has implications for the design of systems to best support such 'remembering' work. Deciding whether computer support for a 'remembering' problem is appropriate is not simply a matter of identifying that there are things that people forget, but of identifying how they go about recalling within a specific work context.

Some of the characteristics of these different forms of 'remembering' activity are clearly documented in the fieldwork extract below. Here one of the designers has been modifying a drawing of the 'Eurotrain' and discovers that one of the views that he needs to modify - a drawing of some jacking points - is apparently missing from the drawing. As he goes about the process of finding the missing view various aspects of remembering as a practical accomplishment are displayed. As part of this memory work the contingent nature of plans and the ways in which instructions and requests are 'recipient designed' are also brought to light.

Next:

1. Using Intergraph EMS (a CAD package) - read only drawing - solebar assembly on the Eurotrain - taken copy from DRAMS - needs to replace some of the information

2. Explains process of design drawings - these are 'working drawings' - when he gets the 'go-ahead' he will be given a DQP (drawing contract) and take out the drawings from DRAMS. When the drawings are reissued from DRAMS the version will be given a new letter (A-Z)

3. Working on new drawing for machining of main door way..

17. Problem. Pointing at diagram " *. this is a bit of a mystery .. its not actually a hole.. its the point where the vehicle will be jacked in the event of an accident.*"

" *.. it doesn't actually say .. it must be drawn somewhere .. it will probably have its own drawing .. in PROTOS .. For the floor assembly or the body assembly .. It depends where they are put together..*"

25.. Looking to see if any other details need copying over " *I think we might need that*"

gets another drawing " *thats the drawing thats related to this T slot*" - and also has details of doorway

26. Gets out plan view - cant find details of view V on drawing which he expects to find (details of saloon doorway)

27. Can't find detail - looking through other drawings - " *I could get out the details of the other vehicles to see if V shows up on those drawings .. the only way to do that is to go into DRAMS and get copies....the proper way is to go into PROTOS and search for the parts list number and from the parts list number.... a quicker way is to go into my drawer and look up the numbers .. because I worked on it previously (gets out list from drawer) . every drawing I did I recorded it in this book*"

28. Looking at paper list of drawings 'New Drawing Numbers' - looking at 'underframe machining' " *I need to look at each of those*" " *or I can go down to the workshop .. and say .. are they applicable to this item..*"

29. " *.. there is .. ought to be .. a slightly quicker way by going to our filing system (green folders). When these drawings were issued we should have got a whole set of them in our filing system.. I suspect they were'nt .. they may not have put them into the file.*"

30. " *I'll go to Jack .. ask him.. if he can remember what the Project number is.... this is information I could put in that notebook (notebook of drawings)*"

31. " *.. this is because we get so many different numbers.. A project had A number and the project files would also be in the same cupboard and because you record the date (you can find the right drawings)*"

32. Asking " *Jack .. do you remember .. when we did the floors . did we put copies in the file .. I know we should have . but did we? .. can you remember the project number? .. you cant..*"

33. " *I'll look in my timesheet .. the project I was looking at about then .. timesheets are a good record.*" - looking through timesheets - gets number " *..its probably that one..*"

" *.. it works because we write a description .. not just ITALY tram or Eurotrain but specific job too..*"

34. Wandering around the office. Goes to filing cupboards - file not there - (shows archive with booking out system - but doesnt apply to files)

35. Asks Secretary if she knows where the file is - no - has to look on people or desks - he knows who's been working on them - Bob and Peter.

36. File is on Peter's desk - drawing not in file - wrong set of drawings - explains problem to Peter " *. I need the floor drawings..*" " *.. they're not in the file.*" Peter replies " *.. well they keep asking so I keep hanging on to them*"

37. Explains his problem to Peter - " *.. that view - V - where is it taken from? because we're going to need that in our detail..*"

38. Looking at drawings with Peter .. " *we're trying to establish where we get that (View V) from*"

Peter says " *people keep phoning me up and I get sick of getting them out of the cupboard so I keep them on my desk..*"

39. Explains to Peter how view V may have disappeared " *they said it was too small so I did this (AJ section) and I may have lost V - so if you look in the original drawing ..*"

40. They look at original drawings together but its not there " *its at this point that you think its worth legging it down the works*" (Bodyshellwhere the train is assembled - to ask them about the holes in View V)

Still looking at drawings .. talking to Peter .. " *is there a footstep on this vehicle? .. is this what they're for? (the holes in view V)*" " *.. in producing a fully machined solebar it implies we need the detail there...*"

41. Looking at another batch of drawings. - " *.. because the job has been done by so many people and gone on so long .. the sequencing of details is a bit haphazard..*"

42. Still looking through drawings " *From what Peter has just said there is another way (we can find view V).. by going through earlier copies in DRAMS until we find one that's got V written on it..*"

