'Dasein of the Times': Temporal Features of Dependability

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ABSTRACT
This paper is a modified version of a chapter in the PA2 'Trustbook' (Clarke et al. Forthcoming) that uses our ethnographic studies of everyday work to illustrate sociological approaches to explicating some temporal features of dependability.

Keywords
Timeliness; Ethnography; Healthcare; Technology.

"..man is nothing; he is, at most, the carcase of time"
(Marx and Engels 1976: 127)

"Human beings are fundamentally temporal; they find their meaning in the temporal character of human existence"
(Lash and Urry 1994: 230)

1. Introduction: Time
Issues of time and timeliness are pervasive in all aspects of the design and deployment of computer-based systems. This paper uses our empirical ethnographic studies on organisational culture and trust to examine issues of timeliness as a feature of dependability. In 'Technics and Civilisation', Mumford (1963) suggests that *"The first characteristic of modern machine civilization is its temporal regularity"* (Mumford 1963: 269) involving the structuring of social life by forcing activities into fairly rigid temporal patterns. Mumford identifies four major forms of temporal regularity - regular patterns of associating social events and activities - rigid sequential structures, fixed durations, standard temporal locations, and uniform rates of recurrence, stressing the fact that these often constitute binding normative prescriptions. Similar arguments have been advanced more recently by Bolter (1984) who compares the computer with the clock in terms of its massive social impact – not just on time itself but every aspect of social life and our ways of thinking about the world.

Issues of time and arguments about time have long occupied sociologists who have endlessly theorized about (if rather less investigated) its social character – and little more than a brief (and probably ineffective) sketch can be offered here. Durkheim (1947) in 'Elementary Forms of Religious Life pointed to the intimate connection between social and temporal issues, that time is in modern sociological parlance (though he would not have used the phrase) 'socially constructed': "it is the rhythm of social life which is at the basis of the category time." For Marx the orientation to and regulation of time – in particular labour time - was a central feature of industrial capitalism and part of the inherent logic of capitalism involved attempts to devise means to squeeze more time out of the proletariat either by extending the working day or, in the long run more productively through the denser forms of work supported by technology. The impact of these new forms of working and people's new orientations and responses to time, and what amounted to the discipline of time, are outlined in Weber's treatment of the Protestant ethic and Franklin's epigram "time is money". More recently, (Lash and Urry 1994; Adam 1990) sociologists have proffered a range of different understandings of time. Giddens (1981), for example, drawing on Heidegger (1978) outlines a number of concepts for understanding the social impact of temporal change: regionalization, presence-availability, time-space distantiation, time-space edges, power-containers and the disembedding of time and space from social activities. Giddens also suggests we need to consider three time-scales – the *'duree'* of daily time, the *'dasein'* of life time and the *'longue duree'* of history. (And Lash and Urry 1994) suggest these omit other important – faster and slower time scales – what they call 'instantaneous' time and 'glacial' time) While there is insufficient space to give these even a cursory treatment the important point is that, whilst acknowledging the social character of time, as Adam (1990) comments, these sociological accounts have rarely reached much agreement about time – associating it, for example, with death, with order and structure and treating it as a measure, as a parameter and as an idea.

2. Time and Technology
Sociologists have also identified a number of different and changing forms of temporal organization that reflect and contribute to wider social features and how technology – the clock, the steam engine, the computer - has acted to mediate a range of 'natural' rhythms and cycles. According to Castells (1996) the dominant temporality of contemporary society is what he terms 'timeless time' – this occurs because computer systems can disorder the sequence of events and make them simultaneous and thereby time is dissolved and past present and future mingled. At the organizational level ICT supposedly generates new patterns of working and new forms of organizations – the most remarked upon, and the most hyped, being the 'virtual organization'. Such an organizational form supposedly heralds massive changes in temporal and spatial aspects of work and organization as the 'time discipline' associated with industrial capitalism is challenged and transformed by new technologies that supposedly overcome spatial and temporal constraints. In a similar fashion Nowotny (1994) argues that the immediacy

presented and produced by ICT produce an experience of 'instantaneous time' and, with specific reference to issues of trust Adam (1990) would suggest that such experiences of 'instant time' can lead to a distrust of the future. We are, however, a little sceptical of many of these claims (Hughes et al 2002), a reliance on notions of 'virtuality' too often obscures rather than illuminates the very real issues associated with the relationship between ICT and everyday working practices within changing organizational contexts. Much of the work is also theoretical rather than empirical – focusing on providing explanations for these changing temporal frames rather than an understanding based on real world explication (Thrift 1996).

