Alternation

Interdisciplinary Journal for the Study of the
Arts and Humanities in
Southern Africa

Informatics in South African Higher Education

Guest Editor
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2005

CSSALL
Durban

ARTICLES

Acknowledgement of Reviewers

Informatics in South Africa: An Overview

Rembrandt Klopper

Abstract

In this contribution the author provides an overview of the state of Informatics teaching and research in South Africa, taking as point of departure the peer reviewed contributions of academics at South African Higher Education Institutions. Contributions in the fields of information technology for development, emerging trends in information technology, informatics research, human-computer interaction, and informatics pedagogy are reviewed. While the vast majority of Informatics scholars that contributed reside in South Africa, there are also authors from as far away as Britain and Japan. Besides a review of current trends in Informatics, *Alter*nation 12.1a and *Alter*nation 12.1b also contain contributions about emerging and possible future trends in Informatics.

Informatics in South Africa

As the editor of the two special *Informatics* issues of the interdisciplinary journal *Alter*nation, it is a pleasure to write a brief overview of the contents of the first of the two consecutive issues of the journal. The research reported here is important, not only for scholars of Informatics, but also for those of other disciplines, because Informatics has become the atmosphere in which 21st century open societies live, in which interpersonal communications increasingly take place, in which knowledge driven economies thrive and in which academic trans-disciplinary discourse predominantly takes place, irrespective of one's discipline.

Let me begin with a conundrum. Due to the large number of excellent contributions received, *Alter*nation will dedicate both issues of 2005 to Informatics, and for the first time ever a single issue, *Alter*nation 12.1, will consist of two separate volumes, namely *Alter*nation

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12.1a and *Alter*nation 12.1b. Together these three volumes provide an excellent perspective on the current state of Informatics teaching, research and practice in South Africa.

This contribution presents an overview of the articles that appear in *Alter*nation 12.1a and *Alter*nation 12.1b focusing on themes like information technology for development, emerging trends in information technology, informatics research, human-computer interaction, informatics pedagogy and computer programming.

Buthelezi *et al.* report the results of research about how Telecentres could be used to support conventional education delivery in higher education as well as in public secondary school education.

Sikhakhane *et al.* investigate problems experienced in rural local communities in the KwaZulu-Natal province of South Africa, and review several approaches that were followed worldwide to solve the problem of the digital divide, showing which ones succeeded.

Focusing on the restructuring of the South African Higher Education system, **Maharaj** concludes that there is no doubt that information systems and information technology are the glue that holds together an information organization and warns that the South African higher education environment is in danger of floundering due to the lack of visionary leadership at both the local and national level because large scale social engineering has not taken into account the key issues that are redefining the direction that universities are being forced into internationally.

Revealing that the future is upon us, **Cowley & Kanda** report the results of their research on "friendly machines", interaction-oriented robots that among others use facial expressions to simulate human behaviour, or visual and auditory data that mimic aspects of human personality as they begin to freely participate in human social life, and as they attract humans to establish inter-"personal" relationships with them.

In the first of two consecutive, thematically related articles **Klopper** analyses the emergence of electronic communication in the mid nineteen fifties as the most recent manifestation of a variety of forms of human communication that have emerged over time in response to the ever increasing complexity of human cultural behaviour. Klopper argues that nonverbal forms of human communication like facial expressions, gesture, body stance, body movement and tone of voice emerged as part of a survival imperative during the hunter-gatherer phase of human existence, that graphical and written forms of communication emerged during the pastoral phase of human existence in response to the greater levels of cultural complexity brought about by pastoral societies. Klopper notes that electronic communication is incorporating human nonverbal communication, and that communication instruments are disappearing from desktops into walls, furniture and our clothes. He predicts that advances in nanotechnology and neuro-informatics will cause electronic communication to disappear into our bodies, and will give rise to sentient communications between human cyborgs and a variety of forms of artificial intelligence.

Gordon & Bhowan analyse the factors that influence online shopping behaviour worldwide as context for South African online shopping behaviour. They show that globally just over a third of Internet users shop online, and that about a third of the online shoppers, that can be characterised as "relatively young, busy, working, elite people" cite convenience as an important reason for online shopping. Based on the global and local trends that Gordon and Bhowan identify, they make particular recommendations for online marketers, policy-makers and media owners.

Writing about ethical aspects of cyberspace, **Pretorius & Barnard** state that, apart from being able to identify ethical problems, computing professionals need to be able to analyse ethical problems that arise in the computing context in general, and also in particular for the development of software artefacts for solving real problems. Pretorius and Barnard argue that computing professionals should have the

knowledge and skills to decide on ethical courses of action in resolving such problems. Their contribution focuses on a number of issues relevant to ethical decision making skills required of computing professionals active in cyberspace.

Lubbe & Mudaray analyse the impact of research on tertiary activities in Southern Africa. They show that many of the overseas universities use research output for promotion and tenure whereas the same is not happening in South Africa. Most of the research output in South Africa is done by academics who are involved in postgraduate research supervision. Lubbe and Mudaray propose that the South African approach to research will to have change – junior staff must be motivated to produce more papers.

Pather *et al.* address the problem of poor research dissertation completion rates at Masters level at many Higher Education Institutions. Their contribution details various measures to support part-time Masters students in the Faculty of Business Informatics at the Cape Peninsula University of Technology, including offering a structured study program that directly supports the skills and resources that a Masters student needs to complete a dissertation.

Lubbe *et al.* focus on the problem of the poor completion rate of PhD studies. According to them the completion rate for doctorates ranges from poor to abysmal worldwide and state that the responsibility for this must be shared by candidates, supervisors and the institutions to which they belong. They review a number of problems experienced by postgraduate students that cause their studies to derail. While supervisors can change particular supervision protocols to improve doctoral throughput rates, the extent to which postgraduate students themselves take ownership of their research, will ultimately determine their degree of success. Lubbe, Worrall and Klopper's contribution discusses some of the problems that frequently occur and present some insights from their own experience as supervisors of doctoral candidates.

Harypursat *et al.* report research findings about the thinking styles of second year students in Information Systems and Technology on the Westville Campus of the University of KwaZulu-Natal, situated in Durban, South Africa. The article explores whether there is a relationship between student thinking styles and their examination marks against the background of primary thinking styles identified in Harrison and Bramson (1984), namely the Analyst, Synthesist, Pragmatist, and Realist thinking styles. Most of the findings reported by Harypursat, Lubbe and Klopper support those of Harrison and Bramson (1984). They highlight the implications of their findings for both teaching and research in Informatics.

According to **Alexander** visualization of information is an important human computer interaction (HCI) research topic which is however, not generally included in university courses. Alexander identifies Geographical Information Systems (GIS) as excellent examples of applications where visualization is used to represent information. She argues that GIS require sophisticated interfaces so that the users can manipulate and query the underlying data. Hence, in practical exercises using GIS students interpret information and use interfaces that differ somewhat from standard Windows objects and text. As this context and form of interaction are unfamiliar to typical Information Systems students, this experience can be exploited further to emphasize the fact that end users frequently operate outside their comfort zones when they use information systems. Alexander's contribution describes a strategy to enhance the teaching of HCI in the form of an HCI evaluation of GIS software in a usability laboratory where students play the roles of end-users and researchers / evaluators. Alexander reports that such an exercise allows the lecturer to demonstrate exactly how usability data, including satisfaction questionnaires, can be collected and analyzed.

Krauss states that to date aesthetics has not played a significant role in human computer interaction (HCI) research despite its centrality to human thought and practice. He states that traditionally, the

field of HCI's main emphasis has been on efficiency considerations. Although aesthetics applies to all human sensory domains Krauss mainly focuses on the visual domain. Krauss states that visual aesthetics exists in everyday life, and it subconsciously influences many of our choices, including web design. Krauss foregrounds the importance of visual aesthetics in website design through his research so that it will become a prominent feature of successful website design.

Averweg reports the results of research about the Technology Acceptance Model (TAM) in the Arab world (Saudi Arabia), Malaysia and Africa (South Africa). Research in Saudi Arabia supports the applicability of TAM to the Arab culture. The TAM can also be applied in the Malaysian environment. However, in South Africa the study does not provide any direct evidence to support the applicability of the TAM's determinants of usage. Averweg concludes that while the TAM literature suggests that results are mostly convergent, there are situations where they are conflicting. The author provides new evidence about this matter.

De Villiers states that with the advent of e-learning, educators and designers of learning resources should view technology as a tool and a medium, but should not confuse it with the message. The title of her article poses the rhetorical question as to whether e-learning artefacts and variants are based on sound learning theory. It traces the evolution of e-learning and describes characteristics that indicate underlying theoretical biases in traditional educational software, as well as in online courses and web-based instruction. De Villiers presents a synthesis of contemporary learning theory, the Hexa-C Metamodel (De Villiers, 2002, 2003), whose six elements can play a role in the design and development of e-learning environments and instructional systems, and which can also be used in evaluating educational applications from a learning theory perspective.

The article of **Mallinson & Sewrey** describes the introduction and evolution of an e-Learning module for Information Systems students, from a half-module in 2001 through to its current form as a full module within the Information Systems Honours / Fourth year Programme at Rhodes University, situated in Grahamstown, South Africa. They state that the opportunity to use a blended approach to module delivery has afforded a wealth of pedagogical opportunities for the module facilitator, and proved to be an exciting learning environment for the learners, while at the same time taking advantage of the 'medium is the message'. Mallinson and Sewry conclude that while few problems have been experienced with regard to implementing the desired technologies for the module, it has become evident that the blended or hybrid mode of module delivery is best suited to a more lengthy delivery time span.

According to **Barnard** *et al.* recent technological advances have led to the emergence of new technologies, frameworks and methodologies in the field of computing, the regulation of which are governed by scientific principles. They provide examples such as the Internet, global connectivity and mobile agent technology, collectively referred to as cyberspace. Barnard, Pretorius and Venter also state that regulating human interaction with cyberspace has become one of the great challenges of the information age – a challenge in which legislation plays a central role. At present the regulation of human interaction with cyberspace by means of legislation, is awarded prominence on a global level by governments. It is within this context that the authors consider what influence the new South African Electronic Communications and Transactions (ECT) Act (Act No. 25, 2002) may have on a typical computing curriculum.

Mkhize & Lubbe point out that web entrepreneurship pertains to people who run a wide variety of online enterprises of which some succeed and some have failed. Examples of the latter are the enterprise heavenly-doors.com, which operated a funeral service over the Internet and other online businesses that provided retailing services that ultimately failed because sellers did not pay attention to user demands. Therefore, a significant number of such businesses have closed their virtual doors as web traders since 2000. The au-

thors report the results of their analysis of business plans obtained from a businesses plan archive website, to establish if there are common mistakes made by web entrepreneurs. This enabled them to determine where unsuccessful web entrepreneurs were short-sighted, and to identify possible solutions to be kept in mind by prospective Internet entrepreneurs.

According to **Reinhardt & Pillay** spreadsheets have become a routine application in most organizations and universities. Consequently, students are required to learn spreadsheet applications such as Microsoft Excel. The learning of spreadsheets is often accompanied by problems related to spreadsheet applications and their mathematical content. The EXITS (Excel Intelligent Tutoring System) research project aims to develop a Microsoft Excel tutor that helps students to overcome their learning difficulties. The paper reports on the first phase of the EXITS research project. The authors firstly identify barriers that may prevent a student from successfully using a spreadsheet program. They then analyse the different types of errors students make and identify their causes. They also classify the errors. This classification will form the basis for an error library that is required for our student model. At the end of the paper they give an example of how their model could be used for student modelling purposes.

Sewlal & Lubbe focus their attention on issues of establishing common Information Systems and Technology curricula on the different campuses of the University of KwaZulu-Natal subsequent to the merger of the erstwhile universities of Natal and Durban-Westville. Taking an inter-disciplinary point of departure Sewlal and Lubbe develop a definition of IS by extending the discussion raised by Colin Tully in his paper for the 1st UKAIS Conference (1996) on the associations between IS and other areas of study in related fields. The paper concludes by raising a number of general considerations all those developing the subject Information Systems and Technol-

ogy should be wary of if a clear identity is to emerge for the subject area.

Seymour et al. begin their analysis of web based learning tools by pointing out that several studies on technology adoption have attempted to develop models, such as the technology accepted model, that can be generally applied to any technology. According to the authors typical web-based learning technologies such as WebCT, however, are composed of several distinct tool sets, and student motivations for using each may differ, due to the different purposes and characteristics of each tool. After reporting and analysing survey results regarding the factors that affect utilisation of the WebCT bulletin board and quiz tool, the authors conclude that perceived usefulness and perceived ease of use were found to affect student intentions to use the bulletin board, while compatibility with learning style, self efficacy and long-term consequences all affected intentions to use the quiz tool.

Van der Merwe et al. report the results of their research on identifying a set of characteristics for a functional requirements elicitation procedure in the higher education domain. Although various application domains use requirements elicitation procedures to gather information and model the application domain, only a few guidelines mention the important characteristics that are essential for such procedures. Their research contributes to a better understanding of the elicitation procedure in the higher education domain.

Brown et al. investigate perceptions about web-based learning technologies technology adoption, among a group of university students within a multicultural framework by means of a number of hypotheses that are empirically tested. Following that they discuss the implications of their findings, before ideas for future research are suggested.

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ment of Computer Science and Information Systems at the Nelson Mandela Metropolitan University (the former University of Port Elizabeth (UPE)) can improve their throughput rates through the development of an experimental iconic programming notation, B#. The authors propose a cognitive mapping that illustrates the correspondence of fourteen cognitive dimensions to Nielsen's ten heuristics, after which they discuss each cognitive dimension in terms of an assessment from a design perspective of the way in which B# supports it.

Goosen & Pieterse report the results of their research into how difficult or easy computer science students at the University of Pretoria perceive programming in an object-oriented style to be, how well they actually learn object-oriented programming (OOP) and how well they retain their understanding of OOP. By analysing this information and ideas of best practices provided in related literature, the authors make recommendations for improving instruction of OO concepts.

Dehinbo presents the results of an evaluation of four programming languages namely C++, Visual Basic, Java and Pascal, in terms of their ease of learning, ease of use under pressure, Line of Codes (LOC) and overall rating. Survey and Experimental approaches were used to construct a research design for the study. Questionnaires were administered to respondents using any of the four languages: C++, Java, Visual Basic, and other structured languages (like Pascal or Basic) in different study groups. In addition, a simple programming exercise was given to respondents to solve and the estimated Lines of Codes (LOC) for the solution in each programming language was measured. Dehinbo concludes that unlike Pascal, there is no significant difference in the factors studied for C++, Visual Basic and Java. The findings therefore show that a careful combination of the languages can achieve the desired result.

Cohen addresses problems experienced with equipping B.Com Information Systems students with basic programming skills under conditions where lecturers have limited laboratory resources and are dealing with students from many diverse educational and technological

backgrounds but points out that elements of her approach would also be relevant in contexts where academics are better resourced. The approach that Cohen describes includes a programming concepts course that is run during lecture time, complemented by a series of detailed on-line tutorial sessions.

Singh presents the results of research on e-Commerce trends in South Africa between 2001 and 2004. To gather data a questionnaire was sent to 122 companies with an Internet presence. The results reported by Singh show that that there have been improvements in e-Commerce in South Africa with respect to income generation, customer service and cost reduction, but that e-Commerce has not reached its full potential and needs to be given greater strategic importance within corporate plans.

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Telecentres: Islands in a Sea of Information with no Ship in Sight

Maxwell M Buthelezi

Sam Lubbe

Rembrandt Klopper

Abstract

The aim with this article is to report the results of research about how Telecentres could be used to support conventional education delivery in higher education as well as in public secondary school education. The researchers primarily focus on the possible use of Telecentres in higher education settings, but the conclusions made equally pertain to the use of Telecentres as part of the electronic education (e-Education) framework for public schools in KwaZulu-Natal. This study forms part of a coordinated research programme on e-Education conducted by the School of Information Systems & Technology at the University of KwaZulu-Natal.

Despite the difficulties around the use of Telecentres reported here, such facilities could contribute towards integrated knowledge sharing in academic institutions. The results reported here reveal opportunities to transform chalk-and-talk delivery into electronic education (e-Education). A major finding is that students from disadvantaged communities feel there is a need for Telecentres in their communities to enhance conventional forms of education delivery and to extend their interactions with their lecturers.

Introduction

Latchem (2001) argues that technology can be used to disseminate course materials to students in remote locations in order to reduce their feelings of isolation, and in the process create virtual learning communities. Telecentres provide one means of contact between lecturers and

students to establish and maintain such virtual learning communities. We want to stress from the outset that we do not propose the use of Telecentres as the all-cure for problems of robust and affordable education delivery. They can only form a part of a range of electronic delivery strategies. There obviously will be limitations to how Telecentres can form part of electronic education delivery. Once established, this mode of delivery may however be economical and convenient. Access to electronic modes of education delivery remains a real problem in Africa, including South Africa.

Indicators of development in the knowledge-based digital world (namely levels of literacy, newspaper readerships, the use of radios, television sets, telephones and *per capita* access to computers) show that Africa is not doing well at present. The patterns of availability of these instruments and tools for knowledge creation, and information sharing are also unfortunately not evenly distributed among the urban and rural populations in South Africa. A study was therefore conducted at the University of KwaZulu-Natal among the staff and students of the School of Information Systems and Technology (IS&T) to establish their perceptions about how useful Telecentres would be to complement conventional forms of learning.

Literature Review

Benjamin and Dahms (1999a) state that the Information Revolution has increased information access around the globe, but that questions need to be answered regarding who has access to these technologies. Connection to global information networks and services impacts on almost all aspects of societies, including education, employment, health care and business. The question is however: Will these technologies and systems lead to increasing disparities between the connected Information Elite and the Information Starved, or can these systems be used to support widespread development and contribute to the development of a more just society?

In 1996 only five African countries had Internet capability; today all are connected and internet-enabled. This new age variously labelled as the Computer Age, the Internet Age, or the Information Age, could ensure that knowledge becomes accessible by more than the conventional methods. In Africa Internet access however, has translated into a digital divide of which the contours appear to trace earlier demarcations of rich and poor societies, and of developed and developing countries (Borja, 1999).

According to Emmanuelle (2001), Telecentres have a potential for narrowing the digital divide in remote, rural and otherwise disadvantaged communities. They could be useful in helping developing countries to take advantage of the information economy, access to education, to government information, to healthcare and other social services.

Current Education, Internet Access and Connectivity

INASP (2003) notes that with wider Internet connectivity, educational institutions in developing countries are beginning to tap the opportunities offered by more mature information societies. These digital connections act as gateways where researchers and librarians find, download and share knowledge and learning materials. They also provide platforms from which local research is published, disseminated and uploaded, and they facilitate links and collaboration among scientists, promoting discourse and dialogue on shared issues and problems. However, the same connectivity also supports applications and behaviours that consume bandwidth. Typical solutions are to upgrade infrastructure, to install faster, larger, and higher performing systems, lines and facilities.

Previous projects and telematic experiments have provided experience in the integration of computer technologies and networks for distance delivery of courses. Live satellite TV transmissions, for example, exploit the quality of audio and video content appropriate to be re-

ceived at a distance and digital quality ensures open pictures within the beam coverage of the satellite transmission.

A decade ago Renner (1995) warned that unless universities come to grips with new modes of electronic education delivery, they would in the next decade face the prospect of a diminishing role in education or even extinction as knowledge providers.

Six years ago Grodzinsky (1999) predicted that convergence opportunities in electronic information delivery would stimulate Universities to rethink their educational priorities. For example, conventional forms of communication between lecturers and students via ordinary mail, telephonic communication can easily be enhanced by more economical forms of computer mediated communication like electronic mail, the dissemination of pre-recorded audio and video content, ISDN-based videoconferencing and Internet-based telephony, or by emerging and converging forms of knowledge dissemination like blogging (web-logging) and vlogging (video-blogging).

Increasingly, also South African universities will be pressured to give budget precedence to electronic delivery systems. Students, even those close to university campuses, will be able to complete portions of their degrees through electronic access. In future, lecturers could become as familiar with their students from screen images as from face-to-face contact. The multi-media interactive communication centre of an institution could form the hub of campus activities. Students world-wide will be able to enrol and study at the university of their choice via global multi-media highways. Virtual alliances between universities in enriched societies and those in developing societies could enrich both types of institutions. Since these changes are already being implemented outside of academia, South African universities should reconsider their established policies and practices of educational delivery that limit them to localised education delivery in line with changes that higher education institutions abroad adopted more than a decade ago:

i. Such institutions implemented interactive technologies for economic, social, industrial and educational development (Oliver and Grant, 1994).

ii. Lecturers abroad had to become more technologically literate, more aware of the non-neutral nature of technology, better skilled in the use of emergent and convergent communication systems, more willing to use innovative communication systems, and less inclined to be content with established educational practices (Beynon, 1993).

Telematic communications is a good example of innovative knowledge delivery. Wheeler (1997) describes the term 'Telematics' as the convergence of a number of technologies to enable computer mediated communications. This technological convergence has come about due to the increasing miniaturization of electronic components, which makes possible Telecentres equipped with a variety of electronic communication instruments.

Implementation, Policies and Regulatory Issues

Telecentres have recently become the focus of attention in international development discourses, hailed as the solution to development problems by providing desperately needed access to information and communication technologies (ICTs). Telecentres are springing up in Africa, Latin America and Asia. Avenues for new research are suggested in order to foster greater understanding of the role of ICTs in international development of many sectors and different aspects of life (Gomez and Menou, 1999).

McConnell *et al.* (2004) argue that Multi-Purpose Communication Centres provide people with opportunities to acquire information and literacy skills to maximize their learning opportunities. However, Telecentres should not be seen as a panacea to social or economic problems. Telecentres must be designed according to established needs, sound business planning and realistic expectations of what can be achieved within a certain timeframe.

According to Etta (2003) the Telecentre movement on the African continent is still young. The earliest community Telecentres are estimated to have opened their doors in 1998. The nature and functions of African Telecentres vary slightly from country to country. The costs of developing and implementing national information policies will depend on the specific situation of each country. The two proposals for national action draw mainly on existing resources and capacity and can probably be implemented upon adoption without external assistance (Mfaye, 1998).

Ladikpo (2002) states that in developing countries the emphasis is often on infrastructure policy development, while dimensions of human resource development and information-content issues are neglected. Maintaining an integrated approach in ICT for development interventions is essential to ensure that the overall goals are achieved for empowering communities, improving people's quality of life, and creating more equal, open societies in the region. Often, in a developing country, the focus is on the infrastructure development dimension of policy, while dimensions that relate to the development of human resource capacity, and to the production, exchange and dissemination of information content needs some attention.

Support and Benefits of Higher Education

Collings (1999) emphasises that the use of ICT in education development and delivery is vital if universities are to achieve competitive success in the international market for higher education. Moeng (2004) notes that education for all is only possible through a new education delivery paradigm, the so called e-Campus initiative.

Benjamin and Dahms (1999b) argue that education can benefit from telecommunications. While tele-Education and using the Internet for teaching is of advantage in well-resourced areas, basic telephone use is useful in schools for support purposes. One example of the use of telecommunications in education is the Monterrey Institute of Technology in Mexico. They use satellite-delivered compressed video

to reach 26 campuses nationally, allowing one lecturer to reach 2 000 students. Adequate telecommunications can also reduce the need for travelling to find information.

Sayed (2004) notes that free, adaptable open source software, such as Linux, allows developing countries to implement affordable information communication solutions. His comments are timely becuase they coincide with a heated debate in Africa following the South African government's acceptance in 2003 of free Microsoft software for use in its schools. Sayed notes that the government's agreement is at odds with its own Advisory Council on Innovation (NACI) recommendation that open source software has the potential to empower people in many ways that proprietary software simply does not allow.

The digital convergence of ICTs has lessened two interrelated obstacles to education, namely poor regional access to high quality resources and the effect of long distances from high quality resources. Cheaper, more rapid, and a varied means of communicating amounts of information through the Internet, among other networks, is creating a world in which there is far greater access to information than ever before. ICT is making access to information symmetrical because people have access to more information whenever and wherever they need it. This is disrupting established educational relations. The effect will be profound changes in the structure of markets and organizations and established patterns of economic behaviour. While much attention has surrounded the volatile new world of the dotcoms, this is a distraction: the true potential of ICT will transform the education system (Collins, 1999).

Perraton (2002) points out that distance education has particular strengths when it is used to support extension agents so that a multiplier effect comes into play. In many cases its modest costs are matched by modest success, however, poor completion and pass rates mean that costs per successful student tend to compare less favourably with conventional alternatives. Distance education offers learners freedom in what, when, where and how they learn, but many first-time dis-

tance learners do not know how to deal with this responsibility. Staff should help learners cope with the technology, point out useful resources, encourage the formation of self-help groups and interaction with online teachers, tutors or trainers (Gómez and Hunt, 1999).

Latchem and Walker (2001) state that Telecentres or telecottages are helping those at the margins of the knowledge economy gain and apply new understandings and skills. Telecentres may be seen as a socially responsive example of think global, act local. With an ever-growing dependence on technology, there is a danger of ever-increasing disparity in access to education, training, information, and employment opportunities. Telecentres can act as an equalizer, allowing the disadvantaged to log onto a world of opportunity.

Telecentres as a Service Base

According to the Digital Dividend Clearinghouse (2001), smaller Telecentres usually include basic Internet service, and many also include access to fax, phone, and photocopying. Others may include targeted services in education and training, health, e-Commerce, e-Government services, etc. The physical compositions of Telecentres vary. Models include kiosks, school computer labs made available to the public after hours, multipurpose community centres (MPCCs), and mobile Telecentres. Regardless of the different configurations, Telecentres all have one common feature: they use IT to provide a range of services using a shared access model.

Pieterse (2004) states that the primary service objective of Telecentres is to create public telephone access and to then to introduce a range of other services dependent on the telephone line backbone, such as fax, e-mail, and Internet access. A very basic Internet-based Telecentre consists of a furnished room with 3 or more computer terminals and simple furnishings that provide shared access to the Internet and computer services to the public at large. Urban Telecentres, commonly known as cyber cafés, are profitable in many parts of the world, and are quite sustainable. They provide connectivity to a large segment of the population, especially to poor people who cannot afford individual access. Telecentres are about to give people a voice, a set of tools to learn and improve their wellbeing, to organise themselves, to become innovators and full participants in modern society (Proenza, 2004).

Hanna (2004) stresses that we should primarily consider Telecentres to be learning environments, and not simply technological solutions to communication problems. He names the following roles for Telecentres:

- Providing a means of transacting and connecting;
- Serving as tools for governments to provide services via the Net (especially to poor and rural regions);
- Providing information and knowledge for competitiveness and economies; and
- Enabling community driven development at grassroots level.

Whyte (1999) argues that Telecentres respond to the ICT needs of the communities they serve. Isis International-Manila (2002) notes that even Telecentre projects that tend to be community focused, gender equity is not an integral part of the planning equation.

Fuchs (1998) has identified three stages of Telecentre development, namely the investment, contract and user fee stages.

The investment stage is the initial stage where a non-profit making organization forms a partnership with a local community, attempting to help the community by encouraging them to participate in the information society. At this stage the organisation finances the information technology initiatives, provides equipment and training for local partners, key persons and staff, as a way of demonstrating the practical utility of information.

In the contract stage the Telecentre gains autonomy from the parent organizations and starts to make contractual agreements with other agencies such as government departments or other organizations e.g.

hospitals or schools building up a clientele to which it provides services as well as technical support in the setting up of their facilities.

By the time the Telecentre gets to the user fee stage donor dependency is a thing of the past, since by this time the communities are well aware of the products and benefits of the Telecentre and are therefore willing to pay for services

Oestmann and Dymond (1997) point out that there is scope for exploring new models of Telecentre ownership and financing, and interest in doing that is growing among private-sector ICT providers. Only economically successful models are likely to replicate themselves in larger numbers and spread the benefits beyond single locations.

Fuchs (1998) raises the point that Telecentres range in size and description and services. Assisted by a group of international development agencies, Fuchs took a closer look at a Telecentre operating as part of a Multi-Purpose Community Centre at Nakeseke in Uganda. The centre housed a public telephone and fax, networked computers and a community library. Typically, one could see a primary school pupil poring over a large dictionary, an older student using a book on sustainable agriculture for a school paper, and community volunteers practicing a computer program that they would later on teach to others.

A Telecentre could serve as stimulus for further community development. Benjamin and Dahms (1999b) recount the development of one such centre in South Africa, the Gaseleka Centre in Gauteng Province. Initially it only offered access to equipment. Soon after the the Gaseleka Telecentre opened, a new government funded Reconstruction and Development Program (RDP) housing project was built nearby. This brought 300 families in close proximity to the Telecentre, making it the *de facto* community centre, a place to hang out and chat. Because there was no post office in the area, the Telecentre in 2000 successfully applied to become a postal service point. A bank of 1,000 post boxes was installed next to the Telecentre, which most families regularly visit to check the post. The centre has meanwhile developed various other services as the need and opportunity arose. Most of the peo-

ple use the centre to make phone calls, as it is just about the only usable pay phone in the area. Soon people started using the centre to send faxes and do photocopying. The local schools have become major users, for preparing and reproducing curricula, question papers and report cards on the computers. Computer training has become another major activity in the centre.

Library and Information Services for Distance Education

Longo (2001) acknowledges that creating, acquiring, and managing information have emerged as the central focus of the digital economy. Creating and sharing information are the basis of social relationships within specific virtual communities. This set up a long-term challenge for every library or information centre as well as for every professional involved in publishing and education. In his opinion the most promising road today is that of helping people develop their own cognitive abilities, understand their own needs, and learn how to express them correctly.

Lennon (2002) states that the Library and Information Science Program cultivates the skills needed to prepare information professionals to manage and evaluate information effectively. Students will be engaged in a student-centred learning environment that focuses on both practice and theory-based principles that prepare them to be critical consumers. They participate in research, build relationships and model the behaviours needed to effectively provide service to their communities, meet the needs of underserved groups, and provide information services in a changing society.

Training for Telecentre Usage

Fuchs (1998) observes that as Telecentres have to operate with tight budgets and under difficult circumstances, partnerships with public, private and community organizations are often the most beneficial and sustainable. Hudson (1999) proposes that each Telecentre should build in mechanisms that can be used to gauge how well the project is progressing, to provide feedback to partners.

Collee and Roman (2001) note that computers are no longer strange and mysterious machines to many users in different communities. The Telecentre has demystified computer communications through training programs. A large number of community members have been trained in computer communication services at the Telecentre, which led to the growth of a core group of skilled people within the local community. Management systems have been tried and established for sustainable Telecentre operations. The industry as a whole should look at bringing in more black people to the workforce, ensuring better skills development and human resource (McLeod, 2004).

Courses on computer applications can be conducted at Telecentres in collaboration with a university. Some of the courses could lead up to the awarding of certificates to successful trainees, while the others could be run as continuing education courses.

Telecentre Management

A Telecentre is a community owned and non-profit organization, while the Management Committee is made up of elected Telecentre members. Their role is to represent the Telecentre in the community, to present the needs and views of the community, to provide a forum for new initiatives and to act as a board of review. A manager and several part time staff operate the Telecentre on a daily basis. Community members are encouraged to register their skills in a community skills register, should business opportunities arise (Lamshed *et al.*, 2004).

Telecentres as a Sole Mode of Computer Access

The NAMI Organization (2004) argues that most learners expect to improve their work performance, prospects, or opportunities for further learning. Telecentres can assist by advertising jobs and courses, arranging for work experience opportunities, and by encouraging ICT-based enterprise or teleworking. Common applications are word processing, desktop publishing and printing, Web and multi media design, software development, abstracting, editing and proofreading.

People visit these centres with different goals in mind and they expect quality service during their visits. Some people prefer to use newsgroups electronically, whereby they can exchange views, questions and answers with other people joined to that group.

Stoll (2000) indicates that most of the information on the Internet is accessible to anyone with a computer and a modem. Even those without hardware can go to a Netcafe or a public library to access the Net. Newsgroups and Chat rooms where people exchange ideas have different status.

Stoll (2000) argues that global distribution of information mirrors the distribution of wealth. One could use the analogy of the hierarchal pyramid to describe the structure of public accessibility as a broad base of publicly accessible information with tapering sides representing levels of increasing restriction on who may access them. The sheer volume of information, even after selective measures, constitutes information overload.

The results show that Telecentres contribute in improving the current learning system. Nearly all of the respondents argue that Telecentres will improve the standards of information access. Information could be delivered through Telecentres, which may be referred to as knowledge. Telecentres could help present facilities together into one organized centre and be divided into various sections and different service categories. The findings indicate that people are in support of taking education to reach heights with Telecentre technologies as new and efficient tool to obtain, share, circulate and utilize that information accordingly.

