

Chaos, Information Technology, Global Administration and Daily Life

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AIMS AND BACKGROUND

The world seems to be becoming more disrupted and chaotic: economically, politically and socially. This sense of disruption is also found in people's daily and work lives. We hypothesise that a significant part of this chaos and complexity grows out of attempts to order life and work through Information and Communication Technology (ICT). Hence we propose to investigate disruption produced by ICT at both the macro, or global, social level and the micro, or daily life, level. We also assert that Order and Disorder are not independent events but form an order/disorder 'complex', with disorder and disruption produced by the modes of ordering employed. The investigation is carried out via document research, interview and ethnographic study. Research on the production of social disorder through ICT implementation and adoption is needed in order to reduce, cope with, or predict, unintended and disruptive effects to organisations and to social life.

In summary, the project aims to:

- 1) Explore the nature and effects of Information and Communication Technology on governance (social, political and economic) in a world in which people are embedded in ICT.
- 2) Explore how disorder and chaos arises from the use of ICT as a mode of producing order, and the effects of this order/disorder complex on systems of administration.
- 3) Explore how governance is now distributed through, often inexplicitly, connected information systems, and is thus beyond the control of i) those who expect to have power, ii) those lower in the hierarchy, and iii) those subject to its use.
- 4) Explore the ways in which people manipulate these ICT systems, or their surrounding social systems, in order to act in the 'real world' where the programmed models and categories they have to use may not be accurate or enabling.
- 5) Investigate the ways that the social structures of an organisation may be unexpectedly changed by new structures of communication, and the ways in which the patterns of communication, as embedded in the software, may conflict with the objectives of the organisation, without assuming that the effects must be uniform throughout the organisation.
- 6) Write a detailed ethnographic comparison of two software installations and their effects on organisational structures and ordering.
- 7) Produce strategies to predict, minimise, manage or incorporate these disordering effects.

ICT is usually implemented in order to increase efficiency, reduce duplication, simplify labour and improve the flow and handling of data. However, everyday experience shows that this does not always result. Saran (2003), for example, reports a survey in which 73% of 450 IT directors across the UK, Germany and France said they had suffered from major faults in their IT systems.

However, even when successful, ICT often increases complexity, produces disruption, or restricts actions (e.g. Markus 1994; Ross & Chiasson 2005). Previously simple procedures can become complicated and local flexibility can become constrained. Users have to contend with programmed categories rather than their reality, and have to learn how to 'fudge' the system in order to function. ICT can also cause loss of local knowledge (if data is not in the system it does not appear to exist), and it fosters the rapid and humanly uncheckable accumulation of unforeseen consequences which may result in chaotic breakdown.

ICT has social and political effects as it allows governance to be distributed through the socio-technical system, so that it becomes unclear who, if anyone, has responsibility. Socio-political models are hidden in the software so that as Henman implies (1997) computers themselves become political players, and uncertainty or inflexibility increases again. Members of an organisation may employ these hidden models, or the diffuseness of responsibility, to implement their own projects, leaving those lower in the hierarchy feeling confused and helpless; thus increasing resentments in the workplace, or among those subject to the administration. If, as Marshall (2000, 2004a) suggests, the way communication is organised enables and restricts different types of behaviour, then changes

to this structure through ICT (especially distribution of governance), may change the organisation in unexpected ways, setting up new internal or external conflicts and disrupting its operation still further. These effects are common everywhere and thus a normal, if unstudied, part of social life.

Unintended technological effects have been addressed by a number of writers, most of whom focus on those major accidents which result from complex systemic interactions between parts of the technology. Such work is usually taken to begin with Perrow's *Normal Accidents* (1999, originally 1984). Perrow observes that attempts to make complex systems safer may add further levels of complexity and thus paradoxically make things more dangerous. However, despite arguing that people become part of the systems they build and operate, and thus that technology cannot be separated from social organisation, and pointing out the social aspects of accident location – “the issue is not risk, but... the power to impose risks on the many for the benefit of the few” (ibid: 306) – the book has little observer-based research of social systems, and reduces the issues to management, (good) design or individual people. As well, Perrow tends to consider catastrophic aspects of technology rather than the ‘normal’ disordering aspects of imposed order. Similar remarks apply to developers of this approach such as Sagan (1995), and Chiles (2001). Other studies of technological failure, such as Dörner (1996), focus entirely on aspects of human thinking, as if these could be divorced from social situation and technology.

These limited perspectives, could be expanded by considering how disorder could arise through a combination of social and systemic factors, such as: a) the complexity and inter-linkage of the technology mentioned above, b) the relationship between the technology and the social systems it is used within, c) the way it enables or restricts change in work, privilege and power differently for different people, d) the ways it speeds up certain behaviours or attentions while glossing over others, e) its placement within pre-existent conflicts, and f) the general relations between perceived order and chaos. If a technology is complex in itself, then it becomes still more complex when the social linkages, divisions and struggles between humans are added. As Kallinikos (2005) suggests; if ICT systems add complexity and connection, then they almost inevitably sabotage standard modes of organising which depend upon simplification and boundaries.