43. Puts folders with drawings back on Peter's desk

44. Gets bunch of DQPs off PPP's desk .. *in here we should expect to find early copies - drawings which we were given when we started the job.*"
45. Finds view V on old drawing .. *"We've got to go back to issue A of the drawing to find it .. so what I'll do I'll copy that .. in case anything has changed .. the latest copy of that should contain the details.."*
46. Makes note of the drawing number .. *".. if it isnt in the current number there should be a DQP to change it.."*
47. *"I should show Peter because it will affect him in a few days time"*
48. Goes to show Peter - chatting
49. Puts drawing back with other DQPs and drawings on Peter's desk. *"I'll pick it up electronically.."*

In the extract we see the unfolding of a number of 'plans' to deal with various contingencies as they arise in the search for the missing detail 'view V' on a drawing - that take the form of remembering 'how' activities. It contrasts the 'proper' way *"to go into PROTOS and search for the parts list number"* with a quicker way - *"to go into my drawer and look up the numbers"* and other possible responses - *"I can go down to the workshop"; "going to our filing system"; "I'll go to John .. ask him.. if he can remember what the Project number is"; "I'll look in my timesheet"*. But no great claims are being made here about the efficacy of any of these practical approaches - the list in the drawer is not Proust's tea-soaked madeline or cobbled pavement that suddenly brings memories flooding back (see Brown, S. 2000) but simply practical responses to the problem at hand.

While these 'remembering how' strategies fail, the designer carefully, and at the same time, highlights another remembering strategy of 'remembering who' going through a number of possibilities, of asking the Secretary; of asking Peter and then thinking about who else might be using that file and so on. The problem of 'remembering how' is then not simply a problem of 'I have forgotten' and 'how do I go about remembering', but a problem of the social distribution of expertise. This in turn involves 'remembering that' processes in terms of recovering rationales involved in the activities of developing, storing and modifying drawings. The extract thereby highlights an important feature of everyday practical remembering work - that such remembering activity - taking the form of remembering 'how'; remembering 'who' and remembering 'that' - is dependent on the practical understandings about what to do in *these* circumstances, using *these* resources, *these* people, and so on. Thus although remembering activity may be presented in the form of abstract plans, as manuals, as statements of procedures, and so forth, all encapsulated within an OM system - and 'remembering' viewed as simply the application of these plans - the 'just what' it takes to realise them is a practical matter. It requires 'making the plan work' through all the various and inevitable contingencies that can arise. Remembering routines are then not slavishly adhered to but involve the considerable exercise of judgement involving the circumstances under which a routine is to be strictly followed and the circumstances under which modifications or 'short-cuts' may be employed through, for example, the utilisation of informal teamwork or 'local knowledge'. Such an analysis, of course, is relevant to considerations of 'organisational memory' and essentially problematises some of the assumptions on which such systems are based.

Conclusion: Distributed Design, Legacy Data and Organisational Memory

". in order to augment organizational memory with computer systems, we need to better understand the critical organizational issues facing such augmentation efforts." (Ackerman 1994)

Although admittedly based on a small scale, 'quick and dirty' (Hughes et al 1994) ethnography - the observations of the everyday use of legacy data found little evidence for an organisational memory problem in the conventional sense that people were unable to locate artefacts, data or procedures. Our observations indicate how people routinely addressed issues of 'remembering' and we document exactly how they go about it. However, although sceptical about notions of 'organisational memory', we obviously do not suggest that organisations do not need forms of record keeping, process maps, data banks, formal accounts of who does what when, and so on, or that systems cannot be designed to augment and support these processes. Our complaint about the notion of 'organisational memory' is that it does little analytic work which facilitates our understanding of organisational life and the design of systems to support such cooperative work. Understanding organisational activities, analysing the characteristics of cooperative work and thinking about how they may be more effectively supported is difficult, and some current notions of 'organisational memory' may well be a distraction from facing up to difficult issues in the support of distributed work.

Understanding 'organisational memory' is not a problem of simply delineating the 'bins' into which memories may be distributed but one of understanding the various things that are going on in organisations when people can be said to be 'remembering'. Supporting work with all its contingencies requires that OM systems pay attention to the occasioned character of remembering activities, and most importantly to the fact that 'remembering' is a number of loosely related activities, each raising their own particular problem. The obdurate problem for 'organisational memory' systems in this context is that of offering multiple pathways such that whatever the occasion for remembering, a suitable connection can be found. We see little evidence that models of 'organisational memory', nor the systems designed to augment it, have as yet adequately come to terms with these nuances. Such systems will depend on the degree to which we have understood what kind of remembering activity is taking place, and what implications the activity carries. Computer support for and through abstract models of organisational behaviour does not as yet provide support for the kinds of subtlety and contingency we have identified in our studies. If we wish to support organisational remembering OM systems need to take into account the character of that remembering as a practical activity in order to support it. Before rushing headlong to embrace organisational 'solutions' - in the form of 'organisational memory' systems - we need to think more clearly about the organisational 'problems' to which they are the proposed solution.

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