Planning, Ownership and Telecentre Sustainability

Collee and Roman (2001) note that the initiation, diffusion and adoption of the Telecentre idea have been an eclectic process, largely devoid of systematic research and planning. The approach has generally been one of pilot projects — trying out models to see what works to achieve a diversity of objectives. In some cases the approach has

been simply entrepreneurial, with enterprising business people exploring opportunities for profit-making. A range of issues is linked to the operation and success of Telecentres. These include: sustainability, relevance, government policy, information and communication technology (ICT policies), research, community partnerships and participation, Telecentre objectives, and business planning.

Karelse and Sylla (2000) state that despite the recentness of the movement and the relative paucity of Telecentre research, some issues emerge in the available literature as pertinent. The factors commonly associated with sustainability include the operating environment, ownership and management styles, community participation, relevance of services and content.

Stoll (2000) states that despite the fact that every possible due care being taken, after only a short period of operation, Telecentres usually encounter the same problems as other IT based projects in a particular region. Management must therefore be able to offer a total solution that also takes training needs into account (Falkenberg, 2004).

Howard (1999) notes that there have been far too many examples in South Africa of Internet cafés having to shut their doors because they were non-viable. The Telecentre must therefore levy appropriate charges for usage and, unless these can be subsidised in some way by institutions or organizations, the users must have capacity to pay.

Menou (1999) and Gomez, and Menou (1999), note that there are other factors that affect the success of Telecentres. They operate at the micro and macro socio-political levels and include such aspects as the national policy environment and the social arrangements for the control and management of facilities. In the late 90's the move to create new policy instruments that would support growth in the sector on a continent-wide scale commenced with the Africa Information Society Initiative and Africa Development Forum. The moderate harvest of new national information and communication infrastructure plans in about a third of the countries is testimony that things are indeed changing. Community ownership is also believed to be related to success,

but models of true ownership are rare as most of the Telecentres with a community label are not genuinely owned or fully administered the communities.

Heeks *et al.* (2005) point out that financial sustainability is the first thing that comes to mind, and Telecentres should aim to be financially sustainable if possible from day one of their operation. Financial sustainability of a Telecentre is seen as crucial, and many Telecentres base their business model on the provision of ICT and related services to their respective communities.

Murrugarra (2004) feels that many initiatives and models have been tried and tested, and that success stories have emerged. The global Telecentre movement still seems to be out of its grasp, the sustainability of Telecentres. Telecentres of all kinds (commonly known as MPCCs) are in fact not sustainable in the long term without long-term outside funding. There are some remarkable examples emerging that show that the real sustainability of Telecentres is indeed possible if some basic principles and rules are followed in the implementation and running of a Telecentre.

This section investigated general issues regarding the sustainable use of Telecentres. The next section elaborates on the techniques and methods to be used by the researchers in conducting this study.

Telecentre Sustainability and e-Readiness

The concept *e-Readiness* relates to how skilled and willing societies, regions, communities and institutions are to utilise information communication technologies (ICTs) to access and utilise global electronic resources for business, education, health, government, and leisure activities.

Bridges.org (2005) discusses e-Readiness tools that can help establish the level of preparedness of participants in the global knowledge economy.

Research Methodology

The results reported here are based on a quantitative research methodology. According to Hopkins (2000) quantitative research designs are either descriptive (subjects usually measured once) or experimental (subjects measured before and after a treatment). A descriptive study establishes only associations between variables. For an accurate estimate of the relationship between variables, a descriptive study usually needs a sample of hundreds or even thousands of subjects. The respondents in this survey were handed the research questionnaires to complete, and by so doing, the respondents had freedom to answer any question the way they understood and felt and ensure a better return rate. The questionnaires consisted of two types of questions, viz.:

1. **Closed ended questions**, and in these types of questions the participants were answering questions by giving Yes/No or scaled responses.

2. **Open ended questions**, with these types of questions, the respondents had to answer questions in any way they understood and felt. The purpose of this is to obtain the imaginary understanding of the participant about the topic.

Questionnaire Design Instrumentation

The questionnaire was divided into the following subsections:

1. Questions 1 –5 were used to collect demographic data;

2. Questions 6 -- 14 were used to collect data about the respondents' capabilities on computer usage; and

3. Questions 15 – 19 were used to collect data on opinions of the respondents about Telecentres.

The researchers entered and analysed the data on SPSS 11.5 since it provided appropriate analytical tools for this study.

Discussion of Results

Demographics

This section is based on the analysis, discussions and interpretation of the data that was collected and gathered from 60 respondents, conveniently selected from among the IS&T undergraduate students on the Westville campus of UKZN at open access student local area networks (LANs).

The findings reveal that 53% of the respondents were female, and that the perceptions of female computer users are therefore adequately represented in this study. Isis International-Manila (2002) notes from a gender perspective that, Telecentre projects must make an active effort to consider the disparate needs of women and men in the communities they serve. Because of disparate literacy levels and language, it may be necessary to develop different training curriculum for different user groups. Unfortunately, and as in other areas, women and girls tend to benefit marginally from developments in telecommunications and access to services, particularly in the initial planning and implementation stages. Even in Telecentre projects, which tend to be community-focused and are supposedly more aware of community needs, gender is not an integral part of the planning equation.

The statistics reflected that the more accessible participants have been the Africans (or rather Blacks) who spend most of their time using the free on-campus resources because they tend not to privately subscribe to these at home. Based on the findings, African respondents constitute 67% of the sample, followed by Indians (18%), Coloureds (8%) and Whites (7%).

Latchem (2001) states that it is vital to ensure that learning and information are available to all, regardless of user circumstances. Telecentres can provide people with information and literacy skills to

maximize their learning opportunities. However, Telecentres should not be seen as a quick solution to every social or economic problem. Telecentres are essentially about linking resources, knowledge and people without physical proximity. Telecentre support for distance learning will be effective where they are connected in a unified, coherent and innovative national or regional system for educational and social reform.

The dominant age group among the respondent was 20-29. This age group positively correlates with the undergraduate level of education. Finally, the least represented age group in the sample is older students. A fair number of older students are already actively employed, and mostly have access to ICTs at work. One would therefore expect fewer of them to use open access student LANs Even though the researchers had the intentions of involving other older groups of 40 years and above, they could not find anyone of this age.

Pieterse (2004) notes that by providing high speed internet service, teacher training and high quality, commercial free educational television programming, broadband access will particularly enable younger students to explore and understand the world they live in. Technology lies at the core of the Telecentre concept and can undoubtedly bring benefits to communities.

The Rate of Computer Literacy among Respondents

The vast majority of these respondents (59 of the 60 students polled) regard themselves as computer literate. Furthermore, of the 60 respondents 54 rated themselves as having attained either a medium level of computer literacy (28), or an expert level of computer literacy (26). This result should be understood in the context that the survey was conducted among second and third year level Information Systems & Technology students who would have acquired good computer literacy skills as part of their course work.

Different people enjoy different things they can do with computers. Forty six percent of the respondents prefer to use the Internet

and of which 32% noted that they are doing their academic work on computers. Entertainment included categories such as playing games, music, cards and watching movies (20%). Telecentres could play a role in getting people together and help people get interested in learning to do other things which they were not interested in doing.

Willingness to Pay for Assistance

The table below shows that only a minority of the respondents were willing to pay for assistance, revealing that only 27 of the 60 students sampled were willing to pay between R100-R150 a year for help, followed by 25 out of the 60 students who were unwilling to pay at all for assistance.

Amount	Number
R100-R150	27
R150-R250	3
R250-R350	2
R+350	1
Nothing	25
No Response	2

Table 1 Amount willing to pay for help

Phone Ownership

INASP (2003) notes that educational institutions in developing countries are beginning to develop opportunities that are offered by today's information societies. These connections act as gateways where researchers and librarians find, download and share knowledge and learning materials. The same connectivity also supports applications and behaviours that consume bandwidth. Typical solutions are to upgrade infrastructure, to install faster, larger, and higher performing systems, lines and facilities.

When asked how many of the respondents own telephones at home, slightly more than half of them (32 out of 60) reported that they owned landline telephones at home. The survey solicited information

about the home use of landline telephones, to the exclusion of cell phone use on the assumption that the use of landline phones could also give subscribers access to the Internet. The researchers conducted follow-up interviews with respondents who indicated that they did not own phones to determine why they did not have phones. Sixteen respondents indicated that they did not see the need for landlines because they were in possession of mobile telephones (cellular phones), stating that life is easier with them because one is not restricted to receive and make calls (as long as there is sufficient coverage).

Casual observation leads one to the conclusion that the vast majority of students own mobile phones, but not the most recent ones that could give subscribers access to e-Mail and more sophisticated Internet download facilities. In retrospect, it would have been prudent to also have included questions in the questionnaire about cell phone usage, particularly in view of the fact that new communication devices like smart phones, PDAs and Pocket PCs allow both voice telecommunications and Internet access.

Initiators in Telecentre Establishment

The table below shows that the biggest group of respondents (31) felt that the Council of the University should be responsible for providing an on-campus Telecentre.

Initiator	Number
School of IS&T	15
University of KwaZulu Natal	31
The Government	14

Table 2 Preferred initiators of Telecentres

Respondents felt that having the centre built by external sponsors could cause trouble regarding the regulating of the centre. They further pointed out that the University is in an appropriate position to meet their needs and knows the suitable services for the students. The second largest group among the respondents (15) expressed the opinion

that the School of IS&T (as agent of the university) should initiate the Telecentre. A smaller, but still significant group of respondents (14) expressed the opinion that government should initiate the Telecentre. They went on to note that the government is involved in sponsorships towards improving the education system in SA.

Khelladi (2004) suggests that there should be a permanent feedback from the local process to the authorities in charge of the national ICT plans implementation, throughout the appropriate channels, to permanently adapt strategies and support local activities. Many students would prefer to use a Telecentre to engage in their studies while off campus or in residence. It may be used for other reasons, but this shows most respondents had their focus on getting themselves equipped in developing and growth.

Best Uses for an On-Campus Telecentre

The table below indicates that majority (39) of the respondents would prefer to use the Telecentre to engage in their studies.

Best Use	Number
Research and Projects	11
E-Learning and Online Information	18
Recreation and Skills Development	10
Communication	8
Surfing the Web and Internet	9
No Response	4

Table 3 Perceived best uses for Telecentres

The centre may be used for other reasons too, but it shows that most students were focussed on academic development. Distance education gives learners freedom in what they are learning, but other first-time distance learners will not know how to deal with this responsibility.

Summary of Findings

The previous section highlighted some results of the study. In this section research questions that have been posed earlier on will be answered and recommendations will be made with regard to the operation of Telecentres in academic settings.

Our recommendations are based on a statistical analysis and interpretation of data that was collected during the 2004 academic year from IS&T undergraduate students on the Westville Campus of the University of KwaZulu-Natal. Demographic questions were asked about the age, academic rank, the link between the respondents' level of education and their employment status, and their means of information access.

A subsequent set of questions was asked to determine the respondents' perceptions about the usefulness of Telecentres in higher education settings. In the next section the researchers present their conclusions and recommendations.

Recommendations

The study has revealed that there is a need to address the issue of information access and sharing in tertiary institutions. It was noted that the present infrastructure is not adequate to fulfil the needs of students from disadvantaged backgrounds. The following recommendations are made.

Equipping Students

Students at entry level and other undergraduate levels are not given enough attention and opportunities to immerse themselves in the global information society. Training at these levels is crucial as many people at this stage need to build confidence in their choices of study. Inadequate facilities deter their academic progress because they are unable to complete assignments and meet submission deadlines.

Resource Management

Administrators should develop a strategy that will help identify students in need of special assistance and develop interventions that will support them academically. They should start to develop an improved learning system. Programs like the 'Discussion Forum' should be allowed to expand in departments of the institution.

Learning Conditions

Some students only get information from their educators and there are no properly supervised study sessions for young learners who require support from teachers. This means that they do not get any additional information from relevant resources.

Training

Education and training are sound investments for the individual and for society, but in most countries the expectation is for institutions and learners, rather than governments or the general taxpayer to bear all or most of the costs. This is an issue in poorer countries and communities and needs attention.

Job Creation

Telecentres could become part of a solution for creating employment opportunities for IS&T graduates.

Answers to Research Questions

Is There a Place in Academia for Telecentres?

Education for all can only be possible by utilising new educational paradigms. Africa's new emphasis on science, technology and innovation bodes well for the future. An e-Campus initiative however, that includes the establishment and maintenance of Telecentres in disadvantaged communities, will have a direct, positive impact on the enrolment of tertiary institutions, as well as on their rate of through-put.

Which Groups Would Benefit Most from Telecentres?

Students from disadvantaged communities would benefit more than those from advantaged communities, and females would benefit more than males. Telecentre projects must actively supply the telecommunication needs of females and males in disadvantaged communities. For example, more females may need training in computer literacy while more men could be trained in customer maintenance to provide them with career opportunities. In addition, because of disparate literacy levels and language, it may be necessary to develop different training curricula for different user groups.

Could a Telecentre be used for the IS&T Courses at UKZN?

Telecentre support for distance learning will be effective where they are connected in a unified, coherent and innovative national or regional system for educational and social reform. Learning and information must be available to all, regardless of their social circumstances. Telecentres can provide students with information and literacy skills to maximise their learning opportunities. However, Telecentres should not be seen as a solution to every social or economic problem. Telecentres must be designed to fulfil determined community needs, managed on sound business principles and create realistic expectations among its patrons of what can be achieved within a given timeframe.

Would the Lack of Resources Affect the Use of Telecentres?

Poor planning, expensive software and underutilisation can make computers a costly mistake for African Universities. Good planning and utilisation, such as making computers available for community use outside academic hours could compensate for this. The deployment of Telecentres in developing countries constitutes a promising way to narrow the digital divide and to improve the quality of life of men and women particularly in low-income rural and under-served areas.

Bibliography

Benjamin, P & M Dahms, 1999a. CommUnity Universal Service and Universal Access issues. http://www. communitysa.org.za/ paperuni.htm, [Accessed: 05 May 2004]

Benjamin, P & M Dahms 1999b. Universal Service and Universal Access issues. http://www.communitysa.org.za/paperuni.htm, [Accessed: 24 April 2004]

Beynon, J 1993. Technological Literacy. http://lsn.curtin.edu.au/tlf/ tlf1995/renner.html, [Accessed: 03 May 2004]

Borja, R 1999. Africa's Entrepreneurial ICT Opportunities—Ideas Waiting to Happen.http://www.balancingactafrica.com/news/back/ balancing-act_106.html, [Accessed: 23 April 2004]

Bridges.org 2005. *E-readiness Assessment Tools Comparison.* Copyright 2005 bridges.org under the Creative Commons Attribution-NoDerivs-NonCommercial License. Available at www.bridges.org

Collee, R & R Roman 2001. Modules for Training Telecentre Staffs, *An Interim Report with Sample Modules,* Cornell University 01 June 2001 http://www.itu.int/ITUD/univaccess/telecentres/ documents/ ModTrainingTelecStaff.pdf, [Accessed: 12 August 2004]

Collins, R 1999. Telecentres or Telecottages Are Helping Those At The Margins Of The Knowledge Economy Gain And Apply New Understandings And Skills. http://www.col.org/Knowledge/ kstelecentres.htm. [Accessed: 23 May 2004]

Collings, P 1999. Sustaining Academics' Agency in Determining Work Practices in Information Technology-Mediated Teaching and Learning. Unpublished conference paper, *HERDSA Annual International Conference,* Melbourne, 12-15 July 1999.

http://www.herdsa.org.au/branches/vic/Cornerstones/pdf/Collings. PDF, [Accessed: 23 August 2004]

Digital Dividend Clearinghouse 2001. Lessons from the Field: ICTs in Telecenters http://www.digitaldividend.org/pubs/pubs02tele.htm, [Accessed: 27 May 2004]

Emmanuelle, M 2001. People and Information Society: The Citizen's Communication Skills and the Opening of New Prospects for the Civil Society http://www.kit.nl/frameset.asp?/specials/ html/itebibliography.asp&frnr=1&. [Accessed: 05 May 2004]

Etta, F 2003. The Experience with Community Telecentres, http://web.idrc.ca/openebooks /006-3/, [Accessed: 15 August 2004]

Falkenberg, R 2004. Hi-Performance Learning HPL http://www. elearning institute.co.za/Webplace%20HPL.htm, [Accessed: 17 June 2004]

Fuchs, R 1998. Little Engines that Did: Case Histories from the Global Telecentre Movement. www.idrc.ca/ acacia/engin, [Accessed: 12 May 2004]

Grodzinsky, F 1999. Internet Ethics, http://www.cs.mdx.ac.uk/ staff-pages/penny/allchapters.pdf, [Accessed: 23 March 2004]

Gómez, R & M Menou 1999. ICTS in Africa: The Landscape for Growing Telecentres http://web.idrc.ca/es/ev-56546-201-1-DO_TOPIC.html, [Accessed: 03 March 2004]

Gómez, R & P Hunt, 1999. Telecentre Evaluation and Research: A Global Perspective. www.idrc.ca/telecentre, [Accessed: 23 May 2004]

Hanna, N 2004. Ensuring Universal Access to Knowledge and Services Through Telecenters. http://topics.development gateway.org/edevelopment/rc/fildownload.do~itemId=400917, [Accessed: 29 March 2004]

Heeks, R, E Alampay & P Soliva 2005. Bridging the Digital Divide? Self-Manage IT – A Ugandan Case Study, *School of Economics and Commercial Law*, Göteborg University, Department of Infor-

matics 21 January 2005. http://www.handels.gu.se/ epc/archive/00004095/01/Nr%5F6%5FJH. pdf. [Accessed: 16 August 2005]

Hopkins, W 2000. Quantitative Research Design http://www. sportsci.org/ jour/0001 /wghdesign.html, [Accessed: 03 March 2004]

Howard, L 1999. The Daimler Chrysler Distance Learning Support Centre in Maseru, Lesotho, *Focus Communications.* http://www. col.org/telecentres/chapter%2012.pdf, [Accessed: 03 May 2004]

Hudson, H 1999. Telecentre Evaluation: Issues and Strategies http://www.usfca.edu/fac-saff/hudson/ papers/Telecentre%20 Evaluation.htm, [Accessed: 03 May 2004]

INASP 2003. Optimising Internet Bandwidth in Developing Country Higher Education, *INASP infobrief* 1 July 2003. http://www. inasp.info/pubs/bandwidth/bandwidth-infobrieffinal.pdf, [Accessed: 23 May 2004]

Isis International-Manila 2002. Telecentres for Universal Access: Engendered Policy Options

http://www.isiswomen.org/pub/ wia/wia202/telecentres.htm, [Accessed: 23 March 2004]

Karelse C & F Sylla 2000. ICTs in Africa: The Landscape for Growing Telecentres

http://web.idrc.ca/es/ev-56546-201-1-DO_TOPIC.html, [Accessed: 23 April 2004]

Khelladi, Y 2004. 10 Lessons for Telecentres Social Impact on Communities.
http://www.cinsa.info/portal/index.php?option=articles&task=view article& artid=127, [Accessed: 29 March 2004]

Ladikpo, M 2002. APC Africa Strategy Development Meeting Report: Appropriate Infrastructure Development. http://web.idrc.ca/ es/ev-9517-201-1-DO_TOPIC.html, [Accessed: 15 August 2004]

Lamshed, K, P Kaltenrieder, M Christensen & T Oversby 2004. Boyup Brook Telecentre http://www.boyupbrook.org/Management/management.htm, [Accessed: 23 May 2004]

Latchem, C 2001. Using Telecentres in Support of Distance Education. http://www.col.org/Knowledge/ks_telecentres.htm, [Accessed: 22 April 2004]

Latchem, C & D Walker, 2001. Telecentres: Case Studies and Key Issues. The Commonwealth of Learning, Vancouver. www.col.org/telecentres. [Accessed: 12 August 2004]

Lennon, F 2002. Digital Transformation: A Framework for ICT Literacy http://www.ets.org/research/ictliteracy/ictreport.pdf, [Accessed: 26 August 2004]

Longo, B 2001. How a Librarian Can Live Nine Lives in a Knowledge-Based Economy.
http://www.infotoday.com/cilmag/nov01/ longo.htm, [Accessed: 23 April 2004]

McConnell, S, D Richardson, M Doehler, & W Wong, 2004. Telecentres Around the World: Issues to be Considered and Lessons Learned http://www.odi.org.uk/RAPID/Projects/R0093/Abstracts/doc067abs.html, [Accessed: 25 May 2004]

McLeod, D 2004. IT Little Reason for Cheer.
http://www.topcompanies.co.za/topicos2004/stories/tc28.htm, [Accessed: 03 March 2004]

Menou, M 1999. ICTS in Africa: The Landscape for Growing Telecentres http://web.idrc.ca/es/ev-56546-201-1-DO_TOPIC.html, [Accessed: 03 March 2004]

Mfaye, G 1998. The African Development Forum '99: Information and Communication Policies and Strategies.
http://www.uneca.org/adf99/ adf99policy.htm [Accessed: 12 May 2004]

Moeng, B 2004. E-Campus Model Urged for Africa.
http://www.itweb.co.za/sections/business/2004/0411111101.asp, [Accessed: 21 November 2004]

Murrugarra, L 2004. WSIS CS-Plenary Partners March 2004: Latin America and Around the World.
http://mailman.greennet.org.uk/public/plenary/2004March/002291.html, [Accessed: 12 April 2004]

NAMI Organization 2004. Peer-to-Peer: NAMI's Recovery Curriculum http://www.nami.org/Content/NavigationMenu/FindSupport/EducationandTraing/Education_TrainingandPeerSupportCenter/Peer-to-Peer/Default 320.htm. [Accessed: 27 May 2004]

Oestmann, S & A Dymond 1997. Telecentres — Experiences, Lessons and Trends http://www.col.org/ telecentres/chapter%2001.pdf *Intelecon Research & Consultancy Ltd.*, [Accessed: 27 May 2004]

Oliver, R & M Grant, 1994. Distance Education Technologies: A Review of Instructional Technologies for Distance Education and Open Learning. http://lsn.curtin.edu.au/tlf/tlf1995/renner.html, [Accessed: 03 May 2004]

Pieterse, F 2004. E-Learning Needed to Bridge the Digital Divide, says Marconi.
http://www.marconi.com/Home/press_office/News%20&%20Events/News%20Archive/2001/November/ELearing%20Needed%20to%20Bridge%20the%20Digital%20Divide,%20says% 20Marconi. [Accessed: 17 April 2004]

Perraton, H 2002. Technologies, Education, Development and Costs: A Third Look at the Educational Crisis. *Paper for round table 'University and technology for literacy / basic education partnerships in developing countries'* Paris 10-12 September 2002 http:// literacy.org/products/ili/pdf/UTLPperraton.pdf. [Accessed: 23 April 2004]

Proenza, F 2004. Ensuring Universal Access to Knowledge and Services through Telecentres., http://topics.developmentgateway.org/edeveloment/rc/filedownload.do~itemId=4009, [Accessed: 23 March 2004]

Renner, M 1995. Convergence and Distance Education: The Promise and Problems of Emerging Communication Technologies http://lsn.curtin.eduau/tlf/ tlf1995 /renner.html, [Accessed: 03 May 2004]

Sayed, Y 2004. Computers in Secondary Schools: High-cost Problem or Low-cost Cure-all? http://www.cinsa.info/portal/index.php?option=articles &task=viewarticle&artid=12, [Accessed: 24 March 2004]

Stoll, K 2000. Telecentre Management and Self-Sustainability. http://www.chasquinet.org/ninosdelacalle/e-result_ta1.html,[Accessed: 13 May 2004]

Wheeler, S 1997. Distance Education and New Convergent Technologies: Video Conferencing. http://www.bcsnsg.org.uk/itin09/wheel1.htm, [Accessed: 12 May 2004]

Whyte, A 1999. Assessing Community Telecentres Guidelines for Researcher. http://www.idrc.ca/acb/howdetl.cfm?DID=6&ProductID=576, [Accessed: 23 April 2004]

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The Digital Divide and Access to Information Communication Technologies
An Investigation into Some Problems in Rural Local Communities[1] in KwaZulu-Natal, South Africa

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Abstract

This contribution profiles one local community[2] in KwaZulu-Natal with regard to the digital divide. It reviews several approaches that were followed worldwide to solve the problem of the digital divide and shows which ones succeeded. For the empirical part of this article the authors collected data by means of questionnaires and subsequently conducted interviews with some of the respondents to clarify some comments they made while completing questionnaires. The conclusion for the study is that the Government needs to pay attention to issues that could help reduce the gap. It will, however, take a couple of years to show a real reduction.

Key Terms

Digital divide, information communication technology (ICT), local community, information, literacy, computer literacy, computer skills

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[1] The term "rural local community" and "urban local community" are used rather than "rural community" and "urban community" because the latter terms have become stigmatized from a developmental point of view. Furthermore, with the proper implementation of information communication technologies (ICTs) the specific urban or rural locality of a community will be immaterial to the access that its inhabitants have to electronic information communication sources.

[2] The term "local community" is being used rather than "rural community" because the latter term has become stigmatized from a developmental point of view. Furthermore, with the proper implementation of information communication technologies (ICTs) the locality of a community will be immaterial to the access that its inhabitants have to electronic information sources.

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Introduction

What rural local communities in third world countries find a problem with is the lack of access to information in rural local communities (Yu (2002)). The lack of infrastructure in rural local communities contributed to the lack of access to information and the lives of African people in the community. This was motivation for the researchers to investigate these problems experienced to access information in rural areas. This study used the residents in Melmoth, Emkhindini Reserve in KwaZulu-Natal (South Africa) as respondents.

The digital divide refers to a gap that exists between individuals who have reasonable opportunities to access technology tools and these that do not have such opportunities. The digital divide breaks along many fault lines, including but not limited to, education, income, ethnicity, geography, infrastructure, and disability. The digital divide exists anytime there is a gap in opportunities experienced (Yu (2002)).

Theoretical Review of Past Research

It appears that there is a gap between rural and urban local communities accessing information (The Daily, 2003). In urban communities, people have easier access to resources (i.e. libraries, computers and Multipurpose Community Centres (MPCCs)) that can be used to access information. However, in rural local communities people have no access at all and they fall behind in accessing information due to a scarcity of resources (Warschauer (2002)).

People living in rural local communities lack access to information because of poor infrastructure. Houses are scattered and it is difficult to have a centre for people to access information (Computers for Africa, 2004). People living in rural local communities don't have skills to use resources and there are no trainers to assist people to use these resources (Warschauer (2002)). Millward (2003), on the other hand, states that the Internet remains the main source of information.

Anding (2003) notes that communities do not know how to decrease the digital divide. McMillan (2003) supports this by stating that information and other government services are not accessible to everyone because they have no resources. To access resources they have to travel long distances to reach those services (i.e. libraries, clinics, internet cafes, etc.).

Fell (2002) states that the digital divide is getting wider even though telecommunications penetration had risen worldwide. In Westernised countries people use mobile phones that allow them easier access to computers and the Internet. In Third World countries the lack of infrastructure does not allow people to think about tomorrow (Gennaio (2002)). Whelan (2004) reports that people in Africa are denied access to computers (1 in every 100 has access to a telephone). Lepage (2004) states that Africa is lagging behind the rest of the world to develop their ICT infrastructures.

There are more factors contributing towards a lack of facilities in rural areas. These include low literacy level, high rate of unemployment, and lower level of income (all ignored by governments). These families have to make a decision between buying a computer or food on the table (Tognetti (2004)). People living in urban areas are getting a better income, and it is easier for them to invest into computers or they might have access to a computing facility, they have a phone for basic communication and a TV.

Developing Countries and the Digital Divide

Most of these countries are poor; they have a high unemployment rate and are overpopulated. They are financially unstable and the infrastructure is poor. Therefore, in order for developing countries to bridge the digital divide, the infrastructure must be improved (Fors (2003)). Programs have been established to conceptualize the digital divide in Africa (e.g. Canadian Fund for Africa, Whelan (2004)). Whelan (2004) also states that in partnership with African institutions, Connectivity Africa support research development and effective use of ICT in

the following areas: innovative, low-cost applications and connectivity across regions, research and development, etc.

"Computers for Africa" is another non-profit organization that refurbishes second hand computers and ships them to Africa (Computers for Africa (2004)). These computers are given to disadvantaged groups, and organizations that work for social development. They state that in Africa there are only three computers for every 1000 persons (Computers for Africa (2004)). In 2002 the government of New Delhi (India), in collaboration with Information Technology Corporation, established a project known as the "Hole-in-the-Wall" experiment to provide computers for the city's street children (Warschauer (2002)). These computers are connected to the Internet (24/7) through a dial-up access and no instructors are provided to allow learning at their own pace and speeding (Warschauer (2002)).

SA has been regarded as a country that has a better infrastructure in Africa. To bridge the digital divide SA has dedicated itself by introducing Multi-Purpose Community Centres (MPCCs) into the communities, bringing services closer to people in rural areas; also government services (e.g. identity documents, marriage certificates, birth certificates (Annual Report (2002)). Martindale (2002) argues that the digital divide is evident in technology. ICT has unwittingly excluded the masses as technology raced on leaving many in SA behind. Socio-economic circumstances, imbalanced education polices, as well as language barriers are some of the factors forcing this exclusion.

In Johannesburg there is a group that formed an independent community organization to help bridge the digital divide. They hope to create an environment where people can become computer literate and learn about benefits of technology (Scott, 2004). This will help people in poorer communities to learn computer skills and to access information. Scott (2004) cites Mzolo (a founder member of the project) who noted that they would provide computer literacy training. Most computer programs are in English and to deal with this matter, translate.org.za (i.e. http://www.translate.org.za) has been set up to translate software into other languages in SA (Martindale (2002)). In order to close the literacy gap, banks have changed their Automatic Teller Machines to a multilingual system. In March 2004 ABSA machines allowed users to select from five different languages used in SA.

In SA the Government is trying to bring services to the people as a way of combating the digital divide. In 2002 the SA government installed more than 29 MPCCs throughout the country (Annual Report, 2002). In Colesberg people used to travel 200 kilometres to De Aar to access Government services using private transport (about R300) for a trip to access information. In Soweto the Ekurhuleni Metro Municipality is fighting the lack of access by participating in the Mindset Network Schools Mayoral Project to assist schools by providing a program that delivers courses (e.g. Mathematics, Physical Science and English). It includes TV sets, video recorders, satellite dishes and smart cards (Sunday Times, 30/05/04 p 22).

Literacy

Literacy can help to bridge the digital divide. It is understood that, for a nation to develop, the level of literacy must be uplifted. People in developing countries also have low levels of literacy compared to those in developed countries because of unavailability of resources to educate people (Warschauer (2002)). In developing countries people are not concerned about information because they can't use it, which causes these countries to fall behind (The Daily, 2003). The Internet is supporting instruction with new models of e-Learning, with the students at the centre of the learning process. Institutions for learning are placing course materials online; schools can become agents for change, helping to reengineer the education system and stimulate life-long learning (Ishaq (2001)).

Sehrt (2003) states that organizations (e.g. World Bank) provide a training program that has trained teachers in African, Asian, Latin American and Middle Eastern nations in the use of technology. For e-Learning to be successful in the developing world it needs another im-

portant pillar, i.e. a decent infrastructure and the Internet (Sehrt (2003)). There are some connections between literacy and Internet access. Warschauer (2002), for instance, argues that access to the Internet is like being connected to advances in communication by means of knowledge and production.

For learners schooling usually correlates with the income level of the child's parents. It is difficult for children in rural local communities to advance in school because most people living in rural local communities do not have any income (The Daily, 2003) (e.g. 70% of Ghanaians cannot read and write - Eyiah, 2004). Tognetti (2004) cites Brynson who argues that it is hard for people who don't speak English to become computer literate because programs are in English. Early school leavers find it difficult to learn computer skills as many of the computer programs are in English. The other factor that contributes towards illiteracy in rural local communities is that schools are built far away from the community due to structures of the land.

Training

Training is integral to the sustainability of ICT projects. Technology changes and it is necessary for tutors to keep up-to-date with software trends (Problems that keep the Divide in existence...., 2004). Fors (2003) suggests that the UN together with the IT companies provide the community with skills to use computers and the Internet. Sehrt (2003) states that computer literacy is a precondition for learners to benefit from technology based learning as e-Learning can build on basic computer skills.

Technology and Infrastructure

The digital divide is a complex concept, as it does not only cover the Internet access; it encompasses anything that accesses information and communication (i.e. computers connected to the Internet, radios, TV, access to telephone and mobile phone networks, etc.). Developed countries are advanced in technology but there is a big gap between the USA and Africa. The cost of supporting computers and the Internet

today is billions of dollars and African countries do not have these funds available. Additionally, the cost for training, support, and changes in infrastructure will make ICTs projects less desirable then other pressing and easily solvable issues (Problems that keep the Divide in existence...., 2004).