Although writings on catastrophe are suggestive, accidents are not the focus of this project, which grows out of three strands of work. Firstly, that of CI James Goodman on world politics, global social movements and uneven development in an insecure and unpredictable world affected by the “revenge effects of nature” (2000a, 2000b, 2004, 2005, 2006). Secondly that of CI Didar Zowghi's work on software requirements engineering and the social factors in software failure and in the unexpected usages of ICT *after* failure (Coulin & Zowghi 2005, Yusup, Lowe & Zowghi 2005, Sarosa & Zowghi 2003) and thirdly that of Research Fellow Jonathan Marshall's investigation of social control and gender on the internet Mailing List ‘Cybermind’ (Marshall 2000, 2004a), on the paradoxes of the information economy (Marshall 2004b, 2006a) and on the Australian Customs Service's Integrated Cargo System which has led to importers and exporters having severe problems doing previously easy work, and to large delays on the docks (Marshall 2006b). Despite claims of spontaneous order, or even semi-authoritarian structures, life for the people studied seemed fractious and overtly chaotic, with these disruptions centring on the use of ICT even when successfully implemented. The problem is not just one of software failure but of social confusion.

The resulting sense of political alienation, social chaos and helplessness could easily be explained by the hypothesis of the increasing dominance of the corporate sector and the ways that, in the ‘information economy’, corporate interests are taken as universal interests. However this is inadequate. Garten's interviews with top CEOs (2001) shows that they do not feel in control; Lapham's (1998) account of a Davos conference also displays our leaders' confusion. The recent massive collapse of companies such as Enron, or HIH also imply that financial control, or gaining State support, is more difficult than might be expected within a corporate dominance model. In addition, it is a constant refrain of those who support the politics of corporate ascendancy that they do not feel in control either or that the ‘centre’ of power is elsewhere. Such facts suggest that the experience of confusion and chaos is systemic rather than class based.

The first writers attempting to deal with the complex spread of these issues were Negri and Hardt in their books *Empire* (2000) and *Multitude* (2004). In terms of comment aroused, these books may be the most successful academic analysis of the contemporary world in the last twenty years (see Abu-Manneh 2003, Balakrishnan & Aronowitz 2003, Passavant & Dean 2004). Hardt and Negri argue that the world is now governed by what they call 'Empire'. This is an unfortunate term and has led to an eruption of argument about whether the USA constitutes an empire, which is irrelevant to their main point. By Empire they mean that in,

contrast to imperialism, Empire establishes no territorial center of power and does not rely on fixed boundaries or barriers. It is a decentered and deterritorializing apparatus of rule that progressively incorporates the entire global realm within its open, expanding frontiers (Hardt & Negri, 2000: xii).

Negri defines Empire as "the transfer of sovereignty of nation-states to a higher entity", but not to a World Nation, or to an existent nation like the United States (Negri 2004: 59). It is "a network power" (Hardt & Negri 2004: xii) dependent on ICT. It "takes form when language and communication, or really when immaterial labor and cooperation become the dominant force" (2000: 385). Governance is distributed and no longer has clear outlines. The implication that there is no longer a fulcrum point for control, helps explain the diffusion of feelings of powerlessness.

There are, however, significant problems with Negri and Hardt's position (Marshall 2006a). They tend to use a rather utopian version of information society theory, implying that the Internet is inherently radical, that information workers (across the world) will easily unite, that use of ICT extends co-operation between different workers thus fostering socialism, and that the human embedded in technology (or the 'cyborg') is necessarily radical and powerful.

Here Negri and Hardt's reference is to Haraway's famous paper on cyborgs (1991), which still has enormous currency and influence on visions of the future. For example, the December 2006 issue of the leading academic journal *Theory, Culture and Society*, had no less than six articles on Haraway and cyborgs. The cyborg metaphor implies some kind of distributed de-centred, hybrid governance occurring between people. However, boundary crossing and automatic hybridity are not necessarily 'liberating', but can easily be subsumed into a totalising ICT system which does not recognise boundaries of any sort. Such a system has the potential to incorporate most forms of human life, and subject them to the implicit politics of its data categories or to unpredicted feedback and chaotic demands. If disorder is implicated by ordering, then the boundaries broken may be those necessary for more local democratic orders.

