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The Internet, E-Commerce and Older People: an Actor-Network Approach to Researching Reasons for Adoption and Use

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Abstract

Many older people are discovering the Internet, and some are also making good use of electronic commerce and all that goes with it. Others, however, are not adopting these technologies. This paper questions why some older people adopt Internet technologies while others do not, and offers a research framework, based on actor-network theory, for investigating adoption of Internet technologies by older people. In this paper, innovation translation is used to illustrate how specific cases of adoption have occurred. Innovation translation presents a different view of innovation than the better known theory of innovation diffusion, but one that the authors argue is better suited for research in socio-technical situations like this.

Keywords

Electronic commerce, the Internet, older people, innovation translation, actor-network theory

Introduction: Older People and the Internet

The Australian Bureau of Statistics (ABS) defines *older people*, for statistical purposes, as those who are fifty-five years of age and over. Figures from the ABS indicate that older people are taking up Internet technology at a rapid rate, but that their use of the Internet for electronic commerce (e-commerce) activities remains quite low, with older people forming just 1% of the total of adult Internet shoppers (ABS, 2000). Individual older people often have particular needs that differ from those of younger people, and it appears that use of the Internet may help with some of these. As people grow older they can become physically less mobile and could benefit if they were able to conduct more of their financial affairs, such as banking and bill paying, from home. In other words, e-commerce has something useful to offer them. The research literature (Williamson, Bow and Wale, 1996; Council on the Ageing, 2000b; Mitchell, 2000; Lloyd, 2001), however, and also data from an Older Person Focus Group in Melbourne (Council on the Ageing, 2000a), reveal significant barriers to the adoption of e-commerce by older people. This paper will outline a research approach, based on actor-network theory, for investigating the adoption of Internet technologies and e-commerce by older people.

E-commerce can be defined as the purchase and sale of information, products and services using any one of the thousands of computer networks that make up the Internet (Lawrence, Corbitt, Tidwell, Fisher and Lawrence, 1998). Typical e-commerce activities include on-line banking, purchase of goods, purchase of services such as insurance, arranging and paying for travel and accommodation, on-line share purchase, soliciting investment advice, and the use of automatic teller machines (ATM).

During the twelve months prior to February 2000 almost half of the adults in Australia connected to the Internet (ABS, 2000), but the highest Internet usage was, as could be expected, among younger adults. Of the older people, only 13% were Internet users, and this group was likely to access the Internet from home, suggesting that most older Australians are currently unlikely to be Internet shoppers.

Older people purchase computers for a variety of reasons. Lewis (2001) suggests that the main drivers when they are deciding whether or not to buy a computer are the on-line services of banking, e-mail and convenience shopping, but that when they actually *get* the computer their main use is for word processing, e-mail, Internet browsing and games.

Older People and Their Needs

The US-based Spry Foundation (2000) sees the needs of older people revolving around four interrelated themes:

- financial security,
- physical health and well being,
- mental health and social environment, and
- engaging in intellectual endeavours.

Financial security is seen as particularly important by older people who, in retirement, need to be assured of adequate income to maintain their lifestyle. Many older people in Australia, as well as in Europe and North America, must arrange their own retirement finances and in doing so seek appropriate investment information (Cutler, 1997; Manchester, 1997).

The Australian Government has recently released a number of issues papers examining the older person's ability to remain active and independent (Bishop, 2000). A key feature of these is an emphasis on communication technology, particularly the Internet, that enables older people to use e-mail to communicate with family and friends, to access information, and to engage in e-commerce activities such as bill paying, the purchase of goods and services, and electronic banking (Coulson, 2000; Fozard, Rietsma, Bouma and Graafmans, 2000). The low uptake of Internet shopping, mentioned above, may have some serious implications in future for government policies aimed at increasing the independence of disabled older people.