Warschauer (2002) compares a Professor at the University of California with a high-speed connection in her office, a student in Seoul who occasionally uses a cyber café, and a rural activist in Indonesia who has no computer or phone line, but whose female colleagues in her group download and print the information for her. This illustrates the digital divide on three dimensions and shows how people from different parts of the world access the information. Mulama (2004) argues that the communication infrastructure in Africa is concentrated in urban areas, 50% of telephone lines are found in capitals where only about 10% of Africa's population resides. Infrastructures are essential for economic globalization and improving international competition (Mulama (2004)). SA's communication system is almost entirely digital with microwave and fibre optics serving as the main transmission media. State controlled Telkom is responsible for the installation and maintenance of these facilities (Bendi (2002)).

Benefits of ICTs

Companies, governmental and NGO's who help combating the digital divide are aware of the benefits that ICTs can bring to the community. ICTs have the capacity to decrease marginalisation and empower people fully by giving access to information (Jackson, 2004). The introduction of ICTs, a factor in combating the digital divide in the community, provides isolated individuals with the opportunity to communicate.

Crede & Mause (2004) state that if governments and other stakeholders design and implement effective ICTs and services this may reduce the knowledge gap between community members. These strategies need to focus on using ICTs in ways relevant to development pri-

orities. They also argue that special attention needs to be given to provide least-developed countries (especially Sub-Saharan Africa), with financial resources, physical infrastructure, and a knowledge base to achieve sustainable development goals.

Crede & Mause (2004) showed that a digital divide also exists between males and females. They give an example as follows: in the USA women account for more than 50% of Internet users, the percentage of women using internet is as low as 19% in SA, 13% in Netherlands and 8% in China (non-literacy is an obstacle to Internet access and women make up to nearly two thirds of the world's non-literates).

By implementing ICTs in working environments, employees directly promote technological changes in their organizations and indirectly in society in general.

Research Questions

This article addressed the need of communities influenced by the digital divide. Some aspects of the literature have solved part of the problem, however the following needs attention:

1. How do the computer skills of the community compare with other places?
2. How can computer skills help to bridge the digital divide?
3. Can this be extended to other communities?
4. How can the digital divide gap be closed in rural areas?
5. Who is responsible for closing the gap?
6. Why is bridging the digital divide important?
7. What resources are available to bridge the digital divide?

Summary of Theory

The revolution in computers and telecommunications networks and the accelerated rate of this change along with the explosion in knowledge are creating changes in information needs among communities. New jobs, an explosion in entrepreneurship, access to education, and new models of community building, ease of access to global markets, and many more are dividends of this revolution. Yet the benefits of the information age are out of reach for many in both developed and developing countries. This gap threatens to cut off populations from a chance to participate in society.

Research Methodology

The study was conducted in Melmoth (Emkhindini Reserve, KwaZulu-Natal Midlands, South Africa) with a population of about 500. The researchers randomly selected a sample of 200 people by using a quantitative approach to meet the demands of accuracy and reliability for a scientific research project. According to Chaudhary (1991:8) quantitative research is based on the measurement of the quantity of the phenomenon under study. The researchers handed the questionnaires to respondents to complete. The questionnaires consisted of two types of questions (multiple choice and open ended). The researchers received 196 completed questionnaires from the people in the community of Melmoth at Emkhindini Reserve. All the data gathered from the respondents was analyzed, interpreted and expressed in the form of graphs, tables, percentages and statistical analysis by means of the program SPSS 11.5.

Discussion of the Results

The purpose of the data analysis in this research is to reflect the extent in which the lack of information access affects disadvantaged communities, especially those living in rural local communities in SA.

Demographics

Because some members in the community cannot read and write, it was difficult for them to complete the questionnaire on their own. The survey was therefore conducted during one-on-one interviews. The findings reveal that of the 193 interviewees, 62% are males and 38% females. The gender imbalance in the sample is due to the fact

that in rural local communities females are not as easily accessible for research as males because they are assigned domestic duties in the home while males by contrast generally perform physical work outdoors, making them more accessible than females as interviewees. The investigation reveals that males in rural local communities are likely to decide who is going to be interviewed because they regard themselves as heads of their families. This is in accordance with an observation in the Daily (2003) to the effect that the levels of education between males and females are reported to be different, with males usually being better educated than females.

African households largely occupy the area where the study was conducted. Approximately 93% of the population in the area are Africans followed by coloureds (4%) and whites (3%). The investigation reveals that unavailability of resources is related to past policies. Many white people were not affected by the lack of information access as they own computers and have a better infrastructure. One contributing factor to the lack of access to information in the community is the need of knowledge. Even if people have access to information, in many cases they don't know how and where to use it (Warschauer (2002)).

Fifty five percent of the participants (106) were younger than 20 years and all reported being negatively affected by a lack of resources in the community. It is especially difficult for learners because some of the material is computerized and they cannot access it. In the village there are two schools (a primary and a secondary school) that respectively offer Grade 0 to Grade 7 and Grade 8 to Grade 12, but without any ICT infrastructure. If learners want to use a computer they have to travel to Empangeni or Eshowe where there are computers available to the public.

Older people are not concerned about accessing information, among others because they don't know how to use the information to alleviate the immediate pressing problems of daily existence. This observation is supported by the findings reported in Millward (2003).

The researchers in the present project discovered that the lack of education in the community is a contributing factor to the poor information access. For instance, only 16% of the respondents reported having some higher education qualification Most of the educated community members are teachers, appointed from outside, therefore long-term residents in the community. This is in accordance with Scott (2004) who noted that the digital divide is applicable to permanent members of the community, and an environment where these people can become computer literate must be established. This is supported by Daly (2004) which states that African learners and students are failing to properly adhere to the current educational system based on technology. As a result they find themselves at a disadvantage in their careers.

Computer Literacy and Ownership

The study discovered that about 70% of the members of the community do not have computer skills. This is because there is no infrastructure and there are no people in the community who can teach them. This is supported by Gennaio (2003) who states that in third world countries there are debts to be paid and people do not have funds available for training. Schools are using typewriters to prepare test and examination papers, but they cannot photocopy them because they do not have facilities. These papers are then written on blackboards for the learners to answer.

Some people in the community don't even know what a computer looks like and what it is used for. Another contributing factor to the poor infrastructure in the community is that the geographical location of the village is not conducive to personal visits, let alone electronic communications. Dwellings in the community are scattered and some of them are isolated by mountains or dense bushes. There is no convenient central location where a community centre can be built and households have little spare income to put towards visits to such a centre. Only 30% of the community members have some computer skills and about 29% of the respondents report having poor skills. Those who reported having good computer skills were students or learners

who were taught to use computers in the schools in the Melmoth area. However, few families can afford to educate their children in Melmoth because of higher school fees and additional travel costs.

About 98% of the community (mostly Zulu people) do not own computers. This is, among others, because their income is too low to buy computers, or because they do not have the infrastructure to operate a computer and Internet access (e.g. electricity and telephone lines). This is in agreement with the results of McMillan (2003) who notes that services like electricity and telephones are not accessible to everyone. The data also reveals that elderly people (pensioners) support most homes while some are dependent on child support grants. The income of grandparent supported households is too meagre to enable them to buy computers. This statement is also in agreement with the findings of Computers for Africa (2004) which state that African workers are so financially disadvantaged that some people only earn $1.00 a day, about R7.00 a day (South African currency) at the present exchange rate.
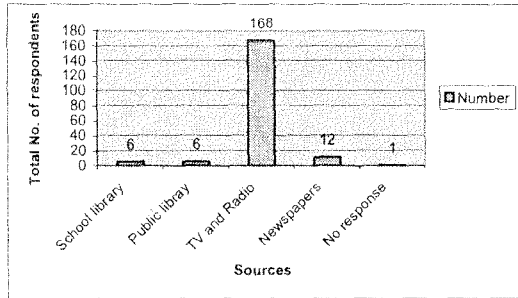
Figure 1: Where interviewees access information

Figure 1 indicates that most community members depend on passive (non-interactive) forms of electronic communication like television and radio to get information (87%). The public library is in Melmoth and it is difficult for people to travel for library visits due to financial constraints. Schools in the community don't have libraries and learners get all their information from teachers. This contributes to the

gap in the digital divide because teachers themselves do not have access to electronic data on the Internet. McMillan (2003) notes that governmental news services are not accessible to everyone with the result that people in rural local communities use radios and TVs, which confirms the findings of the present study.

Regular use of information	Number
Never	16
Daily	112
Weekly	43
Monthly	16
No response	6

Table 1: Regular use of information

Nearly 60% of the members of the community report that they depend on the news for current information. Although they listen to the news they generally do not have the means of using the information. This is confirmed by Computers for Africa (2004) who proposes that pre-owned computers could be refurbished and donated to disadvantaged communities to promote literacy and social development.

There is a 92% unemployment rate in the community that was studied, and therefore a wide gap between employed and the unemployed people in the community. The findings of the present study reveals that most people in the community are not working because of the following reasons:

- The level of education is low in the community;
- There are no business sectors where they can work;
- There is no infrastructure; as a result it is difficult to establish a small business;
- They have no knowledge or information on how to create jobs for themselves;

- There are no community projects that will help them to use the land they have; and

- No Community Outreach Programs to educate people.

The unemployed people in the community contributed to the lack of information access. Ninety five percent of the community members believe that by providing computers to the community it will solve problems by giving people access to information. Although most of them don't know anything about computers they believe that computers could help close the gap (digital divide) between them and those who have access to computers. The research also reveals that people in the community that have never used computers before are willing to learn how to use computers. They think that computers can improve their lives. The majority of community members believe that computers will provide them with marketable skills and easier access to information.

Computers play a role in business, providing education via the Internet, etc. Thus the community will be able to empower themselves (especially the unemployed). Computers in rural schools can help close the gap that exists between rural learners and urban learners. This is in agreement with Sehrt (2003) who argues that, for e-Learning to be successful in the developing world, it needs to build on another pillar (that is the existence of infrastructure along with access to the Internet).

		do you have pc skills?			
		yes	no	spoilt response	no response
gender	male	42	75	1	2
	female	19	52		2

Table 2: Computer skills by gender

		level of education					
		no formal education	primary education	secondary education	tertiary education	other	no response
gender	male	3	5	100	7	1	4
	female	3	4	57	9		

Table 3: Level of education by gender

		how much will you spend per month on pc training?				
		R100 or less	R101-R200	R301-R400	R401 or more	no response
gender	male	39	22	23	30	6
	female	17	9	22	23	2

Table 4: The amounts that female and male interviewees are willing to spend per month on computer training

There are more males with computer skills than females (Table 2). The table shows that the correlation between gender and computer skills is 0.087, which is close to 0. This indicates a weak correlation between these variables (gender and computer skills are independent). Having computer skills does not depend on gender because any person can learn to use a computer regardless of gender. There is a weak negative correlation (-.082) between gender and level of education. This is close to 0, this meaning that these variables are independent. Gender has nothing to do with education because either male or female can go to school. So there is no contribution of gender to education meaning all should have equal access to information.

There is a significant positive correlation (.672) between computer skills and the level of understanding. This is supported by Warschauer (2002) in his study where he argued that if you grew up with computers you understand them better.

The above table shows that *per capita* females in the community are willing to spend more money on computer training than males. The reason for this could be that females are more concerned about meeting needs of their families rather than their own needs. Clearly, over and above the provision of ICT in this community, Government should implement developmental policies that promote the sustained com-

puter skills training of the inhabitants of the community. The correlation is 0.106, which indicates a weak positive correlation. These two variables do not possess a stronger relationship between them and displays no casualty – anybody can thus spend any amount of money on computer training. It supports the findings.

age		do you have pc skills?			
		yes	no	spoilt response	no response
age	19 or younger	31	75	1	1
	20-29	26	40		3
	30-39	3	4		
	40-49	1	1		
	50 or above		7		

Table 5: Age and computer skills

Most of the affected members in the community are the youth, as the statistics show that many people under the age of 30 do not have computer skills. Most of these are people who learned or are currently learning at schools in the village where there are no ICT resources. This should be kept in mind by Government when they design strategies to reduce the digital divide between South African urban and rural local communities.

Most people are unemployed in the community, among others because the level of education in the community too low to provide a skills base for sustainable community development. The correlation is weak (–0.075). This means that there is no relationship between the two variables. This would affect the digital divide and help increase it. This is in agreement with Computers for Africa (2004) who argue that low levels of education in rural communities will ensure a big gap between rural and urban communities.

Most of the younger people state that they would be willing to pay for computer skills training like word processing skills, learning how to play computer games, and how to use the Internet. Not surprisingly,

it seems that older people in the community are not interested in computers (few of them are willing to spend money on computer training). A lack of general literacy and Web skills among the elderly leads to the opinion among them that ICTs are for the young. This finding is supported by Millward, (2003). There is a positive correlation (0.181) between age and the number of people that are willing to spend on computer training because younger people are the ones who want to learn about computers. Therefore, this should help the Government to identify those who could help to reduce the digital divide between urban and rural local communities.

Summary

The research project of which the results are reported in this contribution investigated the effects that difficulties of accessing information by means of ICT has on present-day rural communities in KwaZulu-Natal Province. It used the Melmoth community at Emkhindini Reserve (KwaZulu-Natal Midlands) as a population. If the results reported here is anything to go by, people in rural communities are lagging behind in the usage of the Internet, and this deficit significantly contributes to the lack of economic and social development in these communities. This investigation's first objective was to explore the role that can be played by the Government and other NGOs in empowering the community with resources. It further aimed to discover what could be done by local communities to empower themselves with access to the Internet by building their own resources and thereby realise their own latent potentials.

Because lack of information access is a complicated problem in rural local communities, the researchers reviewed literature with the aim of discovering basic aspects of how the lack of information access affects rural communities. It also investigated strategies that are currently used to deal with the difficulties of accessing information in rural local communities using ICT and how these strategies can be applied in SA as part of an IT for Development framework.

The Government is Not Empowering Communities in Rural Areas

One of the goals of the S. A. Government has been to empower rural local communities. This goal has never been met. The lack of ICT infrastructure and training in Emkhindini Community can be considered as an indication that the South African Government seems to be preoccupied with addressing other pressing social and economic problems rather than using ICT to educate and empower the rural poor with knowledge and skills that would allow them to take an active role in their own development. This observation is supported by the fact that 70 % of the interviewees in the Emkhindini Community who indicated that they have no computer skills and their situation is not improving.

Poor Education and Unemployment Are Some of the Reasons for Lack of Information in Local Rural Communities

The problem of poor education and high rate of unemployment in rural local communities has been an exacerbating factor to poor information access. It has been found that 92% of the interviewees in the Emkhindini Community reported that they were unemployed, and that the majority of the respondents associated their status of poor information access with shortage of resources in the community. They also expressed the view that the high rate of unemployment contributes to their problem of access to information. Low levels of education and lack of access to ICT are posited as mutually self-reinforcing conditions that prevent members of local communities to actively contribute to the development of their communities.

Answers to Research Questions

The researchers conducted this study because there were some questions regarding IT for development that were raised in current literature on the topic. These questions were answered as follows:

1. How do computer skills of the community compare with other places?

The study revealed that only 30% of the interviewees in the Emkhindini Community reported having computer skills. By contrast, in some Indian rural communities computers are connected to the Internet around the clock, giving even street children the opportunity to teach themselves how to use ICT to improve their levels of education.

2. How can computer skills help to bridge the digital divide?

Computers connected to the Internet are main sources of information and therefore bringing computers to the community will help them to gain computer skills (Computers for Africa, 2004).

3. Can this be extended to the other communities?

There is no doubt that computers in the community can contribute to rural development as Yu (2002) emphasizes. Communities that lack knowledge and technology have difficulty in competing and will become increasingly poor and isolated.

4. How will the gap in the digital divide be closed in rural areas?

This can be done in the following ways:

- Prepare young people with technology literacy skills needed.
- Ensure that schools and communities equip individuals with the technology skills they will need to be contributing members to the development of their communities.
- Ensure that adequate funding is provided for schools and communities that will allow them access to technology resources.
- Put technology to work to address the needs of low income and underserved communities.

5. Who is responsible for closing the gap?

All members in the community and the Government are responsible for combating the digital divide.

6. Why is bridging the digital divide important?

The digital divide refers to the knowledge and skills gap that exists between people who have access to technology tools and those who do not have access to those tools (Wikipedia (2004)). Therefore, by bridging the digital divide the community will benefit as follows:

- It helps them acquire knowledge, and enhance educational systems;

- It also enables them to catch up with developed countries by leapfrogging stages of technological development;

- It allows less developed countries to effectively meet their development goals (e.g. poverty reduction, health, sanitation, and education); and

- It also promotes recognition in the international community, thus attracting foreign tourists and investors and enabling the country to benefit from global e-Commerce (Yu (2002)).

7. What resources are available?

The findings of the study reveal that in the rural community there were no resources.

Recommendations

This study has proved that accessing information in rural local communities is a problem. It also discovered that high unemployment rate; low level of literacy and lack of infrastructure contributes to the problem of information access. The study makes the following recommendations:

- People in rural local communities affected by the lack of information should develop a strategy that will need less attention from governmental and focus more on what they can do to combat the digital divide. They should properly manage their own resources.

- The SA Government should revisit the objective of empowerment for poor people who are lagging behind in using technology devices. Special attention should be paid to find solutions that will help neutralize problems associated with information poverty.

- About 92 % of the unemployed at Emkhindini (Melmoth Community) are young people from the local school. Their unemployment is closely related to their low level of education. ICTs should help people to empower themselves with skills and better educational background.

- All recommendations can be made successful by mobilizing people in the community to play a meaningful role in fighting information poverty in the village.

This study argues that the lack of information access in rural local communities is magnified by a lack of infrastructure. Therefore in rural local communities people who are willing to get information have no choice other than listen to the radio or watching television. There are few who use other resources. The reason is that public libraries and newspapers are not available in rural areas, and as a result people in rural local communities do not use this for information (even in schools). Learners get information from their teachers and do not get additional information. Schools that are willing to buy computers have a problem because there is no electricity to run them and it causes the digital divide to grow larger.

Bibliography

Anding, K 2003. Decreasing the Digital Divide. http://articles.findarticles.com/p/articles/mi_m0HFE/is_12_29/ai_111399748, Accessed: 02 March 2004.

Annual Report 2002. Address to the Launch of a MPCC, http://www.anc.org.za/acdocs/history/zuma/2002/j21118.html Accessed: 08 May 2004

Bendi, M 2002 General information about South Africa. Accessed: 21 September 2004

Chaudhary, C 1991. Research Methodology. Highway Jaipur, Motherland Printing Press.

Computers for Africa 2004. Bridging the Digital Divide. http://www.computers4africa.org Accessed: 01 July 2004

Crede, A, & R Mause 2000. ICTs for Sustainable Development. http://web.idrc.ca/en/ev-28873-201-1-D0_TOPIC.html Accessed: 21 September 2004

Daly, J 2004. Discussion Paper for a Meeting on the Higher Education Information Infrastructure in Africa. http://www.ispnews.com Access: 01 July 2004

Eyiah, J 2004. Taking Advantage of Literacy Programs. http://www.ghanaweb.com Accessed: 21 September 2004

Fell, N 2002. Global Digital Divide Gets Wider, EETimes UK. http://www.digitaldividenetwork.org/content/stories/index.cfm Accessed: 01 July 2004

Fors, M 2003. Closing the Digital Divide: What the UN Can Do. http://articles.findarticles.com/p/articles/mi_ml309/is_4_40/ai_11407087 Accessed: 22 May 2004

Gennaio, G 2002. Bridging the Global Digital Divide, Luiss Roma (Italy) http://www.digitaldividenetwork.org/content/stories/index.cfm Accessed: 1 July 2004

Ishaq, A 2001. On the Global Digital Divide. http://www.imf.org/external/pubs/ft/fandd/2001/09/ishaq.htm Accessed: 23 June 2004

Jackson, C 2004. ICT and Social Exclusion Paper for Professional Issues in IT: Benefits of ICT in a Social Exclusion Context. http://www.student.city.ac.uk/~758/PrIssuesGroupCoursework/#Benefitsofsocialexclusion; Accessed: 10 September 2004

Lepage, R 2004. E-policy Resource Network for Africa. http://www.acdiida.gc.ca/cida_ind.nsf/0/CF4F96B1D79AF685256D18004AFC56?Ope. Accessed: 01 July 2004

Martindale, L 2002. Bridging the Digital Divide in South Africa. http://linuxjournal.com/article.php?sid=5966 Accessed: 01 July 2004

McMillan. R 2002. Education Can Solve Digital Divide, http://articles.findarticles.com/p/articles/mi_m0HDN/is_2000_Jan_3/ai_58464474 Accessed: 28 May 2004

Millward, P 2003. The Grey Digital Divide: Perception, Exclusion and Barriers of Access to the Internet for the Older People, First Monday, Volume 8, Number 7 (July) http://www.firstmonday.org/issues/issue8_7/millward/index.html Accessed: 25 March 2004

Mulama, J 2004. Technology: Rural Africa Yearning for Internet Connectivity.http://www.ispnews.net/interna.asp?idnews=24742 Accessed: 10 September 2004

OECD: Integrating ICT in Development Programmes, Paris (France), 2003. http://www.oecd.org/dac/ict Accessed: 05 November 2004

Problems that Keep the Divide in Existence, Solution: US Involvement 2004. http://www.bsos.umd.edu/gvpt/harwood/333/divide/paper.htm Accessed: 10 September 2004

Scott, I 2004. Young People Tackle Digital Divide. http://www.allafrica.com/stories/printable/200406290029.html Accessed: 1 July 2004

Sehrt, M. 2003 Digital Divide into Digital Opportunities-Learning in the Developing Countries. http://articles.findarticle.com/p/articles/mi_1309/is_4_40/ai_114007095 Accessed: 22 May 2004

Sunday Times 2004. Ekurhuleni Acts on Poor Matric Results, Sunday Times, 30 May p22

The Daily 2003. Digital Divide in Schools: Student Access and Use of Computers, The Daily 23 June. http://www.statcan.ca/Daily/English/030623/d030623b.htm Accessed: 23 June 2004

Tognetti, C 2004. Digital Divide in the Silicon Valley.

http://girloydispatch.com/news/newsview.asp?c=111618   Accessed: 23 June 2004

Warschauer, M 2002. Reconceptualising the Digital Divide, Volume 7, Number 7(July 2002), First Monday. http://www.firstmonday.org/issues/issue7_7/warschauer/index.html Accessed: 25 March 2004

Whelan, S 2004. Bridging the Digital Divide: Initiatives of the Fund, International Development Research Center. http://www.acdicida.gc.ca/cidaind.nsf/0/CF4F96B1D73F9AF685 25618004AFC56?Ope... Accessed: 01 July 2004

Wikipedia 2004. Rural http://en.wikipedia.org/wiki/rural Accessed 23 June 2004

Yu, K 2002. Terrorism and the Global Digital Divide: Why Bridging Digital Divide is Even More Important after September 11. http://writ.news.findlaw.com/commentary/20020211_yu.html Accessed: 23 June 2004

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The Potential Crisis Facing South African Universities

Manoj Maharaj

"If the rate of change inside an institution is less than the rate of change outside, the end is in sight"

Jack Welch

1. Introduction

The South African Higher education system, shaped as it was by History, needs to bootstrap itself into the 21st century. An analysis of the various position papers and policy documents make it clear that our education planners are not preparing for the revolution in Higher Education that is being driven by advances in Information Technology and communications. Instead of just considering IT as a facilitator of Higher Education, it is imperative that education policy and planning recognize IT as a driver of Higher Education or we run the risk of being mired in bureaucracy while the information revolution passes us by.

The restructuring of the South African Higher Education system must create a leaner and more efficient system that is geared towards to the imperatives forced upon it by the developments both nationally and internationally. The physical distance that for long isolated our institutions from international competition has now collapsed. Our distance from the developed economies is now measured virtually rather than physically. And this virtual closeness makes it clear that the rate of change within our HE institutions is less than the rate of change in industry and commerce and also lags the changes being introduced

at HE institutions internationally. Failing to recognize this will place our institutions at a serious disadvantage.

South Africa possesses one of the most advanced information and communications infrastructures in the world. Yet, the plans and strategies for the future of the HE system ignore the very simple fact that in order to react to rapid and discontinuous change imposed upon it by technological developments we need to have agile organizations. The creation of behemoths through mergers and acquisitions runs contrary to the logical solution of creating small specialized institutions that are agile enough to react quickly. In the present system universities require up to a year to introduce programmes of study that would reflect the needs of society. Independent institutions, both international and national, that are represented in our country can react much more quickly and capture the growing market.

2. The Emerging Higher Education Landscape

A university may be defined as an organization that is geared towards the collation, creation and dissemination of information. The manner and efficiency in which this process is managed will impact directly upon the university's success. The central role of information within a university naturally implies that it is significantly affected by the rapid advances in information and communications technology.

One of the most far reaching changes in the 1990s is the exponential increase in the accessibility of information to society at large. The information revolution has reached the stage where it controls the rate of change of our society. The global economy is moving from creating and transporting physical objects to the creation and transportation of knowledge itself. In this information society employment growth directly related to the processing and dissemination of information/ data/ knowledge exceeds the growth in employment within the primary and tertiary sectors of the economy. This has been driven by the convergence of various previously disparate parts of the information economy and this will have a

significant impact on the way a university goes about its business. Universities have to redefine themselves as learning organizations and gear themselves up to provide education and training for the new global information economy.

Information technology touches every part of our society, often in unexpected indirect ways, and influences every facet of the university's business. A university is a knowledge–driven organization, and information and communications technologies are set to play an increasingly important role in teaching, research, communication, publishing and administration. Advances within the ICT sector will lead to improvements within the university environment providing that the institution is geared up to encompass and react to these advances. The quality of information at hand for the university senior executive will determine the quality of its decision making. Executive decision support mechanisms are vital to the proper governance of the university and can easily be achieved by a sound and reliable IT infrastructure.

Increasingly, private service providers and organizations are encroaching into the university's traditional arena and providing training and education in specifically directed learning areas geared towards the needs of the organization. This is because the traditional degree structures are failing to provide graduates suitable for the workplace. The shrinking of the information float means that the useful life of a traditional degree is now measured in months rather than years. Much of what is taught in a traditional degree is rendered quickly useless as the new graduate is required to reskill to keep pace with his/her rapidly changing workplace. Employers spend a significant amount of money and effort in retraining our graduates so that they may be useful within their environment. Unless universities acknowledge this, we are at risk of becoming redundant to the needs of our economy.

New technologies that can assist universities in addressing these needs emerge on a daily basis. University academics and

administrators struggle to understand and integrate the reality of mobile, portable and ubiquitous computing into their environment. It is clear that institutions with inferior IT infrastructure, strategies and resources will be increasingly at a competitive disadvantage.

The preservation and creation of knowledge is the primary function of a university. The convergence of digital technologies is set to have a far greater impact on knowledge production and preservation than any of the technologies introduced thus far. Central to the preservation of knowledge is the university library. The university needs to see the modern library as more than just a collection of neatly delineated and categorized books and manuscripts. When supplemented by electronic resources the traditional library significantly expands its scope to potentially make available to its users all other electronic resources in the world. The effective management of these resources is arguably as important as the assets the library possesses. Knowledge that is available but not accessible is not useful. Knowledge on demand is set to become a prime driver of the direction in which the university library is moving. Properly managed, libraries are set to become the central to the learning experience as traditional lecture halls dissolve into cyberspace.

3. The Way Forward

Ironically the slowest adopters and adaptors to the ICT revolution are our universities. While ICTs are used in research and communication, teaching is carried out in the traditional way. This is largely due to the fact that we are being driven and guided by CEOs who cannot or are unwilling to recognize the importance of ICTs beyond being just glorified typewriters. In trying to create an African Ivy League they are missing the opportunities presented by new technologies that will enable African universities to leapfrog their international counterparts. Our inability or unwillingness to enter the age of the global (and virtual) university could well see the traditional university forever playing catch up.

The rapidly changing economic, technological and industrial landscape requires that workers embark on a programme of lifelong learning. This trend will place increasing pressure on knowledge organizations to make information available when and where required. This changing student demographic coupled with reduced state funding for higher education will see the advent of the virtual global university. In order to counter this threat the traditional university needs to become more adaptive and agile. The traditional universities need to position themselves to be able to meet the needs of the students rather than requiring that the student be straight-jacketed into their cumbersome and inflexible programmes. The increasingly regulated and less agile South African HE sector hampers such innovation.

Those institutions that fully embrace the potential provided by information and communications technologies will be more likely to survive these changes intact. These survivors will have integrated themselves into a "knowledge and learning" industry that is being driven by the convergence of HE with IT-intensive sectors such as publishing, telecommunications and entertainment. As the access to information resources becomes equally available to both the student and the lecturer the traditional role of the lecturer will change from one of teacher to one of a learning facilitator. In information rich environment both the teacher and the student will learn at the same accelerated pace.

To address these opportunities and threats universities must develop strategies to at least sense the potential changes to aid in the understanding of where the technology may drive it and must include the development of sufficient in-house expertise among faculty and staff to track the technological trends and to access the various courses of action, the opportunity for experimentation and the ability to form alliances with other academic institutions, with business as well as governmental organizations.

The formation of such alliances and the diversification of the offerings of campus based institutions, using the power and reach of

IT, are expressly forbidden within the South African HE landscape. This policy can only further hamstring Universities from addressing the needs of the country in which the educational needs of adult learners will outstrip the needs of traditional learners as they seek to adapt to the rapidly transforming workplace. The availability of high quality information at any time will require a major shift in educational methods for both traditional and adult learners. Universities must move towards interactive and collaborative learning paradigms which are available anywhere and anytime. Rather than restricting our student numbers, both directly and indirectly, universities should be expanding their programmes and reach to a large a group as possible. In the technological age in which we find ourselves and in the information age towards which we are evolving, only those who are sufficiently educated have a chance of success. It is becoming ever more important for our students to be equipped with skills that include an interdisciplinary approach, problem identification, acquiring and managing information, and working virtually.

The convergence of traditional universities with other knowledge intensive organisations such as telecommunications, publishing, entertainment and information service companies is inevitable. Unless universities recognise this they face the risk of becoming increasingly irrelevant. Higher Education must focus on new competencies. Technology fluency, like basic numeracy and literacy must be regarded as a basic skill. We must prepare students for jobs that are yet to be invented. As a case in point consider the job description of webmaster which did not exist 12 years ago.

The majority of universities will face a major challenge in promoting ICT integration to a strategic level. A successful integration will require a top down and a bottom up approach. A coherent IT strategy for the university needs to be formulated in the context of an overall information management strategy. Universities with an ICT strategy will be more advanced in their integration of ICT into their own administration and organization as well as their educational

setting. The fact this is not the case within the South African HE environment is evidenced by the fact that none of our Universities have strategic IT representation at the highest levels of governance.

Every value chain that is involved in the creation of our primary products, graduates and research, has both a physical and an information processing component and as such is critically dependent on IT. The information processing component encompasses the steps required to capture, manipulate, and channel the data necessary to perform the activity. Every value activity creates and uses information of some kind. Information technology not only affects how individual activities are performed, it also greatly enhances the Universities ability to exploit linkages between activities both within and outside the institution.

There is sufficient evidence to suggest that the HE environment is rapidly changing. The licensing of private institutions and the introduction of campuses of private international institutions within our environment makes it imperative that we recognize this and position ourselves so that we have the competitive advantage in the pursuance of our vision and mission. The fact that many of these institutions are not recognized or accredited by the Department of Education does not deny their existence. It is clear that the traditional Universities ignore these institutions at their peril. Employers will not necessarily require potential employees to have SAQA or HEQC accredited degrees. Students with international qualifications, obtained through distance education, and obtained from recognised institutions will not be ignored by the economy. To develop and nurture a competitive advantage it is imperative that our universities anticipate, innovate and lead change. If not we will be forced to accept the changes that others initiate and find ourselves at a competitive disadvantage. IT remains a profound catalyst for the creation of a strategic differentiation because it creates possibilities and options that did not exist before. However, for the university to act on and harness these possibilities requires insight, vision and innovations in business

practice. The challenge of formulating a clear strategy is an organizational one and depends on leadership who will articulate a clear intellectual framework within which this strategy is developed. A high-level and long-term view of the operating environment helps to focus and prioritize near-term innovations thereby helping to build a strategic advantage. In the Harvard Business Review's "Breakthrough Ideas for 2004", the crosscurrent running through each of the 20 ideas is that "managers with open minds and access to new thinking can make a difference to the competitiveness of their organizations and the well–being of the world."