As an example, the most obvious 'cyborg bodies' which people have to contend with are their computer records, which may be hidden and accessed without their consent or knowledge, and which can dramatically affect their lives. Disruption can arise here from what Henman (2003) calls 'targeting', or the ways that people are forced into categories in order to comply with the requirements of the data processing system. While such categorisation assigns worth, risk and treatment to people, and dictates business behaviour towards them, it may not reflect the more complex reality. People, who resemble offenders in a constructed category, may end up as much the focus of government effort or surveillance in time and money as those who do offend, and their behaviour may alter in unexpected ways as a result. Governments are also increasingly using ICT to 'cut red tape' and to give back 'responsibility' to their 'clients', yet these programmes may not have their intended effects as a result of targeting through inappropriate categories, and this may be inevitable given the modes of implementation. Such encounters lead to feelings of resentment and disempowerment rather than of responsibility, and governmental records can become increasingly disconnected from life as these hypothetical categories are reinforced by use, which further adds to experiences of disorder and inefficiencies in the undertaking of governance.

Despite objections to Hardt and Negri's optimism, their main ideas of distributed governance and the deferral of responsibility, points towards the complexities of modern social organisation and its relation to ICT, and needs further elaboration and ethnographic investigation.

SIGNIFICANCE AND INNOVATION

Significance is marked in two ways. Firstly because of the possibility of diminishing the enormous monetary and social costs which result from failure of ICT or from the disruption even successful ICT generates; and secondly through the development of a new social theory about the relationship between order and disorder, which will not only apply to ICT, but to society in general.

The financial cost of failure is obvious. For example, the UK National Health System's, National Program for Information Technology (NPfIT) had by late 2006 at least doubled in cost to £12 billion, with massive delays, pull out by programming companies, allegations that the software systems did not work and loss of confidence in eventual success among users. Similarly the UK Parliamentary Public Accounts Committee declared a £100m UK Customs Service was a failure because the new system was more complicated than the previous paper-based version (McCartney 2006). The American Internal Revenue Service wrote off a \$4 billion multi-year overhaul of its computer system when it failed completely in 1997. In 2004-5 the Standish Group, a technology consultancy company, estimated that that 30% of all software projects were cancelled, nine out of ten come in late, almost half ran over budget, and 60% were considered failures by the organisations that initiated them (Economist 2004). The American National Institute of Standards estimated that straightforward computer bugs "cost the U.S. economy an estimated \$59.5 billion annually" (Newman 2002). The amount of work hours lost through these failures, through the 'normal' disruptions of existing social organisation, the misfit between targeted data and 'reality' and the added work produced by overcomplexification, would significantly add to these figures.

The theoretical gain from this project stems from taking chaos and disruption as results of ordering processes, rather than seeing them as residual categories which can be extinguished by the application of further order of the same type. This approach leads us to look at factors outside the 'technical' for explanation, and it is these factors we approach in the first two years of this project.

Traditionally, studies of governance, focus almost exclusively on the 'problem of order' in isolation; seeing chaos as something upon which order is imposed or as residual to order. Thus Hobbes alleged that people would fear chaos and surrender their freedom for imposed order. Marx implied that conflict and disorder was a product of class society which would end with its collapse. Anarchists tend to see order as arising spontaneously from the natural activities of humans (P.Marshall 1992). Conflict theorists tend to see conflict as a failure of order, or as a means of maintaining, or applying, order (the order of stratification in Collins 1975, structure and personality in Ross 1993). Disorder thus tends to be reduced to an epiphenomenon or a 'glitch', either temporary or structurally threatening, rather than as something which grows up with a mode of ordering, or which can be used politically to justify that ordering.

For example, Arrighi et al's promisingly titled *Chaos and Governance in the Modern World System* (1999) is primarily about hegemonic transition among States, taking the monolithic State as the firm basis of power. Its consideration of chaos is limited to a review of the contradictions of Western colonial policy in Asia, and the suggestion that financial and military power are no longer completely congruent with State-based territory. The authors conventionally see chaos as symptomatic of a decay, breakdown or crisis, of order and hegemony, rather than as a result of a particular ordering, and thus ignore arguments that the State has always been a site of conflict, or that power has never been entirely congruent with territory, that power involves resistance, and that these are features of order not of breakdown alone.

ICT directly enters into the question with those global business systems (such as derivatives and forex markets), which only exist due to ICT and which are intended to produce order, but which may actually increase unpredictability through adding complexity, or by undermining conventionally necessary distinctions (Soros 1998: 187-91; Partnoy 2003; Millo et al 2005). Estimated turnover on the Forex markets is 1.9 trillion US dollars a day (of which 95% is speculative), and on derivatives is 1.2 trillion US dollars per day; dwarfing conventional trade and making the 'regular' economy parasitic on chaotic speculation (BIS 2004). What the Bank for International Settlements calls "an unusual, perhaps unprecedented, combination of financial imbalances" produced by the use of ICT systems cannot be ignored in a study of instability in

global social and political systems. Palan (2003) also points to the deliberately chaotic nature of the 'offshore world', defined by its exemption from taxation and regulation, as an important part of modern business. However, despite market instability, volatility, the exploitation of chaos and the collapse of large numbers of businesses, most economists still use a variety of equilibrium theory and see disorderly processes as temporary (Ormerod 1997, 2005).