Barriers to the Use of Electronic Commerce by Older People

For those older people without their own computers, limited access to Internet technology through public libraries and community centres is seen as a problem. For those who have set up their own Internet facilities at home, capital costs, running costs and maintenance become important issues (Williamson, Bow et al, 1996; Council on the Ageing, 2000a; Human Rights and Equal Opportunity Commission, 2000). Lloyd (2001) suggests that the costs associated with buying a computer and getting it on-line are an obstacle to almost 35% of the 55-plus age group. Knowing how to make use of the technology presents a problem and there is a need for appropriate training at various levels in both basic information technology and in information handling skills (Echt and Roger, 1998; Cody, Dunn, Hoppin and Wendt, 1999; Hollis-Sawyer and Sterns, 1999; Human Rights and Equal Opportunity Commission, 2000). Many older people also have difficulty in searching for the information they require as some Web-sites contained complex information that is hard to understand.

Usability issues are seen as a potential barrier with the interface, information structures, and navigation being important contributors. Research reported by Noonan (2001) stresses the link between disability and aging, and Scott (2001) points out that the 'self-service model' of

electronic banking and automated phone services cannot be expected to suit all users, particularly older ones. For those older people with visual or motor disabilities, the absence of interfaces and services that allow for these disabilities is a very significant barrier (Human Rights and Equal Opportunity Commission, 2000; Mitchell, 2000). Security and privacy are also important considerations, and Lloyd (2001) notes that older people are very concerned about these issues, particularly regarding credit card transactions. A similar response came from discussions with the Focus Group (Council on the Ageing, 2000a).

One way these barriers are being addressed is in the growth of seniors computer clubs. Describing her experiences in organising these clubs, Bosler (2001) notes that often, when older people arrive at a club, they confess that a son or daughter has just bought a new computer and given them the old one. They then add that said son or daughter was very busy and had no time to teach them to use it. Another reason that people join these clubs is that they have had some workplace experience with computers but want to learn to use a computer for their *own* purposes. When questioned on why they wanted to use computers, answers included: booking a holiday, buying/selling shares, genealogy, information on cancer drugs, paying bills and using e-mail (Lepa, 2002; Bosler, 2001). Many people said they wanted to be able to keep in touch with family and friends while some said they wanted to shop or research. Bosler tells of one older woman who bought a computer, with word processing software and e-mail access, specifically so she could write her memoirs.

A Framework for Modelling Older People's Adoption of the Internet

Many older people are quite innovative and entrepreneurial, and are prepared to consider the advantages offered by using e-commerce. Conversely, others are happy to continue to do things in the same way they always have and see no need to investigate use of this technology. How and why people differ in this way, and why some adopt some technologies and not others will be considered now. Rogers (1995 :11) defines an innovation as "... an idea, practice, or object that is perceived as new by an individual ...", and we will argue that the adoption of e-commerce by an older person should be seen as an innovation and considered through the lens of innovation theory. The most widely accepted theory of how technological innovation takes place is provided by innovation diffusion (Rogers, 1995), but most of the research based on this model involves studies of large organisations like General Electric, Xerox Park and the British Navy, or societal groups such as bottle-fed babies, adopters of mobile phones and organic farmers (Rogers, 1995). This paper argues that another approach, that of innovation translation, has more to offer when considering details of the adoption of e-commerce by older people.

The innovation translation approach draws on the sociology of translations, more commonly known as actor-network theory (ANT). The core of this approach is translation (Law, 1992), which can be defined as: "... the means by which one entity gives a role to others." (Singleton and Michael, 1993 :229). In considering how the adoption of e-commerce by older people occurs it is necessary to examine their interactions with a number of other people. It is also important not to ignore the influence of the many non-human actors that are involved, including computers, modems, Web browsers, Internet service providers, e-mail documents and Web pages. In trying to understand this adoption it is useful to see these interactions in terms of negotiations, not just between humans but also involving non-humans.

Actor-network theory (Callon, 1986; Law, 1992; Latour, 1996) attempts impartiality between all actors, whether human or non-human, and makes no distinction in approach between the social, the natural and the technological. Using an actor-network approach all the factors (both human and non-human) influencing e-commerce adoption are seen as actors, and the

combination of all of these in terms of networks. It is a feature of actor-network theory that the extent of a network is determined by actors that are able to make their presence *individually felt* (Law, 1987) by other actors.