The focus of this paper is on issues of time and timeliness as instantiated in our empirical studies of everyday work - how time is woven into organisational culture. As Failla and Bagnara (1992) argue the relationship between technology and time should be considered in the context of organizational culture. Our interest is in discovering and demonstrating how temporal patterns – rhythms and trajectories - provide individuals with a resource for seeking, providing, and managing information in the course of their everyday work and the implications these findings have for the design and deployment of dependable socio-technical systems. The material on which this paper is based upon is from long-term ethnographic studies, and as such temporal issues are at the heart of the research enterprise. As we have said in more detail elsewhere, the point of ethnography is to provide a detailed exposition of 'real world, real time' activities in their natural setting (Hughes et al 1994; Lebbon et al 2003). The aim is to provide details of the everyday practices through which the work is accomplished, identifying the contingencies that can arise, how they are overcome and accomodated, how the interdependencies of a division of labour are actually achieved, how technology does or does not get to be incorporated into work activities, and so on. The focus is a social one emphasising the 'situated' character of work and the related judgements and discretion routinely employed in response to everyday work and its inevitable contingencies. It is 'being there' which enables the ethnographer to identify the cooperative aspects of 'real time, real world' work, such as the small-scale constellations of assistance, the deployment of local knowledge of how the organisation works, the awareness of others, etc., which support the actual performance of work activities. The method is directed toward producing a rich portrayal of work activities on the grounds that theoretical categorisation is likely to prematurely 'construct' a picture of the work which is likely to bear only a superficial relationship to the work as actually done in 'real time'.

Our empirical, ethnographic studies of organizational work in DIRC have highlighted a number of facets of timeliness that we will draw upon in our analysis. In our studies of road safety engineers, for example, aspects of time - such as the time of day, the day of the week and the month of the year were all seen as crucial in both understanding and providing viable solutions to road traffic accidents (Harper et al 2001). Or in steelmaking and the rolling of steel plate - where speed of rolling is vital in maintaining the heat within the slab and thus ease of rolling - timeliness becomes a central feature of awareness and coordination of the working division of labour (Clarke et al 2003). Or in our studies of mammography where the consideration of mammograms over time afford consideration of the identification (and treatment) of cancers (Hartswood et al 2001).

Our studies of engine manufacture highlight mundane issues of timeliness within 'just-in-time' production. The ethnographic study of work in a manufacturing plant 'ENGINECO' (Voss et al 2001) producing mass-customised diesel engines provides some interesting insights into coping with temporal features of 'just-in-time' production and the contingencies and 'local logics' of day-to-day production management. Here computer systems are an integral feature of 'just-in-time' production; reducing stock and work in progress, improving flexibility and avoiding late deliveries. At ENGINECO the precondition for 'just-in-time' production is that all parts are available in time for production – called 'buildability'. This requires that all component parts and information are available before production starts. Material is delivered to an external logistics provider that operates a high-shelf storage facility near the factory. Upon ENGINECO's order, the logistics provider delivers parts to the plant. The factory itself was not designed to store large numbers of parts, containing buffer spaces for only four hours of production. Assembly planners download assembly packages (collections of production orders) into the Assembly Control Host. These production packages are supposed to be compiled with a lead time of one or two working days, enabling the timely scheduling of material and creating a buffer of spare orders for production in case some orders cannot be built because of breakdowns. At ENGINECO, and other companies employing just-in-time production methods, software systems have often failed to deliver expected outcomes since the technology carried assumptions about the organisational setting that did not match the temporal and spatial realities of everyday working life – or, more simply, fail to cope when things go wrong (and things always go wrong). The temporal aspect is particularly relevant here because, of course, decisions are made in real time. Workable solutions to everyday production problems manifested themselves in the form of 'local logics', organizational and temporal 'workarounds' that attend to the incompleteness of knowledge on both organizational and spatial-temporal levels. This included ideas about where items are or should be, the timeliness of activities as well as what actions were organizationally acceptable, what was acceptable solution *just here and just now*. As an example of the worldly, temporal contingencies that routinely arise, Voss et al (2001) describe how when a material storage tower went offline so that no messages to the Assembly Control Host were generated when boxes were emptied (and thus no new parts would be ordered) Control Room workers solved this problem by marking all material in the tower "faulty" which resulted in new material being ordered from the logistics provider. Consequently, supporting production work in all its contingent aspects requires that planning systems pay attention to the occasioned character of the logic of production. Thus successful long-term IT development critically depends on the day-to-day interaction (and trust) between use and development, between users and developers as they collaboratively track down troubles with the system and work to come up with solutions, as temporary fixes, changed working practices (e.g., stable work-arounds) or changes to the IT system.