Taking these conventions as truth, Software Engineering or Management studies of chaos and software tend to take as their first principle the idea that chaos and disorder are aberrant and only arise from failure to implement, or manage, the project properly (e.g. Burke & Morrison 2001; Glass 1997). Some writers (Jones, 1995, Cooper 2004) seem more eager to shift blame for failure away from programmers or software designers than to analyse complex events. None of these writings examine the ways that people deal with the resultant distortions of reality and the disruptions of expectations, or look at social conflicts in programming. Yourdon (1997) suggests that the "death march" style of organising software development (with impossible staffing, scheduling and budgeting), is not only popular with companies, although each death march seems to be a unique event, but adds (and is known to add) to the possibility of failure. However, his book is more a celebration of this chaotic organisation, than an analysis of the social and technological factors behind it. Goguen recognises that the "requirements phase of a large system development is the most error prone... unfortunately it is also the least explored and has the least satisfactory intellectual foundations" (1994: 166), and that "the design of an information system is a natural occasion for power struggles" (ibid: 174), but instead of recommending close ethnographic study lapses into post-hoc formalism comparing software installations to sporting fixtures in which the rules are known and decided in advance rather than changed as the installation proceeds. In other words 'order' is assumed. Other studies of software disruption get bogged down in abstract attempts to classify different types of failure or even arguing about whether something has really failed or not (Lyytinen & Hirschheim 1987, Sauer 1993), while ignoring the possibility that the difference could result from conflict between the social groups doing the interpretation.

Studies of noted software failures such as that of the London ambulance service (Inquiry 1993, Beynon-Davies 1999, McGarth 2002) or the Australian Customs (Booze Allen Hamilton 2006) are all conducted after the events. They are based upon recollections rather than observations, and they miss studying prior practices and social organisations which contribute to the disruption experienced. When social factors are recognised, then it is assumed they can be fixed by good management or better communication, without consideration of the possibility that communication may have been 'good' and that workers, say in the Ambulance service, may have accurately recognised that Management was attempting to make them disposable and less able to use their initiative and skills after a lengthy pay dispute. The Customs Software Installation Report consistently ignored overt conflicts resulting from the differing needs of different importers and between different software companies, and saw the issue as purely technical and managerial. Calls for better management seem ritualised, as if none of the managers involved in the project would have ever thought of the possibility of 'managing well'. It is never considered whether 'good' management had led to the problems in the first place (Marshall 2006b). This is despite management theorists recognising that what is excellent management in one situation can lead to failure in another, especially when new and 'disruptive' technology is involved (Christensen 1997).

None of these studies recognise that there may be socially placed differing views of order which drive the chaos/order configuration which arises, or that we need to research competing dynamics of ordering, the points from which chaos is defined and the politics of that defining (such a realisation might be implicit in Robey and Boudreau (1999), but it is certainly not explicit). Views which separate out chaos and order into discrete universal entities on which everyone in a social field can necessarily agree, retard the study of society in the same way as the assumption that 'culture' had to be shared by everyone in a group. Nowadays scholars are more likely to accept the existence of competing ideo-cultures tied in with power relations, rhetoric, and interpretations (cf. Barth 1993). Differing interpretations and distributions of culture are part of the social dynamics driving culture, as are differing interpretations and distributions of the chaos and order complex.

This project is not an application of chaos theory to ICT, as the aim of that theory seems to be to find, what science writer John Gribbin (2004) calls “deep simplicity”, or the order underlying chaotic appearances, rather than exploring the mutual relationship between humanly defined order and chaos. However, features of chaos and complexity theory, such as the significance of initial conditions, history and feedback loops will be recognised as important to the kinds of disorder experienced. In terms of complexity theory, it is hypothesisable that some disorder arises because of conflicts between the social behaviours or organisation emergent from the workers and users, and the more top-down command organisation imposed by ICT.

Therefore the project looks at an important problem for many academic discourses, in a new way. It focuses on ICT, not only because of the researcher’s background in ICT research, but because anecdote and experience suggests that people frequently perceive ICT as a source of disruption which attempts to restructure their work and life in ways which were presumably not anticipated by the implementers, even though the disruptions seem to have recurrent patterns. It assumes that existing social organisation or disorganisation, and group based conflicts, such as struggles over status and methods, cannot be left out of a consideration of technology’s effects. This study’s focus on both ethnographic research and the disruptive effects of ordering is innovative.

APPROACH AND METHODOLOGY

The research is to be conducted primarily through literature research, theory building, interviews and ethnographic field work over a five year period.

In the first year and second years, research will primarily focus on developing theory in concert with interviews. We shall complete a post-hoc study of problems in software installation looking for the social aspects of the situation and the order/disorder factors generated by the software. Team member Marshall has already written (2006b) a preliminary socially based analysis of the problems in the Australian Customs software case. The analysis shows that software implementation cannot be treated as simply a technical problem with the interests of, and conflicts between, the different groups involved ignored, and that technical ability to accumulate more ordering data can lead to increasing problems with human error. This initial work will be expanded by interviews with importing companies, programmers and archival research.