Research in technological innovation is often approached by focusing on the technical aspects of an innovation and treating 'the social' as the context in which its adoption takes place: assuming that outcomes of technological change can be attributed to the 'technological' rather than the 'social' (Grint and Woolgar, 1997). On the other hand social determinism holds that social categories can be used to explain change. It concentrates on investigation of social interactions, relegating the technology to context. Bromley (1997) argues that as long as 'technology' is seen as a distinct type of entity which is separate from 'society' the question will always need to be asked 'does technology affect society or not?' One answer to this question is that it does, but this leads us to the technological determinist position of viewing technology as autonomous and as having some essential attributes (Tatnall and Gilding, 1999) that act externally to society. The other answer: that it does not, means that technology must be neutral and that individual humans must assign it their own values and decide on their own account how to use it. This view is close to a social determinist position. Bromley maintains that neither answer provides a useful interpretation of how technological innovation operates, and argues against an either/or stance like this. He argues that we should abandon the idea that technology is separate from society.

Rather than recognising in advance the essences of humans and of social organisations and distinguishing their actions from the inanimate behaviour of technological and natural objects, ANT adopts an anti-essentialist position in which it rejects there being some difference in essence between humans and non-humans (Latour, 1986). To address the need to treat both human and non-human actors fairly and in the same way, ANT is based upon three principles: agnosticism, generalised symmetry and free association (Callon, 1986). The first of these, agnosticism, means that analytical impartiality is demanded towards all the actors involved in the project under consideration, whether they be human or non-human. Generalised symmetry offers to explain the conflicting viewpoints of different actors in the same terms by use of an abstract and neutral vocabulary that works the same way for human and non-human actors. Neither the social nor the technical elements in these 'heterogeneous networks' (Law, 1987) should then be given any special explanatory status. Finally, the principle of free association requires the elimination and abandonment of all a priori distinctions between the technological or natural, and the social (Callon, 1986; Singleton and Michael, 1993). As Callon (1986 :200) puts it: "The rule which we must respect is not to change registers when we move from the technical to the social aspects of the problem studied."

Actor-network theory has been used to investigate the success of a number of technological innovations and, in particular, to describe a number of heroic failures, several of which are listed below. Grint and Woolgar (1997) have used ANT to explain the Luddite movement in England last century. McMaster et al. (1997) have applied it to the adoption of a particular approach to systems analysis by a local council in the UK, and Vidgen and McMaster (1996) to car parking systems. Latour has used innovation translation to describe the life and death of the revolutionary Parisian public transportation system known as Aramis (Latour, 1996). An innovation translation model has also been used in several studies of curriculum innovation including those of Nespor (1994), Gilding (1997), Bigum (1998b; 1998a), Busch (1997) and Tatnall (2000).

The Process of Innovation Translation

Grint and Woolgar (1997) note that an actor-network is configured by the enrolment of both human and non-human allies, and that this is done by means of a series of negotiations in a process of re-definition (Callon, 1986) where one set of actors seeks to impose definitions and roles on others. In an innovation translation model the movement of an innovation is in the hands of people (Latour, 1996) whom may react to it in different ways. Instead of a process of transmission we have a process of continuous transformation (Latour, 1996) where getting an innovation accepted calls for strategies aimed at the enrolment of others.

Callon (1986) outlines four stages in the process of translation, the first of which he calls *problematization*. In this stage a group of one or more key actors attempts to define the nature of the problem and the roles of other actors so that these key actors are seen as having the answer, and being indispensable to the solution of the problem. In other words, the problem is re-defined (translated) in terms of solutions offered by these actors (Bloomfield and Best, 1992). The second stage, which Callon calls *interessement*, is a series of processes that attempt to impose the identities and roles defined in the problematisation on the other actors. It means interesting and attracting an entity by coming between it and some other entity (Law, 1987). If the *interessement* is successful the third stage, *enrolment*, will follow through a process of coercion, seduction, or consent in which one set of actors imposes their will on others and these others yield to the persuasion (Singleton and Michael, 1993). All going well, this will then lead to the establishment of a stable network of alliances. Finally *mobilisation* occurs as the proposed solution gains wider acceptance and an even larger network of 'absent entities' (Grint and Woolgar, 1997) is created through some actors acting as spokespersons for others not previously involved.

