5 INFORMATION SYSTEMS— A CYBORG DISCIPLINE?

Magnus Ramage
Open Systems Research Group
Open University

Abstract This paper argues for a model of information systems in terms of cyborgs: a boundary-crossing mixture of the technical and the social. The argument for this model is substantiated from the personal experience of the author, presented as examples of being a cyborg researcher within a disciplinary context. Lessons for information systems are drawn.

Keywords: Cyborgs, interdisciplinarity, reflective practice, sociology of technology

1 INTRODUCTION: ON CYBORGS, CYBORGNESS AND DISCIPLINES

In this paper, I shall put a case for regarding information systems as a cyborg discipline. To do this, I shall begin in this section by discussing the concepts of cyborgs and of disciplines.

The term *cyborg* is a shortening of the phrase *cybernetic organism*, used by Clynes and Kline (1960) to refer to a combination of human and machine that would be able to function in the harsh physical environment of space travel. The science-fictional resonances of such a concept—and its parallels in the hybrid monsters of literature—made the term well-known. Cyborgs have become widely adopted in popular culture—a typical example is Arnold Schwarznegger's character in the movie *The Terminator*—to mean something that is part machine and part human.

However, the term cyborg is used in a wider sense by Haraway (1991), writing within the sociology of science with a strong feminist and postmodernist tone. Haraway's argument is that a defining property of the cyborg is that it straddles the social and technical domain: it is part human and part machine. This clearly challenges the requirement of modernist society to have everything categorized, to belong to a well-

understood domain. It is thus both a metaphor for the human-technical mix of our times, and a description of situations where the social and the technical merge and blur.

The use of the word *cybernetics* in the term cyborg is interesting, given the strong links of that field with the field of systems thinking (and thus of information systems). Cybernetics as a field (Heims 1991; Wiener 1948) was explicitly concerned in its early days with the study of messages, information, and feedback within a range of domains, but especially machines and humans, and the way that knowledge about one might appropriately be applied to the other. However, it began around the time of two key events, with which it was closely linked: the birth of the digital computer and the contribution of American science and technology to the cold war. Both of these events led to cybernetics being popularly regarded in Wstern culture as being concerned with issues such as artificial intelligence, robotics, and the space race. (It is for this reason that the prefix "cyber-" has been used to denote a range of computer-related areas, such as cyberspace.)

For Haraway (1991), the concept of the cyborg is "an ironic political myth" (p. 149), it is "a condensed image of both imagination and material reality." Haraway's cyborg is both an ontological statement, about the way things *are*, that "we are all chimeras, theorized and fabricated hybrids of machine and organism." However, it is also a statement about how things *could be*, that by breaking down the boundaries between human and machine, we break down boundaries and categories in general, and allow the questioning of the hierarchies of power that depend on boundary. It is metaphorical in the sense that it uses an image of one thing to describe something else, but it has a close parallel to the thing being described; as Haraway (2000, p. 82) says in a different context, it "is not merely a metaphor that illuminates something else, but an inexhaustible source of getting at the non-literalness of the world."

Richard and Whitley (2000) have considered the concept of the cyborg as applied to IS. They equate it to the concept of the *hybrid agent* taken from the application of actor-network theory within IS; they describe the cyborg as "neither human nor machine, but [a] hybrid construct of the two that is fleeting, precarious and always mutating." However, they are skeptical about its usefulness as a term, suggesting it "has become too fashionable and politicized to be of much to the IS community at present." I hope to show in this paper ways in which the concept can be useful to the IS community.

There seems a clear parallel between the cyborg boundary-crossing and information systems, in that IS as a field of study inevitably straddles both the social and the technical domains. It is hardly a new statement to say that IS is inevitably interdisciplinary, nor is it new to look at ways to straddle the divide between social and technical perspectives. In various ways this has been a key theme in much research in IS and cognate fields (e.g., Checkland and Holwell 1998).