3. Time in Medical Settings - Illness Trajectory and Rhythm

The bulk of this paper will be concerned with temporal issues arising from our ethnographic studies of everyday hospital work such as staff handover, bed management, process modeling and mapping and developing and deploying new IT systems, to illustrate some of the temporal features of everyday work in medical settings. Healthcare informatics is a rich source of dependability issues. Healthcare also represents a domain in which dependability is of considerable public concern and policy importance. It thus represents a site that is of considerable strategic importance to DIRC and our efforts to demonstrate the relevance of our achievements.

Time features heavily in sociological analyses of the experience of illness. The concept of Illness Trajectory (Glaser and Strauss 1967) refers to:" not only to the physiological unfolding of a patient's disease but to the total organization of work done over that course of illness plus the impact on those involved with that work and its organization. ...we shall occasionally refer to "trajectory work", simply meaning the various kinds of work done in managing the course of the illness and in handling the interrelationships involved in that task. In this view *trajectory* replaces the singular notion of process with a more complex, multi-dimensional flow of events and situations. Illness trajectory has four aspects or facets; the physiological, the temporal, the sentimental and the social. The physiological involves disease and disease processes. The temporal facet reflects the consequences of time in illness and the schedules of the day-to-day activities of nursing care. The sentimental focuses on carer-patient interaction and the intensity of sentiment associated with confronting illness and its consequences. The social aspect pays attention to the social consequences of illness, of dependency and so on.

The 'temporal order' refers to, and provides a means of understanding, the meanings that use of time introduces to medical events or situations. So, for example, the daily 'round' structures medical staff's view of a day and its likely sequence of activities. For nursing staff the daily shift is structured into a temporal sequence by regularly scheduled events like meal times or periodic observations on patients. Particular days, operating days or admission days for example, will possess and achieve a temporal order that is noticeably different:

> "But time as a facet of the illness trajectory is only a reflection of the established or re-negotiated temporal order. Time passing is experienced by the patient and by the nurse. Some days are slow and tedious as they happen, some weeks seem to pass by unnoticed. The common experience of visitors to a patient is that visits pass uncommonly slowly while for the patient who has anticipated visiting time for much of the day, they pass all too fast. To the busy nurse, a minute or two at the bedside seems costly time; to the patient the interaction was hurried and, in consequence, uncaring. How medical staff, nursing staff, patients and others experience time-passing, how they cooperate with or fight against someone's proposed schedule and what that schedule means for these various participants fills in the temporal facet of that trajectory" (Kelly nd).

The notion of recurrence of temporal patterns is a particular feature of Zerubavel's (1985) work on 'temporal rhythms' in hospital settings: "The world in which we live is a fairly structured place. Even the most casual glance at our environment would already reveal a certain degree of orderliness. One of the fundamental parameters of this orderliness is time - there are numerous temporal patterns around us" (Zerubavel 1985: 1) In his classic study of social rhythms in a hospital, Zerubavel described the cyclical nature of work in order to emphasise its temporal features- helping us understand the work of an organization by foregrounding its intrinsically temporal and cyclic nature. Zerubavel's (1985) discussion of schedules and cultural calendars presents an intriguing picture of the pervasiveness of social rhythms, of how rhythms are socially created and manifest themselves in various ways as a facet of our everyday lives. Although these rhythms are a feature of the daily work they are not unchanging or unchangeable but are affected by unexpected occurrences. As Reddy and Dourish (2002) suggest, while work rhythms provide information to help people accomplish their work and guide future activities, they can also pose challenges to the coordination of work. "Medical practitioners must continually balance and integrate medical and organizational information in decision-making; that the processes of seeking and providing information are seamlessly interwoven with other working activities; and that they are coordinated in part through the set of working rhythms that provide a resource to interpret and manage work". The relevance of rhythms in everyday working life is that they orient members towards likely future activities and information needs in the course of doing their work. Current activities are crafted with an orientation towards expectations of future events. Different work rhythms can conflict with each other - nurses and physicians for example - and can produce different expectations about the availability of information.