We will also interview a range of politicians and their staff, public servants, business people, people in NGOs, programmers and users, to investigate how they respond to ICT chaos. Questions will take the form of semi-structured, rather than fully structured, interviews in order to allow the people involved to reveal what they consider to be the important issues. Expected questions will focus on issues of evaluation, fit between ICT and the ‘real world’, effects of ICT on social networks within organisations, issues of targeting and categorisation, and the effects of legacy systems. As the data and questions become more structured it will be possible to run web-based surveys, promoted through relevant mailing lists. Although such surveys have to be treated cautiously, they can also lead to new lines of questioning and to new sources of information.

We will produce a book elaborating and integrating this research with Marshall’s Hardt and Negri papers and with Goodman’s global politics papers, with Zowghi checking for technical accuracy, so as to build a global and historical picture of the world linked by ICT, while ensuring the theory confronts, and is modified by data from the world. The book will criticise the common theories about the information economy mentioned above, and engage with other ideas such as the claim that ICT lowers hierarchies and thus increases freedom of action (e.g. Friedman 2005). Lower hierarchies, especially when key strokes can be traced, imply less separation between the centre and the periphery, and less room for the periphery to move and adapt to local conditions, thus decreasing the ability of organisations to adapt, and increasing the amount of inaccurate information the centre will receive to plan its response. Conflict may increase, given expectations of autonomy and the reality of uninformed centrality. This book will tighten the macro level associations of ICT with order and chaos and identify those areas more vulnerable to ICT produced chaos.

This elaboration of the features of distributed governance would be of interest to people engaged in governance, activism and envisioning the future, as it will investigate the weaknesses and strengths of the current world system and the dangers it might face from information technology

acting as a source of order. Rather than hoping for new coherence to arise spontaneously (or autopoetically) from the multitude as do Hardt and Negri, the projected book asks what can be done to crystallize any emergent coherence in an equitable and functional manner before the possibilities of system collapse become overwhelming.

The second year is also spent gaining contacts for the subsequent years' work. Many UTS sponsors are IT companies or companies with significant IT layouts, and should find the project of benefit and interest. Goodman has well developed contacts with international NGOs. Marshall has already had enthusiastic but informal discussions with people from IBM and EDS. We will also search standard databases of companies with significant IT departments, and invite their involvement. As software installation is rarely planned more than a year in advance, it is not possible to state at this period, given the necessary time taken to process ARC grants, exactly what organisations will eventually participate in the ethnographic study.

The third and fourth years involve full time ethnographic fieldwork on two different ICT implementations, in a Business and in an NGO allowing us to investigate ICT effects within different types of organisation. The fieldwork will begin before the implementation so we can capture disruption as it occurs, before the defences and 'kludges' or 'cheats' that keep it running, have become automatic and unconscious. We will compare the two field sites studied, and contrast the general points people have made in the earlier interviews with what is observed to be the case. We cannot guarantee software will fail, but in observing two installations we will observe normal disruptive effects, how people cope, and the influence of different organisational priorities.

Ethnographic fieldwork enables the observation of features which are either not available to the recall of participants or which they wish to ignore. Interviews alone are not sufficient, as people will probably not notice how they deal with these issues, and human behaviour occurs in interaction with others, so the interaction shapes both the behaviour and the meanings attributed to the behaviour. Fieldwork and observation of the traces of communication through electronic means, when appropriate, adds to the accuracy, and allows the description of temporal and context based changes in these networks. Fieldwork does not assume that all events will have the same interpretation from different actors; or even from the same actor at different times. These shifting patterns have to be traced, within the system of interrelations, as they occur. This allows us to investigate aspects of the group's life which are not part of the group's official mode of behaviour, and which are thus not included in programmer models when these are made. Thus, although people may be prepared to talk about how IT, or changes in IT disrupts their lives, they may not be so prepared to discuss the ways that they use IT to disrupt others, or the ways that the deploy secrecy as part of managing their place at work. As Suchman suggests (1995) ideas about the work currently or previously done by an organisation are part of the organisation's structure and necessarily involve ignorance of what other people actually do; so that focusing on managerial, or summary, accounts of work is always misleading. Fieldwork is open ended and research responds directly to the situation as encountered rather than to previous formulations. Such research helps prevent the common neglect of management-employee conflict or of the role of unions (Cohen-Rosenthal 1997), or the assumption that good communication produces harmony. Previous fieldwork has also indicated, for example, that ICT is often implemented almost by faith, without review of its effectiveness or cost (Knox 2005). We are investigating complex and changing situations, and the only way to follow events as experienced is to try and participate within them.

This fieldwork, together with Zowghi's experience of Software Requirements Engineering will enable us to construct a new model of software implementation which formally directs developer's attentions towards the relevant social factors, and thus reduces the possibilities of severe disruption.