However, this has been primarily considered from an *internal* perspective (i.e., from within the IS community). Looked at from outside IS, what one sees is precisely the double-headed monster (cf. Law 1991) that breaks societal norms, is therefore threatening and must be persecuted.

This may sound extreme. Yet it fits with the experience of many in the IS community. This resembles the argument of Jones (1997), who talks about the concept of an academic discipline. He suggests, drawing on the work of Foucault, that the common use of the term *to discipline* in the sense of *to punish* is relevant to the way that academic disciplines police their boundaries.

For example, a department of computer science might regard the institution of an information systems program as encroaching upon its territory in an inappropriate way: not only is it covering the same intellectual ground (the study of computers) but, much worse, it is doing so in a way that understands that ground quite differently. It is thus breaking the rules of the game as they see it: "They are playing at not playing a game. If I show them I see they are, I shall break the rules and they will punish me. I must play their game, of not seeing I see the game" (Laing 1970).

Worse, for some, the whole information systems field is invisible. I have experienced this in attending a workshop on the theme of how information systems and software engineering could come together, where a senior professor of software engineering argued that the question was simply a category error, as software engineering was an academic discipline, while an information system was just a thing. Although well-respected and well-informed in his own field, he had no conception of information systems as a discipline.

Referring to information systems as a cyborg discipline carries risks as well as insights. Perhaps the most striking is the technocratic emphasis of the term *cyborg*: beyond Haraway's work, its main connotations are around machines rather than people. Given the prevalence of technological imagery and concerns within information systems, and its constant confusion with information technology, this could be problematic. In a way, though, this confusion gives strength to the cyborg concept in its ambiguity and fluidity. To live as a cyborg is not to be comfortable, it is to be challenging and challenged. As Haraway (2000, p. 129) says, the cyborg concept "does unexpected things and accounts for contradictory histories while allowing for some kind of working *in* and *of* the world."

A further danger is found in the organismic nature of the cyborg concept (cf. Morgan 1986), with its overtones of analysis leading to a single perspective, ignoring the politics of, and conflict between, multiple points of view. In fact, it is precisely the ambiguity and boundary-crossing nature of the cyborg that makes it a useful model. Undoubtedly the concept of the cyborg is that of an organism—the origins of the term imply as much—but the focus of the concept is to blur the boundaries between the cyborg's different parts. It is systemic in the sense that it has emergent properties that go beyond those of its components, and in the sense that it can only be understood through the relationships between those components (cf. Bateson 1972), not in the sense that it has a single purpose or goal. Indeed, as Letiche (1999:150) remarks, a key feature of the cyborg concept is that it embodies "*différance*—complex relationships of individual, mechanical, natural, synthetic and cultural activity that would lead to indeterminate identity and dynamic interaction." We do need to beware of reification, however: while the cyborg of science fiction may be a thing, the cyborg concept describes something fluid and changing.

What I hope to do in this paper is to illustrate the experience of IS as a cyborg discipline—to argue for its cyborgness—by describing my own encounters, as an IS academic, with boundary crossing in various academic departments.

I present my personal experiences here not because they are of interest in their own right, but as a set of typical examples which illustrate the case I am trying to make. I intend this to be within the spirit of the reflective practitioner (Schön 1983). It is also relevant from the feminist perspective that partly informed Haraway in her discussion of cyborgs, which validates personal experience as a mode of discourse.

I shall discuss these experiences in two different settings. First was my time as a doctoral student at the University of Lancaster, within their Computer Science department. Second was a period I spent at the University of Durham as a researcher on a consciously interdisciplinary project. The accounts are necessarily personal; I hope nothing in them is taken as criticism of particular individuals. Both accounts were written while I was in the situation, so the "now" in each story is some years in the past.

2 CYBORG TALE 1: AS A DOCTORAL STUDENT

My first experiences come from a piece I wrote in 1996 (but never published) that reflected on my experiences as a doctoral student. Although based in a department of computer science, I was working within the field of computer-supported cooperative work (CSCW). This field arose within computer science, separately from information systems, as an offshoot of human-computer interaction. However, there are many parallels with IS (Kuutti 1996) and the issues around its cyborg status are similar.