Reddy and Dourish (2002) use the concept of rhythms to highlight how temporal patterns or rhythms provide individuals with a resource for seeking and providing information. These rhythms can be more or less regular, and operate on a large or a small scale, though clearly rhythms can be disrupted by unexpected occurrences. Dourish and Reddy distinguish between 'large scale rhythms' and 'fine-grained rhythms'. Large scale rhythms refer to the broad pattern of daily work such as shift changes, doctors' rounds, patient changeover and so on. Fine-grained rhythms refer to patterns of medication administration, the arrival of lab or test results. These working rhythms orient staff, patients and others towards likely future activities and information needs in the course of doing their work.

One area in which temporal rhythms come up against organisational requirements is in the perennial bug-bear of bed management. Bed management is an abiding concern, common throughout the NHS but contained within it are more specific temporal issues e.g. 'winter planning', when the hospitals try to plan for 'known' seasonal problems. Hospital waiting lists and the availability of hospital beds is always a highly charged political issue. For example, at the time of our ethnographic observations (November 2000) a great deal of concern was given to 'winter planning' which was related to national press reports, from the previous year, of hospitals being full and effectively closed to new patients. As one manager commented; ".. it came down from on high that this year there would not be a Winter crisis .. and I mean from On High..".

This concern over 'winter planning' was reflected not just in a daily managerial focus on bed numbers but also related statistics connected to waiting time on trolleys and the 'escalation policy'. Again this was linked to national press reports of patients spending enormous amounts of time on hospitals trolleys as they waited for beds to become available. The 'escalation policy' was linked to a government requirement that no patient should be kept on a trolley for more than 12 hours. Trolley waiting times were closely monitored and the Trust had contingency plans to open up a day-case theatre to accommodate more beds and patients. Bed management was associated with a system of alerts that instigated various managerial responses: " to go to red (alert) the Directorate Manager has to go and count.. if the position is that we (the Hospital) are ..closed to admissions the Directorate Manager has to come in and physically count the beds .The managerial focus on bed management was supported by the collation of a weekly site report circulated by email, for example;

> "Weekly site rep attached for your information. Large volume of medical sleepouts at both main sites. Current position:
>
> XXX: no available beds now although position will change. Some elective admissions for today being cancelled and admissions for next 2 days under review with relevant clinical directorates..
>
> ZZZ contacted by GGG last night to take medicine emergencies from south of GGG area… some patients at ZZZ still waiting for beds at DDD to become available"

In this fashion temporal features interlock with other managerial concerns of space and everyday organizational working.

Another example of these temporal rhythms comes from our ethnographic studies of everyday work in a toxicology ward, a specialised inpatient service that allows for joint medical and psychiatric assessment of patients who have been referred following a suspected self-harm incident. Of particular interest is temporal features of access to and use of patient notes as a feature of mundane work. Record folders for each patient are kept in a trolley that follows the cycle of activity within the ward. During the morning ward round (usually held between 8.30 and 9.00am) it is wheeled from bed to bed and each of the record folders are accessed in turn. At the 9.00am meeting two handovers are given to the Psychiatric Assessment Team. Typically the consultant toxicologist runs through the medical status of each of the patients, and a nurse gives a 'psychosocial' handover. The records trolley is wheeled into the ward at the beginning of this meeting, allowing sequential access to the records as each patient is discussed. A nurse produces each of the records in turn, referring to the progress notes to give a brief synopsis of salient factors of each presentation. The sequential structures of the activities lend themselves to a similar sequential access to the notes. At the end of the morning meeting the patients are allocated to team members for assessment, who then avail themselves of the relevant notes. Team members will typically read through these notes prior to seeing the patient. After the assessment is complete it is the nurses who make the final entries in the notes when the patient is discharged. This is typically done at the nurses' station in the ward. The pages comprising the completed notes are removed from the record folder and placed in the wire basket on top of the filing cabinet in the doctors' room and collected routinely by the secretaries. Thus there is a tie between the location of the records as a collection, and the particular activities carried out on the ward, and variations in the organisation of the records as a collection depending on the activity.