In formulating these strategies within the university environment it must be borne in mind that the economic and strategic impact of ICTs arise out of incremental innovations whose cumulative effect is discontinuous change. The university's ability to deal successfully with these discontinuities will determine its long term future.

While the use of IT within the university is spreading rapidly, most users of IT are not willing or able to spend their time learning about current and emerging IT applications and operations and academics are beginning to expand their use of IT beyond the traditional to create new ways to teach as well as new things to teach.

The university's IT strategy should not only define a framework for regulation and resource allocation, but should challenge all parts of the university to take advantage of the opportunities opened up by new technologies. This strategy must be designed to provide a competitive environment and add value to the traditional methods of teaching, learning, research and administration that will attract students and high quality academics. These strategies must encompass emerging trends that include bioinformatics, telemedicine, and library digitization amongst others.

The importance of higher education in producing highly educated people to be employed within the information economy means that ICT must assume a position as a core competency within our institutions.

Recognizing that IT is a core competency and to harness the opportunities, address the issues and develop IT strategies the university needs to appoint a functional head of information management at the most senior level. An investigation of the trends internationally will show that leading Universities have taken this view and made such appointments.

4. Conclusion

There is no doubt that information systems and information technology are the glue that holds together an information organization. For information organization to transform into a learning organization it is imperative that the institutional management fully understand the complex interrelationship between the technology that supports the institution and the business of the institution.

The South African higher education environment is in danger of floundering due to the lack of visionary leadership at both the local and national level. The political imperative to redesign the HE environment through large scale social engineering has not taken into account the key issues that are redefining the direction that universities are being forced into internationally. The mergers and acquisitions within the HE environment are set to perpetuate the pre-independence landscape. The large and unwieldy institutions being created are not flexible enough to adapt rapidly to a discontinuously changing environment.

Finally, IT direction and planning are not framed by the capabilities that technology can offer but by the business needs that they must serve. Technology must be seen as a means to achieve the strategic goals defined by the institution in realizing is mission and vision and not as an end of itself.

Bibliography

Business Higher Education Forum n.d., *Building a Nation of Learners: The Need for Changes in Teaching and Learning to Meet Global Challenges,* Learning and Teaching Working Group.

Baer, Walter S 1998. *Will the Internet Transform Higher Education*, in The Emerging Internet, Annual Review, Institute for Information Studies.

Bernbrock, Christopher W n.d. *Open Education. A New Model for Policy Makers In Promoting Public and Private Partnerships For Cyber Education*, IBM Global Education, Asia Pacific, Fountain Valley, California.

Blunkett, David 2000. Secretary of State for Education and Employment, U.K., 15 February 2000, Speech to the University of Greenwich on the future of Higher Education.

Cogburn, Derrick L n.d. *Globalization of the Human Capacity in the Knowledge Economy: Understanding Geographically Distributed Collaborative Learning Between Developed and Developing Countries*, School of Information, University of Michigan.

Cunningham S, Yoni Ryan, Lawrence Steadman, Suellen Tapsall, Kerry Bagdon, Terry Flew & Peter Coaldrake 2000. *The Business of Borderless Education*, Evaluation and Investigations Programme, Higher Education Division, Department of Training and Youth Affairs, Commonwealth of Australia.

Duderstadt, James J 2000. *A University for the 21st Century*, Ann Arbor: University of Michigan Press.

Duderstadt, James J, Daniel E Atkins, John Seely Brown, Marye Anne Fox, Ralph E Gomory, Nils Hasselmo, Paul M Horn, Shirley Ann Jackson, Frank H T Rhodes, Marshall S Smith, Lee Sproull, Doug Van Houwelling, Robert Weisbuch, WM A Wulf & Joe B Wyatt 2002. *Preparing for the Revolution, Information Technology and the Future of the Research University*, Washington D C, National Academies Press.

Katz, Richard N 1999. *Competitive Strategies for Higher Education in the Information Age*, Educom Review, September/October 1999.

Magrath, Peter 1996. *The Future of Public Universities*, Proceedings October 1996 Membership Meeting, Association of Research Libraries.

Moynagh, Michael & Richard Worsley 2003. *Learning form the Future: Scenarios for Post-16 Learning*, The Tomorrow Project, The Learning and Skills Research Centre, U.K.

Ramboll PLS Management 2004. *Studies in the context of the E-Learning Initiative: Virtual Models of European Universities (Lot 1) – Final Report, 2004*, Director General Education and Culture, European Commission.

Wulf, Wm (*sic*) A 2003. *Higher Education Alert: The Information Railroad is Coming*, Educause Review, January/February.

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Friendly Machines: Interaction-Oriented Robots Today and Tomorrow

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1.0 Introduction

Robot engineers have recently built machines whose functions are based on acting jointly with human beings. By participating freely in social life, interaction-oriented robots attract us to establish relationships with them. They may use facial expressions to reproduce aspects of human behaviour (Breazeal & Scassellati, 1999), or visual and auditory data that mimic aspects of personality (Okuno *et al.* 2002) They may carry out tasks like guiding people in a museum (Burgard *et al.* 1998), or use gaze to identify 'intentions' implicit in behaviour (Scassellati, 2000). Below, we report on how an interaction-oriented robot influences schoolchildren who 'get to know' the machine. In describing Robovie, we spell out why it could be of use in, for example, peer tutoring in a foreign language (Kanda *et al.* 2004a). In this paper, our main goal is to show how the friendly machine builds relationships and, thus, shows potential for making a positive contribution to society

Interactions occurred during a two-month experiment in an elementary school. In analyzing human-robot encounters we aim to use the robot's progress to enhance its future performance. Accordingly, we examine what children manifestly value in encounters with 'Robovie'. Focusing on what robots could detect and respond to, we highlight salient human activity and, especially, strategic responses that could be used to extend a robot's interactional powers. Highlighting 'realistic' behaviour, we sketch changes in human-robot encounters over the two months while emphasising how children tried to change

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the interactional context. Thus, we stress moments when children either take the robot to 'mean' something or seek to 'tell' the robot something by using strategic affect. We believe that the 'context-making' function of such interpretations and signals is of considerable importance. Pursuing this, we sketch what context-making implies for software-design.

2.0 Interaction Oriented Robotics and Relationships

In interaction oriented robotics, machines are designed to interact with humans. These robots differ greatly from the task-oriented robots on which research has usually focused. The most successful task-oriented robots serve in factory automation where they typically assemble electronic devices or deal with heavy objects. Other task-oriented robots include space-exploration devices such as the Mars rover, cleaning robots, and so on. These all perform in limited domains because their control problems arise in a human-independent physical world. So, while task-oriented robots rely on physics and mechatronics, social behaviour is paramount in interaction-oriented robotics. Control is no longer separable from how robots influence us and thus participate in human life. In this field, perhaps the most notable success is with Aibo which behaved like a pet (Fujita, 2001). In more psychologically-oriented work, Breazeal and her colleagues explored robot sociality with respect to learning (e.g. Breazeal & Scasselati, 1999). Relatedly, Okuno and his team have a humanoid head that tracks a speaking person's visual and auditory data while altering a controlling parameter to adjust the robot's 'personality' (Okuno, et al 2002). In a practical application, Burgard et al. (1998) report on a tour guide robot whose robust navigational skills have been used in orienting people to a museum. Others have focused on specific capacities. For example, recognizing that joint-attention (Moore & Dunham, 1995; Tomasello, 1999) is essential to social life, Scassellati (2000) made a device that follows gaze and, using a different design, another robot develops similar powers (Kozima & Vatikiotis-Bateson, 2001). Plainly, robots can act in line with the 'intentions' that partly constitute

human behaviour. Finally, a robot system can estimate human evaluation of robot doings by 'observing' body movements (Kanda et al. 2003a)

Reversing this emphasis, we examine how humans engage with robots. Using experimental work, we report how individual schoolchildren relate to robot partners and how the class-as-a-whole is affected by Robovie's presence. This issue arises because, to have a positive social impact, robots must prompt humans to evaluate their responses. Later, such activity can, we hope, be anticipated by the robots themselves. If this is done, instead of relying on canned behaviour to 'fool' humans, robots can act as if they grasped how activity is meant. While this may seem ambitious, no complex understanding is required. Rather, robots can use predictable human display that is inherent to the affective variability of their behaviour. Further, by modelling such processes, our work may serve the study of social learning. For the moment, however, in dealing with what response affords, we focus on behaviour that can enable robots to exploit human attempts at relationship-building.
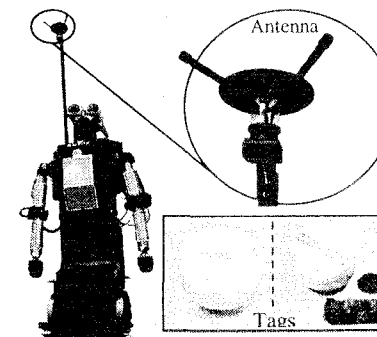
Figure 1: Robovie and Wireless tags

3.0 Robovie: A Behavioral Approach

Robovie is designed to interact at a child's level. For this reason, rather than focus on appearance or learning, the work aims to generate interactionally appropriate behaviour patterns. These rely on human-like expression using robot arms together with its eyes and head. Taken together, these produce gestures that prompt human interaction-oriented behaviour. Robovie also recognizes individuals by using actuators and auditory, tactile, ultrasonic, and vision sensors. The

machine's processing and control systems, the computer and motor control hardware, are located within the robot's body (see, Figure 1).

The robot's activities are controlled by software that ensures it performs consistent behaviour. In design, our 'active interaction' approach aims to compensate for the machine's imperfect sensory processing. This is important because sensory-recognition technology is not yet sufficiently advanced to identify much human behaviour. In this approach, therefore, robots proactively initiate interactions that entice humans to respond adaptively to the robot. The robot performs a series of interaction-oriented behaviours so that its embodiment (head, eyes, arms, etc.) entrains humans to its behaviour. This is generated by a situated module whose operations use communicative units (see Kanda *et al.* 2002 for discussion of the mechanism).

Currently, the robot uses 100 interactive patterns including shaking hands, hugging, playing paper-scissors-rock, exercising, greeting, kissing, singing, verbal output, and pointing to a nearby object. In addition, the robot has about 20 idling behaviours such as scratching the head and folding the arms, as well as 10 moving-around behaviours. In total, the robot utters more than 300 constructions and recognizes about 50 word-sounds. These give rise to patterns sequenced in accordance with simple rules. For example, the robot may trigger interaction with, "Let's play. Touch me." Next it exhibits idling or moving-around until the child responds. If this occurs, it performs friendly behaviours to sustain the child's interest. Then, when the child stops reacting, the robot ceases its behaviour, produces "good bye," and returns to idling or moving-around.
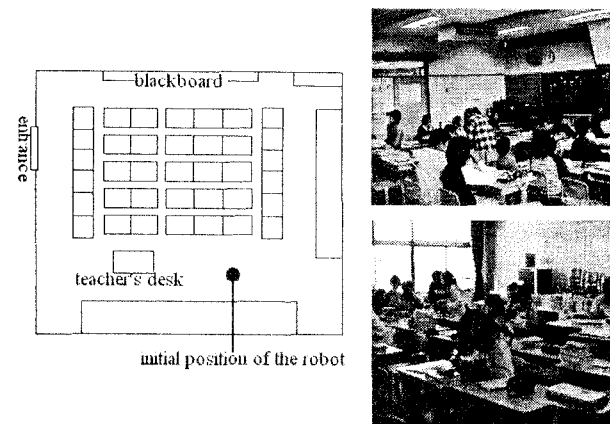
Figure 2: Environment of the elementary school

Given interest in relationships and long-term interaction, the robot has person identification functions based on infrared logo carried by each child. To facilitate this, the child's name is sometimes uttered when he or she is near the robot. For instance, if a child (named Yamada) is near the robot, hearing "Hello, Yamada-kun, let's play together" will strike her as significant. The affective consequences of the robot's action thus prompt both immediate and subsequent interaction. Where patterns emerge across interactions, following Hinde (1979), the resulting behaviour is said to enact a 'relationship'. Further to this, sustained interaction and relationships are also served by pseudo-learning. When a child interacts repeatedly with the device, the machine expands its active repertoire. Thus while a child who interact with the robot for the first time sees at most 10 behaviours, one with 180 minutes of experience may encounter up to 100 interactive patterns. Since actions are coupled with the child's experience this Robovie, appearance of learning is created. Last, the robot confides personal-themed matters to its frequent partners. This time threshold serves to motivate children to spend more time with the robot. Personal themes include the comments, "I like chattering" (said to a child who has played for 120 minutes), "I don't like the cold" (180 minutes), "I like our class teacher" (420 minutes), and "I support the Hanshin-Tigers (a baseball team)" (540 minutes).

To achieve human-like expression and recognize individuals, the robot uses various actuators and sensors. Its arms posses 4 degrees of

freedom (DOF), its eyes 2, and its head 3 (Fig. 1, left, above). The sensory equipment includes auditory, tactile, ultrasonic, and vision sensors, which allow the robot to behave autonomously during encounters. For similar reasons, processing and control systems, such as computer and motor control hardware, are inside the robot's body. To identify individuals, it uses a wireless tag system for multi-person recognition. Recent radio frequency identification (RFID) technology permits this to be achieved using contactless identification cards and chips. In this study, children wore nameplates (5 cm in diameter) in which a wireless tag was embedded. A tag (Fig. 1, lower-right, above) periodically transmitted an ID to a reader on the robot. In turn, the reader relayed received IDs to the robot's control system. Software made it possible to adjust the reception range of the receiver's tag in real-time. The wireless tag system provided the robots with a robust means of identifying many children simultaneously. Consequently, Robovie showed adaptation by recalling the interaction history of a relationship (Kanda *et al.* 2003b)

4.0 Methods

Using Robovie, we conducted a field experiment in a school. Next, we sketch what happened before and, in the following sections, turn to how the robot affected the children.

Robovie was maintained in the classroom of an elementary school. It could thus interact easily with 37 subjects (10-11 years old, 18 male and 19 female) who belonged to a fifth-grade class. The experiment lasted for about 2 months or 32 'experiment days'. (Of 40 school days, 8 were omitted for pedagogical reasons.). The children freely interacted with the robot during a 30-minutes recess after lunch (Fig. 2.). To focus on long-term interactions and relationships, the children wore nameplates with an embedded wireless tag. These enabled the robot to record the tags, recognize the children, and calculate how long each spent with the robot. The data were used in analyzing the interaction. Finally, we administered a questionnaire that asked about both the children's friendship with other children and their interest in the robot.

5.0 How Children Relate to Robovie

We classify the nine weeks into three phases (Fig. 3), and explain the interactional transitions between them. Then we focus on who interacted with Robovie and their claimed reasons for so doing.

During the first phase, children crowded around the robot. Initially, they started a queue (Fig. 4) and, on the first day, up to 17 children were simultaneously present. During the first two weeks, its novelty ensured that the robot almost always had children nearby. Although the numbers gradually decreased, at least one child was almost always engaged in interaction. We highlight some scenes:
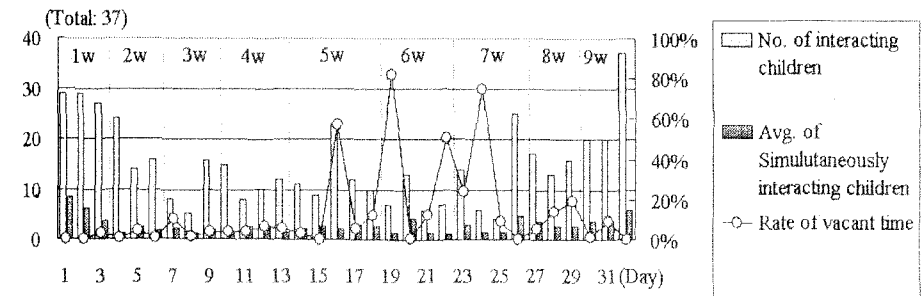

Figure 3: Transitions of the interaction between children and the robot

Many children were attracted by the name calling behaviour.

- Children tried to get the robot to call their names by showing their nameplates to the robot's eye and omnidirectional camera (Fig. 4-b).
- Hugging behaviour was a favourite of the children

(a) Beginning of the first day: Children formed a line   (b) showing nameplate   (c) "I can't see" behaviour preferred

Figure 4: Scene of the experiment

In the second phase, from the 3rd to the 7th week, interactions tended to stabilize. Generally, Robovie attracted up to ten children and, at any one moment, one or more would interact with the machine. When it was raining, children who often played outside boosted the number of partners who played the machine. During these five weeks, as interest diminished, vacant time increased. Then, the "confiding of personal matters" behaviour first appeared and became popular. In this second phase, we observed the following.

- Child A observed the "confiding of personal matters" and told her friend, "the robot said that if you play with it for a long time, it will tell you a secret."
- Child B said, "Please tell me your secret (personal matters)!"
- Although Child C asked the robot about the personal matters, the robot didn't say anything. Child D was watching the scene and told child C what had previously been confided.

The robot gradually performed new behaviours using a pseudo-learning mechanism, and these behaviours caught their attention.

- When Robovie's eyes were hidden (Fig. 4-c), it brushed off the obstacle and said "I can't see." This new behaviour was so popular that children often tried to hide the robot's eyes.
- The robot started singing, and the children joined in.

In the final phase, although the number of children around the robot increased, the number playing with the robot remained constant.

	Correlation / Statistic test result (*p<.05)
Gender (male/female)	not significant
Friendship motivation (Q.1)	0.35 *
Mechanical interest (Q.2)	-0.40 *
Indoors/ Outdoors (Q.3)	significant *

Many simply came to watch the interaction. On the first day of the 8th week, the class teacher told them that the robot would leave at the end of the next week and, clearly, this affected their behaviour. Further, as "confiding of personal matters" became well-known, children were fascinated. For example, they listed the robot's claims on the blackboard. Of these, the most popular was its statement, "I like the class teacher." When the robot first said this, children ran out of the classroom to tell the teacher. Finally, on the last day, the children held a farewell party for the robot. They formed a queue and played with the robot one by one.

5.1 Who Did What When?

To investigate who did what in detail, we sub-classified the children by how much time they had spent with the robot. Simply, we divided them into a "more than half" category (children who played with Robovie more than 16 out of 32 days) and a "less than half" one (children who played with it on fewer than or equal to 16 days). This enabled us to compare the children's explanations of what they had done with measures of total interaction time. In total, 10 children (4 males and 6 females) fell into the "more than half" group (27 had interacted less than half) and, unsurprisingly, these children had played more consistently with the robot over the period. By contrast, others had tended to play with it, especially, when it was novel and just before it left (in the first and third phases) (Figures 5 and 6).

To get a preliminary idea of how children explained their actions, we used a questionnaire asking whether they were motivated by friendship, mechanical interest, gender and where they usually played. Not surprisingly, explanations in terms of friendship (Q.1) had a significant positive correlation with total interaction, and, strikingly, mechanical interest (Q.2) had a sig-

chanical interest (Q.2) a significant negative correlation. While the effect of gender was non-significant, children who usually played inside were significantly more likely to fall into the positively correlated group than outdoors types (Q.3: outdoors type and indoors type) $(F(1,35)=4.39, p<.05)$ (Table 1).
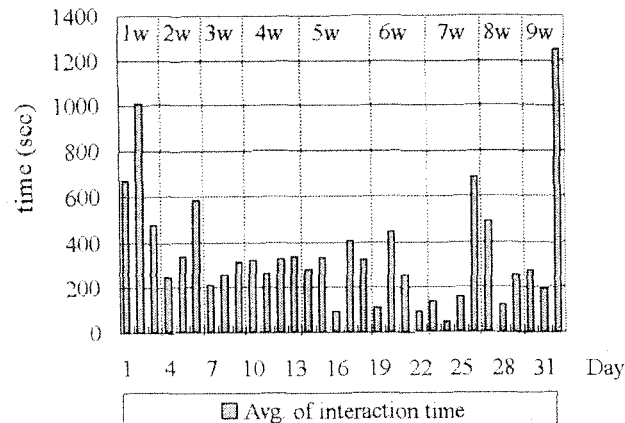

Figure 5: Average interaction time
(More than 16 days children)
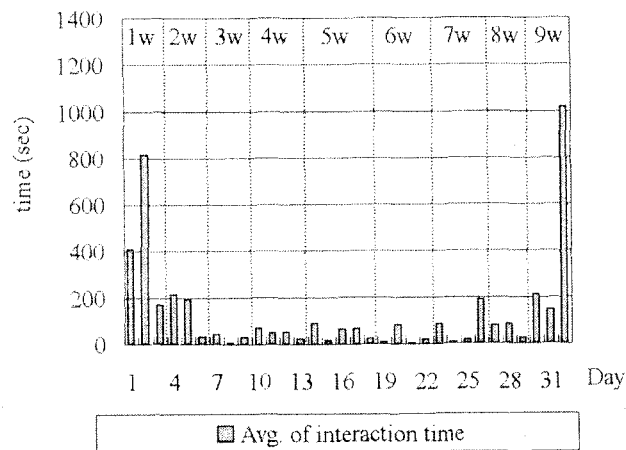
Figure 6: Average interaction time
(Less than or equal to 16 days children)

These findings suggest that when children want to be friends, they do *not* want to know about mechanisms. Less surprisingly, friendship motivation affects the time spent playing with the robot as does whether a child is an outside or an inside type. What is most striking, however, is that a motivation for relationships (as opposed to seeing the robot as a machine) is correlated with the time spent in encounters. Clearly, since much depends on a child's imagination the relationship is asymmetrical and represents what we call social 'partnerhood'.

6.0 Engaging with Interaction-Oriented Robots

Robovie continued friendly interaction for two months using its basic functions, a capacity to identify individuals, pseudo-learning and personal confidences. The children's responses contrasted with what often happens with a novel object. This was because encounters were shaped both by micro-behaviour and relationship typical patterns. The relationships dimension of encounters is marked, above all, in differences in how children respond. While the subject of current research, we next delimit how children's reactions varied across the stages to suggest this signifies for current design. Next, however, we sketch why we focus on relationships.

Primate behaviour has complexity not found in other social mammals (see, Hinde, 1983, 1987). Especially in the great apes, this is reflected in dominance hierarchies, individual recognition, the all-pervasiveness of affect, and interindividual relationships. These serve, above all, in alliances whose hedonic quality influences individual outcomes while contributing to the formation, maintenance and transformation of social roles. With Humphrey (1976), the rise of such relationships probably drove the evolution of primate intelligence. In humans, moreover, another factor is prominent: while other species have culture (e.g. Rendell & Whitehead, 2001), our material and oral institutions permit novel ways of spreading acting, feeling and knowing in space-time. Together with social intelligence, culture transforms life-

worlds by re-organizing activity and, by extension, brains (e.g. Deacon, 1997). Both relationships and cognitive powers, therefore, are crucial to the outcomes that arise as we co-operate and compete with one another.

While all behaviour is multiply caused (Tinbergen, 1952; Hinde, 1987), material and oral culture give human life-forms unique complexity. Our interactions can deviate from common primate patterns by virtue of our use of language. In Dunbar's (1993) terms, we add gossip to relationships. This not only allows for forms of indirect manipulation but gives a role to folk psychology and many social institutions. Taken seriously, this view allows talk to be seen as an extension of expressive behaviour (Cowley & Spurrett, 2003; Spurrett & Cowley, 2004). Since this makes human communication, ontogenetically, no different from that of other animals, the view has advantages. Above all, like that found of other species, human communication depends on expressive activity that serves to assess and manage conspecifics (Owings & Morton, 1998). Accordingly, as Hinde (1983; 1987), shows, it can be described by dialectical linkages between levels of complexity. On this model, even an act of greeting can be informative about a person's internal state, identity, desire to interact, social background, allegiance to sub-groups, inter-group history as well as situation and time-bound cultural process. Simply, human activity exploits wants and beliefs.

Human-robot encounters use how a child's beliefs are manifest in behaviour. How the device responds can be designed, to an extent, around seeking to manage humans by orienting to social norms. Unless goal driven or task-oriented, humans treat messages as inseparable from messengers and create coherence by ensuring that text and context constitute each other (see, Glenn *et al.* 2003). These outcomes, then, use cognitive powers that spread beyond the brain. Agents can rely on physical resources (or programs), material artefacts, and organized activity (Hutchins, 1995). Human cognition is distributed in that artefacts, norms and beliefs are used for cognitive, affective and prac-

tical goals. Emphasising the distributed nature of cognition, we stress that robots prompt action based in beliefs and affect-laden impressions. In contrast to human-computer interaction, the human-like nature of a robot prompts humans to experience a range of emotions. Children thus use interaction-oriented robots not merely to optimize goal-directed behaviour (within the constraints of task and competence) but also to gain affective rewards. To co-ordinate activity 'realistically', a robot's behavioural repertoire must include ways of responding to the context-making that we describe in terms of beliefs, feelings, moods and desires.

While human-robot relationships exploit design or hard-wiring, they also use hedonic behaviour, tricks, in-built biases and environmental factors. Just as biological systems soft-assemble new kinds of functionality, robots can use affective behaviour encounters to retool their repertoire. In this respect there is a parallel with a human ability to co-construct higher-order functions by using input-output mechanisms to exploit external features of interactions. For example, if speaking evokes unexpected laughter, a speaker will reorient both what is said and how s/he presents her/himself by producing (what we call) a new 'context'. With robots, opportunities for similar behaviour arise, say, when children cover Robovie's eyes. This 'debugging' behaviour has the potential to engender new forms of interaction. Another example arises with children who relish the 'hugging' that Robovie is hard-wired to perform. In their belief-worlds, this is *more than* concerted movement. Although this sense is unconscious and based on affect and cultural processes, hugging is treated as intrinsic to a relationship. In building interaction-oriented robots, therefore, we focus on behaviour motivated by and aimed at relationships. Accordingly, we now ask how in-built tricks and biases influence the children and, equally, how human activity aims to influence Robovie. In reporting on both human response and context-making, we reflect on events of significance for relationships.

6.1 Human Response to Simple Tricks

Human response to Robovie is not dominated by either motor movements or canned phrases. Far from treating the machine's activity as rule-governed output, children often interpret it as designed to change the context. This semblance of context-making arises, in part, from Robovie's 'simple tricks'. As specified below, these both persuade children that they are party to two-way relationships and, in real-time, motivate strategic context-making. For the software designer this means that, in principle, robot-motivated response could be used to soft-assemble high-level interactional functions. Next, we show how simple tricks prompt context-making interpretation. This enables us, in following section, to show how human propensities to base relationships on affect prompt context-making behaviour that a robot could detect with even current technology.

Since Robovie recognizes individuals, humans react as if the behaviour was interesting (Kanda *et al.* 2003b) and, perhaps, flattering. Thus they respond positively while trying to set up name-calling routines. For example while one child shows a name-plate to a camera, another's strategy is to tell the robot what he is called. Although this can be described at an interaction level, the children are engaged in context-making that, in a human setting, serves at building a two-way relationship. By attempting to "tell" the robot something, they attempt to consolidate their partnerhood. Were robots able to detect and support the relevant beliefs, context-making outcomes could be incorporated in an interaction history to serve 'special' features of relationships. From a child's perspective, the resulting behaviour would show that the robot 'understood' relationship-level patterns. Using something like the self-fulfilling prophesies of child development, they could be used to develop joint routines. Robots and human-partners could use context-making to construct interactional routines that give a relationship a unique quality. For a child, this would be of considerable social significance.

Similar generalizations apply to pseudo-learning. While some children found that the novelty-value of the robot wore off, others showed sensitivity to its repertoire. Thus, one child who played with the robot intermittently found it boring because, in part, "Robovie can talk, but it always speaks about the same thing." In contrast, another said, "Since the vocabulary of the robot increases, it became easy to talk with the robot." The examples show that pseudo-learning contributes to long-term interaction and relationships. Using an ability to remember what Robovie previously said as well as human beliefs (and wants), a child values context-making behaviour that makes talking 'easier'. Given such results, Robovie's potential can be developed by controlling the increase of such behaviour. Ideally, of course, this will link with context-making to allow for the strategic management of a specific relationship.

The most significant effects of the robot's ability to 'confide personal matters' appears, not in relationships, but at the level of the group. Instead of providing a new context for relationships, this enabled a child to "tell" to the group. Given design where a reward for interaction was that of being singled out for confidences, playing with the robot influenced a child's group-status (at least briefly). This goes towards explaining comments like "I played with Robovie to investigate its personal matters." Evidence that canned phrases affected how the group perceived Robovie is found in for example, institutional use of the blackboard to list his confidences. No doubt, this had a positive effect on the person to whom the 'matter' was confided and at the same time, the individual's place in the class. Robovie has potential for using interindividual relationships to influence the class-as-a-whole. Interaction-oriented robots can exert positive effects on human groups.

6.2 Spontaneous Context-Making Signals

Perhaps the most significant finding in how children respond to Robovie is that, as with humans, what they do is less affected by robot behaviour than an imagined relationship. This depends, above all, on interpreting aspects of behaviour as designed to change the context.

Clear evidence is found among children who want to be friends with the machine. Rather than treat Robovie as a computer-like tool, these children experience partnerhood with a device they imagine to be human-like. Not only does this come out in questionnaires but it is also manifest in what they say and do. Thus one child who interacted extensively with the machine reported, "Robovie seems lonely and wants to talk," and, "although Robovie is a robot, I feel it has a human-like presence." She also said "when I interacted with Robovie, I felt as if I had interacted with a human friend. Perhaps, this is because I got accustomed to interacting with it." For some children, Robovie's human-like properties are salient.

While reflected in verbal expression, context-making attributions are also manifest in behaviour. In only minutes, therefore, a human observer can establish which children have the 'best' relationships with Robovie. This is possible because the tone of an encounter is shaped by a child's sense of the context-of-relationship. While ongoing research is needed to clarify 'good' human-robot interaction, an intuitive notion of quality rapidly appears. For example, after Robovie has rewarded her with a song, one child does a dance of delight and then pats the robot's head. This is important because, in principle, such context-making could be predicted and used to trigger robot responses. Indeed, if robots attend to such context-making, they would be experienced as attuning to how children feel. While robotics research must not rely on changing human attributions, context-making can be used to enhance robot-human relationships. In this way it would parallel infant-directed speech which, while 'unrealistic' makes infant affect and bodily action more comprehensible. Further, since this kind of context-making has strategic functions like making things 'interesting', similar events can help a robot drive long-term behavioural change by coupling inner and outer motives. Changes in activity could thus be prompted by context changing behaviour: the robot might, for example, manifestly try to hide its mechanism, or act to make a child more alert to its 'friendliness'.

6.3 Relationships and Human Emotions

We have used examples of context-making that do not use affect. In primates, however, interindividual relationships juxtapose hedonic events with competitive practices and changing social roles. In humans, these use a range of emotions and bodily dynamics that serve, above all, to build, maintain and challenge alliances (Ross & Dumouchel, in press). Of course, in primates, these ensure group cohesion and reflect both an individual's powers and social 'status'. Accordingly, many affective strategies used during interaction exploit a subset of emotions for social ends (allowing us to avoid nasty dilemmas). This is especially so for emotions (and bodily dispositions) like interest, disappointment, pride, shame, respect and guilt as well as expression-kinds associated with behaviour that we describe as showing delight, disappointment and surprise. It is of interest, then, whether human response exploits this emotional profile and the extent to which it is of potential value for robots.

While possible to give only a sketch, it is clear that reactions to Robovie reflect, among other things, children's strategic signals. For example, *Hanako* (invented name) experiences a close relationship with the robot. Not only did she spend a total of 8.44 hours with the machine but, after the experiment, she reports that she thinks of Robovie as a friend. Thus, she is happy when Robovie calls her name and describes herself as chatting with the machine (in fact, she replied to verbal sounds). When she touched his shoulder and Robovie said "What is it?", she felt "Robovie behaves as if it is human." On one occasion, she got him to sing a song. When it carried out this wish, she carried out a dance of delight. Clearly, individual differences affect relationships through the child's 'model' of Robovie. Even statistically, those interested in how the machine works have poorer relationships than those who see Robovie as a friend. Children who interacted frequently reported, "Robovie seems lonely and wants to talk with others as if it is a human," and "with Robovie, I felt as if I am with a human friend." This, moreover, is bound up with preferences about modes of

play and, specifically, if they choose to interact with the robot or other objects.

What is striking about such incidents is that, far from reacting to the robot, events that are interpreted within a personal relationship nonetheless motivate the child to share experience. Not only does Hanako feel delight but, she seeks to share this with her classmates and, then, comes back to show gratitude to the robot. Plainly, if robots can be pre-programmed to pick up strategic signals, this would impact on how we conceptualize relationships and the group as a whole. Not only could elicited behaviour set off such responses but, in principle, Robovie could respond to her responding. In principle, such events could be stored in a relationship memory and recycled to increase a child's sense that she was special *to the robot*. By setting up relationship-based norms, powerful affective responses could be provoked. In this way the robot would mimic primate-like intelligence without needing hedonic tone. As goes without saying, this could produce positive (and negative) responses: the routine could thus also sustain reinforcement learning. For the same reason, it could be used in ways that had an impact on an individual's social status.