Shapiro (1994) lists about 15 disciplines from which CSCW has taken some input that have gone to shape its discussions. The number of these contributing disciplines makes the field immensely richer, as well as considerably more complex. It does lend the field a slightly uneasy air, however.

Could the nature of CSCW be any different? Surely not. One of its characteristics is that the very subject of its discourse is itself a cyborg: a mixture of the technical and social, a mixture of computers and people and networks and organizations. Given this cyborg nature, it would be strange if the research and practice of the discipline was not itself a mixture of the disciplines that have studied these things. Of course, there are places where the combination of people and technology is studied with purely technical interest with little concern for the effects upon people (such as in some computer science departments and IT consultancy firms); again, there are some places where the technology is ignored and only its social effects considered (such as by some sociologists), or only the effects upon the individual psyche (such as by some psycho dynamic psychologists). Such perspectives do tell us useful things: how to build better ISDN networks, what are the societal dangers of the Internet, what to celebrate and what to be wary of in electronic communication. But the perspective of CSCW is different from these: it considers instead how people work together (cooperative work) *and* how computers can change this (computer support). Combining these two aspects to more effectively design socio-technical systems has been much of the effort of CSCW.

To ask this question in a slightly different way: Who does CSCW? Is it an enterprise for members of well-defined disciplines (computer science, sociology, social psychology, management, etc.), who come together on multidisciplinary projects to study and develop new computer systems? Is it an enterprise for researchers who remain within their own traditional disciplines, while learning something of the knowledge of researchers from other disciplines, so that they covertly become interdisciplinary within themselves? Or is it an enterprise for those who are less interested in disciplinary boundaries than in relevant information, from whatever source it may come? The answer to each question is yes. All three models have been followed in various projects within CSCW. All three represent cyborg research, research that crosses boundaries of

disciplines. In the first case, the research team as a whole is a cyborg. In the second, the cyborgness is somewhere between the team and the individual. In the third case, the researcher him/herself is a cyborg. People in the third category often seem to move from one discipline to another, as new opportunities arise, or they end up establishing jobs and departments that reflect their new cyborg status (such as the universities which now have CSCW departments and research centers independent from other departments, although more often they seem to exist as a kind of virtual department, where collaboration between people is more significant than structures).

However, cyborgs are not popular with society. Establishing a new department is one move sometimes undertaken to calm this insecurity, although it is a move that does little but reinforce the disciplinary walls by setting up new disciplines. In this way, for example, computer science was formed as a new discipline in the 1940s by a mixture of electronic engineers and mathematicians, but rather quickly set up its own disciplinary structures and now is as much a participant in the fractured academic culture as the older disciplines. In the context of CSCW, this doesn't matter as such (as its focus is not the breaking down of barriers for the sake of doing so) but it does remove some of the creative tension that exists between the different constituent disciplines of the field.

This last point brings us to the other reason why CSCW is a cyborg discipline: because it is useful for it to be so. If the only place where people from different disciplines, all looking at people working together via computers, could meet was at an annual conference, or the occasional project with disciplinary boundaries fully up ("you are the computer scientist on this project, you are the anthropologist and you are the organization theorist"), it would be rather dull and a lot less fruitful. One of the big risks in CSCW are the "paradigm wars" seen in various kinds of social science—groups of true believers in one way of conducting research or another, who come together not so much to engage in dialogue as to fight each other with the same old arguments. If the risks of this are so strong at the moment, imagine what it would be like if the members of those paradigm communities never spoke to each other except at conferences.

This leads me to label CSCW as a cyborg discipline: of itself, by its nature, it is a cyborg between the technical (of various kinds) and the social (of various kinds). On the one hand, this is simply its nature, a description of what it is. On the other, it is usefully so, and much productive research and practice has been conducted as a result.