Although these activities were not always as neatly temporally organised as portrayed, such common patterns – and the process described is not unusual - illustrate the role that rhythms play in knowledge work, in particular in information seeking. Examining information seeking in the light of an understanding of work rhythms indicates that people want information - in this case the patient records - when it will be the most beneficial to them in their work. The rhythms of their work guide their need for, and likelihood of getting, information. Taking rhythms into consideration therefore affects notions of information seeking and how we might think about providing such information – for example through electronic patient record systems. Of particular relevance is some form of situated understanding of the extent to which the request for and the provision of information is couple or 'decoupled' to any particular work rhythm. But different work rhythms can produce different expectations about the availability and timeliness of information and problems may occur when the information needs of different types of work - for example, medical and administrative - conflict. Clinical notions of exactly what information is time critical and exactly what timeliness might entail are often very different from administrative considerations of these issues.

4. "Improving Knife To Skin Time": Time, Process Modelling and New Technology.

As modern healthcare institutions have become increasingly information intensive technology increasingly plays an important role in healthcare delivery and management. When 'time is money' healthcare information systems are intended to supply cost effective improvements in managing patient care; in information gathering and dissemination; and in coordinating distributed organisational work (Doherty et al

1999). One organisationally popular approach to ensuring time, resources, staff and systems are allocated and used efficiently is process modelling. Process modelling is fundamentally about time allocation and time awareness - it requires knowing appropriate sequences of activity and the likely or preferred time each activity will take. This section presents some findings from our observational research shadowing hospital managers documenting their everyday activities as they dealt with the creation and implementation of process models. The intention was to standardise as many processes as possible to ensure an identity of service and practise across the distributed operations of the hospital. At the time of the fieldwork the production of process maps was being used to identify "bottlenecks" in the 'processing' of patients which, in the words of one manager, delayed "knife to skin" time.

One initial and obvious problem with process modelling in a distributed organisation was that despite the increasing investment in new technology managerial work often involved working with various kinds of 'legacy' system. A legacy system is one which, having been introduced with the best of intentions as an 'all singing, all dancing' solution has not been maintained, modified or developed to accommodate organisational or technological change. This has a temporal relevance in that the system is unlikely to do all that is required or even 'talk' to more recent applications resulting in various time consuming 'workarounds'; workarounds that may well defeat some of the central objectives of process modelling. So, for example, the Pharmacy system, crucial for process models in terms of the costing of drugs and treatment, was unable to 'talk' to any of the other databases or management information systems, necessitating time consuming 'workarounds' in the form of the printing of documents and multiple entry of data. The paradox of such legacy systems is that, despite their outdated and time-consuming character, they are often trusted. Such systems are adhered to long after their usefulness has become limited, precisely because of the way in which they are embedded in longstanding social and organisational processes.

One particularly important observation of the development of process models in the hospital is the ways in which process modelling becomes centrally implicated in activities of working towards achieving *mutual relevances* and *co-ordination*. Members frequently drew upon *ad hoc* and wholly contingent interpretations and activities in order to arrive at an adequate representation of a particular flow of work. It is just these kinds of fine-grained, situated practices that are often 'missing' from the ultimate process model. This recognition of what a process model will inevitably miss is not intended as a suggestion that process modelling is somehow without any efficacy. On the contrary, despite the ironies and the quips and the griping exhibited while doing it, members clearly *did* find some kind of purpose in doing all of this. A paramount achievement was, however, arrival at some kind of shared local appreciation, 'knowledge' of what a particular division of labour or process amounted to, and the implicativeness of that. That is, process modelling in the hospital was noteworthy for the way in which it promoted 'knowledge' through *co-ordination* and arrival at a sense of *mutual relevances*, and understanding of 'how a place like this works'. The actual achievement of any process map makes it clear that all versions of 'best practice' are negotiated products. The formulation of 'best practice' is a situated affair - and process maps are, at heart, locally sensible versions of best practice and problems may arise where such locally sensible versions are exported throughout an organisation to other settings where other relevances may apply. One significant finding here, then, is that process maps are not systematic, rational, scientific deductions of the most efficient process. Rather they are contingent objects of negotiation and experimentation amongst members who primarily attend to local, situated concerns and understandings.