7. 0 Robotics in Behavioural Science: Future Directions

The complexity of child response to Robovie suggests that, just as the invention of computers boosted the study of cognition, the development of robots may change thinking about complex behaviour. In dealing with robots, children exploit events in ways that are irreducible to behavioural sequences. As seen in around simple tricks, context-making and affect, child activity defies Stimulus-Response or Input-Plan-Action description. While sensitive to Robovie's actions, this serves mainly to background attempts at relationship building. As context-making strategies show, encounters are 'deeply' affected by telling and sharing affect. What happens depends, strikingly, on wants and beliefs. Equally, what we 'think' of robots (are they partners or mechanical tools?) affects encounters as much as a child's feelings, social status, and their lived relationship. While not unexpected, these find-

ings matter. Above all, software can be designed to deal with effects that are only distantly related to 'legal' input. Instead of relying on defining symbol-object connections in advance (MacDorman, 1999), it is possible to play down the use of competence-performance models. Instead, software designers can develop systems that soft-assemble by using what a human individual's behaviour affords. Salient features of encounters thus become resources used in the robot's relationship-building. While much can be gained from robust sensory systems, much also depends on creating software that exploits human context-making.

In robotics, current thinking focuses on using cognitive resources efficiently and realistically. It is often assumed that competence-performance models are a good basis for designing software. Our findings give reason for doubt. In practical terms, focus on efficiency ensures that, as technology and tasks change, designs become obsolete. This, we believe, means that designers of social robots need to conceptualise the software-behaviour relationship strategically. In addition to programs that control what robots do, we need mechanisms that prompt and respond to longitudinal changes in how humans seek to alter the context. In conceptual terms, of course, robot behaviour must be designed to influence social life while also exploiting the constraints of the physical world. In this domain, what is characteristic of humans is not the consistency of behaviour but, rather, that their activity adjusts round norms. Accordingly, when other persons are present, we constantly adjust our doings to context (see, Goffman, 1959, 1974). Indeed, as Watzlawick *et al.* noted (1967), the pattern is so marked that even doing nothing is usually communicative or, in our terms, has strategic, context-changing value. Models that specify 'realistic' human-robot encounters can emphasise context-making to use changes in human behaviour for parameter setting. While tricks can provoke context-making, machines can also be made sensitive to their strategic human-based counterparts. Accordingly, software can be dedicated to self-organizing behaviour that establishes what seem to be two-way relationships. This is why it matters that robot-child encounters use be-

haviour, beliefs prompted by simple tricks, context-making and affect. To be 'realistic' robots can exploit what people say and do together with feelings, wants and beliefs. This kind of software design will enable a system to develop what can be called 'social strategy management'. In such a model, a robot will exploit both behavioural variability and context-making in routines and relationships.

To specify how people respond to robot doings and set up relationship-oriented initiatives we need to develop coding systems to characterise human-robot interaction. In current work, therefore, we aim to capture what human activity affords a robot (of given specifications) and, in the longer term, to describe 'quality' human-robot interaction. While such models depend on longitudinal observation, they will also use theories of sociocognitive development and constructivist social learning. Since humans respond to Robovie in complex ways, the robot can be eclectic in using resources to optimize performance. On this view, rather than focus on hardware specification based on behaviour, we stress the need for soft-assembled interfaces that, using interactions, make a machine friendly. Given human interest in relationships, human-robot encounters are best seen as complex social behaviour. Rather than treat cognitive resources as exclusively internal, robot response can be trained by children's activity. This is consistent with work on learning in apes and human infants where developmental complexity depends on interactive gearing of environment and brain. During infant development, moreover, people facilitate their adjustments and, in so doing, encounters complexify so that joint behaviour adjusts to shared beliefs. In such terms, encounters are dynamical events where humans exploit the iconic, indexical and symbolic properties of activity (Deacon, 1997; Thibault, 2000; Cowley *et al.* 2004). By attending to the quality of movements, we gradually become participants in joint action. Human-robot encounters can develop along such lines provided that we use imaginative software design. Above all, this must enable human behaviour to serve the robot in reorganizing its actions to 'fit' recognizable human acts.

Human-robot encounters already use built-in functions together with belief-based analysis. Note is made of strategic affect, context-making and how human desires and beliefs about relationships shape their reactions to, say, simple tricks, pseudo-learning and robot appearance. It follows, then, that strategic phenomena ought to be of as much interest to robots as is human behaviour. Further, since relationships motivate much human action, it is especially important to consider the relevant regularities. This, indeed, is the importance of debugging behaviours as well as their context-making counterparts. In seeking to characterise how interaction develops in relationships, we move towards defining what makes some encounters 'good'. Of course, this level of description cannot be separate from either software design or the robot's hardware. In appealing to cognitive efficiency and human-like performance, importance must also be given to behaviour and appearance. Yet, far from focusing single-mindedly on making action 'true-to-life', we must establish how behaviour varies within (predictable) human parameters. This, we believe, is the importance of perceptually salient events like debugging, strategic affect, and context-making. In principle, such child-activity can be detected by Robovie and, thus, used to respond to what children believe. If a robot responds to debugging, a child will feel she has made a difference; in picking up on context-making affect, she will feel that the robot is sensitive to her feelings. Since the child will act as if the robot is responding intelligently, this will allow the machine to mimic two-way relationships. In software design, one goal is to use the robot to concert interaction around relationships that can be described both behaviourally and around strategic affect. One can speculate, moreover, that such behavioural effects can be enhanced by giving robots powers of facial expression. Indeed, given such signalling, children would treat the robot as acting strategically: furthermore, if based on human performance, such dynamic properties would make them easy to recognize and detect.

8.0 Friendly Machines Today

Placing Robovie in an elementary school for two weeks shows clearly that children seek to build relationships with an interaction-oriented robot. More than that, they treat such a machine as inherently friendly. While the evidence is less strong, questionnaires and behavioural evidence confirm that Robovie's presence has positive effects on individuals, relationships and the class. This is achieved, we stress, by a robot which is human-like through the eyes of imaginative children. Currently, of course, there are serious limitations not only on the robot's sensory and motor resources but also software-design that functions by supplementing interactionally appropriate initiatives with output based on sense-data, individual recognition, pseudo-learning and secret-telling.

Given the software's simplicity, the complexity of human-robot encounters is startling. Above all, children value the machine's human-like nature and treat it with affection. Far from perceiving Robovie as a rule governed device, they freely strive to establish a relationship with a human-like friend. Significantly, they perceive some unusual behaviours as context-making and, thus, of potential value in relationships. While many are taken personally and lead to reciprocal attempts at context-making (such in individual recognition and name telling), others have marked social consequences. This is most obviously so in the robot's confiding behaviour. In this classroom, having a relationship that 'persuades' Robovie to sing songs or tell you secrets makes a child partner feel good and, briefly at least, raises her social standing. In dealing with Robovie, therefore, it is misleading to describe events as program derived sequences. Even now, response to Robovie is driven less by what the robot does than by what children believe and feel.

Viewed both longitudinally and around striking incidents, children value moments where the machine is felt to produce behaviour directed at the individual. They value friendliness. In this respect, there is a telling contrast with the 'personalization' important in relationships with computers. Since Robovie cannot be programmed, issues of ownership and personalization give way to what children treat as a complex interface that, potentially, can sustain a two-way relationship. Drawing on a history of encounters, a child tends to treat the machine as human-like and, as described above, may come to feel special 'for' the robot. This way of setting up a relationship, we stress, depends no more on robot behaviour than a child's imaginings or a robot's tricks. Strikingly, the perception underpins both context-making and produce positive group outcomes.

Currently, a two-way relationship is a figment of the child's imagination. Where Robovie is taken to be "telling" things, events depend on hard-wired tricks. Conversely, where the robot is "told" things, it lacks the wherewithal to detect (let alone interpret!) the activity. This has implications for the robot's perceptual and motor systems and, above all, software design. First, it shows that limits to the competence-performance models that serve von Neumann machines. If Robovie and children are to do more than set up interactional routines, software must promote the rise of strategic behaviour. Instead of tying software to function, co-action must become a basis for developing new kinds of functionality. A history of encounters can shape software design which promotes strategic social management. In this way the robot could use distinctive responding to identify human context-making moves. This might be hard-wired by programming where energetic response to pseudo-learning or personal confidence was treated as strategic and thus as carrying special value. Conversely, if robots are designed to detect strategic signalling, this will enhance their capacity for relationships. While current technology is only beginning to get robots to orient to human beliefs and feelings, relationship building can be improved if attention is given to perceptually salient, strategically important context-making.

Examination of how children respond to a friendly robot can tell us much about human nature. For this reason, we are currently developing a model of how behaviour changes over time. Among other things, we hope to program robots that integrate human 'tellings' with

their repertoire. This social learning is, we believe, consistent with seeing human intelligence as based in relationships. Since Robovie is unlike us, it is extraordinary that children want to be his friend. It is also striking that they work at relationships and, showing their best side, allow a friendly machine to influence both their self-worth and the dynamics of a class-group. Such outcomes make us confident that Robovie is one of the first in a long line of friendly robots. As we come to understand more about human responses and how each party motivates the other to attune to this adjustment, such machines will change dramatically. We will find many uses for human-like robot partners that have, among other things, the powers of tomorrow's computing technology.

Acknowledgements

References

Breazeal, C & A Scassellati, 1999. Context-Dependent Attention System for a Social Robot, *Proceedings of International Joint Conference on Artificial Intelligence (IJCAI'99)*, pp. 1146-1151.

Burgard, W, AB Cremers, D Fox, D Hahnel, G Lakemeyer, D Schulz, W Steiner & S Thrun, 1998. The Interactive Museum Tour-Guide Robot, *Proceeding. of National Conference on Artificial Intelligence*, pp. 11-18.

Cowley, SJ & D Spurrett 2003. Putting Apes, (Body and Language) Together Again. *Language Sciences*, 25: 289-318.

Cowley, SJ, S Moodley, & A Fiori-Cowley 2004. Grounding Signs of Culture: Primary Intersubjectivity in Social Semiosis. *Mind, Culture and Activity*, 11/2: 109-132.

Deacon, T 1997. *The Symbolic Species: The Co-Evolution of Language and the Human Brain*. Harmondsworth: Penguin.

Dunbar, R 1993. Grooming, Gossip and the Evolution of Language. Harmondsworth: Penguin.

Fujita, M 2001. AIBO; Towards the Era of Digital Creatures, *International Journal of Robotics Research,* 20/10, pp. 781-794.

Glenn, P, CD LeBaron & J Mandelbaum 2003. *Studies in Language and Social Interaction*. New York: Lawrence Erlbaum.

Goffman, E 1959. *The Presentation of Self in Everyday Life*. New York: Doubleday Anchor.

Goffman, E 1974. *Frame Analysis: An Essay on the Organisation of Experience*. New York: Harper and Row.

Hinde, R 1979. *Toward Understanding Relationships*. London: Academic Press.

Hinde, R 1983. *Primate Social Relationships: An Integrated Approach*. Oxford: Blackwell.

Hinde, R 1987. *Individuals, Relationships, Culture*. Cambridge: Cambridge University Press.

Humphrey, N 1976. The Social Function of Intellect. In *Growing Points in Ethology,* P. Bateson & R. Hinde (eds.), Cambridge: Cambridge University Press, pp. 303- 317.

Hutchins, E 1995. *Cognition in the Wild*. Cambridge MA: MIT Press.

Kanda, T, H Ishiguro, M Imai, T Ono, & K Mase 2002. A Constructive Approach for Developing Interactive Humanoid Robots, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2002)*, pp. 1265-1270.

Kanda, T, H Ishiguro, M Imai, & T Ono, 2003a. Body Movement Analysis of Human-Robot Interaction, *International Joint Conference on Artificial Intelligence (IJCAI2003)*, pp. 177-182

Kanda, T. T Hirano. D Eaton & H Ishiguro 2003b. Person Identification and Interaction of Social Robots by Using Wireless Tags, *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pp.1657-1664.

Kanda, T, T Hirano, D Eaton & H Ishiguro 2004a. Interactive Robots as Social Partners and Peer Tutors for Children: A Field Trial, *Journal of Human Computer Interaction*, Vol. 19, No. 1-2, pp. 61-84

Kanda, T, R Sato, N Saiwaki, & H Ishiguro 2004b. Friendly Social Robot that Understands Human's Friendly Relationships, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2004)*, 2004. (to appear)

Kozima, H. & E Vatikiotis-Bateson 2001. Communicative Criteria for Processing Time/Space-Varying Information, *Proceedings of the IEEE International Workshop on Robot and Human Communication.*

MacDorman, KF 1999. Grounding Symbols through Sensorimotor Integration. *Journal of the Robotics Society of Japan*, 17(1): 20-24.

Moore C & PJ Dunham, (eds.) 1995. *Joint Attention: Its Origins and Role in Development.* New York: Lawrence Erlbaum.

Okuno, HG, K Nakadai, & H Kitano 2002. Realizing Audio-Visually Triggered ELIZA-Like Non-Verbal Behaviors, *PRICAI2002, LNAI 2417, Lecture Notes in Artificial Intelligence,* Springer-Verlag, pp. 552-562.

Owings, D & E Morton 1998. *The Evolution of Vocal Communication: A New Approach.* Cambridge: Cambridge University Press.

Rendall, L & H Whitehead 2001. Culture in Whales and Dolphins. *Behavioral and Brain Sciences*, 24(2), 309-382.

Ross, D & P Dumouchel, 2004. Emotions as Strategic Signals. *Rationality and Society* 16: 251-286.

Scassellati, B 2000. Investigating Models of Social Development Using a Humanoid Robot, *Biorobotics,* MIT Press.

Spurrett, D & SJ Cowley, 2004. How to Do Things without Words. *Language Sciences*, 26/5; 443-466.

Thibault, P 2000. The Dialogical Integration of The Brain in Social Semiosis: Edelman and the Case for Downward Causation. *Mind, Culture and Activity*, 7/4, 291-311.

Tinbergen, N 1952. Derived Activities: Their Causation, Biological Significance, Origin and Emancipation during Evolution. *Quarterly Review of Biology*, 27: 1-32.

Tomasello, M 1999. *The Cultural Origins of Human Cognition.* Cambridge MA: Harvard University Press.

Watzlawick, P Bavelas, J & D Jackson 1967. *The Pragmatics of Human Communication: A Study of Interactional Patterns, Pathologies and Practices.* New York: W.W. Norton.

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The Evolution of Human Communication from Nonverbal Communication to Electronic Communications

Rembrandt Klopper

Abstract

In the first article of this two part contribution, *The Evolution of Human Communication from Nonverbal Communication to Electronic Communications*, I show how past forms of communication have periodically emerged to help humans cope with ever increasing cultural complexification, particularly after nomadic bands of our hunter-gatherer ancestors settled down in pastoral communities near sustainable about 10,000 and years ago after they had mastered the principles of animal husbandry and planting and harvesting, and that present-day emerging forms of mobile communications will take off and incorporate existing forms of electronic communication because humans remain nomads at heart in spite of ten thousand years of settled existence, first in pastoral communities and recently as city dwellers. In the second article, *Future Communications: Mobile Communications, Cybernetics, Neuro-Informatics and Beyond*, I extrapolate from present-day emerging and converging forms of electronic communication to predict how different forms of human communication are set to change in the immediate future, the intermediate future and in the more distant future.

The five major conclusions that I come to in the first article are:

1. The psyches and metabolisms of modern humans were forged over aeons of hunter-gatherer nomadic existence. Our ancient nomadic souls are incongruent with present-day sedentary existence.

2. Human communication past and future range along a *cooperation>competition>confrontation* continuum.

3. From time to time over the past 200,000 years new forms of communication have emerged for survival sake to help humans cope with greater cultural complexification. Nonverbal communication, (popularly known as body language), emerged first and were complemented by verbal communication dur-

ing humankind's hunter-gatherer phase of existence. About 10,000 years ago ancient forms of graphical representation, found in cave art, successively developed into pictographic, syllabographic and alphabetic writing systems, after our nomadic ancestors learnt to domesticate plants and animals in the Northern Mediterranean climatic zone that stretches across the supercontinent of Eurasia.

4. During the era of the Industrial Revolution, starting about 300 years ago, written communication was optimised and stretched to its very limits to cope with accounts of new geographical, technological and scientific discoveries.

5. The first forms of electronic communication, in the form of the telegraph and radio towards the end of the 19th Century, signalled the emergence of the Age of electronic communication.

Social Cognition and Communication

Human communication is underpinned by a social survival imperative, because we are not merely brains in nutrient-rich vats that can exist in isolation of other humans. We are brains, clad in bodies that generate self-aware minds that interact with the minds generated by other body-clad brains in order to exist, survive and thrive. In the words of Blakemore, Winston & Frith (2004: 216):

> *Humans crave the company of others and suffer profoundly*
> *if temporarily isolated from society.*

Our present-day ability to communicate with anyone anywhere at any time is due to the emergence of electronic communication over the past 100 years. Electronic communication however, is merely the most recent addition to the quiver of forms of communication that our ancestors evolved for survival's sake over the past hundred and fifty thousand years. Our early ancestors were compelled to communicate in order to survive in a hostile world where they formed part of the food chain of more predatory hunters. Those whose genes we carry survived long enough to procreate by conforming to the social will of their band of fellow hunter-gatherer nomads. Social skills enhanced our ancestors' survival chances because the more vigilant eyes and ears and voices there were, the better the individual's chances would have been to survive.

Later on, humans were compelled to evolve further forms of communication, such as public communication and written communication, to cope with the increasing complexity of the societies once our nomadic ancestors settled down in pastoral communities (Diamond (1999)), many of which eventually developed into our present-day villages, towns and cities.

Electronic communication has emerged in information age societies to cope with the increasingly complex global society in which we live. Only after information has been interpreted during communication, it becomes knowledge, the actual currency that drives knowledge economies. In this context, technology is merely the instrument that enables us to communicate information between individual minds. This implies that new Internet-based services like e-business, e-government, and especially e-education should be seen and studied as diversifying forms of maturing e-communication. This of course begs the question, what is communication?

Human Communication

Communication is one of those things that everyone does, but which everyone finds hard to define. To explain what communication is, we have to take as point of departure that humankind fundamentally is a social species. As I have already indicated, since prehistoric times humans have had to depend on others in their bands of fellow nomads to survive.

Intrapersonal and Interpersonal Communication

Reduced to its essence, communication is a contested meeting of minds, where fellow communicators cooperate, compete or confront one another to clearly convey their intentions and contentions. To achieve such a meeting of minds one simultaneously has to engage in intrapersonal and interpersonal communication.

Intrapersonal communication is one of the most neglected forms of human communication. Yet, it is vital to one's success or failure in persuading others to see one's point of view, and ultimately to whether

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one lives a successful or failed life. Intrapersonal communication consists of a range of subconscious reasoning processes that one employs while just thinking about things on one's own, or while one communicates with others. Considering alternatives, deciding between options, weighing up facts, determining the validity of statements, considering interrelationships, discerning the intentions behind the actions of others, or their attitudes, these are all forms of intrapersonal communication that allow us to be well socialised members of the groups to which we belong. Intrapersonal communication goes into overdrive as soon as one actively interacts with others.

A person who is conscious, sober and of sound mind therefore cannot help but engage in intrapersonal communication when interacting with others. Furthermore, even though one may not be saying anything out loud, one's body language is leaking opinions and attitudes all of the time unless one is actively concealing these by intentionally keeping one's facial expressions, gestures, body movements and body stances neutral and non-committal.

In contrast with intrapersonal communication, interpersonal communication can be characterised as any direct interaction between two or more persons with the intention of exchanging knowledge to negotiate social influence. Communication should therefore not be seen as a power-neutral human interaction during which we merely speak or write messages to convey meaning.

A combination of knowledge and communication skills determine the individual's social influence within groups, because they enable the individual to cooperate with others for survival's sake, to effectively compete with others in their group for interpersonal power and social influence, and to attempt to get others to comply with what s/he wants them to do (Gass & Seiter (2003)). It is important to acknowledge that since the beginning of humankind communication is not per se the transmission of meaning from one mind to another, but the contested negotiation of power relationships between individuals through knowledge transmission. The greater the amount of survival related knowledge that one commands, the more one's social influence among

others with whom one interacts, because knowledge allows one to contribute to the ability of one's group to compete with other groups for survival and prosperity. In time of war, for instance, communication is in the heart of any group's preplanned, rehearsed and coordinated ability to engage in forms of confrontation to maintain safety, and to gain and maintain the competitive advantage.

The Cooperation ⊠Competition ⊠Confrontation Continuum

Klopper (2002: 278) posits a three-phase compliance-gaining human interaction continuum as part of a general theory of the optimisation of human communication. Stated briefly, this theory implies that communication interactions are forms of behaviour that range along a continuum: *cooperate⊠compete⊠confront*. Effective communicators have to be good at all three of these to get along with others in their groups, to realise their best potential in their groups, to withstand rank challenges within their groups, to contribute to the betterment of their groups, and to help survive the hostile intentions of competing groups.

The C⇨C⇨C continuum can be characterized by means of a few axiomatic statements:

1. Humans are driven to communicate for survival's sake.
2. The survival principle of enlightened self-interest determines that one only cooperates with others if it is to one's advantage.
3. People or groups compete to gain and maintain the survival advantage.
4. Competing individuals or groups engage in confrontations to obtain or retain competitive advantage.
5. Humans also employ the C⇨C⇨C continuum in education, business and leisure.

How Communication Evolved During the Different Eras of Humankind

Taking Toffler (1978/1991) as point of departure, one can discern four consecutive phases of human cultural evolution, namely the nomadic age, the pastoral age, the industrial age and the information age. In each of these ages, particular forms of communication emerged to

help humans cope with new challenges that they encountered in the struggle for survival.

It is a misnomer to limit the term "knowledge economy" only to the Information Age, because the employment of knowledge is a prerequisite for survival whether one is a nomad in pursuit of one's food on foot, whether one is farming with domesticated plants and animals, whether one is using mechanical means to manufacture goods for sale, or whether one is using electronic communication networks to regulate the production, manufacture, distribution and sale of goods and services.

Verbal and Nonverbal Communication, and Graphical Representation Emerge in the Age of the Hunter-Gatherer Nomads

Klopper (2002) analyses the different forms of human communication that emerged at the different stages of human cultural evolution. In brief, nonverbal forms of communication (facial expressions, gestures, body movement, body stance and tone of voice) emerged in conjunction with verbal communication in the hunter-gatherer phase.

Klopper (2002) reviews evidence of how anatomically modern humans emerged from Africa on foot as Stone Age hunter-gatherer nomads in successive waves of migration, particularly during ice ages which eventually caused sea levels to drop and land bridges to open up where continents are only separated by shallow straits. By using these temporary land bridges between North Africa and the Arabian Peninsula and between North Africa and the Iberian Peninsula in pursuit of game, modern humans steadily populated all of the continents of earth on foot over the past 100,000 years. When they encountered Neanderthal man[1] in Europe, they either absorbed them or displaced them, eventually causing their demise.

What distinguishes human communication from animal communication is the fact that we use language as a symbolic form of commu-

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[1] According to fossil evidence Neanderthals were the descendants of Homo erectus who had exited Africa during a previous ice age about two million years ago.

nication, supplemented by nonverbal indexical forms of nonverbal communication, to convey our perceptions and conceptions to one another, and thereby establishing personal niches for ourselves on the interpersonal social networks that we share with others.

Human symbolic capacity however extends beyond verbal and nonverbal communication to a variety of forms of graphical representation as evidenced in writing systems, drawings, paintings and sculptures. Already in prehistoric times, anatomically modern humans also used their capacity for symbolic thinking to make graphical representations of things that were important to them. There is evidence that as far back as 30, 000 years ago, of graphical symbolic representations in the form rock face paintings, carvings, and statuettes sculpted from stone, ivory and bone, that have been found at European archaeological sites.
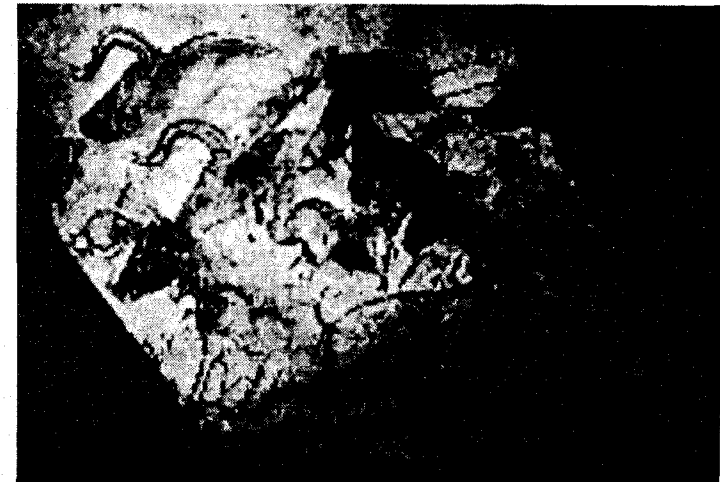

Figure 1: The bull as prominent symbol on prehistoric cave paintings at Chevaux, Southern France

Symbolic images of bulls, like the ones above, dating back to up to 30, 000 years ago, predominate among the rock face and cave paintings at Chevaux and Lascaux in the South of France. Objects, that were created according to principles of visual aesthetics such as cave

paintings, engravings and carvings, clearly could be seen as precursors of the representations that formed the basis of pictographic writing systems millennia later, as demonstrated later on in Figure 2 below.

Public Communication and Writing Systems Emerge During the Pastoral Age

In time, some hunter-gatherer nomads came across and settled down along major river and lake systems that provided year-round sustainable resources for their primary sources of food, game, fruits, grains and tubers. Diamond (1999) presents persuasive evidence that between 13,000 and 10,000 years ago hunter-gatherer bands of nomads were able to settle down along the northern Mediterranean climatic zone, which stretches all of the way from the Iberian Peninsula (Southern France, Portugal and Spain) and North Africa across Eurasia to the Orient. According to Diamond (1999: 131-156), our hunter-gatherer nomadic ancestors were able to settle down in pastoral communities in the northern Mediterranean latitude because the genetic code for domesticating certain plants and animals was cracked in a region known as the Fertile Crescent.

The Fertile Crescent stretched from present-day Israel, through Iraq to Iran. Within a few hundred years, the knowledge about domesticating food resources spread by word of mouth from one band of hunter-gatherer nomads to the next. According to Diamond (1999: 322-333) there is evidence that knowledge of domestication independently arose in China from where it spread throughout the Orient.

Because plants and animals are acclimatised to particular climatic zones, attempts at domesticating Mediterranean type plants and animals as food resources would have succeeded only along the relatively narrow northern band of the Mediterranean climatic zone, which stretches all of the way from the Iberian Peninsula to the Orient.

Where Stone Age nomads would have carried only the barest necessities while moving about on foot, Pastoral Age settlers would have had the first opportunity to acquire a significant number of possessions in the form of agricultural tools, household utensils, weaponry and ob-

jects of beauty for personal adornment. Where Stone Age nomads would have worn amulets of stone, bone, ivory, crystal or metal to ward off evil forces, it now would have become possible to wear items of beauty for the mere pleasure of owning them and for the pleasure of emphasising one's personal status in the community.

From a religious perspective, the shamans were replaced by political leaders like emperors and kings. This led to the formalisation of public communication because rival leaders now would have had to address their followers during power struggles for supremacy, and they would have had to address their peers in whatever leadership forums there emerged in their communities. With the rise of political leadership, shamans, who were the undisputed leaders during the Stone Age, had to reinvent themselves as priesthoods who were in control of temples where religious matters were interpreted for kings and ordinary people by divination rituals, and particularly through a new invention that only priesthoods understood, namely pictographic writing. For example, the Egyptian hieroglyphic inscriptions found on walls inside the pyramids were instructions to the pharaohs on what they should be doing when they awoke along with their entourage of slaves and vehicles of transport in the underworld.

In response to rapid cultural complexification during the Pastoral Age pictographic writing, which may have been used sporadically before, emerged as a formal system of representation. Along with writing there emerged other forms of graphical representation that were based on precise calculation and measurement to accommodate the more complex societies that were evolving. Early forms of writing used mini word pictures (pictograms) to represent objects in the environment. An instructive example is the image of the bull that already was prominent during the Stone Age as cave art 30,000 years ago. Initially a simple line drawing of a bull's head was used to represent the concept "bull." When it dawned upon the early scribes that thousands upon thousands of such mini word pictures were needed for effective written communication, writing systems were simplified to syllable writing systems, and in some cases to letter-based (alphabetic) writing systems (Gelb

(1969)). In Figure 2 below, one can see the changes that one such writing symbol underwent from representing a bull's head to being the capital letter A of the Latin alphabet:
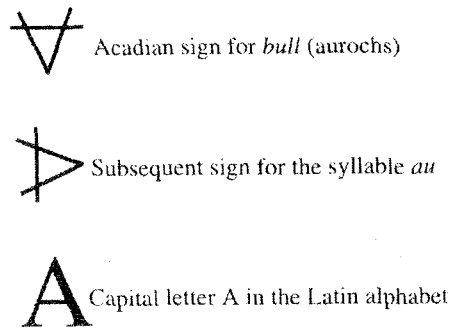
 Acadian sign for *bull* (aurochs)

 Subsequent sign for the syllable *au*

 Capital letter A in the Latin alphabet

Figure 2: The evolution of a writing symbol from a word picture for bull to the capital letter A in the Latin alphabet

Written communication enabled humans to progress to the crucial stage where different domains of knowledge could be recorded, systematised and critically assessed. In medieval Europe priests in monasteries played a major role to preserve written knowledge by painstakingly copying and adorning manuscripts by hand. Through this knowledge was firmly under the control of the church because ordinary people remained illiterate. Writing became the primary form of knowledge generation and knowledge dissemination after Gutenberg invented the printing press in 1452 by adapting the olive oil press.

Before the existence of printed books, almost all transfer of knowledge was by word of mouth and to a lesser extent, by scribes who, for a fee, would read and write your messages for you. Before the invention of printing, the only way that one could have learned new ideas, or have gained new skills, was by being indentured as a novice trainee with a paid instructor. The invention of the printing press was the beginning of the knowledge revolution because it allowed people to learn independently and to communicate across time and space with

people elsewhere, or with later generations. Printing led to the secularisation of knowledge, which until that time was under the control of the clergy behind monastery walls.

Industrial Age Communications

The Industrial Age, that is said to have begun about 300 years ago, is characterised by rapid urbanization in already existing metropolises, and the mass production of goods by mechanical means by labourers that fulfilled specialist duties for remuneration as part of an extensive mutual benefit social contract that unfortunately was greatly biased in favour of the industrial masters. The Industrial Age formed the last phase of the colonial era during which massive amounts of raw materials were extracted from far flung colonies, transported by sea to colonial homelands, refined and used in the manufacture of goods for local consumption, and to be exported for sale to other countries. Towards the end of the colonial era rapidly increasing refinements in technological capacities served as push chains, while the vast distances that had to be traversed between colonies and colonial homelands served as pull chains for the development of the first forms of electronic communication, the continental telegraph and the mass electronic forms of communication, the radio and television.

The first forms of global electronic communication emerged in the mid-eighteen sixties with the laying of several Trans-Atlantic telegraphic cables between The United States of America and Europe via Canada, Ireland and the United Kingdom, followed by Trans-Atlantic telephone cables with higher data carrying capacity between the two World Wars. The cordite fumes of the World War II had barely settled when, driven by the human need to know and share knowledge, the half a dozen Trans-Atlantic cables stirred and began creeping along sea beds, connecting major population centres across the globe.

Conclusion

In this article I have shown how the forms of human communication, namely nonverbal communication, small group direct verbal communication, public communication, written communication and

organisational communication have successively emerged to help humans cope with the increasing complexification of human culture when hunter-gatherer nomads learnt to domesticate plants and animals in the Northern Mediterranean climatic zone, which allowed them to settle down in pastoral communities which became evermore complex, eventually evolving into the major metropolises across the world. In the second of the two articles I deal with future forms of communication.

In a subsequent article, *Future Communications: Mobile Communications, Cybernetics, Neuro-Informatics and Beyond,* I will show that a range of mobile communication is becoming the predominant form of interpersonal communication because it restores the ability of humans, who are still nomadic hunter-gatherers in heart and soul, to employ the full range of interpersonal communication while on the move, including the use of facial expressions, gestures, tone of voice, body movement and body stance. By analysing emerging technological trends, I will also predict where mobile communication will take us in the next few centuries to come.

References

Agee, WK, PH Ault & E Emery 1998. *Introduction to Mass Communication.* 9th edition. New York: Harper and Row.