But of more interest to me is the fact that I see myself (writing in 1996) as a cyborg researcher. In what way do I mean this? In the sense, as with CSCW itself, of sitting between the technical and the social. Thus my background and interests are a mixture of the technical (computer science, mathematics) and the social (psychology, sociology, management, philosophy). Likewise, my worldview sits between these, not pure computing (no C++ code was to be found in the eventual thesis, and while I find computers to be a useful tool, to me they are part of an overall process of organizational change); but also not pure social science (references to Habermas, Weber or Garfinkel were kept to a minimum, and the aim of the work is essentially pragmatic).

Why should this be so? Partly, as with my first reason to be a cyborg given above, because it is what I am. I have this mixture of disciplines within me, I don't find it possible or interesting to confine my thoughts within a single disciplinary matrix, and my thoughts by their nature move swiftly from one set of ideas to another, like a bee resting upon different flowers and (hopefully) spreading pollen from one to another.

This, it might be thought, is my problem. If I want to be a cyborg, then that's fine in my own time, but if I want to write a Ph.D. I should knuckle under the disciplinary norms of computer science and write a thesis that is pure computing (whatever that means). I have not done this, choosing instead to write in a style that is a mixture of social and technical not just because it suits my temperament, but also because I think it is good science—it is appropriate to this context.

This is principally, of course, because of the nature of CSCW that I discussed above. By its nature, CSCW is a mixture of people, computers, and organizations, a study of the facilitation of human cooperation by technology. Therefore it will be appropriate to get a handle on what is the nature of work, cooperation, and organizations and to be aware of what things affect people and how, as well as being aware of the technology and how to make it better. My task here is the evaluation of systems (some part of which are based on computers) that support cooperative work, and to evaluate these effectively requires a knowledge of the full context of the work.

It might be helpful to briefly consider what happens when one does *not* consider the organizational and human context of work when designing and evaluating computer systems to support it. A good example from my research concerned a university accounting system (Ramage 1999). One reason why this was a failure was the change in organizational culture that occurred in the finance department around the same time as the accounting system was introduced. The new culture was one strongly focused on financial targets, as favored by the government at the time, and also on a highly structured information hierarchy, where as little information flowed through the hierarchy (i.e., from the finance director to the departmental budget-holders, or vice-versa) as possible. This led to a large degree of resentment, which made budget-holders considerably more resistant to the system, but also to inflexibility in that the system (a package written for several universities) was not changed to meet the information needs of the budget-holders. The resulting problems with the system are an indicator of one reason why it would have been useful to consider properly the whole organizational system sooner.

The complementary challenge to the earlier example about computer science might also be that if I want to write a thesis on the human influences of technology, then I should be writing it in a sociology or management department, and confine myself to the norms of those cultures. After all, do such places not frequently specialize in such things? This I would similarly refute, saying that these areas alone are equally inadequate to the systemic study of technology in use. (Of course, one can also do perfectly good work on the sociological or organizational aspects of technology, and plenty has been done; my point is not to denigrate that work, but rather to say that I prefer to use a wider angle of lens.)

And so it is that I chose the difficult middle way of being a cyborg, sitting between the technical and the social in a department of computing, writing about computers but being concerned for their effects upon people and organizations, an unholy and unclean mixture—but a necessary one.

3 CYBORG TALE 2: AN INTERDISCIPLINARY RESEARCH PROJECT

The second experiences around cyborg research arise from the problems of communication occurring in an interdisciplinary research project. The project, Software

as a Business Asset, ran from 1997 to 2000, with three academic staff (two software engineers and one organizational analyst), one researcher (me), and one doctoral student. The results from the project have been extensively written-up elsewhere (e.g., Bennett et al. 1999; Brooke and Ramage 2001).