5. Time and Project Work: Temporal Aspects in Developing a Dependable EPR.

In this final section of the paper we focus on some temporal aspects of an associated feature of much of the process modelling reported earlier - moves to provide comprehensive, integrated computer support through developing and deploying electronic patient records (EPRs) that all NHS Trusts are required to develop in the next 5-10 year period. We present some very early findings from a DIRC research project that has been investigating some of the everyday practicalities of delivering an EPR project within a hospital Trust. The EPR presents a means to provide timely and location-independent access to comprehensive patient data that can be integrated with respect both to type (clinicians' notes, medical imaging, charts etc.) and time (a single patient-centred record of each and every interaction between patient and healthcare providers). The EPR is seen as providing the conditions for the imposition of greater discipline and structure on record-keeping practices, and has also become a major factor in the drive for the standardisation of medical record formats and ontologies. The intention is to design and deploy systems that support and facilitate clinical work as well as administrative and reporting functions and thereby provide integrated working as a means to more coordinated and, importantly, cost-effective healthcare. In examining temporal features of this work – and it is work that is ongoing in many NHS hospital trusts - the emphasis is on the EPR as a project, a project that needs to be managed in order to be successful.. Our focus is on the everyday work of the project, of the mundane and routine concern with addressing organisational contingencies and constraints, documenting how and in what ways the orderly character of such project work is achieved and delivered.

System design in a large NHS Trust (and the associated processes of analysis, configuration, testing, integration, evolution etc) is a complex, messy business, but, given national, governmental targets and priorities there is a sense in which this is a project that cannot afford to fail, despite the long history of IT failures within the NHS. Implementation Team Meetings are the arena in which practical project activities are reported, discussed, negotiated, planned, and decisions made. These team meetings provide an opportunity for people to orient to the project as a totality and provide some correspondence between what project members should be and are doing. At the same time the project manager uses team meetings to keep people informed, thereby keeping any progress or problems visible. A key feature of this concerns temporal aspects of project work and is evident in the debates about 'roll-out' time:

– News has come from XCo that the dates they've given us for rolling out the .. database and the interface are months behind ... it doesn't look like they can give us lot the interface when we need it, ... there's no guarantee that we're not going to have a microbiology interface up and running for the beginning of phase one

– Well the fact is that they're not doing it until September ....we won't have it for Phase One I can assure you of that.. .. the fact that only two of the pathology systems will be linked .. people will lose faith in the EPR system and in a sense this one isn't our issue..."

Our observations indicate a number of ways by which the contingencies and uncertainties of organisational and project life can be handled. As Button and Sharrock (1994) note, organising a project into 'phases', for example, is intended to ensure that tasks are worked on until completed, to achieve for the work a paced sequential progression and provide for the recognition of uncompleted steps. All phases are planned in advance in terms of what they consist of and when they will take place - identifiable major phases in this project include: procurement, award and signing of contract, 'data collection', 'database build and configuration', 'application testing', 'integration testing', and finally 'go-live and transition management'. Phasing exhibits some sensitivity to timelines of practical decision making - by specifying considerations relevant to a decision prior to any deliberation on that decision. Phases may be (almost certainly will be) delayed, tasks reallocated, items of the contract and hence the phasing re-negotiated and re-defined. Nevertheless phasing remains a key resource for the on-going practical management of the project – enabling the distribution and coordination of work, allocating responsibilities, keeping track of activities, measuring work progress.

Phasing also relates to another aspect of practical project management, the methodic handling of tasks (or at least maintaining the semblance of method) and some way of measuring progression - how they are doing, how much has been done, where they are, what remains to be done. This involves maintaining the agenda of tasks, ordering, sequencing, allocating, managing and keeping track of progress and problems through the issues and risks logs. In this fashion the project manager can determine where they are relative to the project schedule, and whether the work, going at the pace it is now being conducted at, will be done by the scheduled date. The field note below, from a project meeting, illustrates just such an attempt to keep a project 'up-to-speed':

"And if I can just ask everyone to keep doing that I think we have to be very pro-active and keep emailing your analyst and say what do you want me to work on what d'you want me to do ..-I'm getting nervous for a variety of reasons .. I'm just not sure what they're going to throw back at me .. just want to make sure we're .. covering our bases as well."..

Of course, 'slippage' from the plan is a 'normal, natural trouble' and its importance or magnitude is measured against the schedule:

"…there was fifty three days where we were looking at database configuration and I've said that now there's, not to scare anyone, twenty eight days left … twenty eight business days left before .. its in the plan its identified that we're going to start testing, we've not done any configuration"

Where 'slippage' does occur, contingency plans are made by reference to possible implications:

"…it may be that we'll we'll have to go with the idea that they don't interface in phase one…… but we'll carry on in discussing it um, further just to sort of look at all of the implications around it and I'm hoping that its not as. Its more annoying than anything right now if the truth be told, but in term of the scope of the overall project I think there's ways we can get around it without making it um too too specific too too much of an impact on the end user"

Such solutions often involve considering various workarounds.