Using Innovation Translation to Investigate Internet Adoption

One reason often given by older people (Gross, 1998; Bosler, 2001) for adopting Internet technologies is, quite simply, so that the world does not pass them by and so that they won't be left out of things. The means of social interaction is increasingly moving away from posted letters to e-mail, and those not using e-mail are finding it harder to keep in touch. A growing number of older people are finding that an e-mail address has become essential (Perry, 2000).

Many older people consider that being able to keep in touch and to converse sensibly with their grandchildren is very important (Alexander, 2000). As this requires that they spend some time coming to grips with, and using the technology (Philbeck, 1997) they make adoption decisions for this reason. In the same vein, being able to understand what is meant by a 'dot com', and why some people see the continuing growth of Microsoft as a threat, means that they need to engage with the technology (Perry, 2000).

These, and related reasons for adoption of Internet technologies such as "All my friends use e-mail and I'll be left out if I don't" (Council on the Ageing, 2000a) suggest that characteristics of the technology have less to do with things than do social interactions and the creation and maintenance of interpersonal networks. We will illustrate this further in the brief case study examples that follow. Whereas innovation diffusion (Rogers, 1995) places considerable importance on (supposedly) innate characteristics of the technology, innovation translation offers a research approach based on networks of human and non-human actors. For older people the issue of whether or not to adopt Internet technologies has been problematised (Callon, 1986) in this context, not as one that relates to diverse characteristics of the technology, but as one *specifically* of communication and keeping in touch with family and friends. The growth of seniors computer clubs is another example of this. The Internet, that is capable of so much, has been *translated* here to include just the means by which these people

can maintain their place in society and keep relevant to their family and friends (Bosler, 2001). What they have adopted is not the Internet as a business might know it, but a translation of the Internet resulting in technology that offers a means of maintaining contact with the world (Tatnall, 2000).

The three short accounts of Internet adoption by older people that follow result from research undertaken by the authors, and give some useful insights into how and why these people *really* adopt this technology. These accounts were derived from a series of interviews with older Internet users. An important piece of methodological advice offered by the proponents of actor-network theory is to 'follow the actors' (Callon 1986; Latour 1996) and let them set the framework and limits of the study themselves. After initial discussions with the Focus Group, leaders in seniors computing clubs and other people involved in promoting the use of the Internet by older people, this process was followed to identify others to be interviewed. The accounts given below represent only a few of those obtained in this on-going research.

Bernie (2001), a recently retired retail sales manager, has an interest in the stock market. He had, in the past, invested small sums through a firm of stockbrokers, and watched the fate of his shares with interest. The problem had been time as he had been very busy at work. The lure of purchasing shares had always been, to him, more in the gamble than as a means of making money. Now that he had retired and had a lot more spare time, he had decided to indulge in this hobby in a bigger way. One day he read an article in the newspaper about using the Internet for share trading, and decided to give it a go. Knowing little of computers and the WWW he now needed to do some research into how to proceed. After purchasing the necessary hardware, setting up an account with an Internet Service Provider, and another with the on-line share broking service offered by his bank, he tried to make sense of using the Internet, and came to a full stop. It was all too hard. His motivation to succeed, however, was strong. He found out about a class offered by the local municipal library in use of the WWW, enrolled for the class, and overcame the block. Attending the class reinforced his early view that most of what was on the WWW was of little interest to him, but he did now know how to access any given site and could proceed with his on-line share trading. In terms of innovation translation he had *problematized* the Internet as a share broking service. If Bernie needed any more convincing, the fact that using the Internet was cheaper than his stockbroker, and that it removed the need to listen to the advice of the cocky young 'share expert', had provided it. This *interessement* quickly came between him and the stockbroker and led to his *enrolment* of the Internet as a means of share trading. *Mobilisation* occurred when he joined an investment club for retired people and began to convince the other members of the advantages of using the Internet.