In the fourth year, as well as continuing with fieldwork, we will hold a research colloquium involving people from all over Australia, from various fields, to contribute to our understanding of IT and disorder. This will result in a published edited set of proceedings, which will add extra depth to the continuing ethnographic questions and research, and which should have wide application.

The final year involves writing up the results of the research as papers and a book, with returns to the field for more information, to maintain ethical contact and to check theories and results and the test the software implementation model.

Time Table Summary

Year 1-2	<ul style="list-style-type: none"> a) Gain ethics clearance for field and interview research. b) Interviews with people in business, politics, administration, software installation and usage, about their experience of chaotic effects and events. Analyse interviews. c) Write study of confused and complex software installations. b) Write book elaborating the role of distributed governance in the world, criticising and elaborating Negri and Hardt. d) Make contacts through UTS, and personal connections for interviews and fieldwork.
Years 3-4	<ul style="list-style-type: none"> a) Do fieldwork in two different sites for purposes of comparison. b) Year 3 only. Attend three overseas conferences to publicise work and gain criticism. c) Year 4. Research Colloquium, with edited, published proceedings.
Year 5	<ul style="list-style-type: none"> a) Write up final results as book. b) Check results back in the field, so as to explore the coping strategies which have been developed around the disruptions which eventuated. c) Promulgate findings in popular media, business and political journals, as well as in academic journals.

NATIONAL BENEFITS

This project investigates general features of information technology and its implementation, the ways that technology can contribute to cost and disorder, and the ways that the introduction, transfer and uptake of innovation can be disrupted. This will lead to positive recommendations for action. Software consultancy services and provision of customized services by themselves cost Australia around \$5,646 million in 2004-5 (ABS 2006: 7) and will only increase, irrespective of the implementation failure rate. Although we have pointed at the costs of apparently unsuccessful projects, the costs of normal disruption are harder to estimate, but simple loss of work hours is undoubtedly significant. Without investigations such as ours ICT will continue to be considered in abstract, away from its actual use, and away from the problems that it may engender. Organisations will continue to be chaotically transformed through unconsidered application of ICT and use of ‘best practices’ which do not mesh with reality. Without this research, Australia may continue to produce better and better software which makes life unexpectedly more and more complex, chaotic and ungovernable. As life becomes more and more enmeshed in ICT for work, education, politics, business and so on, the disorder produced will have greater detrimental effect unless we know how to deal with it. Thus the project will contribute significantly to the National Benefit.

The project fits in with the Government’s research priority “Frontier Technologies for Building and Transforming Australian Industries” as this priority recognises that ICT is “currently the critical enabling technology and is a major contributor to national productivity and growth” especially as it relates to “smart information use” and promoting “an innovation culture and economy”.

Ideally the project has the potential to change the practice of IT implementation, to make people and the systems they use more sensitive to unintended effects, and to dealing with those effects – thus diminishing uncontrollable chaotic feedbacks. It may direct administrators’ attentions to the chaos, and potential chaos, created by their modes of ordering. At the very least it should establish that social factors are not simply secondary ‘barriers’ to software implementation, but dynamic forces which interact with that implementation and transform it, thus increasing software managers’ awareness of the complexity of social organisation and research into it. Finally it may allow the incorporation of what are seen as disordered or chaotic political movements into more mainstream and useful forums, resulting in a more realistic view of the way people think the world operates.

COMMUNICATION OF RESULTS

Initial research is already being communicated via the Web and conference papers. Further results will be published in journals as research progresses, and in papers presented at conferences to business and/or academic groups. We aim to produce three books, firstly the initial work on

world systems and governance, secondly an edited set of colloquium/conference papers, and finally the comparative ethnography of software fieldwork sites. We will also publish more popular articles in the special features sections of newspapers and in relevant industry and popular magazines.

ROLE OF PERSONNEL

CI James Goodman provides the expertise in economics, international relations and global social movements which are required to integrate the project with the world scene. Goodman will devote at least half a day a week to the project. He will work closely with the ARF to refine and check ongoing research methodology. Subsequently he will help synthesize the project's empirical findings, organise the colloquium, and investigate collaborative publishing ventures to ensure those findings are widely disseminated. Some of these ventures should arise from the colloquium.

CI Didar Zowghi will provide the technical expertise and the background in requirements engineering, which will ground the project in the realities of programming and the functionality and dysfunctionality of software. She will open the project to people who might otherwise find social research of software implementation questionable. Zowghi will also devote at least half a day per week to the project. She will generate the model to improve software adoption and implementation.

ARF Jonathan Marshall will work full time on this project. He will undertake the first year's theoretical developments in collaboration with the CIs, and write the initial papers and book. Goodman and Zowghi's experience and record will undoubtedly help publication of this initial work and the later proceedings. Interviews will largely be conducted by Marshall and the fieldwork is his responsibility as it builds upon his expertise and experience.