6. Conclusion: Designing Systems in Time

Our particular interest in the DIRC project has been in time as a feature of the background expectancies of trust in organizational life - how technology influences the temporality, the temporal organization, of our social and organizational activities – does it allow us to work faster, alter our background expectancies about how long tasks might or should take? Temporality encompasses a variety of aspects that reflexively influences the introduction and use of technology. The spatial and temporal aspects of mobility in human interaction have been researched in various ways. Within CSCW, for example, temporal aspects of everyday work have been discussed in relation to technological innovations such as the internet applications, groupware and various information systems (e.g. Ellis et al., 199) as well as mobile ICT applications (Bellotti and Bly, 1996; Dix and Beale, 1996;) that supposedly make the work environment flexible and independent from geographical and temporal constraints. Time is especially relevant to IT systems since efforts to invent new technologies and introduce them into existing work settings are frequently motivated by temporal issues: accelerating the speed of work and saving time. Negroponte (1995) for example, documents the impact of email on work time, its effect on the rhythm of work and notions of the working day and week.

But speeding-up and saving time are not the only temporal transformation of social activities induced by new technologies, nor should temporal changes be misconstrued as being merely 'about time'. As Barley (1988) argues the temporal order of the workplace serves as a template for organizing behaviour as well as an interpretive framework for rendering action in the setting meaningful. Barley diffentiates between structural and interpretive aspects of temporal change. Structural aspects include notions such as sequence, duration, temporal location and recurrence Interpretive aspects of temporality are concerned with how people in the work place interpret the change of the structural parameters. He argues that such an approach lends meaning to events in the everyday

world of work – as reflected in everyday comments such as "isn't X (person, process, document etc) a bit late?" "you should have done that already" and so on. Barley's study of temporal order and its change in hospital radiology departments further distinguishes between monochronic (single task) and polychromic (multi-task) approaches to organising temporality. He suggests that the newly introduced technology increased the monochronicity of actors' activities by restructuring structural and interpretive framework of temporality. In a similar fashion Lee and Liebenau (2000) found that a new EDI system restructured the temporal order of the companies' business operations, increasing monochronicity. Perhaps reflecting the wider scale and diversity of our research no such simple conclusions have been reached. Our studies of hospital managers, for example, have showed that by using email or other asynchronous ICT applications, managers deal with multiple tasks simultaneously; ICT permits information and ideas to be instantaneously transmitted and accessed contributing therefore to what Barley would term polychronicity. As Dix (1996) argues in 'Natural Time' what matters is not absolute timing, but the match, the relationship between the pace of interaction and the pace of the task which we are performing. *"The problem is usually not so much that the computer is too fast for you, but more the often erratic delays which break the flow of your work. The mismatch is between the speeds at which the computer works and the paces of activity that seem natural for you. So, what exactly is a natural timescale? "* As he suggests, to answer this question, we need to know about the sort of jobs we are doing – and, we would suggest we need to know about this in real world, real time as opposed to laboratory, conditions. Hence the attractiveness to DIRC of, for want of a better word, ethnomethodologically informed ethnographic approaches, particularly as this leads to the design of systems for people engaged in real world, real time, work rather than, as Dix (1996) playfully suggests, building computers for cavemen.

This paper reiterates a more general message emanating from DIRC's research that we have outlined on a number of occasions (Hartswood et al 2003). This is a timely, but not a simple or even optimistic, message. When design for dependability is taken seriously, as when, in this instance, the temporal features of everyday work and design are foregrounded and design relevant; when IT systems and artefacts become ubiquitous at work, and design becomes more entwined with the complexities of organisational working, then the challenges facing systems designers correspondingly increase. The 'design problem' becomes not so much concerned with the simple creation of new technical artefacts or the 'computerization' and replacement of work practices as it is with the effective integration of computer systems with existing and developing localised work practises. This thereby effectively takes the 'design problem', and the various temporal issues associated with it, beyond the design phase to implementation and deployment, where users must try and apply any new system to their work and its temporal rhythms, its interruptions, slow downs and moments of frenetic activity, in order for these systems to be useful, trustable and dependable.

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