Roy (2002), a retired history and geography teacher, has an interest in researching genealogy, and in the history of hand-tools used in woodwork, and has made use of the Internet for this purpose. With no background at all in the use of information technology he was initially most concerned that he would not be able to learn to use a computer, but a former colleague who lived nearby sat down with him and gave him some lessons in use of the WWW. He now makes occasional use of the Internet, by accessing computers at the local library, where he looks up information relating to his genealogical interests. He also accesses the Web sites of wood-working tool clubs around the world. With this *translation* the Internet became, to him, just a means of obtaining this information. Other aspects of the Internet were of little interest, and he would not have made the adoption based on what might be considered its *innate characteristics* (Rogers, 1995). Roy could not accurately be said to have adopted the Internet as such at all, but rather a translation of it relating just to its use for obtaining information relating to genealogy and wood-working tools.

In a final example consider the case of Jean (2001), a Melbourne grandmother with family in London and Rome, considering the adoption of e-mail as a means of keeping in touch with them. Like many older people she had previously relied on posting airmail letters as she found the cost of phone calls too high. She also preferred writing to speaking on the phone. Electronic mail offered a problematisation of letter writing where the 'letters' could be short, informal, and sent as frequently as required for low cost, in contrast to the longer, more formal style of airmail letters. This offered her a *translation* of Internet use to become just a means of writing letters as often as she wanted, that will be 'delivered' very quickly and for low cost (once the computer system has been set up). Jean saw no point in 'browsing' or 'surfing the Internet' and would not have adopted Internet use for these reasons. The *translation* of the Internet to ignore all these features and concentrate just on letter writing is what was instrumental in convincing her to consider its adoption. All the other characteristics of the Internet were irrelevant to her (Bosler, 2001). Without this translation she saw the Internet as too intimidating; now it was something she could understand and handle. *Interessement* was then offered by the informality, lower cost and quicker delivery time of the e-mail, in comparison to ordinary letters. This came between her and her use of ordinary mail and made e-mail seem even more attractive. The result was *enrolment*, as she saw and became convinced of the benefits of e-mail and then adopted this technology. She soon began to *mobilise* the technology by attempting to get other friends in Perth or New York to whom she currently also sent letters, to also adopt e-mail so that she could more easily communicate with them also.

Conclusion

In this paper we have noted that while some older people find the idea of using the Internet threatening, others see it as a means of maintaining their independence. We have argued that which of these groups older people find themselves in has more to do with their network of interactions with both people and technology than with any innate characteristics of the technology itself.

Bernie (2001) was not interested in whether or not the Internet linked lots of sites around the world, or that it gave access to a wide range of interesting material; he only wanted to use it for share trading. Roy (2002) likewise only wanted to use the Internet to investigate genealogical information and sites relating to wood-working tools. That it provided access to much more information of other types was not the reason he adopted it. Jean's (2001) adoption of the Internet related only to her use of e-mail for communicating with her family and friends, not with browsing for information or amusement. In each case the adoption decisions of these people had little to do with any supposedly innate characteristics of the technology, but rather in *specific uses* of this technology that related to their social interactions and environment.

The theory of innovation diffusion concentrates largely on characteristics of the technology itself, while innovation translation looks at the formation of networks of human and non-human actors and how these networks interact. Translation looks more at the uses people might make of the innovation, and how the innovation needs to be *translated* for these uses to be achieved. It offers a means by which any number of small subtle factors can be addressed in each instance of adoption, rather than just looking for large-scale answers across the board. While diffusion theory may be useful in describing the worldwide movement to adopt Internet technologies, the cases described in this paper show that translation theory offers a better means of looking at the *detail* of individual adoptions. We contend that an innovation translation approach offers a useful way of investigating the *detail* of how and why older people adopt, or fail to adopt Internet technologies and electronic commerce. We argue that

bringing out this detail is especially important in any understanding of how this complex process occurs, and that it allows useful insights that do not otherwise become apparent.

Another aspect of Internet adoption by older people that the authors are currently researching concerns the role played by another group of important actors representing the technology itself. In actor-network theory, interactions with non-human entities like this are no less important than interactions with other humans, and must be treated in the same way. In the next stage of the research this line of inquiry will be further investigated to follow up the interactions between these people and the information technology they are using, looking at how they negotiate with the technology (Callon, 1986) and how it negotiates with them.