Argyle, M & P Trower 1979. *Person-to-Person Ways of communicating.* London: Multimedia Publications Inc.

Canby, Courtland, Leonard Jossel, & Lincoln Barnett 1961. *The Epic of Man.* New York: Time Incorporated.

Cann, RL, M Stoneking, & AC Wilson 1987. Mitochondrial DNA and Human Evolution. *Nature,* 325:32-36.

Cavalli-Sforza, LL 2000. *Genes, Peoples, and Languages.* (No city of publication stated) North Point Press.

Clark, GA & CM Willermet (editors.) 1997. *Conceptual Issues in Modern Human Origins Research.* Aldine: De Gruyter.

Diamond, Jared 1999. *Guns, Germs, and Steel: The Fates of Human Societies.* New York, London: W.W. Norton and Company.

Gass, Robert H & John S Seiter 2003. *Persuasion, social influence and compliance gaining.* Boston: Allen and Bacon.

Gelb, IJ 1969. *A study of writing.* Chicago: University of Chicago Press.

Givon, T 1997. *Conversation: Cognitive, Communicative and Social Perspectives.* USA: John Benjamins Publishing Co.

Goldstein DB, AR Linares, LL Cavalli-Sforza & MW Feldman 1995. Genetic Absolute Dating Based on Microsatellites and the Origin of Modern Humans. *Proceedings of the National Academy of Science,* 92: 6723-6727.

Harris Jerome E & Jody Hey 1999. X chromosome Evidence for Ancient Human Histories. *PNAS Online* 96,6: 3320-3324, Accessed on 16 March 1999 at 22:14 CAT, at http://www.pnas.org/cgi/content/full/96/6/3320.

Harpending Henry C, Mark A Batzer, Michael Gurven, Lynn B Jorde, Alan R Rogers, & Stephen T Sherry 1998. Genetic traces of ancient demography. In *PNAS Online,* Volume 95, Issue 4, 1961-1967. Accessed on 17 February 1998 at 13:47 cat, at http://www.pnas.org/cgi/ content/full/95/4/1961.

Ingman, M, H Kaessmann, S Pääbo, & U Gyllensten 2000. Mitochondrial Genome Variation and the Origin of Modern Humans. *Nature* 408:708-713.

Jones, Bruce 1979. *The Development of Print Technology.* Accessed on 15 January 1999 at 22:14 CAT at http://communication. ucsd.edu/ bjones /Books/printech.

Klein, R 2000. Archaeology and the Evolution of Human Behavior. *Evolutionary Anthropology* 9:17-36.

Krings, M, H Geisert, RW Schmitz, H Krainitzki & S Pääbo 1999. DNA Sequence of the Mitochondrial Hypervariable Region II from the Neanderthal Type Specimen. *Proceedings of the. National. Academy of Science* (USA) 96: 5581-5585.

Mersham, Gary & Chris Skinner 1999. *New Insights into Communication and Public Relations.* Sandton: Heinemann Higher Education.

Mersham, Gary & Chris Skinner. 2001a. *New Insights into Communication and Media.* Sandton: Heinemann Higher Education.

Mersham, Gary & Chris Skinner 2001b. *New Insights into Business and Organisational Communication*. Sandton: Heinemann Higher Education.

Nitecki, MH & DV Nitecki (editors) 1994. *Origins of Anatomically Modern Humans*. Plenum Press.

Noble, Ivan 2001 Boost for 'Out of Africa' Theory. *BBC News* online at http://news.bbc.co.uk/1/hi/sci/tech/1323485.stm.

Pease, A 1999. *Body Language: How to read others' thoughts by their gestures*. South Africa: Oxford University Press.

Sternberg, Robert J 1998. *In Search of the Human Mind*. Fort Worth: Harcourt Brace College Publishers.

Tattersall, I & JH Schwartz 1999. Hominids and Hybrids: The Place of Neanderthals in Human Evolution. In *Proceedings of the National. Academy of Science* (USA) 96:7117-7119.

Williams, F 1992. *The New Communications*. Belmont, California: Wadsworth Publishing Company.

Williams, N & P Hartley 1990. *Technology in Human Communication*. London: Pinter Publishers (Great Britain).

Wolpoff, MH & R Caspari 1996. *Race and Human Evolution: A Fatal Attraction*. New York: Simon and Schuster.

Wolpoff, MH, J Hawks, DW Frayer & K Hunley 2001. Modern Human Ancestry at the Peripheries: A Test of the Replacement Theory. In *Science* 291:293-297.

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Future Communications: Mobile Communications, Cybernetics, Neuro-Informatics and Beyond

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Abstract

In the first article of this two part contribution, *The evolution of human communication,* I showed how past forms of communication have emerged periodically to help humans cope with increasing cultural complexification. In the second article, *Future Communications* I extrapolate from present-day emerging and converging forms of electronic communication to predict how different forms of human communication are set to change in the immediate future, the intermediate and in the more distant future. Two *theses* inform the conclusions that I present in the two interrelated articles:

1. The emergence of electronic forms of communication must be analysed and understood in relation to the past emergence of other forms of human communication;

2. The rapid pace at which forms of electronic communication are presently emerging, maturing and converging is determined by psychodynamic and sociodynamic forces that are as old as humankind itself.

The four major conclusions that I come to when the two interrelated articles, *The Evolution of Human Communication from Nonverbal Communication to Electronic Communications* and *Future Communications: Mobile Communications, Cybernetics, Neuro-Informatics and Beyond* are read together, are:

1. The psyches and metabolisms of modern humans were forged over aeons of hunter-gatherer nomadic existence. Our ancient nomadic souls are incongruent with present-day sedentary existence. However, it is the same hunter-gatherer nomadic soul that has embraced the conceptual metaphor cluster, *to communicate electronically is to move about, explore, travel and visit people at new destinations,* revealing a nomadic belief system as old as humankind

itself that also underpins all of our Internet-related and mobile communications.

2. In the short and medium terms, electronic communication instruments are disappearing from our desktops into the walls of our buildings and into our furniture, into vehicles of transport and clothing. In the more distant future electronic communication will diversify and disappear into our nomadic bodies electric.

3. Human bionics[1] will emerge as one of the major applications of informatics in the 21st century, first in the form of biomedical informatics, but later on in the form of biosensory enhancement for pleasure in the virtual reality leisure time industry which is beginning to emerge at present.

4. In the longer term, human communication will be extended to encompass credible communication with sentient, self-aware forms of artificial intelligence (AI) of which some forms will be identifiable as android companion robots, while other forms of AI will be diffused throughout the complex layers of informatics that will regulate the global knowledge culture that has begun taking shape since the nineteen sixties.

Information Age Communications

In 1969, the year that the first human set foot on the moon, I was asked to address fellow students at a convention that had as theme the impact that technology was expected to have on the future of humankind. After I consulted the works of a number of futurologists, I spoke on the likelihood that the rampant use of technology would cause catastrophic worldwide pollution. I also spoke about future scenarios for space exploration, and about the tremendous impact that astronomy was expected to have on humankind's understanding of our place in the universe. I concluded my speech by talking about the role that future satellite communication was expected to play in the development of global mass communications. The one topic that I did not talk about, because not even the experts had foreseen its emergence a decade later, was the personal computer, and the tremendous role that it would play in the globalisation of human culture, knowledge dissemi-

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[1] Bionics: the twofold study of biological functions and mechanics, and the application of knowledge from these fields to machine design in order to create electronic devices to enhance or replace damaged limbs and organs.

nation and independent learning, once linked to a global information network that was to become known as the Internet.

The reason why I totally failed to anticipate the rise of global electronic communication, which was set to redefine how humans would live, work, learn and play in the 21st Century, is because I failed to understand that the human psyche was forged over a period of a hundred thousand years when our ancestors wandered across the globe on foot, following their major food resources, game, and foraging as they went along. The soul of present-day humanity essentially remains the same as the nomadic soul of our hunter-gatherer ancestors. The powerful grip of nomadism on the modern mind can be seen in the fact that learning is conceptualised by means of a cluster of movement metaphors. For instance, one *explores* alternatives, one *comes* to conclusions, one *goes* to look for solutions, one *arrives* at new conclusions, etc. My contention is that humans were driven to develop a facility like the Internet because it gives expression to our beliefs that learning is a journey of exploration. The Internet enables us to believe that we are surfing and going places, while in fact we remain stationary.

When I first used the fledgling South African branch of the Internet in the late nineteen eighties, I had to place a long distance telephone call from Durban to the CSIR in Pretoria. Once connected to a search agency in the USA via satellite, I furtively delivered a pre-prepared search query. Twelve hours later, I had to dial in again to the CSIR in Pretoria to download the plain text results of my query. Today we have access to a vast array of services from all over the world at local telephone call rates. For those who can afford the vastly over-priced rates charged for DSL connectivity provided by Telkom, or the marginally better priced rates charged by the satellite signal distribution company, Sentech, year-round twenty-four-hour, wide band connectivity has now become available in certain metropolitan centres in South Africa. The sad fact is that telecommunications is about twenty times too expensive in South Africa in comparison with enriched so-

cieties like the USA, Britain, Europe, Canada, Australia, Singapore and Japan.

By using one of dozens of search engines or clustering/ meta search engines (which simultaneously query multiple search engines), one can have at your disposal in seconds documents in full colour with sound and video files embedded, available day and night on more than five million servers worldwide. Worth noting is Google's Scholar search engine at www.scholar.google.com, which filters out about 95% of the irrelevant websites, allowing proper scholarly search queries. Other Google services that provide superior search facilities are Google Suggest and Google Earth.

The 20th century saw the rise of informatics as free-market, open societies increasingly began depending on the Internet to form part of an integrated global knowledge-driven free market economy, regulated by the flow of data between economies, including the flow of electronic capital that is not substantiated by bullion or hard currency. Globally disseminated knowledge flows enable national economies and cultures to rapidly adjust to trends of increasingly rapid change in order to maintain a competitive edge over economies that remain trapped in pastoral and industrial cultures.

By the most recent estimate, there are now 6.5 billion humans on the planet. We have settled every landmass on the planet with the exception of Antarctica. Equipped with the proper communication devices, any two humans who wish can now instantly communicate with one another regardless of where they are. This is a remarkable achievement, considering that until very recently we could only communicate with people in our immediate vicinity.

Present-Day Internet Communications

According to The new media Consortium (2005) a profound shift is taking place in the way people communicate and express themselves. Fueled by media that increasingly are crafted for a global audience, pervasive access to goods and services from ever more distant locales, access to networks and communication services that span the planet, and generational ties between youth that transcend borders, a new concept of language — and what it means to be literate — is evolving.

Unlike the traditional notions of language and literacy, which are primarily unimodal and textual, this new form of communication and self-expression occurs multimodally, incorporating visual and aural elements with textual elements, and an immediacy which itself is a dimension of the new language. Technology, which has done much to make the creation and dissemination of written communication a familiar everyday occurrence for most people, plays an especially important role in these new forms as well.

Today, robust electronic communication networks integrate facilities for e-Communication, e-Commerce, e-Entertainment, e-Government, e-Health and e-Learning in information age cultures. These online facilities enable individuals to communicate with relatives on far-flung corners of the globe. They allow people to pay monthly accounts via online banking facilities, to buy and sell products worldwide, to play computer games against opponents at distant locations, to join virtual communities online, consisting of people with mutual interests, to watch downloaded movies, to access data on government department websites, or to obtain certificates and degrees by means of online self-paced learning. Ordinary people can do any or all of these at the time of their choice from any networked location in the world, including from wireless broadband networks that allow mobile communication from busses and trains.

Digital Content Delivery by means of Flexible IT Pull-Technology

Digital satellite TV, such as Skye TV in Britain and DStv in Sub-Saharan Africa has widened the range of channels and programme types to which subscribers have access. DStv, for instance, gives subscribers access to a variety of entertainment and educational channels, over and above local public service broadcaster channels like TV 1-3 and e.

Where an information technology is used that allows the content provider to control the time of delivery, one has an instance of push technology. Where an information technology is used that enables the subscriber to decide on the time of delivery, one has an instance of pull technology. A common characteristic of present digital TV channels is that they still use push technology — that the viewer still has to wait for the time slot in which a program is transmitted before they can view it. In the case of international channels that transmit content in several cycles over a 24 hours period, viewers have the limited flexibility of deciding in which phase of the repeat cycle they want to view a particular programme. However, in the case of pre-recorded (non-live) digital content it is already possible in principle to implement pull technology — to enable subscribers to customise at what times of which days they want to download and watch particular programmes. With the increasing sophistication of digital content compression and delivery, and particularly as competition between digital content providers increases, it is only a matter of time before content will be delivered at the convenience of individual subscribers rather than at the convenience of service providers.

Already Among Us: Small, Smart and Powerful Mobile Communication Devices

With the introduction of sound and the graphical user interface (GUI) the desktop computer in the mid nineteen eighties allowed users to take the first steps to use electronic communication in the same way as nonverbal and verbal communication. Not only could text be formatted in any way that the user desired, s/he could embed full colour graphics and sound in documents. An emerging array of multifunctional communication devices allows people to employ humankind's primary form of communication, nonverbal and verbal communication in direct person to person communication.

However, these are only the first baby steps in the mobile communication revolution that is about to unfold. The future of interpersonal communications increasingly will be powerful, mobile, multi

sensory and miniature. The past fifteen years has seen the emergence and convergence of a range of personal mobile communication instruments. It began with brick-sized voice-only mobile phones, soon followed by dual-purpose pocket size mobile phones that enabled voice and text messages. The present generation of low-end mobile phones are positively petite, with voice, text and photograph-and-send capabilities. Middle level phones are equipped with cameras, video, global positioning and Internet connectivity.

According to Hand (2004) and Hall & Dumas (2004) a range of high-end multipurpose mobile communication and computation instruments are available that allow their owners to phone, surf the Internet, and send e-mail and other documents, to word-process document and create spreadsheets that can be wirelessly downloaded on personal computers. An example of this is the multipurpose BlackBerry mobile communicator with full phone and e-mail capabilities:
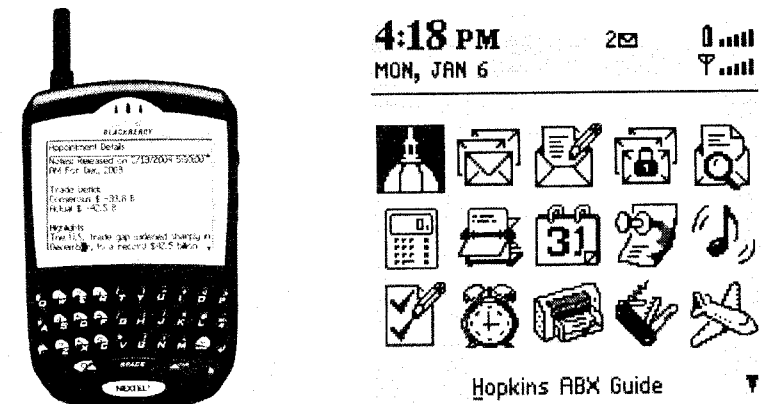

Figure 1: The BlackBerry multipurpose communicator at www.syncpak.com/ and it's on-screen program options

Mobile communications devices like the Pocket PC and other types of Smart Phones can be used for basic word processing (by using a stylus on an on-screen keyboard), e-mail, web browsing, as a

MP 3 music player, a photo album, as well as an e-library for books stored on stamp-size interchangeable 2 GB smartcards.

Such devices also allow the user or the receiver to identify the user's geographical location by means of global positioning satellite (GPS) technology, or to be navigated by voice prompts through the streets of the major cities in the USA. In addition, in the USA such mobile communications instruments are used by paramedics to upload the diagnostic vital signs of patients being transported to emergency medical facilities, and transmit them to the destination hospital so that emergency medical personnel can prepare for the treatment of the patient ahead of arrival.

Figure 2: The HP iPAQ Pocket PC using the Windows mobile operating system, graphic from *Pocket PC* October 2005, p. 7

According to Fairley (2004), a new generation of cheap, flexible solar cells could avert the world's impending energy crisis. The new solar cell technology, developed by Konarka Technologies, consists of nano-chemical surfaces printed onto flexible plastic sheets, indistinguishable from photographic film, that can be manufactured in any desired length and width, and that will deliver endless energy when exposed to sunlight. Such solar film cells will play a major role in delivering affordable energy to private homes, public institutions and mobile communication devices. They will also be utilised in smart books, lightweight bendable e-Reader tablets that can be uploaded with any amount of audio, video, graphics and text, depending on the memory capacity of the e-Reader. Electronic smart books, newspa-

pers, magazines and journals are set to replace their paper-based counterparts. New editions of these "print" media will be downloaded directly from publishers to the e-Readers of subscribers by means of wireless wideband networks.

According to Tambini (2002), we have recently seen the appearance of the virtual consultant in wireless networked communities. In situations where virtual consultancy operates, a guide with a lightweight mobile television camera mounted on the shoulders and the side of the head, enters a scene that warrants inspection and analysis. At the other end, an expert analyses the situation and decides what has to be done to solve the particular crisis at hand.

A recent addition to the range of mobile communication devices is a lightweight, pocket size personal digital assistant (PDA) with an optional extendable screen that offers telephony, global positioning satellite (GPS) tracking, access to the Internet and a virtual keyboard that uses hand movement scanning sensors to calculate which symbols on the virtual keyboard the user is pressing. The October/ November 2004 issue of the e-magazine *Pocket PC* advertises the WorldNavigator GPS travel companion that offers worldwide maps for road and marine travel, and aviation.

Already available in Japan is a range of multipurpose G3 full video communication devices that await the improvement of wireless bandwidth in the West to deliver high quality video telephony. These devices are bound to signal the demise of teleconferencing just as the present use of cell phone SMS messaging has all but stopped the use of telegrams.

Rapid developments in flexible mobile communications have led the June 7-14 2004 issue of Newsweek to give the following humorous portrayal of "your next computer":

Figure 3: *Newsweek* of June 7-14 2004's humorous depiction of immanent powerful multipurpose mobile communications

On the Horizon: Powerful Wearable Computers

Next generation communication devices will not conglomerate around the heads of people as Newsweek humorously portrays above. Instead, they will disappear into the wall of our homes, into our furniture, and for those on the move, into our clothes. The prototypes of these new mobile communications technologies are known as wearable computers (Mann & Niedzviecki (2002)). They are a range of mobile, multipurpose devices with powerful computing and communication capabilities.

Östling (2004) reports an advanced stage of development of the prototype of an exoskeletal wearable robot that could give soldiers and rescue workers exceptional endurance and strength. When marketed, the exoskeleton will consist of a super-strong metal frame into which the wearer steps. A range of body sensors coordinates the joint movements of the wearer with the movements of the robot, computed by an on-board computer in the wearer's backpack and powered by a power source also housed in the backpack. The robot will enable its wearer to hike vast distances and to effortlessly lift heavy objects.

Vorenberg (2003) predicts that smart clothes will be on shop shelves soon. They will be items of clothing woven from smart thread, a polymer that feels like nylon fabric, but that conducts electricity like metal, and that can therefore replace traditional threads in fabric to give clothes computer-like qualities. The inventors of smart thread are exploring the possibility of using this material to manufacture wearable computing devices, wearable telecommunications devices, wearable medical and athletic devices, and wearable fashion accessories that change colour, either automatically, or on demand.

Clothing made with this material would be able to sense conditions around or inside the wearer. A smart thread shirt or blouse would have the capacity to monitor ambient temperature and to adjust and automatically regulate body heat to make its wearer more comfortable, or it would be able to diagnostically monitor the vital signs of an athlete, a child or a patient.

Telecommunications is seen as a major application of smart thread by 2010. All the components of a videophone will be woven into the fabric of the item of clothing. The fashion industry is looking at using Smart Thread to make clothes that constantly change colour, change colour based on the wearer's preference for the day, or that reflect her mood.

Within the next decade, we can expect to wear trendy clothes with more powerful computational abilities than our present desktop computers. Such clothes will allow instant audio and video communication with anyone anywhere at any time. They will adjust to regulate one's body temperature, and monitor vital signs like one's heart rate, (one's) blood pressure, (one's) blood sugar, or whatever else one wishes to have monitored. Smart clothes will alert you to take whatever medication is due to be taken at the time, and that will tell your physician more accurately what your symptoms are than you yourself will be able to do.

Also on the Horizon: Cyborgs

The eventual convergence of a number of presently emerging technologies will enable humans to engage in cyberkinetic telecommunication and communication between humans and companion robots. The technologies to which I am referring are: nanotechnology, quantum computing neuro-informatics, and cybernetics.

Nanotechnology is a new and fast expanding form of technology that is used to build complex microscopic machinery on the molecular and atomic level. Fully functional, complex nano machines are so small that about a thousand of them next to one another can comfortably pass through the eye of a needle. Nanotechnology is already being employed in computing and is set to transform computing beyond recognition in the near future (Stix (1994, 2001), Collins & Avouris (2000), Lieber (2001), Whitesides & Love (2001), Whitesides (2001), Alivisatos (2001), Roukes (2001) and Drexler (2001)).

Quantum Computing is an emerging new branch of informatics that utilises the principles of quantum mechanics that were formulated nearly a hundred years ago, and which forms the basis for modern physics, chemistry, mathematics and cosmology. Quantum mechanics is a theory that describes the behaviour and interactions of subatomic elementary particles and their energy states. According to quantum theory, energy radiates in discrete packets, known as quanta. Experiments based on quantum theory have demonstrated that matter simultaneously has two modes of existence—it simultaneously manifests itself as particles and as waves. This means that everything in the universe, including humans, is built up from particles that are located in space-time, but which at the same time exists as waves that are not subject to space-time constraints. Quantum theory further states that a particle can be entangled in space-time at two different locations, which means that it simultaneously exists in more than one place.

Because of this dual state of existence quantum theory includes an uncertainty principle, which states that an observer can either measure the velocity of a moving particle or ascertain its whereabouts, but one cannot do both at the same time. According to the theory, quanta change their behaviour when observed, because observation involves properties of quanta that localise them in space-time.

Quantum computing uses the properties of quanta to do powerful information processing at high speeds on increasingly smaller instruments. Present-day information processing is limited to binary data states because it uses only combinations of O (zero) and I (one) to encode data strings. Because of the wave properties of quanta, and entanglement, they can manifest themselves in two places at the same time. This enables the encoding of data in five quantum probabilistic data states which makes it possible to encode vast amounts of information extremely fast by means of very small processors. Quantum encoding allows for data processing speeds that are hundreds of times faster than binary processing. Experimental quantum encryption has succeeded to use entanglement to teleport messages between communication instruments at different locations. It is already possible to teleport quantum messages. Someday it should also be possible to teleport the messenger itself. Brooks (2004:33) says:

> ... *Experiments show that the size of an object is no barrier to quantum-like behaviour ... So, could you be turned quantum? It all comes down to information﹍ or the flow of it. This determines how you interact with the world, and whether you can, for example, be in two places at once. If you want to be quantum you have to isolate yourself from your surroundings by making sure there is no way that you leak information.*

Returning from what may someday become possible to what is likely in the near future, a combination of nanotechnology, quantum computing and cybernetics will within the second or third decade of the 21st century cause communication and computation instruments to entirely disappear into the human body, and will eventually become as commonplace as cell phone communication is today.

Neuro-Informatics is an emerging field of informatics in which microscopic brain implants are performed that allow nano-computers to enhance sensory inputs that enable the blind to see, the deaf to hear and the paralyzed to move.

Cybernetics is a branch of informatics that studies communication in organisms, organic processes, and in electronic systems. A new branch of cybernetics, nano-neuro-cybernetics, is studying how biological control systems in the human body could use nanotechnology at the cellular level to achieve direct human-machine communication. A new form of mathematics is being developed to translate communication between biological cells and nano-instruments in the form of body implants. The following are important facts regarding nano-neuro-cybernetics that form the basis of the discussion of cyberkinetics and neuromorphic microchips in the next section:

- Each cell in a person's body is a battery that generates its own electric field;
- Each body generates its own complex electric aural field by combining the fields of individual cells;
- The active cells during particular brain processes generate brain waves that form an intimate part of cognitive processes by helping activated groups of neurons to co-opt inactivated ones during the process of entrainment;
  - By means of nano-neuro-cybernetic events neural signals are decoded and translated into electronic signals that enable people to regain abilities that have become dysfunctional and to will electronic devices through mind control to perform specific operations. The process of mentally controlling electronic devices to perform specific operations is known as cyberkinetics.

  - Biological forms that are cybernetically enhanced are *cyborgs* and the process of enhancing their abilities, or of compensating for dysfunctional natural abilities, is called *cyberkinetics*.

During *cyberkinetics* neurological implants are used to meld neural signal processing and some form of information communication technology. This enables recipients to bypass damaged areas of their central nervous system to restore hearing and sight, or to bypass the motor cortex by tapping straight into neurons in the parietal lobe of the brain in order to directly control bionic limbs through thought processes. Advances in cyberkinetics are set to help patients with spinal cord injuries, strokes, Lou Gehrig's disease or other neural ailments to communicate better, or even to operate lights and other devices through mind control (Pollack (2004) and Warner (2004)).

A recent beneficiary of cybernetic telecommunication is the American quadriplegic, Matthew Nagle of Stoughton, Massachusetts, who can switch on and off appliances via an electrode array directly implanted into his parietal lobe, the brain lobe that integrates neural signals from different sensory pathways before sending them for executive action to the motor cortex. In Matthew Nagle's case spinal neck injury has left all four of his limbs paralysed. By decoding neural signals in the parietal lobe and redirecting them directly to a computer via a wireless brain implant it is possible for Matthew Nagle to cyberkinetically will certain actions that are then executed by his computer, or to will a bionic hand to open and close, or to grasp (Mishra (2004), Philipkoski (2005), and Unauthored News Report (2005)).

Boahen (2005:57-63) reports advanced research in the design and application of *neuromorphic microchips*. According to Boahen neuromorphic electronics uses compact, efficient microchips that electronically emulate the brain's neuro-chemical signalling processes. A major application would be implantable silicon retinas to restore vision to human patients, and that could also form part of robotic eyes. Neuromorphic microchips also have applications in other electronic sensory systems such as audio and olfactory recognition for robots and other intelligent machines. Boahen (2005:63) concludes:

Morphing neural development processes instead of simply morphing neural circuitry holds great promise for handling complexity in the nanoelectronic systems of the future.

In summary, cyberkinetic nano-computers as wide as the breadth of a hair, are being designed that will be used for manipulating the spin orientation of electrons, utilizing probabilistic quantum spin states for data processing. Such quantum data processing will enable minute computers to process data hundreds of times faster than the binary processing of the processors that we are currently using in state-of-the-art computers.

Just over the Horizon: Companion Robots

Non-humanoid robots have been used for a number of decades in assembly settings to due repetitive precision tasks that tax human concentration beyond its limits. They basically are just expensive precision computational instruments that perform tasks in sequences that human designers have predetermined and pre-programmed. There are also a number of entertainment robots, like Honda's Asimo, that are mainly being used for promotional purposes. Asimo has no sensations about its environment and walks and talks by remote control.

In order for a robot to be intelligent, it must be aware of its environment. This cannot be done by serial information processing, the principle on which 99% of present computers on planet earth work. What is needed is a system of parallel distributed processing (PDP), also known as neural network processing, that allows the computer to become aware of its environment and to program itself by learning from its environment, just as humans do. In PDP computers, there is no distinction between hardware and software. As the computer learns about its environment, it adjusts its neural network settings, just as the human brain does. In both PDP computers and humans the continuous reconfiguration of synaptic settings, reprograms the neural network with up to date information about its environment. The present genera-

tion of PDP computers is said to have a level of intelligence comparable with insects.

Some robotics engineers are making optimistic predictions that bipedal humanoid companion robots, in the form of servants, assistants and companions could be available within the next 20 years.

At the lower end of robotic sophistication one would have a bipedal anthropoid worker like Asimo that can be pre-programmed with scripts for butler like social interactions, or with housemaid like scripts to do the laundry and wash up, and that can engage in general conversations about every-day matters. At the upper end we would be talking about self-aware, sentient beings where parallel distributive processing AI, using nano scale neuromorphic microchip technology, described by Boahen (2005), would generate an open ended, extendable knowledge base that would enable the robot to learn from, and adjust to new experiences.

Cognition, Ethics and AI

A discussion of this nature would be incomplete without an inquiry about ethical and moral issues that at this stage may be considered to be at the periphery of informatics by some information scientists. I personally believe that all species extract particular narrow sensations of the environment in the form of extremely complex species-specific mental models (memories and reasoning processes) that optimise their chances of survival in the particular niches that they occupy in nature. Different species have configurations of sensory abilities that are specialised for their own survival because the mental model of each species would constitute a partial drastically oversimplified abstraction of ultimate reality.

Memories of our past experiences give us self-identity. If my assessment is correct, we will be able to create intelligent companion robots that are sentient, not only at the limited ranges that inform human cognition, but at ranges where we are unaware and agnostic, e.g. at the X-ray range, the ultraviolet range, the infrared range and the extra low

frequency range. Using the principles of kirlian vision (revealing the auras that all life forms radiate in electromagnetic fields), caregiver robots would for instance be able to sense and diagnose maladies for which we now use separate diagnostic instruments.

It is well-known that loneliness drives people to accept radio and TV as surrogate human companions. There is no reason why humans will not also accept companion robots. It would be relatively easy to program a robot to engage in polite small talk and to signal polite submissiveness. However, to be socially acceptable and to engage in credible nuanced meaningful communications robots would have to limit their conversations with humans to sensations with which humans are familiar. They would have to be good at reading nonverbal communication cues (facial expression, gestures, tone of voice, body movement and body stance), and would have to project human emotions by means of their own body language, besides having an extensive, nuanced language based communication capability.

Particular emotions govern all forms of human behaviour. How will we enable robots to understand human behaviour and interpret human communication in view of the fact that learning and memory require the co-indexing of the facts of events and the emotions that we experienced during those events?

In the preceding article, *The Evolution of Human Communication from Nonverbal Communication to Electronic Communications*, I indicated that human behaviour ranges along a survival continuum: *co-operation>competition> confrontation*. Humans have to excel in all three types of behaviour in order to survive. Will we limit/inhibit robots to only cooperative forms of behaviour, *a la* Asimov's famous three laws of robotics? The *de facto* involvement of military establishments in research and funding of AI research make this a utopian objective. We can assume that robotic activities will range from the gentle caring of the vulnerable to the ruthless elimination of enemies.

As I stated before, humans are not brains in nutrient rich vats, but beings that experience as well as remember with our whole bodies, our

central nervous systems as well as our peripheral nervous systems. For instance, when you encounter someone with whom you have had a run in before, that hollow feeling on the pit of your stomach is part of the memories of the past encounter that have been re-awoken. Robots would have to experience emotions before they could understand human behaviour and interpret human communications. Humans distinguish between what is logically true and false, and between what is morally right and wrong. How will we enable our robots to make both sets of distinctions?

A surprising amount of human cognition and communication is metaphoric (Lakoff and Johnson (1980, 1999), Fauconnier and Turner (2002), Klopper (2002, 2003)). The hallmark of metaphoric thinking is that entities that are not literally similar are being equated figuratively in order to focus on unexpected similarities between them. For instance, depending on the nature of a competitive behaviour, opponents could be portrayed as chess players, tennis players, boxers, wrestlers or duellists. In the domain of sexual desire a desiring male can be portrayed as an old goat and a desirable female as tender leaves. Because metaphor formation is spontaneous and creative we are dealing with an open ended process of meaning creation. Therefore, the ultimate challenge would be to get robots to understand the almost infinite variety of figurative meanings that humans could evoke with such metaphors, let alone the emotive mind-body states that metaphors evoke in fellow communicators.

Conclusion

In my characterisation of the evolution of human communication and my predictions about he future of human communications I respectively showed that in order to discern future trends we first have look back at how human nonverbal and small-group verbal communication evolved over the past 100,000 years, during humankind's hunter-gather nomadic phase of existence, because the soul of modern humans was formed over aeons by our ancestors' struggles for survival against the elements, against predators and against other hominids.

I showed how in the course of the past 10,000 years new forms of communication periodically emerged in response to greater cultural complexification. I also showed how over the past 100 years electronic communications emerged as a present-day expression of our survival imperative. I showed how in the immediate future mobile communication and computation instruments are set to disappear into our buildings, furniture and clothes because the human soul that evolved over the past 100,000 years is the soul of a nomad. This is evidenced by the fact that humans worldwide use a range of travel metaphors (going online, surfing the web, visiting a website, entering or exiting a database, etc) that together form a generic conceptual metaphor "experiencing something new is moving somewhere."