The project arose from the need of two different groups of people at the University of Durham. First was a group of software engineers who had developed various methods for dealing with the maintenance of existing software, through understanding the code thoroughly, through performing mathematical transformations on it so it did the same things on different hardware, and through patching it up in various different ways. Their methods were successful, they got grants, student scholarships, and consultancies without problem, and industry used their work. However, somehow there wasn't as much effect of the work as there could be. Somehow businesses took it up and used it, but it got snarled up in politics and structure and process. Somehow they knew that they needed a concern for organizational issues. Elsewhere in the university, a lecturer was doing research and teaching MBA students about people, change and information systems. She had a view of how to help businesses make strategic decisions about their information systems. She used a method that involved looking at various possible futures for the business and thinking those over before you did anything much to the technology. She had some contact with the software engineers down the hill already—so few people at the business school were interested in computers that she needed all the company she could get. So she knew some of their problems, and they realized together that some good work could be done here.

Language was a major issue throughout the project. It seems at times that almost any word which might be used by one group of academics to mean one thing will be used by other academics to mean something completely different. This caused quite a bit of misunderstanding on a number of different occasions.

A particular feature of this was the precision with which words are used. It's not that software engineers actually use words more precisely and exactly than organizational analysts, but they often seem to think they do, and this was a continual issue of tension.

An example of a particular word which turned out to be used rather differently by the two communities was been *tool*. A tool, says the dictionary, is an implement which assists people to do their work more effectively or efficiently. Human beings are, it is often said, "tool-making animals." But what do those tools constitute? Clearly, in everyday situations, a tool is something like a hammer or a chisel. For a software engineer, however, a tool refers to a piece of software which enables them to get their work done more efficiently—for example, in analyzing the structure of a piece of program code. In organizational analysis, by contrast, a tool is more abstract and usually refers to some way of helping people to interact or think more effectively. So when the organizational analyst referred to "the organizational scenarios tool," it made perfect sense in her context that this tool was a way of structuring ideas. However, the software engineers found this such a strange thing to refer to as a tool that they kept writing little notes, in papers intended for their community, to the effect that this wasn't really the kind of tool that you might expect when you heard that word normally.

We constantly came up against the question of whether this sort of interdisciplinary work can actually take place at all, in any meaningful way. In particular, we became aware very early on that the two sides of the project were working from very different intellectual paradigms. In the terms of Burrell and Morgan (1979), software engineers

work from a positivist paradigm whereas the organizational analyst works from an interpretivist paradigm. Formally speaking, these paradigms are incommensurable—that is, it is not possible to resolve the differences between them at an intellectual level. Our constant task was to try to resolve them at a practical level, which was sometimes successful and sometimes not.

The differences in paradigms became apparent at our first full project meeting, about six weeks after the project started. How should we plan the work of the project? What model of research should we use in doing this? Should we expect to build a complete picture of how to handle legacy systems and then try it out in industry, or should we aim to combine the development of our method with trials of small parts of it in industry? The project proposal, principally written by one of the software engineers, reflected the first approach, one which is common in engineering. At the meeting, however, we found ourselves moving more in the direction of an approach based on action research, the more iterative form of research.

Ironically, as the project developed, we moved back to the more engineering-based model; this is partly to do with the lack of industrial involvement in the project, but must surely also derive from the location of the bulk of the project team in a Computer Science department. It was only toward the end of the project, as we conducted the work reported in Brooke and Ramage (2001), that we began once again to take up an action research approach.

The question of paradigms also arose with respect to the relationship between the two parts of the model: organizational and technical change analysis (Bennett et al. 1999). Which part of it should be primary? The organizational change aspects occur first, but the *output* (itself somewhat of an engineering term) from them must be in a form suitable for use by the software change tool.

These were some of the tensions to be found between the two perspectives during the SABA project. Yet we did make a conscious and continual effort to work together as a single team, to do work that was not just multidisciplinary but interdisciplinary, and to try to go beyond the boundaries of our home disciplines. That is, we tried to create a cyborg enterprise together.