References

- Alexander, M. (2000). "Be Online or Be Left Behind - the Older Crowd Head for Cyberspace". *Boston Globe*. Boston.
- ABS (2000). "Use of the Internet by Householders". Canberra, Australian Government.
- Bernie (2001). Personal communication.
- Bigum, C. (1998a). "Boundaries, Barriers and Borders: Teaching Science in a Wired World." *Australian Science Teachers Journal* **44**(1): 13-24.
- Bigum, C. (1998b). "Solutions in Search of Educational Problems: Speaking for Computers in Schools." *Educational Policy* **12**(5): 586-596.
- Bishop, B. M. (2000). "Attitude, Lifestyle and Community Support Discussion Paper". Canberra, Australian Government Printing Service.
- Bloomfield, B. P. and Best, A. (1992). "Management consultants: systems development, power and the translation of problems." *The Sociological Review* **40**(3): 533-560.
- Bosler, N. (2001). *Communication, E-Commerce and Older People*. E-Commerce, Electronic Banking and Older People, Melbourne, Unpublished Seminar Presentation.
- Bromley, H. (1997). "The Social Chicken and the Technological Egg: Educational Computing and the Technology/Society Divide." *Educational Theory* **47**(1): 51-63.
- Busch, K. V. (1997). *Applying Actor Network Theory to Curricula Change in Medical Schools: Policy Strategies for Initiating and Sustaining Change*. Midwest Research-to-Practice Conference in Adult, Continuing and Community Education Conference, Michigan State University.
- Callon, M. (1986). "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay", in Law, J. (Ed) *Power, Action & Belief. A New Sociology of Knowledge?* London, Routledge & Kegan Paul: 196-229.
- Cody, M. J., Dunn, D., Hoppin, S. and Wendt, P. (1999). "Silver Surfers: Training and Evaluating Internet Use Among Older Adult Learners." *Communication Education*(48).
- Coulson, I. (2000). "Introduction: Technological Challenges for Gerontologists in the 21st Century." *Educational Gerontology* **26**(4): 307-316.
- Council on the Ageing (2000a). "Older People and the Internet Focus Group", Unpublished.
- Council on the Ageing (2000b). "Web Discrimination". *ReportAge*: 4.
- Cutler, N. E. (1997). "The False Alarm and Blaring Sirens of Financial Literacy: Middle Ageds' Knowledge of Retirement." *Generations* **21**(2): 34-41.
- Echt, K. V. M. and Roger, W. (1998). "Effects of Age and Training Formats on Basic Computer Literacy." *Educational Gerontology* **24**(1): 3-26.
- Fozard, J. L., Rietsma, J., Bouma, H. and Graafmans, J. A. M. (2000). "Gerontechnology: Creating Enabling Environments for the Challenges and Opportunities of Aging." *Educational Gerontology*(26): 331-344.
- Gilding, T. (1997). "Student Construction of a Knowledge-based System as an Actor Network". *School of Education*. Geelong, Deakin University: 198.