We have asked for assistance during the second year to help with the transcription of interviews, which furthers the ease of analysis considerably. We have also requested a part-time Admin assistant to organise the colloquium and to help with publication of proceedings, and for ten weeks of web programming to help with formatting online questionnaires and presentation of results.

REFERENCES

- ABS (2006) "Information and Communication Technology Australia", Australian Bureau of Statistics 8126.02004-05
- Abu-Manneh, B. (ed), (2003) "Empire and US Imperialism". Special issue of *Interventions* 5(2).
- Arrighi, G. Silver BJ. & Ahmad, I. (1999) *Chaos and Governance in the Modern World System*. U. of Minnesota Press.
- Balakrishnan, G. & Aronowitz, S. (2003) *Debating Empire*. London: Verso.
- Barth, F. (1993) *Balinese Worlds*. Chicago U. P.
- Beynon-Davies, P. (1999) "Human error and information systems failure: the case of the London ambulance service computer-aided despatch system project", *Interacting with Computers* 11::699-720
- BIS (2004) *Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity in April 2004*
<http://www.bis.org/publ/rpfx04.pdf>
- Booze, Allen Hamilton (2006) *FINAL REPORT: Review of the Integrated Cargo System*, Canberra.
- Burke, D. & Morrison (2001) *Business @ the Speed of Stupid*. Cambridge: Perseus Publishing.
- Chiles, JR (2002) *Inviting Disaster: Lessons from the Edge of Technology*, NY, HarperCollins
- Christensen, C.M. (1997) *The Innovators Dilemma*. Harvard Business School Press.
- Cohen-Rosenthal, E. (1997) "Sociotechnical Systems and Unions", *Human Relations* 50(5): 585-604.
- Collins, R. (1975) *Conflict Sociology: toward an explanatory science*, NY: Academic Press.
- Cooper, A (2004) *The Inmates Are Running the Asylum: Why High Tech Products Drive Us Crazy and How To Restore The Sanity*. Sams.
- Coulin C., Zowghi D. (2005) "Requirements Elicitation for Complex Systems: Theory and Practice" in J.L. Maté & A. Silva (eds) *Requirements Engineering for Sociotechnical Systems*, Idea Group.
- Dörner, D (1996) *Logic of Failure*, Cambridge, Perseus Book Group.
- Economist (2004) "Managing complexity", *Economist* 11/27/2004, 373(8403): 71-73
- Friedman, TL. (2005) *The World Is Flat: A Brief History of the Twenty-first Century*. NY: Farrar, Straus and Giroux.
- Garten, JE. (2001) *The Mind of the CEO*. NY: Perseus Books Group.
- Glass, RL. (1997) *Software Runaways: Monumental Software Disasters*. NY: Prentice Hall.
- Goguen, JA (1994) "Requirements Engineering as the Reconciliation of Social and Technical Issues" in M. Jirotko & JA. Goguen (eds) *Requirements engineering: social and technical issues*, Oxford University Computing Lab.
- Goodman, J. (2000a) *Single Europe, single Ireland? Uneven development in process*, Irish Academic Press: Dublin.
- (2000b) "Transnational Contestation: Social Movements Beyond the State", in Cohn, T., McBride, S. & Wiseman, J. (ed.) *Power in the Global Era: Grounding Globalization*, Macmillan: London.
- (2004) "Contested Fields: International Studies in Flux", *Oceanic International Studies Association*, Canberra.
- (2005) "The Production of Insecurity: Conditions and Possibilities", *Sources of Insecurity Conference*.
- (2006) "Leave It In The Ground! Ecosocial Alliances for Sustainability", in Johnston, J., Gismondi, M. & Goodman, J. (eds) *Nature's revenge: Reclaiming sustainability in an age of corporate globalism*, Broadview.