4 TREATING INFORMATION SYSTEMS AS A CYBORG DISCIPLINE

Straddling the disciplinary divide is not a luxury in the study of information systems, but rather a necessity. For a full understanding both social and technical perspectives are necessary, and this can be seen from either side of the divide. From the social perspective, one can see that people interact with technology, it impacts on their lives and their work, but that the detail of the technology makes considerable difference to the nature of that impact. From the technical perspective, one can see that the way in which one's carefully crafted and highly efficient technology is used depends on a whole range of factors that go beyond the value of it as a technology, and thus if one wants it to be used fully (or at all) one must be aware of those factors.

However, to portray oneself, either as an individual or as a group, as conducting information systems work, is to set oneself up as a cyborg entity, and thus due for persecution by the rest of the academic community.

How can we deal with this? There are various solutions with varying likelihood of happening.

Least likely, we can strive to have institutional acceptance of cyborgs (as individuals or disciplines) as a general category. For the reasons outlined above about the challenging nature of cyborgs, this is difficult. An example of this not happening can be seen in the troubles of IS in establishing itself as legitimate as a category within the UK's Research Assessment Exercise, where (despite considerable efforts) in 2001 it existed only as a subsection of the Library and Information Sciences category.

More productive is to put, in particular contexts, the pragmatic case of defending the value of the cyborg nature of IS. Arguments like the one at the start of this section can be made to demonstrate the usefulness of IS, and the necessity of its twin perspectives.

It might be argued that the above is just another way of discussing interdisciplinarity. While it is true that I have drawn on the interdisciplinary character of information systems above, talking of IS in terms of cyborgs adds a different character to the nature of the interdisciplinarity. Haraway (1991) argues clearly that the boundary-crossing nature of cyborgs is to be celebrated, not simply tolerated: "Cyborg imagery can suggest a way out of the maze of dualisms in which we have explained our bodies and our tools to ourselves. This is a dream not of a common language, but of a powerful infidel heteroglossia."

As with Haraway's use of the concept of the cyborg, my use of the term is metaphorical in the sense that it is an image, but I use it to cast light upon the boundary issues in IS, to raise questions about the nature of the discipline. In this sense, the question mark in the title of the paper is deliberate. The goal of looking at IS as a cyborg discipline is not to build "metrics of cyborgness" in particular papers or projects, but precisely to raise questions about the nature of the discipline and the extent to which it crosses boundaries and the implications of that boundary-crossing.

Weber (2003) asks how the IS discipline might establish an identity. I would suggest that it is in this way that looking at the cyborg concept can help. By considering the ways in which our discipline is neither precisely technical, nor social, does not derive its identity from one academic field or another but from a fusion of many—and thus in creating a new way of looking at the world that goes beyond the technical and the social. Exploring what this might mean in practice is a deeper question, but the question of the identity of information systems as a discipline is not simple.

If the concept of IS as a cyborg discipline has use, two final implications follow. First, this boundary-crossing is embedded into the nature of the discipline so firmly that it cannot be escaped—it must rather be embraced. This brings liberation from the strictures of the technical/social divide—it is to reject the language of "either/or" in favor of that of "both/and."

Second, this means that the continual struggle for self-identity, seen in IS research and scholarship over so many years, is both inevitable and a necessary part of the discipline. It is only by asking ourselves who we are that we can begin to grasp the fluid nature of what it means to be both human and machine in our perspectives, and only by continuing to ask that question that we can avoid getting trapped into a single understanding that only works for a particular time. To consider the technical and the social in one, at once, to cross the boundaries of both—that is the cyborg nature of information systems.

ACKNOWLEDGMENTS

This paper has been formulated over several years through conversations (and sometimes readings of pieces of text) with Michael Twidale, Fides Matzdorf, Keith Bennett, Carole Brooke, Karen Shipp, and Rebecca Calcraft. I am also grateful to the four anonymous reviewers for this conference, whose comments helped me to shape the paper.