- Grint, K. and Woolgar, S. (1997). *The Machine at Work - Technology, Work and Organisation*. Cambridge, Polity Press.
- Gross, J. (1998). "Wielding mouse and Modem, Elderly Remain in the Loop". *The New York Times*.
- Hollis-Sawyer, L. and Sterns, H. L. (1999). "A Novel Goal-Oriented Approach to Training Older Adult Computer Novices: Beyond the Effects of Individual Difference Factors." *Educational Gerontology* **25**(4): 661-684.
- Human Rights and Equal Opportunity Commission (2000). "Accessibility of Electronic Commerce and New Service and Information Technologies for Older Australians and People with a Disability". http://www.hreoc.gov.au/disability_rights/ecomrep.frm, Australian Government.
- Jean (2001). Personal Communication.
- Latour, B. (1986). "The Powers of Association". *Power, Action and Belief. A new sociology of knowledge? Sociological Review monograph* 32. Law, J. London, Routledge & Kegan Paul: 264-280.
- Latour, B. (1996). *Aramis or the Love of Technology*. Cambridge, Ma, Harvard University Press.
- Law, J. (1987). "Technology and Heterogeneous Engineering: The Case of Portuguese Expansion", in Bijker, W. E., Hughes, T. P. and Pinch, T. J. (Eds) *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. Cambridge, Ma, MIT Press: 111-134.
- Law, J. (1992). "Notes on the Theory of the Actor-Network: Ordering, Strategy and Heterogeneity." *Systems Practice* **5**(4): 379-393.
- Lawrence, E., Corbitt, B., Tidwell, A., Fisher, J. and Lawrence, J. R. (1998). *Internet Commerce: Digital Models for Business*. Sydney, John Wiley & Sons.
- Lepa, J. (2002). *Internet Information Services for Older Australian People*. Pan-Pacific Conference XIX 'e-Globalization and the Pacific Age', Bangkok, Thailand.
- Lewis, R. (2001). *Greypath - Seniors and IT*. E-Commerce, Electronic Banking and Older People, Melbourne, Unpublished Seminar Presentation.
- Lloyd, S. (2001). "Rise of the Cybersenior". *Business Review Weekly*.
- Manchester, J. (1997). "Aging Boomers and Retirement: Who is at Risk?" *Generations* **21**(2): 19-27.
- McMaster, T., Vidgen, R. T. and Wastell, D. G. (1997). *Towards an Understanding of Technology in Transition. Two Conflicting Theories*. Information Systems Research in Scandinavia, IRIS20 Conference, Hango, Norway, University of Oslo.
- Mitchell, S. (2000). "Catching the Silver Wave". *The Australian*. Melbourne: 53.
- Nespor, J. (1994). *Knowledge in Motion: Space, Time and Curriculum in Undergraduate Physics and Management*. London, Falmer Press.
- Noonan, T. (2001). *Enabling Access to New and Emerging Technologies for All. E-Commerce and its Impacts on People with Disabilities*. E-Commerce, Electronic Banking and Older People, Melbourne, Unpublished Seminar Presentation.
- Perry, J. (2000). "Retirees stay wired to kids - and to one another". *U.S. News and World Report*. USA: 22.
- Philbeck, J. (1997). "Seniors and the Internet". *Cybersociology Magazine*. <http://members.aol.com/cybersoc/is2joyce.html>.
- Rogers, E. (1995). *Diffusion of Innovations*. New York, The Free Press.
- Roy (2002). Personal communication.
- Scott, H. (2001). "Old Dogs Learning New Clicks" - older Australians in the Information Age". *E-Commerce, Electronic Banking and Older People*. <http://www.cota.org.au/ecommerce.htm>, Council on the Aging.

- Singleton, V. and Michael, M. (1993). "Actor-Networks and Ambivalence: General Practitioners in the UK Cervical Screening Programme." *Social Studies of Science* **23**: 227-264.
- Spry Foundation (2000). "Older Adults and the World Wide Web". <http://www.spry.org>.
- Tatnall, A. (2000). "Innovation and Change in the Information Systems Curriculum of an Australian University: a Socio-Technical Perspective". *PhD thesis*. Education. Rockhampton, Central Queensland University.
- Tatnall, A. and Gilding, A. (1999). *Actor-Network Theory and Information Systems Research*. 10th Australasian Conference on Information Systems (ACIS), Wellington, Victoria University of Wellington.
- Vidgen, R., T. and McMaster, T. (1996). "Black Boxes, Non-Human Stakeholders, and the Translation of IT through Mediation". in Orlikowski, W.J. *Information Technology and Changes in Organizational Work*. London, Chapman & Hall: 250-271.
- Williamson, K., Bow, A. and Wale, K. (1996). "Barriers to Public Internet Access." *Communications Research Forum*: 36-50.

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Jerzy Lepa is a lecturer in the School of Information Systems at Victoria University. His original background was in education. He has a Master of Business degree relating to data warehousing, and is currently working on a PhD focused on the use of the Internet and e-commerce by older people. His other main research interest is in database management.