I showed how the confluence of quantum computing, nanotechnology and cybernetics is leading to the emergence of the new science, neuro-nano-informatics that will cause electronic communication and computing devices to disappear into our bodies-electric. This will initially happen to solve medical problems like quadriplegia, deafness and blindness, but will give rise to cyborgs (neuro-technically enhanced humans) as a social phenomenon towards the last quarter of the 21st century. Round about the same time, or perhaps early in the 22nd century, an advanced form of nano-informatics is predicted to give rise to androids (humanoid robots) in the form of a variety of companion robots. The rise of cyborgs and androids as social phenomena will be motivated by the progressive ageing in affluent human populations in the northern hemisphere, and in response to the collapse of the core family during the 20th century as humankind's primary environment for nurturing and socialising children. The collapse of the core family has already set in motion the reconfiguration of social groups, real and virtual, in western societies. The availability of companion androids as caregivers to the young, the infirm and the lonely will be a natural extension of this process of social reconfiguration that has already begun.

Finally, in spite of unmanned probes to nearby planets at present, the nomadic soul of humans will lead to manned space exploration and interplanetary settlement, complemented by android labour. In my estimation, human-android space exploration will be a defining feature of the 22nd century.

References

Aunger, Richard 2002. *The Electric Meme: The New Theory of How We Think.* (No city of publication stated) The Free Press.

Blakemore, Sarah-Jayne, Joel Winston & Uta Frith 2004. Trends. *Cognitive Sciences* Vol.8 No.5 May 2004.

Boahen, Kwabena 2005. Neuromorphic Microchips. *Scientific American* May 2005.

Collins, Philip G & Phaedon Avouris 2000 Nanotubes for Electronics. *Scientific American,* December 2000.

De Moor, Aldo (n.d.) *Information Tools for Sustainable Development: Enabling Distributed Human Intelligence.* Tilburg: Infolab, Tilburg University, P.O. Box 90153, 5000 LE Tilburg. E-mail: ademoor@kub.nl.

Drexler, Eric K 2001. Machine-Phase Nanotechnology. *Scientific American,* September 2001.

Fairley, Peter 2004. Solar-cell Rollout. *MIT's Technology Review,* July/ August 2004: Cambridge, Massachusetts. Part of the Zinio Reader e-Magazine range, available www.technologyreview.com.

Fang, Irving 1997. *A History of Mass Communication: Six Information Revolutions.* Johannesburg: Focal Press.

Fauconnier, Gilles & Mark Turner 2002. *The Way We Think.* Basic Books.

Givens, DB 2000. *The Nonverbal Dictionary of Gestures, Signs and Body Language Cues.* Washington: Center for Nonverbal Studies.

Hall, Rich & Diane Dumas 2004. i-mate Windows Mobile Phone Edition and Smartphone 2003. In *Pocket PC,* August/ September 2004. Fairfield, Los Angeles: Thaddeus Computing, Publisher.

Hand, Kevin 2004. World without Wires. *Newsweek* June 7/ June 14 2004, West 57th Street: New York.

Hutcheson, Dan G 2004. The First Nanochips. *Scientific American,* September 2004.

Kandemeer, M, P Banjeree, A Choudhary, J Ramanujam, & N Shenoy 1998. *A Generalized Framework for Global Communication Optimization.* PDF File. Northwestern University.

Kennedey, Ken & Nenad Nevakovic 1994. Combining Dependence and Data Flow Analysis to Optimize Communication. Center for Research on Parallel Computation, Department of Computer Science, Rice University.

Klopper, Rembrandt 2002. eCommunication and the Theory of the Optimisation of Human Communication. *Alternation* 9,2 (2002) 277 – 298.

Klopper, Rembrandt 2003. Yesterday is another country. *Alternation* 10,2 (2003) 288 – 323.

Lakoff, George & Mark Turner 1980. *Metaphors We Live By.* Chicago: The University of Chicago Press.

Lakoff, George & Mark Turner 1999. *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought.* Chicago: The University of Chicago Press.

Lieber, Charles M 2001. The Incredible Shrinking Circuit. *Scientific American,* September 2001.

Mann, Steve & Hal Niedzviecki 2002. *Cyborg: Digital Destiny and Human Possibility in the Age of the Wearable Computer.* Anchor Canada.

Mishra, Raja 2004. Implant Could Free Power of Thought for the Paralyzed" *Boston Globe,* 9 October 2004.

Östling, Erik. 2004. Wearable Robots. *MIT's Technology Review,* July/ August 2004: Cambridge, Massachusetts. Part of the Zinio Reader e-Magazine range www.technologyreview.com.

Philipkoski, Kristen 2005. Patients Put on Thinking Caps. *Wired News* http://www.wired.com/news/medtech/0,1286, 66259,00.html. Accessed on 14 January 2005, 02:00 CAT.

Pollack, Andrew 2004. Brain implants enabled by thought. *Biomed* http://www.biomed.drexel.edu/new04/. Accessed on Sunday 11 July 2004 at 7:35 CAT.

Rugbeer, H 2001. *Communicating by Ordering Electrons: The Development of Electronic Communication as Part of a Secondary School Communication Science Curriculum in the Language, Literacy and Communication Learning Area.* Unpublished *cum laude* Masters Dissertation, Department of Communication Science, University of Zululand (Durban Campus).

Rugbeer, Y 2001. *A Meeting of Minds: Direct Small Group Communication and Public Communication as Part of a Communication Science Curriculum in Senior Phase Classrooms.* Unpublished *cum laude* Masters Dissertation, Department of Communication Science, University of Zululand (Durban Campus).

Smith, FH & F Spencer (editors) 1984. *The Origins of Modern Humans: A World Survey of the Fossil Evidence.* New York: Liss Publishers.

Stein, E Barry & Meredith MA 1993. *The Merging of the Senses.* United States of America, Massachusetts Institute of Technology.

Stix, Gary 1994. Trends in Nanotechnology: Waiting for Breakthroughs. In *Scientific American,* April 1994.

Stringer, C and R McKie 1996. *African Exodus: The Origins of Modern Humanity.* London: Cape.

Tambini, Michael 2002. *Eyewitness Future.* London and New York: Dorling Kindersley.

Toffler, Alvin & Heidi Toffler 1995. *War and Anti-War* (No city of publication stated). Mass Market Paperback.

Toffler, Alvin 1978/1991. *Future Shock* (No city of publication stated). Bantam Books.

Toffler, Alvin 1991a. *Powershift: Knowledge, Wealth, and Violence at the Edge of the 21st Century.* London: Pan Books.

Toffler, Alvin 1991b. *The Third Wave.* London: Pan Books.

Toffler, Alvin 1999. *Rethinking the Future: Rethinking Business, Principles, Competition, Control and Complexity, Leadership, Markets and the World.* Yarmouth, Maine: Nicholas Brealey.

Unauthored News Report 2005. Matthew Nagle Is the First Person to Receive a Brain Implant that Reads His Thoughts. *NewsTarget.com.* Friday, April 01, 2005.

Vorenberg, Sue 2003. Excuse Me, But I Have to Answer My Shirt: Santa Fe Company Develops a "Smart Thread" that Might Turn Clothing into a Medical Monitor, Tracking Device or Cell Phone. *ABQTRIM.COM News* (The Albuquerque Tribune) http://www.abqtrib.com/archives/ news02/ 080202newsthread. shtml. Accessed on 23 November 2003 at 21:15 CAT.

Warner Jennifer 2004. Brain Implants Move at the Speed of Thought. WebMD http://my.webmd.com/content/Article/ 85/98694.htm. Accessed on Sunday 11 July 2004 at 7:22 CAT.)

Whitesides George M & J Christopher Love 2001 The Art of Building Small. *Scientific American,* September 2001.

Whitesides, George M 2001. The Once and Future Nanomachine. *Scientific American,* September 2001.

Whiting, Lloyd Harrison. 2002. *The Complete Universe of Memes: Branches of Reality on the Reality Tree.* San Jose: Writers Club Press.

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Factors that Influence Online Shopping Behaviour

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Abstract

Online shopping has increased dramatically as marketers have taken advantage of opportunities presented by the Internet. However, in spite of significant potential benefits, many of these Internet efforts have failed. Nevertheless industry watchers advocate there is still hope for e-commerce in South Africa. Because the behaviour of consumers is intrinsic to the success or failure of an e-commerce website, the purpose of this study was therefore to establish, by means of quantitative analysis, the online buying behaviour of South African consumers.

The results of the study indicated that 34% of web users shopped online. The study was conducted in September 2003 on a convenience sample of selected MBA students. The results further revealed that of these relatively young, busy, working, elite people, who constituted the entire sample, those 34% who did buy online strongly valued all matters of convenience provided by online purchasing. However, another group within the same sample, exhibiting the profile of the typical South African online shopper, was significantly deterred from purchasing online, mainly due to inadequate security online, and web site difficulties.

Recommendations for online marketers, policy-makers and media owners are suggested.

1 Overview

1.1 Background

The Internet is set to change the way in which many companies conduct business. Having an online presence does more for a trader than just selling goods over the Internet. It also serves as a customer service and marketing tool (Burrows 2001).

Amongst the significant benefits offered by the Internet, Chronis (2001) advocates that online marketing enables a company to reach diverse target consumers ranging from a mass audience to a specific, demographically targeted audience. Furthermore, following the Internet's ability to capture user data, segmented marketing is easily and cost-effectively facilitated. Information can be quickly and easily gathered from potential customers resulting in faster lead times. Interaction with customers and immediate ordering online is possible, while far more extensive advertising coverage can be achieved for a relatively small outlay (Rowley 1996). For the consumers, the Internet makes it easy to buy online and provides a convenient buying method (Procter 2000a). Customers have access to a broader and deeper product selection and a greater variety of stores, prices are possibly lower resulting from lower overhead, and the Internet is fun (Abramson and Hollingshead 2000).

Internet marketing endeavours for many companies have nevertheless failed, in spite of all the evidence of steady increase in online shopping and the significant benefits that are to be gained by companies, (Kenny and Marshall 2000). Following their first-world counterparts, South African companies have also adopted the web as a marketing medium, although South Africa is lagging in technology. It is therefore apparent that an investigation of consumer online buying is necessary to enable South African companies to optimise use of their web sites, and realise the benefits of online trading.

1.2 Rationale

In South Africa, online shopping is showing definite growth as South Africans are growing increasingly confident about shopping on the Internet (Burrows 2001; Procter 2000). Webchek's November 2000 study conducted on a random sample of Web users living in Gauteng, Cape Town and Durban, revealed that the trend towards online shopping is growing (Proctor 2000). According to the study, 31% of South African web users shopped online in 2000. This indicates an increase from 25% in March 1999 (Procter 2000a). In keeping with this steady increase, Webchek's most recent study revealed that the number of South Africans who had shopped online increased to 41% (Webchek 2004). Using the current Internet World Stats figure of 4.78 million Internet users in South Africa, this translates to approximately 1.96 million people who have shopped online (Internet World Stats 2005).

The Webchek November 2000 study went on further to report that, of the people who had shopped online, there had been an increase in the number of people that had shopped more than once from March 1999 to November 2000 to 94%. This translates into a significant increase in the sales generated by online trading.

Given this apparent trend of increased shopping online in South Africa, it is imperative for companies to take heed of using the Web as part of their business strategy. Furthermore, most of the traditional marketing principles will still apply, including the marketing concept, even though the Internet is a relatively new marketing channel (Abramson and Hollingshead 1999). Application of the marketing concept means that merchants must endeavour to perceive things from the perspective of the consumer to be successful. It is the consumers that visit a website who significantly influence the utilisation of and the benefits yielded by the web site. Thus it is imperative to determine the online buying behaviour of South African consumers.

This study is expected to benefit educational institutions in a few ways. Firstly, in the teaching arena, results of the research may contribute to the education of students, who eventually enter industry, by

assisting in updating teaching curricula in areas such as web design, HCI, and e-marketing. Secondly, in the research arena, new studies may be inspired, some of which are described at the end of this paper. These are two academic ways in which this study may benefit educational institutions. However, it must also be noted that these institutions are actually in the business of selling education, and must therefore, as business enterprises, have marketing plans. Hence, thirdly, the results of this research may also give academic institutions insight into employing their web sites to add value to the services they render to their existing and potential customers, who are their students.

This study is also expected to benefit various other parties. Marketers may be able to increase sales by first understanding the buying behaviour of the 25-34 year old category of consumers provided by this study and then refining their online marketing strategies accordingly. Marketers and IT consultants may be able to adapt their web site designs by taking into cognisance the results of this study to facilitate better and easier web usage by the sample population, which may then increase traffic and sales on the web site. Policy-makers bodies will be made aware of different communications interactions between seller and consumer online in order to help put relevant regulations into place. Consumers will be made aware of what is being offered by online trading and may be encouraged to increase use of the online shopping facility.

1.3 *Problem Statement and Research Objectives*

In response to the opportunity presented by the Internet, many companies adopted web sites as part of their marketing efforts, and online shopping has increased. However, in spite of significant potential benefits, many of these Internet efforts have failed. The purpose of this study was therefore to determine the online buying behaviour of South African consumers with a view to help traders to harness e-business potential advantages. The scope of this study was restricted to a quantitative analysis of selected South African Internet users.

In particular, the study was conducted based on the following research objectives.

- To investigate the online buying traits of South African Internet users (i.e. products purchased, how often purchased, from where access to the Internet was obtained)
- To identify the online retail sites that they bought from
- To investigate demographic factors (LSM, age, income) of these Internet users
- To investigate demographic factors (LSM, age, income) of Internet users who purchase online
- To determine reasons why these consumers buy online
- To determine reasons why Internet users do not buy online
- To determine the perceptions of South African Internet users towards online purchasing.

2 Literature Review

Trends on the new medium of communication, the Internet, are fast and increasing, not only in the nature of communication but also in the nature of products, and the delivery of them. Indeed all four factors of the marketing mix, the four 'P's being product, price, place, and promotion defined by Kotler (2003), are influenced. Marketers such as Kotler (2003) and Abramson *et al.* (1999) indicate that traditionally, the first task in developing a marketing mix is to define the target market to be able to delineate a category of consumer wants and needs that must be satisfied.

Thus this literature review goes on to describe the online shopper, followed by an examination of various factors that influence consumers to purchase online, as well as an examination of those factors that dissuade online purchasing.

2.1 The Online Consumer

According to Abramson and Hollingshead (1999), when marketing to consumers on the Internet, the most important characteristic of the targeted consumer group is that they are people who are connected to the Internet. In terms of demographical information, they tend to be younger with above average education and income. They receive product information from each other or from narrowly focused publications.

These demographics were similar to that of Project SA Web User 2001, a tracking study that was conducted annually from 1999 to 2001 on South African online consumers by Webchek, a South African research company. The study revealed that, although online shoppers were skewed toward males, the gap between males and females was closing. Furthermore, online consumers tended to be between the ages of 25 and 34, English-speaking, had university degrees, were self-employed rather than full-time/part-time workers and those not working. These figures were from the study conducted in November 2001 (Webchek 2001), and were confirmed by Webchek's November 2004 study to still hold true (Webchek 2004).

2.2 Factors Influencing Consumers to Purchase Online

Advantages enjoyed by consumers who buy online are the significant convenience, being able to conduct a wider information search, being able to make a broader product selection, buying at better prices, and having fun shopping experiences(www.gctech.net/articles/ shopping/guide/index.html).

Kotler (2003) and Abramson and Hollingshead (1999) advocate that consumers shop online because it is convenient in terms of being quick and easy to shop and to make product and price comparisons 24/7 from wherever they are. Customers can order products twenty-four hours a day wherever they are, and do not have to walk through countless aisles to find and examine goods (Kotler 2003; Strauss *et al.* 2003).

According to Evans and Wurster (1999), millions of people exchange massive amounts of information directly, quickly, and for free. This search for information is one of the fundamental steps in the consumer's distinctive decision-making process (Hoyer and MacInnis 2001; Schiffman and Kanuk 1997). Consumers can search much more comprehensively and at negligible cost. Furthermore, Abramson and Hollingshead (1999) indicate that consumers will benefit from the Internet by having access to a broader and deeper product selection and to a greater variety of stores.

Prices for goods on the Internet may be relatively low for various reasons. For example, the overhead cost of maintaining a web site is much less than that of a regular retail outlet, yielding a cost saving which may be passed on to the consumer (Abramson and Hollingshead 1999). Prices are driven down by a larger number of competing stores, since the Internet closes the geographical distance of physical stores (Strauss *et al.* 2003).

Abramson and Hollingshead (1999) state that consumers who buy online, do so because of the novel and fun experience of it. It is a relatively new, innovative way of shopping that distinguishes online shoppers from regular shoppers.

2.3 Factors Discouraging Consumer Online Purchasing

Although the Internet offers many benefits for consumers to purchase online, as discussed above, there are also factors, which deter consumers from buying online. These are identified as poor security online, the influence of inadequate web design and technology, delayed delivery of products ordered, no product sampling, and dealing with unknown merchants.

Security online is significantly an ongoing issue concerning online merchants for several reasons. Consumers have concerns about providing credit card numbers online due to unauthorised use thereof, hackers and viruses (Kunkel 2003). They are also concerned that online vendors may not satisfactorily deliver the goods ordered or that

the merchandise may be inferior, incorrectly selected, or may never arrive (Abramson and Hollingshead 1999).

Consumers frequently have difficulties using web applications (Hager *et al.* 1999). It is often difficult to find a desired item or difficult to move between successive phases of a transaction; or it just takes much longer than a similar transaction by using the telephone.

Abramson and Hollingshead (1999) draw attention to other influences that dissuade consumers from buying online. The time lag between consumers making the purchase by conducting the transaction and the final delivery of the goods can be too long. Another problem is that consumers are unable to examine or sample the product to make sure that they are satisfied with what they will get for the purchase. Consumers are also hesitant to buy online because of the risk of dealing with unknown and possibly unreliable merchants.

2.4 *Summary of Literature Review*

More consumers are going to use the Internet in the future for shopping (Abramson and Hollingshead 1999). Moreover, consumers will patronise suppliers who provide more benefits than deterrents in the shopping experience. Thus the above literature review highlights the profile of the online consumer, various factors that influence consumers to purchase online, and those factors that dissuade online purchasing. However, these factors are characteristic of primarily American consumers, which means that the question still remains as to what influences the South African consumer to buy online. This was the question that this study attempted to answer.

3 Research Methodology

The empirical investigation of this study focused on the online buying behaviour of South African Internet users in particular, with the aim of determining the reasons that have encouraged them to do so, and those factors that have discouraged web users from making online purchases. It also attempted to establish the attitudes of South African Internet users toward online buying.

3.1 *The Sampling Procedure*

The sampling frame used comprised all the MBA students in the first year of study at the Graduate School of Business at the former University of Natal, Durban in September 2003, and comprised a total of 218 students, 80 of which constituted the sample measured. The sample was selected by using a non-probability convenience sampling technique.

The selected sample appeared to fit the profile of South African web users as determined by the studies conducted by Webchek (2001, 2004). They were of the desired age group, were working business people, who could be assumed to be reasonably computer literate, who had Internet access at least from university as students, and potentially also at work, and held at least undergraduate degrees. Thus the sample was deemed to be suitable for this study.

3.2 *Data Collection and Analysis*

A self-administered questionnaire, comprising mainly closed-ended questions and a few open-ended questions, was used as the measuring instrument to collect the data. The questionnaire design was intended to yield nominal and ordinal data to facilitate quantitative analysis, which was accomplished by making use of descriptive and multivariate techniques computed by using SPSS software. In particular, the techniques used included frequency distributions, cross-tabulations, and factor analysis.

3.3 *Validity and Reliability*

Validity was established by expert opinion that the questionnaire for the present study had a high degree of content validity, and was pretested to ensure that it measured what it was supposed to measure.

The study was measured for reliability in order to determine if the results of the present study were comparable to those resulting from similar studies conducted by Webchek in 1999, 2000, 2001 and 2004 (Webchek 2001, Webchek 2004). According to the Webchek study, 31% of South African Internet users purchased online in 2000, whilst

the present study revealed that 34% of the respondents made online purchases. Because of this similarity in results, the present study was deemed to contain reliability to a certain extent. Reliability testing was also done for inter-item internal consistency for factors that influenced decisions to buy online, factors that deterred consumers from buying online and perceptions of consumers towards online buying. Results of the tests revealed very high alpha and Spearman-Brown reliability coefficients.

4 Findings

The findings of the statistical data analysis in respect of the buying traits of those who have purchased online, factors that influenced their online purchasing, factors that discouraged their online purchasing, and the perceptions of Internet users toward online purchasing, are discussed below.

4.1 *Online Buying Traits*

Reasons for using the Internet, points where access to the Internet was obtained, and the products that were bought online were analysed by frequency distributions, as illustrated in Table 4.1. Results of the study showed that the main reason for the respondents using the Internet was to search for information on a particular topic of interest (85% response rate). Other significant reasons included work-related reasons (56%), surfing the Internet for pleasure or recreation (55%), and to a lesser extent, gathering information on products and services (49%).

Table 4.1: Purposes for Using the Internet (n=80)

Purpose	No. of Respondents	% of Respondents
To search for information (investigation, research or work)	68	85
For work reasons	45	56
To surf the net (for leisure or recreation)	44	55
To gather information on products (i.e. goods and services)	39	49
For social reasons (e.g. communications)	32	40
To purchase goods and/or services	19	23

These identified reasons for using the Internet appeared to be in keeping with the points from where the respondents had Internet access. Seventy five percent of these respondents had access to the Internet from work, whilst 48% had personal computer access from their homes, as illustrated in Table 4.2. Furthermore, 65% of the respondents accessed the Internet every day, whilst 26% of them accessed the Internet weekly.

Table 4.2: Access Points to the Internet (n=80)

Point of Access to Internet	No. of Respondents	% of Respondents
Work	60	75
Personal computer at home	38	48
Internet café	11	14
Friend/Neighbour/Relative	4	5.0
Other	0	0.0

It appeared that these respondents were busy working people who frequently accessed the Internet, mainly to look for information on various matters. Thus it seemed reasonable to assume that these people would value convenience, as it would assist them in making their busy lives easier. This assumption was confirmed by the factor analysis of variables that influenced online shopping discussed in section 4.2. That the respondents value convenience highly was also confirmed by the factor analysis of the respondents' perceptions about online shopping as discussed in section 4.4, where respondents noted the significance of online shopping as providing a means of easier and low-effort buying. For traders, this means that any way in which they can improve the convenience of the online shopping experience is likely to increase online buying, and consequently turnover.

Respondents were also asked by means of an open-ended question to indicate which shopping web sites they visited. The results, represented in Table 4.3, showed that the most commonly visited site, having a frequency of 6, was Kalahari.net, an online media mall selling products such as books, videos, DVDs, gaming and music. Other frequently visited sites were Amazon.com, selling mainly books; Pick 'n Pay, selling groceries; and Kulula.com which allows consumers to

make reservations and buy airline tickets. ABSA, which provides banking services, and Amway, which sells home products, followed with 2 visits each. A variety of 25 other sites had a frequency of only 1, and is not indicated in Table 4.3. On the whole, only 34% of the respondents visited shopping sites on the Internet.

Table 4.3: Shopping Web Sites Visited (n=80)

Shopping Web sites Visited	No. of Respondents
Kalahari.net	6
Amazon.com	5
Pick n' Pay	4
Kulula.com	4
ABSA	2
Amway	2

Results of the study showed that the most frequently purchased items were entertainment including music, videos, books, and travel bookings. It also suggested that the respondents had not visited a web site unless they intended to purchase from it, and did little or no "window shopping". One reason for this could have been that consumers were still reluctant to purchase online, as indicated in section 4.3 below. Another reason could have been that web sites had not been advertised enough and were difficult to find.

On examining the various web sites visited, groceries were also found to be a relatively frequently purchased item. It is worth noting that these are items that do not require sampling before purchase, and are likely to be known items and/or brands. This is a significant point as further analysis in the present study conducted on factors determined to be potential deterrents from online purchasing showed that one of these deterrents was that online shoppers were not able to sample items before making a purchase - hence they bought known items and brands online.

4.2 Factors Encouraging Online Buying

Factors identified by the literature review as potential variables influencing consumers to purchase online, together with additional factors identified by the researchers, depicted in Table 4.4, were statistically examined by means of factor analysis.

Table 4.4: Factors Encouraging Online Purchases

- Buying online saves time
- Buying online is convenient (no traffic/crowds/parking/24-hour access)
- Buying online offers anonymity
- Prices are cheaper online
- Items purchased online are delivered
- There is a greater selection of products to choose from online
- Products not available or scarce in South Africa can be bought online
- Buying online offers a greater variety of stores to buy from
- Buying online allows one to rapidly survey a wide range of options
- Buying online is a fun and/or novel experience
- My children influenced me to purchase online

The Keiser-Meyer-Olkin (KMO) measure of sampling adequacy, an index used to examine the appropriateness of factor analysis (Malhotra 1993), yielded a value of 0.534, suggesting that factor analysis was useful for those variables identified in Table 4.4. The method used for initial extraction of the factors was principal components analysis, which resulted in a relatively high percentage (67%) of the total variance explained. As suggested by Kinnear and Taylor (1991), the initial extracted solution was then rotated to yield a solution that was more amenable to interpretation by using both the Varimax and Equimax rotational methods.

Table 4.5: Interpretation of Rotated Factor Loading Scores for Factors Influencing Online Purchases (n=27)

Factor A (Shopping Convenience)		
Influencing Factor	Varimax	Equimax
Saves time	.897	.897
Rapidly survey many options	.890	.888
Convenient (parking/traffic/crowds/24hours)	.774	.768
Fun and novel experience	.626	.616
Greater variety of stores	.596	.592

Factor B (Better Product Selection)		
Influencing Factor	Varimax	Equimax
Cheaper prices	.809	.807
Scarce products are available	.795	.794
Greater selection of products	.785	.783

Factor C (Useful Delivery Mode)		
Influencing Factor	Varimax	Equimax
Anonymity	.821	.822
Influenced by children	.683	.688
Goods are delivered	.437	407

Of the eleven factors that were investigated, three underlying factors emerged, namely shopping convenience, better product selection and useful delivery mode, as depicted in Table 4.5. The first factor included variables such as timesaving, the ability to survey many options quickly, no parking, traffic or crowd problems, whilst being able to shop twenty-four hours daily, and the ability to shop at a greater number of stores. This shopping convenience factor explained almost half (44%) of the explained variance, making it the most significant factor that influenced the respondents to purchase online. This suggests that any manner, in which the trader makes the online shopping experience more convenient for the consumer, is likely to yield more sales. The second factor included variables such as the benefit of cheaper product prices online, the ability to source scarce or locally unavailable prod-

ucts online, and the availability of a broader range of products to choose from. This factor explained one third of the explained variance, and is therefore also fairly significant in encouraging the respondents to purchase online. The third factor included variables such as the consumer taking delivery of the goods whilst retaining his/her anonymity, and the convenience of the goods being delivered. This factor explained 23% of the variance.

4.3   *Factors Discouraging Online Buying*

Factors identified by the literature review as potential variables discouraging consumers from purchasing online, together with additional factors identified by the researchers, depicted in Table 4.6, were statistically examined by means of factor analysis.

Table 4.6: Factors Discouraging Online Purchases

> - There is a long time delay between placing an order and delivery of the item
> - The item cannot be examined or sampled before purchase
> - There is a risk of dealing with potentially unreliable or phantom merchants
> - The atmosphere and ambience of the traditional shopping experience is lacking
> - Web page is not user-friendly (easy to use)
> - Slow loading web pages
> - Computer and/or technical malfunctions
> - Difficulty in finding shopping web sites and what products are for sale online
> - Poor and/or lacking customer service
> - Unable to communicate personally with a customer support representative
> - Shipping and handling charges are expensive
> - Merchandise may be of inferior quality
> - Merchandise may be the wrong items
> - Merchandise may be not delivered at all
> - Payment facilities are difficult to use
> - Too much personal information is asked to make a purchase
> - No confidence in the security of confidential information
> - Concern over potential misuse of credit card

After using both the Varimax and Equimax rotational methods, five underlying factors emerged as those discouraging online purchases, namely inadequate security, web site difficulties, problematic product deliveries, inadequate personal attention, and a lack of store atmosphere, as depicted in Table 4.7. Of these, the two most significant influences were identified as inadequate security, and web site difficulties. Inadequate security, accounting for 23% of the total variance explained, included variables such as concern over misuse of credit cards, no confidence in the security of confidential information, the risk of dealing with unreliable or fictitious merchants, and too much personal information being asked for in order to make a purchase. Web site difficulties included factors such as web pages taking too long to load, computer errors and malfunctions, and web pages not being designed to be user-friendly. This factor accounted for 23% of the total explained variance.

Table 4.7:   Interpretation of Rotated Factor Loading Scores for Factors Discouraging Online Purchases (n=80)

FACTOR A (Inadequate Security)		
Discouraging Variable	Varimax	Equimax
Concern over misuse of credit card	.890	.888
No confidence in security of confidential information	.863	.858
Risk of dealing with unreliable or ghost merchants	.785	.772
Too much personal information required for purchase	.598	.590
FACTOR B (Web Site Difficulties)		
Discouraging Variable	Varimax	Equimax
Slow loading web pages	.880	.867
Computer and/or technical malfunctions	.870	.858
Web page is not user-friendly (easy to use)	.674	.616
Difficulty in finding shopping web sites and products	.611	.598
Time delay between placing order and delivery	.572	.580
FACTOR C (Problematic Product Deliveries)		
Discouraging Variable	Varimax	Equimax
Goods delivered may be wrong items	.826	.809

Goods ordered may not be delivered	.754	.752
Payment facilities are difficult to use	.743	.726
Goods delivered may be of inferior quality	.636	.607
Shipping and handling charges are expensive	.435	.411

FACTOR D (Inadequate Personal Attention)		
Discouraging Variable	Varimax	Equimax
Inability to communicate personally with a customer support representative	.847	.833
Poor or lacking customer service	.798	.830
Item cannot be examined or sampled before purchase	.561	.570

FACTOR E (Lacking Store Atmosphere)		
Discouraging Variable	Varimax	Equimax
Atmosphere and ambience of traditional shopping experience is lacking	.866	.896

4.4 *Perceptions of Internet Users toward Online Buying*

Factors identified in the literature review relating to perceptions of Internet users toward online purchasing, depicted in Table 4.8, were investigated by factor analysis in order to establish whether there were any underlying perceptions amongst those identified.

Table 4.8: Perceptions of Consumers towards Online Purchases

- It is easier to search for information online than to sift through magazines and books.
- It is easier and more convenient to acquire services (e.g. banking) online rather than standing in long queues.
- It would be much easier to sit to order items online than go to the shops.
- I obtain valuable information about day-to-day issues on the Internet.
- I prefer to shop online from known retailers than to buy from 'new agents' or 'unknown agents'.
- I prefer to buy well-known brands online rather than buy new or unfamiliar brands that are equally priced.
- I prefer to buy well-known brands online rather than buy new or unfamiliar brands that are offered at a better deal.

- If I see a special offer for a popular brand online, I would purchase it online immediately instead of going to the shops physically.

The KMO measure of sampling adequacy yielded a relatively high value of 0.768, suggesting that factor analysis was appropriate for those variables identified in Table 4.8. Furthermore, the principal components analysis used for initial extraction of the factors also yielded a moderately high percentage of 66% of the total variance in the data being explained.

Table 4.9: Interpretation of Rotated Factor Loading Scores for Perceptions of Consumers towards Online Purchases (n=80)

FACTOR A (Product and Store Brand Loyalty)		
Perception Variable	Varimax	Equimax
Prefer to buy well known brands online rather than buy new or unfamiliar brands which are offered at a better deal	.912	.912
Prefer to shop online from known retailers than to buy from 'new agents' or 'unknown agents'	.843	.843
Prefer to buy well known brands online rather than buy new or unfamiliar brands which are equally priced	.842	.842
Would purchase a popular brand online at a special offer online immediately instead of physically going to the shops for it	.555	.555

FACTOR B (Reduced-Effort Shopping)		
Perception Variable	Varimax	Equimax
Would be much easier to sit to order items online than to go to the shops	.846	.846
Is easier to search for information online than to sift through magazines and books	.845	.845
Is easier and more convenient to acquire services (e.g. banking) online rather than standing in long queues	.830	.830
Obtain valuable information about day to day issues on the Internet	.503	.503

From the analysis, two underlying perceptions emerged, namely product and store brand loyalty, and reduced effort shopping, both of which about equally explained the variance and are depicted in Table 4.9. Regarding the first factor, respondents indicated that they preferred to purchase known brands from known merchants even if other brands of similar items were offered at lower prices. Regarding reduced effort in shopping, respondents perceived it being much easier to order items online than to go to the shops, being easier to search for information online than to sift through magazines and books, being easier and more convenient to acquire services such as banking online rather than standing in long queues, and being able to obtain valuable information about day to day issues on the Internet. It is worthy to note that of these perceptions, product and store brand loyalty reduces the deterrent identified as inadequate security, whilst the perception of reduced-effort shopping is an embodiment of the convenience of online shopping: a factor identified as strongly influencing consumers to buy online.