REFERENCES

Bateson, G. 'The Cybernetics of 'Self': A Theory of Alcoholism," *Steps to an Ecology of Mind*, San Francisco: Chandler, 1972.

Bennett, K., Ramage, M., and Munro, M. "A Decision Model for Legacy Systems," *IEE Proceedings—Software* (146:3), 1999, pp. 153-159.

Brooke, C., and Ramage, M. "Organizational Scenarios and Legacy Systems," *International Journal of Information Management* (21:5), 2001, pp. 365-384.

Burrell, G., and Morgan, G. *Sociological Paradigms and Organizational Analysis*, London: Heinemann, 1979.

Checkland, P., and Holwell, S. *Information, Systems and Information Systems: Making Sense of the Field,* Chichester, UK: John Wiley & Sons, 1998.

Clynes, M. E., and Kline, N. S. "Cyborgs and Space," *Astronautics,* September 26-27, 1960, pp. 75-76.

Haraway, D. J. "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century," in *Simians, Cyborgs and Women: The Reinvention of Nature,* New York: Routledge, 1991, pp. 149-181.

Haraway, D. J. *How Like a Leaf: An Interview with Thyrza Nichols Goodeve*, New York: Routledge, 2000.

Heims, S. J. *Constructing a Social Science for Postwar America: The Cybernetics Group, 1946-1953,* Cambridge, MA: MIT Press. 1991.

Jones, M. "It All Depends What You Mean by Discipline…," in J. Mingers and F. Stowell (Eds.), *Information Systems: An Emerging Discipline?,* London: McGraw-Hill, 1997, pp. 97-112.

Kuutti, K. "Debates in IS and CSCW Research: Anticipating System Design for Post-Fordist Work," in W. J. Orlikowski, G. Walsham, M. R. Jones, and J. I. DeGross (Eds.), *Information Technology and Changes in Organizational Work*, London: Chapman & Hall, 1996, pp. 287-308.

Laing, R. D. *Knots*, London: Tavistock Publications, 1970.

Law, J. (Ed.). *A Sociology of Monsters: Essays on Power, Technology and Domination*, London: Routledge, 1991.

Letiche, H. "Donna Haraway: The Schöne, Schöne, Dona(u)," *Organization* (6:1), 1999, pp. 149-166.

Morgan, G. *Images of Organization,* Beverly Hills, CA: Sage Publications, 1986.

Ramage, M. *The Learning Way: Evaluating Co-operative Systems,* Unpublished Ph.D. Thesis, University of Lancaster, UK, 1999.

Richard, M., and Whitley, E. "Addressing the Cyborg: A Useful Concept for Information Systems Research?," Working Paper 89, Department of Information Systems, London School of Economics, 2000.

Schön, D. A. *The Reflective Practitioner: How Professionals Think in Action*, New York: Basic Books, 1983.

Shapiro, D. "The Limits of Ethnography: Combining Social Sciences for CSCW," in *Proceedings of the Conference on Computer Supported Cooperative Work* (Chapel Hill, NC, 22-26 October 1994), New York: ACM Press, 1994, pp. 417-428.

Weber, R. "Editor's Comments: Still Desperately Seeking the IT Artifact," *MIS Quarterly* (27:2), 2003, pp. iii-xi.

Wiener, N. *Cybernetics: Or Control and Communications in the Animal and the Machine*, Cambridge, MA: MIT Press, 1948.

ABOUT THE AUTHOR

Magnus Ramage works as a lecturer in information systems at the Open University, within their Systems department, a cyborg group that combines interests in information systems, sustainable development, and organizational change, united by perspectives from systems thinking. He teaches and researches on the evolution of information systems (both planned and unplanned), on systems thinking and its history, on information systems evaluation, and on issues around organizational learning and change. As indicated in the paper, he received his PhD in computer science from University of Lancaster, and has also worked at the University of Durham. Magnus can be reached at m.ramage@open.ac.uk.