- Gribben, J. (2004) *Deep Simplicity: Chaos, Complexity and the Emergence of Life*, London, Allen Lane.
- Haraway, D. (1991) "A Manifesto for Cyborgs" in D. Haraway *Simians, Cyborgs and Women*, NY: Routledge.
- Hart, M. & Negri, A. (2000) *Empire*, Harvard UP.
- (2004) *Multitude: War and Democracy in the Age of Empire*. NY, Penguin Putnam.
- Henman, P. (1997) "Computer Technology – a Political Player in Social Policy Processes", *Journal of Social Policy*, 26 (3): 323–340.
- (2003) "Targeted!: Population Segmentation, Electronic Surveillance and Governing the Unemployed in Australia", *International Sociology*, 19(2): 173–191.
- Inquiry (1993) *Report of the Inquiry Into The London Ambulance Service (February 1993)*, International Workshop on Software Specification and Design Case Study, Electronic Version prepared by Anthony Finkelstein
- Jones, C. (1995) *Patterns of Software System Failure and Success*. International Thomson Computer Press.
- Kalinikos, J. (2005) "The Order of Technology: Complexity and Control", *Information and Organization* 15:185–202.
- Knox, H. (2005) "Transformative capacity, information technology, and the making of business 'experts'", paper presented at *Centre for Research on Socio-Cultural Change Conference* Manchester University.
- Lapham, L. (1998) *The Agony of Mammon, The Imperial Global Economy Explains Itself to the Membership in Davos, Switzerland*. London: Verso.
- Lyytinen, K., Hirschheim, R. (1987) "Information systems failures: a survey and classification of the empirical literature", *Oxford Surveys in Information Technology* 4: 257–309.
- Markus (1994) "Finding a happy medium: explaining the negative effects of electronic communication on social life at work", *ACM Transactions on Information Systems* 12(2):119-149.
- Marshall, J. (2000) "Living Online: Categories, Communication and Control". PhD Thesis, Department of Anthropology, University of Sydney.
- (2004a) "Governance, Structure and Existence". *Proceedings of The Australian Electronic Governance Conference*, Centre for Public Policy, U. of Melbourne.
- (2004b) "Internet Politics in an Information economy", *FibreCulture Journal* No.1 http://journal.fibreculture.org/issue1/issue1_marshall.html
- (2006a) "Negri, Hardt, Distributed Governance and Open Source Software", *Portal: Journal of Multidisciplinary International Studies*. 3(1). <http://epress.lib.uts.edu.au/ojs/index.php/portal/article/view/122/>
- (2006b) "Information Technology, Disruption and Disorder: Australian Customs and IT". Paper presented at the *6th International Association of Internet Researchers Conference*, Brisbane. Revised version at: <http://www.geocities.com/jpmarshall.geo/cybermind/Chaos-and-Information-Technology2.pdf>
- Marshall, Peter (1992) *Demanding the Impossible: a history of anarchism*. London: HarperCollins.
- McCartney, L (2006) "U.K. Dept of Health: Prescription for Disaster", *Baseline Magazine*, November 13, 2006 <http://www.baselinemag.com/article2/0,1540,2058198,00.asp>
- McGarth, K. (2002) "The Golden Circle: a way of arguing and acting about technology in the London Ambulance Service", *European Journal of Information Systems*, 11:252-66
- Millo, Y., Muniesa, F., Panourgias, N.S., & Scott, S.V. (2005) "Organised detachment: Clearinghouse mechanisms in financial markets", *Information and Organization* 15: 229–246
- Negri, A. (2004) *Negri on Negri: In Conversation With Anne Dufourmentelle*. NY: Routledge.
- Newman, M (2002) "Software Errors Cost U.S. Economy \$59.5 Billion Annually", NIST Press Release. http://www.nist.gov/public_affairs/releases/n02-10.htm
- Ormerod, P. (1997) *The Death of Economics*. NY: John Wiley.
- (2005) *Why Most Things Fail: Evolution, Extinction and Economics*, London, Faber & Faber.
- Palan, R. (2003) *The Offshore World: Sovereign Markets, Virtual Places, and Nomad Millionaires*. Cornell UP.
- Partnoy, F. (2003) *Infectious Greed*. London: Profile Books.
- Perrow, C. (1999) *Normal Accidents: Living with high-risk technologies*, Princeton U. P.
- Passavant, PA. & Dean, J. (2003) *Empire's New Clothes: Reading Hardt and Negri*. NY: Routledge.
- Robey, D. & Boudreau M. (1999) "Accounting for the contradictory organizational consequences of Information Technology: theoretical directions and methodological implications", *Information Systems Research*, 10(2):167
- Ross, A. & Chiasson, MW. (2005) "A call to (Dis)order: An Ethnomethodological Study of Information Technology 'Disruptions' in the courtroom", *Information and Organization* 15:203–227
- Ross, M.H. (1993) *The Culture of Conflict: Interpretations and Interests in Comparative Perspective*. Yale UP.
- Sagan, SD. (1995) *Limits of Safety*, Princeton U. P.
- Saran, C (2003) "Software failures damage business", *Computer Weekly*, 5/27/2003, p.5
- Sarosa S., & Zowghi D. (2003) "Strategy for Adopting Information Technology for SMEs: Adopting Email within an Indonesian Furniture Company", *Electronic Journal of Information Systems Evaluation* December 2003.
- Sauer, C. (1993) *Why Information Systems Fail: A Case Study Approach*, Henley-On-Thames, Alfred Waller.
- Soros, G. (1998) *The Crisis of Global Capitalism: Open Society Endangered*. NY: Public Affairs.
- Suchman, Lucy. (1995) "Representations of work: Making work visible", *Communications of the ACM*. 38(9): 56–63.
- Yourdon, E. (1997) *Death March: the Complete Software Developers Guide to Surviving Mission Impossible Projects*, New Jersey, Prentice Hall.
- Yusop N., Lowe, D., and Zowghi, D. (2005) "Impacts of Web Systems on their Domain", *Journal of Web Engineering*, 4(4): 313-338.