5 Recommendations for Online Marketers

From the preceding analysis, it is clear that web site security is the main factor that deterred the target consumers from purchasing on the Internet. This concern was shared by both existing and potential online consumers. Presently, there are organisations that are implementing security mechanisms in an attempt to protect consumers who engage in online shopping. Some of these organisations are VeriSign, SecuGen, Veridicom, TRUSTe, econsumer.gov and Better Business Bureau Online. These organisations implement their own various codes of conduct for their own participating members who trade on the Internet.

Taking into account that the world is fast becoming a small global village, it is suggested that all these organisations be merged into a single international agency that enforces a universally known and accepted code of practice for online consumer protection; a code that

consumers will understand and trust. Many consumers lack the time to study privacy policies of Internet marketers, and some do not know how to evaluate an Internet site for security. Thus, consumer protection for online shoppers needs to move towards global standardisation. This could be a function for a UN agency or a private enterprise consortium. In the meanwhile however, every online marketer should be a member of at least one relevant online consumer protection organisation and should display that affiliation conspicuously on their web sites.

Furthermore, media owners have a responsibility to educate consumers on online shopping security issues. Any medium that includes advertising relating to online shopping should conspicuously provide online shopping security guidelines. This is an issue that policymakers could consider for protection of consumer rights.

Regarding the second major concern identified in this study, namely that consumers experience web site difficulties, it is recommended that online marketers conduct market research amongst their online consumers to gain feedback about usability of their web sites. Providing an opportunity on the web site for consumer feedback is useful, but cannot be deemed sufficient because some consumers are not inclined to comment unless they are specifically asked to do so. Hence formal market research is recommended.

Online marketers should also be aware that there exist numerous web sites, such as http://www.website-awards.net/howtowin.htm, that monitor and present awards in recognition of consumer-friendly web sites. These award-givers not only identify criteria that make web sites attractive to consumers, but also make available articles on how to design a good web site. Such criteria should be incorporated by online marketers in their web site design.

6 Conclusion

The results of this study showed that the online buying behaviour of the sample population investigated closely resembled the profile illus-

trated by the literature review. The overwhelming factor that influenced consumers to buy online was identified as significant convenience benefits. Furthermore, only one third of the respondents had made online purchases.

The study also revealed that the sample of Internet users were relatively young, elite, working adults who strongly valued every convenience provided by online purchasing. These demographics were found to be true of the entire sample population as well as of those who bought online. Thus they delimit the target market whose wants and needs merchandisers need to satisfy in order to capitalise on opportunities presented by online trading.

It notably emerged that there yet remains a significant group within this target market, who, despite the valuable conveniences of online shopping, are nevertheless strongly deterred from buying online, mainly due to negative perceptions of inadequate security online, and web site difficulties. Thus it is apparent that merchandisers need to intensify and capitalise on the factors influencing consumers to buy online, especially that of convenience. Furthermore, they need to institute ways to overcome the deterrents, particularly security concerns, that discourage other consumers from buying online, and convert them into online buyers.

7 Recommendations for Further Research

It is apparent that other research in the area of the present study can be undertaken. Firstly, it follows that further research could investigate what would convert non-buyers, especially those who display the profile of the buyers, into buyers online. Secondly, it could be investigated why only the high-income earners buy online, given that shoppers buy online for better prices. What will make the lower income market buy online? Thirdly, further research could investigate whether more computer literacy at the school level of the youth would lead to more Internet usage, and consequently more online purchasing. What are the perceptions of the youth, i.e. future buyers, about online buying? Fourthly, given that the constitutional mandate of the country

is to provide socio-economic rights including telecommunications infrastructure, it is suggested that this study be conducted again in the future to determine whether online purchasing has improved and the possible reasons for it.

8 References

Abramson, J & C Hollingshead 1999. Marketing on the Internet – Providing Customer Satisfaction. *Marketing Mix*. August1999.

Burrows, T 2001. Online Shopping Still Has a Future in SA, Say Retailers. *ITWeb*. 2 November 2001.

Chronis, M 2001. Cyber-media. *Advantage*. October 2001.

Evans, P & Wurster, TS 1999. Getting Real about Virtual Commerce. *Harvard Business Review*. Nov-Dec. Vol. 77 Issue 6 p85.

Hager, D, C Kibler & L Zack, 1999. The Basics of User-Friendly Web Design. *Journal for Quality and Participation*. May/June1999. Vol.22 Issue 3. P58.

How to Win Awards 2005. http://www.website-awards.net/howtowin.htm [Last accessed on 12 September 2005]

Hoyer, WD & DJ MacInnis 2000. *Consumer Behaviour*. United States of America: Houghton Mifflin Company.

Internet World Stats: Usage and Population Statistics 2005. http://www.internetworldstats.com/af/za.htm [last accessed on 12 September 2005]

Kenny, D & JF Marshall 2000. Contextual Marketing – The Real Business of the Internet. *Harvard Business Review*. November-December.

Kinnear, TC & JR Taylor 1991. *Marketing Research – An Applied Approach*. Singapore: McGraw, Inc.

Kotler, P 2003. *Marketing Management*. Eleventh Edition. New Jersey: Prentice Hall.

Kotler, P & G Armstrong 2004. *Principles of Marketing*. Tenth Edition. New Jersey: Pearson Education, Inc.

Kunkel, J 2003. Reducing Risk, Maximising Return in Online Retailing. *Chain Store Age*. September 2003. Issue 9 p3.

Malhotra, NK 1993. *Marketing Research – An Applied Orientation*. New Jersey: Prentice-Hall, Inc.

Procter, K 2000. How Can We Target SA Web Users – Market Related Findings. *Webchek*,
http://www.webchek.co.za/library_media.html
[Last accessed on 13 August 2003]

Procter, K 2000a. Is online shopping growing in popularity in South Africa? *Webchek*,
http://www.webchek.co.za/library_shopping.html [last accessed on 13 August 2003]

Rowley, J 1996. Retailing and Shopping on the Internet. *International Journal of Retail and Distribution Management*. Vol. 24 Number 3.

Schiffman, LG & LL Kanuk 1997. *Consumer Behaviour*. New Jersey: Prentice-Hall, Inc.

South African Institute of Race Relations 2003. *Fast Facts*. No. 9 p3.

South Africa Survey 2002/2003. p423.

Strauss, J, R Frost & A El-Ansary 2003. *E-Marketing*. Third Edition. New Jersey: Prentice-Hall, Inc.

The GCTech.net Guide to Online Shopping.
www.gctech.net/articles/shopping/guide/index.html [Last accessed on 10 September 2005]

Webchek 2001. What is Holding Internet Growth in South Africa.
www.webcheck.co.za/library_holdback.html
[Last accessed on 13 August 2003]

Webchek 2004. Online Shopping Trends – October 2004.
www.webcheck.co.za/library_holdback.html
[Last accessed on 12 September 2005]

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Ethical Decision-Making Skills for Responsible Citizens of Cyberspace: Quo Vadis?

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Abstract

Apart from being able to identify ethical problems, computing professionals need to be able to analyse ethical problems that arise in the computing context in general, and also in the development of software artefacts for solving real problems in particular. Furthermore, they should have the knowledge and skills to decide on ethical courses of action in resolving such problems. This paper focuses on such ethical decision making skills in the context of cyberspace.

1. Introduction

If we agree that computing ethics is that branch of applied philosophy that *"instructs computing specialists on how best to lead their professional lives"* (Lenarcic, 2003), then computing professionals should be equipped with the relevant and appropriate knowledge and skills for this purpose. If we further agree that the computing profession concerns, among others, the development of software artefacts for solving real problems, a mere ethical awareness is not sufficient. Computing professionals need to be able to not only identify ethical problems that arise, but also to analyse them and to decide on ethical courses of action in resolving such problems. This paper focuses on such ethical decision making skills in the context of cyberspace.

In section 2 we provide the context by elaborating on what we mean by *'cyberspace'* and other related terms, on whom the citizens of cyberspace are, and what we mean by the term *'responsible'*. Section 3 concerns a methodology for ethical analysis as well as a number of

relevant and well-known ethical theories, while section 4 focuses on frameworks and procedures for practical ethical decision-making. This is followed by a discussion of two examples. A framework for ethical decision-making is applied to these two examples, one that deals with the analysis of human behaviour particular to the field of computing, while the other deals with an analysis of software agent behaviour. In section 5 we briefly consider possible challenges of the future, in particular the evolution of cyberspace as nanotechnology, ubiquitous computing and ambient intelligence develop, and what this may or would mean in terms of ethical decision-making.

2. The Context

In order to contextualise the subsequent discussion of ethical decision-making skills, the terms occurring in the title, as well as a number of other related concepts, are clarified.

2.1 What is Cyberspace?

The term "cyberspace" was coined by William Gibson in his novel Neuromancer. The *"word Cyberspace is currently used to describe the whole range of information resources available through computer networks"* (Web Hosting Directory, 2005). For the purposes of this paper we thus consider *cyberspace* to be the realm that owes its existence to the global connectivity of networks such as the Internet as well as those global networks constituted by ubiquitous computing technology and devices. Cyberspace is rapidly rendering itself as a central part of early 21st century life.

2.2 Who Are the Citizens of Cyberspace?

In order to explore the implications and consequences of this reality for us as human beings, and as computing professionals in particular, we need to reflect on the entities that populate cyberspace. We distinguish between two classes of citizens of cyberspace, namely *human users* and *software entities*, in particular *software agents,* present in Internet and ubiquitous computing applications. For the purposes of this discussion, we concur with the definition of Fou (2001) that a

software agent is *"a piece of software that has the capacity to autonomously conduct its work."* Such an agent may be autonomous, can act, its actions are specified beforehand, it operates within some environment (in this case cyberspace), and its position within the environment is not necessarily fixed. For a more detailed discussion on this topic, the reader is referred to the exposition of (Smith, Eloff, Venter, Barnard and Pretorius, 2003). Agents form an integral part of cyber society, and as such they interact with one another, as well as with the human citizens of cyberspace (Wagner, 2000). Indeed, we should take clear cognizance of the fact that humans share cyberspace with *software agents*, artificial beings *created by computing professionals*. This means that, apart for the traditional and often expected interaction of human-to-human in cyberspace, software agents deployed in cyberspace now expand the class of entities that can be involved in interactions and, therefore, moral situations (Floridi and Sanders, 2001).

2.3 What is a Responsible Citizen of Cyberspace?

The term *'responsible'* is defined by The Shorter Oxford English Dictionary (1955) as *"answerable or accountable to another for something; morally accountable for one's actions; capable of rational conduct; capable of fulfilling an obligation or trust; reliable or trustworthy"*. The term *'moral'* means *"of or pertaining to the distinction between right and wrong, or good and evil, in relation to actions, volitions or character"* while *'ethics'* is defined as *"the science of morals"*. So, ethics is the *discipline* relating to right and wrong, moral duty and obligation, moral principles and values, and to moral character. Ethics and morality are therefore not synonymous terms, although both refer to customs in their original Greek and Latin respectively (Beck, 2003). The Greek term *'ethics'* also implies character, whereas *'mores'* refers to social customs. We return to this in section 3.1.

In physical space the regulation of our complex society is achieved by various means including ethical, moral and legal systems. The proper functioning of these systems heavily relies on the responsible behaviour of the members of this society. Moreover, in a similar way

the regulation of the equally complex cyberspace society requires regulation, the success of which also relies on the responsible behaviour of its citizens, human and artificial alike.

Tavani (Gruba, 2004) broadens the concept of ethics as defined in The Shorter Oxford English Dictionary (se above) and describes *cyberethics* as the *"study of moral, legal and social issues involving cybertechnology"*, with cybertechnology including the Internet as well as those global networks constituted by ubiquitous computing technology. Moreover,

- privacy,
- property,
- liability,
- security, as well as
- freedom (of choice, speech and values)

constitute the *five ethical dimensions* of cybertechnology, and together characterise the *integrity* of cyberspace (Gruba, 2004; Spinello and Tavani, 2001).

So, in reflecting on what it means to be a responsible citizen of cyberspace, we ultimately need to consider the ethical, moral and legal principles that apply to *both* human *and* software agent activity in cyberspace. A detailed discussion of this falls outside the scope of this paper; see for example (Van der Merwe, Pretorius and Barnard, 2004). What is, however, relevant here, is the multi-faceted role that the computing professional plays in this regard. What exactly is this role and how does it impact on the regulation of cyberspace?

2.4 The Dual Role of the Computing Professional

We may describe the role of computing professionals in the context of cyberspace as that of informed and critical *users* of cybertechnology as it evolves, on the one hand, and as designers, *creators* and developers of this technology and the software agents and applications that populate cyberspace, on the other. This dual role clearly has sig-

nificant implications in terms of the responsibility of computing professionals as citizens of cyberspace. Floridi and Sanders (2003) who use the term *agent* for what we here refer to as the computing professional, furthermore state that *"ethics is not only a question of dealing morally well within a given world. It is also a question of constructing the world, improving its nature and shaping its development in the right way. This proactive approach treats the agent as a world owner, a game designer or referee, a producer of moral goods and evils, a provider, a host, or a creator. ... A mature moral agent is commonly expected to be both a morally good user and a morally good producer of the environment in which she operates."*

Indeed, Lenarcic (2003) goes so far as to say that *"[s]oftware developers in particular potentially wield immense virtual power and should be mindful of their artifacts' long-term consequences."* These important facets of the computing professional's professional life provide the impetus for this, and related research.

2.4.1 Regulating Cyberspace: Ethics, Morality and Law Perspective

Gleason and Friedman (2003) argue that *"the development of particular cyberspatial norms"* will benefit all of the actors involved in online collaboration. They furthermore state that *"efforts should be made to articulate a conceptual model of cyberspace that respects its unique attributes – one that is accessible to both the actors that will take lead organizing and regulating cyberspace, and, more importantly, the citizens of the world who will hold those actors accountable"*. We view the computing professional as playing a leading role in this sense. In this paper we specifically focus on norms for and the ethical behaviour of computing professionals as direct actors, but also indirectly as creators of software agents.

As intimated by Gleason and Friedman (2003), the **actions** performed by both human and software agents within their community, should be constrained in order not to jeopardise the integrity of cyber-

space community. It is thus important that both human and software agents respect these fundamental criteria, namely privacy, property, liability, security, and speech and values.

Successful regulation of cyberspace, as of any system, is largely based on the assumption of individual and collective responsibility and spans the conceptual continuum of personal ethics, public morality and external regulation by means of, among others legislation. One can argue that responsible citizens of cyberspace should act ethically, have high moral values and are law-abiding.

2.4.2 Regulating Cyberspace: Lessig's Perspective

A different, but not unrelated perspective on the regulation of cyberspace is Lessig's paradigm as discussed by Spinello (2003), which distinguishes the following four modalities of regulation of cyberspace, namely:

- law;
- norms;
- the market; and
- architecture (Lessig originally used the term code).

Lessig, as quoted in Spinello (2003), claims that *"the architectures of cyberspace are as important as the law in defining and defeating the liberties of the Net"*. Lessig (1999) is furthermore concerned about the regulative force of architecture (code) because, in his opinion *"while laws are transparent, code is obscure"*. This paradigm puts even more emphasis on the role of code, and therefore on the dual role and responsibility of the computing professional in cyberspace. This affords some priority to the formulation of software development standards for the ethical behaviour of software agents. We argue that, with respect to Lessig's concerns, the formulation of such standards to regulate software agent behaviour is of equal importance to the promulgation of laws to regulate human behaviour. In this respect we have

explored related concerns in (Smith, Eloff, Venter, Barnard and Pretorius, 2003) and proposed an architectural framework to be used by software developers in (Barnard, Cloete and Pretorius, 2004).

Legislation in itself is certainly not sufficient to guarantee acceptable normative behaviour in cyberspace. Lessig (1999) argues that human agents in cyberspace need to demonstrate ethical and moral principles and behaviour if they do not want to compromise their freedom of choice (one of the five ethical dimensions that constitute the integrity of cyberspace, section 2.3). In particular he is concerned that designers of software and hardware might increasingly resort to his modality of architecture for the purposes of regulation, because they do not consider any of the other modalities to be effective (Lessig, 1999).

Recently, Gleason and Friedman (2004) argued that *"[w]ithout a basic framework for understanding, the higher-order process of decision-making becomes difficult – virtue can be threatened by that which we do not understand"*. It is within this context that the computing instructor should not only equip the computing professional of the future with a commensurate level of technological knowledge and understanding of cyberspace, but also with the necessary skills of ethical and moral decision-making in order to ensure the *integrity of cyberspace*. In the following sections we explore some of these skills and frameworks for ethical and moral decision-making.

3. Ethical Decision-Making: Theory

3.1 Background

The discussion of morals is probably as old as language itself. We know that Socrates and Plato, among others, contemplated moral issues and questions at length, but Aristotle was the first to undertake a serious and systematic study of moral principles and employed the term *'ethics'* in his discourse (see, for example Beck, 2003). Aristotle viewed *"ethical theory as a field distinct from the theoretical sciences"*, with a methodology *"that must match its subject matter –*

good action" (Kraut, 2001). In other words, *"[b]ecause ethics is a practical rather than a theoretical science, Aristotle also gave consideration to the aspects of human nature involved in acting and accepting moral responsibility. Moral evaluation of an action presupposes the attribution of responsibility to a human agent"* (Kemerling, 2001).

Summarising, ethics is a practical science concerned with good actions and good actions can only result from good decisions, which, in turn, require systematic evaluation and responsible decision-making. In order to apply this line of reasoning to cyberspace and its citizens, we need to address the questions of:

1. what is *'good'* and

2. how a citizen of cyberspace could arrive at an appropriate *decision*.

3.2 *What Is Good?*

The first question is addressed by briefly discussing some of the better-known ethics theories that may be applied in the analysis of ethical behaviour. In this respect we review the basic principles of two deontological theories, viz. duty-based and rights-based ethics, the teleological theory of utilitarianism (Spinello, 1997), and the theory of just consequentialism (Moor, 2001). Note that these theories need to be discussed in the context of cyberspace.

3.2.1 Duty-Based Ethics Theory

The duty-based ethics of Kant may be summarized as *"the absolute principle of respect for other"* entities (i.e. the citizens of cyberspace) that *"deserve respect because of their rationality and freedom"* (Spinello, 1997: 34). Rananu, Davies and Rogerson (Maner, 2002b) suggest that answers to the following (relevant) questions should be considered with regards to the action of the citizen of cyberspace:

- Fidelity: Is there a promise that should be kept in contemplating or performing some action?

- Reparation: Is there a wrong that should be righted due to the contemplation or performance of said action?

- Justice: Should the outcome of the action be fair?

- Beneficence: Can the lot of others be improved as a result of the contemplation or performance of the action?

- Gratitude: Is an expression of gratitude due to the performance of an action appropriate?

- Non-injury: Can others be protected from injury or harm due to the contemplation or performance of said action?

3.2.2 Rights-Based Ethics Theory

This approach focuses on individual rights and respect for these rights which are equal. According to Spinello (1997: 39) everyone (i.e. all the citizens of cyberspace), *"for example, equally shares in the rights to life and liberty regardless of their nationality or status in society"*. Rananu, Davies and Rogerson (Maner, 2002b) suggest that answers to the following questions should be considered, i.e. is the right of the cybercitizen:

- to know respected?

- to privacy respected?

- to property respected?

3.2.3 Consequence-Based Ethics Theory

Utilitarianism is a widely used form of consequentialism (Spinello, 1997: 27). For the purposes of this paper, we concur with Spinello (1997: 28) that *"utilitarianism is the moral doctrine that an action is morally right if it produces the greatest happiness for the greatest number of"* entities (cybercitizens) *"affected by it"*. One thus needs to determine which cybercitizens would be affected by the contemplation or performance of an action, and to what degree.

3.2.4 Just Consequentialism

Moor (2001) summarises the theory of just consequentialism to imply that the ends, however good, *"do not justify using unjust means"*. Regarding the contemplation, and in particular the performance of some action, one would thus need to determine whether unjust means would be required to facilitate performance of the action by the cybercitizen in question. Therefore, if it is not possible to achieve the envisaged end (performance of the action) without utilizing unjust means, the requirement of just consequentialism is not satisfied.

3.3 How to Decide?

The second question concerns the process by which an agent may arrive at an ethical decision. We follow Spinello (2003, pp. 17-18) who proposes a general three-step approach based on human intuition, a critical normative evaluation and public policy implications. This methodology encompasses the two complementary practical approaches toward ethical decision making in developing information systems, discussed in (Wu, Rogerson and Fairweather, 2001). In particular Wu et al. (2001) first consider the methodological or procedural approach, founded on prescribed procedures, steps or stages, as the basis for ethical decision-making. Secondly, they discuss the approach of placing emphasis on the personal moral character and mature ethical judgement of individuals. Their conclusion is that the combination of these two approaches represents *"an effective and practical paradigm for examining or evaluating ICT workers' ethical activities or performance in developing information systems"* (Wu et al., 2001).

In this respect, we are of the opinion that Spinello's methodology also applies in the context of cyberspace. In particular, Spinello's methodology makes provision for all five positions regarding the foundations of computer ethics to be found in (Floridi and Sanders, 2003):

- no resolution approach (computer ethics has no foundation);

- professional approach (computer ethics is solely a professional ethics);
- radical approach (computer ethics deals with absolutely unique issues);
- conservative approach (computer ethics is only a particular applied ethic); and the
- innovative approach (computer ethics expands the meta-ethical discourse with a substantially new perspective).

We contend that ethical decision-making by (intelligent, autonomous) software agents is a relatively new and complex topic, and we illustrate this briefly with an example in a subsequent section.

3.3.1 Spinello's General Approach to Ethical Decision-Making

As a general methodology we focus on Spinello's (2003, pp. 17-18) general three-step approach based on:

- human intuition;
- a critical normative evaluation; and
- public policy implications.

The first step in this approach of Spinello relies on the informal ethical and moral disposition and sense of integrity of the decision-maker – representing the moral character and maturity of judgement, as referred to by (Wu et al., 2001). For the purposes of this paper we assume that the computing professional is responsible, i.e. ethically and morally sensitive, in the sense previously discussed, and has been sensitised to the importance of computing ethics, see for example (Barnard, De Ridder, Pretorius and Cohen, 2003).

Secondly, a critical normative evaluation is conducted within the context of a chosen ethical theory, a number of which are discussed below. Although responsible human beings are *assumed* to be capable of acceptable moral and ethical judgement, heuristics and procedural guidelines for making ethical decisions in complex situations are use-

ful and even suitable, particularly in the case of computing profession-als adept to procedural thinking. Indeed, *"[t]he search for useful ana-lytical heuristics has been a common theme in applied ethics for many years. ... Within computer ethics, heuristics have been of early and continuous interest."* (Maner, 2002a). We return to one such heuristic framework in subsequent sections.

Thirdly, public policy implications as embodied in legal and or-ganisational rules of conduct, and codes of ethics are investigated and appropriately applied. A detailed discussion of such policies falls out-side the scope of this paper. We do, however, contend that (future) computing professionals should acquaint themselves with the legisla-tion and codes of ethics that apply in their specific circumstances. Of special significance in the South African context is the Electronic Communications and Transactions Act (Act 25 of 2002), see for ex-ample (Barnard, Pretorius and Venter, 2004)

4. Ethical Decision-Making: Practice

From a practical perspective, ethical decision-making may be de-scribed as a process of (Gruba, 2004):

- identifying a problem;
- generating alternatives; and
- choosing among them.

The alternatives selected above should maximize the most impor-tant ethical values while achieving an intended goal.

Wu et al. (2001) claim that *"more and more ethicists and comput-ing professionals have focused their attention on the possibility and viability on applying ethics in the field of ICT through various methods or procedures."* In this respect Maner made a significant contribution in his paper entitled *Heuristic Methods for Computing Ethics* (Maner, 2002a) and supplemented this paper by a website that extensively cov-ers procedures for ethical decision-making (Maner, 2002b). In our opinion these two contributions of Maner are of practical use to both

the computing instructors who want to systematically introduce their students to practical ethical decision-making, as well as to the respon-sible computing practitioner who requires procedural and practical de-cision-making assistance in complex real-life situations, particularly in cyberspace. Below we illustrate how one such procedure can be ap-plied for ethical decision-making pertaining to human users and soft-ware agents as citizens of cyberspace.

4.1 A Framework for Ethical Decision-Making

Regarding an ethical analysis of cybercitizen behaviour we use the *Five-step Process of Ethical Analysis* of Rananu, Davies and Rogerson (Maner, 2002b) as basis. Other similar procedures for ethical analysis may be found in Maner (2002a and 2002b). The analysis procedure of Rananu, Davies and Rogerson, originally designed primarily for the analysis of human behaviour and ethical decision-making, was chosen because it can be readily applied to the ethical analysis of cybercitizen behaviour in general. For the purposes of this paper we *modify this process* to be *applicable in cyberspace* as outlined below:

4.1.1 Step 1: Analysis of the Scenario

In analysing the behaviour of a citizen of cyberspace, the follow-ing must be considered:

What are the facts?

Who are the stakeholders?

Identify relevant ethical and social issues.

4.1.2 Step 2: Application of Appropriate Formal Guidelines

In analysing the behaviour of a citizen of cyberspace, the follow-ing must be considered:

- Consider common themes for corporate or professional codes of conduct; see (Maner, 2002b) for more details.

- Does the behaviour of the citizen of cyberspace conform to or violate the Golden Rule that states, *"do unto others as you would have them do unto you"* (Spinello, 1997: 37)
- Who benefits from or is harmed by the actions of the cybercitizen?

4.1.3 Step 3: Application of Ethics Theories

We propose the use of the four ethics theories presented in sections 3.3 through 3.6 and refer the interested reader to (Maner, 2002b) for more details.

4.1.4 Step 4: Application of Relevant Laws

In analysing the behaviour of a citizen of cyberspace, the following must be considered:

Laws passed to regulate the information industry and cyberspace.

The rare law that enforces unethical behaviour.

4.1.5 Step 5: Application of Informal Guidelines

Rananu, Davies and Rogerson (Maner, 2002b) suggest that answers to the following appropriate informal questions should be considered where applicable:

- Recall your first impressions or reactions and what your moral intuition said about the action?
- Apply the mother test: Would you tell her? Would she be proud or ashamed?
- Apply the TV test: Would you inform the entire cyberspace community of your actions?
- Apply the Other Person's Shoe test: What if the roles were reversed?
- Apply the market test: Could you advertise the act to give you a marketing edge?

4.1.6 Step 6: Make a Defensible Decision

An ethical conclusion regarding the cybercitizen's actions and behaviour can be made based on the above five steps.

4.2 Example 1: Human Behaviour

In (Pretorius & Barnard, 2004) a detailed case study regarding the unethical use of e-mail facilities by computing professionals was presented. In particular, on September 11 2001, eight hours after the terrorist attacks on the World Trade Center and Pentagon, two South African brothers, Willem and Christiaan Conradie, allegedly fabricated and distributed the following e-mail message (Damon, 2001):

Title: CNN News flash 4255/11/09/200/23h15 (sic)

Verbatim extracts: *'The US Secretary of State, Colin Powell, revealed late last night that there is a strong possibility that South Africans and possibly the South African government might be involved ... Video footage from the airports revealed that at least three South Africans boarded each fatal plane. The subject is still under investigation, but sources believe that it has a strong link to the recent US boikot (sic) of the racism conference held in the South African city of Durban. CNN information sources disclose (sic) that some of the masterminds might be in hideaway in South Africa. Strong links has (sic) also been made between SA and Lybia (sic).'*

It was reported by the South African (SA) newspaper media that this e-mail had significant national, international, and financial repercussions and influenced relations between the United States (US) and the SA governments at a difficult time in the history of the US. It reportedly resulted in the decline of the SA currency and had a negative effect on the Johannesburg Stock Exchange ("Bolandse broers", 2001; Coetzee, 2001; Damon, 2001; Momberg, 2001). The Conradie brothers, allegedly responsible for the creation and dissemination of the e-

mail, were arrested and charged with sabotage and fraud, but eventually all charges against them were dropped.

Pretorius & Barnard (2004) analysed this incident from various perspectives, taking a closer look at the reported perceptions of the different stakeholders and considering various aspects of appropriate ethical analyses including the application of the framework of section 4.1. The purpose of this paper was firstly to demonstrate the application various approaches to ethical analysis and not to justify the seemingly obvious conclusion that the alleged creation and dissemination of the hoax e-mail was unethical and lead to the spreading of harmful misinformation (Pretorius and Barnard, 2004). Secondly, it was shown that the ethical and legal conclusions were not consistent. We maintain that real life ethical issues are usually more complex and would benefit from systematic analysis.

4.3 Example 2: Software Agent Behaviour

In this section we consider the Microsoft Office Assistant (Microsoft named it Clippy because of its paper clip persona) as a representative example of intelligent agent technology. Clippy is the little animated figure that appears on the user's screen and presents tips about using Microsoft programs. When first released, critics dismissed Clippy as the equivalent of training wheels for computer novices. Yet the friendliness of Clippy conceals a great deal of computing potential. *"In fact, it's essentially a back door for Microsoft to allow macros that can take control of a PC and help out users"* (Lemos, 2003).

We note that Clippy's settings are global for all programs in the Microsoft Office suite. When Clippy is set to provide a set of help options for one program in the suite, it will do the same for all the others within that suite. Furthermore, Clippy exhibits a number of salient features of an agent as described in section 2.2 and can therefore be classified as a citizen of cyberspace.

It is instructive to perform a systematic a posteriori ethical analysis of the actions of Clippy (excerpt from Smith, Eloff, Venter, Barnard and Pretorius, 2003).

Step 1: analysis of the scenario

In analysing Clippy's behaviour, we take note of the following:

Facts: The agent Clippy is a little animated figure that appears on the user's screen and provides tips about using Microsoft Office programs. It also opens a dialogue box that allows a user to bypass the Help menu and enter a simple question in natural language.

Stakeholders: The human user, the agent Clippy, and the host on which the Microsoft Office package is installed.

Ethical and social issue: Does Clippy exhibit any unacceptable or unethical behaviour by being present on the user's screen and employing continual intrusive animation in order to offer unsolicited assistance?

Step 2: application of appropriate formal guidelines

No corporate or professional codes of conduct available to Clippy.

Clippy's conformance/violation of the Golden Rule: One can argue that Clippy's continual intrusive animation in order to offer unsolicited assistance, can be viewed by the user as distracting him/her from the task at hand. More fundamentally, Clippy's continued presence and monitoring of the user's actions and keystrokes can be viewed as an invasion of the privacy of the user. The fact that Clippy sometimes also goes to sleep when a period of inaction on the part of the user is detected, can be viewed in a negative light, and even experienced as intimidating behaviour on the part of Clippy towards the user. On a certain level thus it may seem as if Clippy violates the golden rule. However, the user has the option to control or de-activate Clippy's presence and one can hence argue that if Clippy is in violation of the golden rule, it is with the consent of the user. As an independent agent thus Clippy does not violate the golden rule.

Who benefits from or is harmed by Clippy's actions? By design Clippy is intended to assist the user - a novice user may find the continued assistance helpful, whereas a more advanced user can customise

Clippy's level of assistance and presence (and in the extreme even de-activate Clippy). Therefore the user can benefit from Clippy.

One can thus conclude that Clippy does not intentionally violate these formal guidelines.

Step 3: application of ethics theories

Duty-based ethical theory

Fidelity: Clippy does offer the user relevant assistance, and thus lives up to the promise of user support.

Reparation: Not applicable.

Justice: Clippy's assistance is available to all Office users.

Beneficence: Clippy's design implies that assistance is freely available to all users irrespective of competency levels. Thus this agent may improve the lot of the user in general. The expert user may find Clippy's presence distracting but still has the option to either customise or de-activate Clippy.

Gratitude: Not applicable.

Non-injury: Not applicable.

In terms of the duty-based theory thus, Clippy's actions towards the user are not regarded as unethical.

Rights-based ethical theory

Clippy's visual presence or not is a true reflection of the agent's activity, and thus the user is always fully aware of its presence. Therefore the user's right to know is respected.

The default design of the agent is that it is always present and active. The deactivation ability is only an option. Thus we contend that the user's right to privacy is not respected.

Clippy has no autonomous intervention capabilities, and thus the user's right to property, i.e. his/her control and possession of electronic data and the concomitant integrity thereof, is respected.

Clippy poses a minor threat to the user's right to privacy (which can be counteracted by the user), while respecting the user's right to know and right to property. In terms of rights-based ethics thus, Clippy's actions towards the user are not regarded as unethical.

Consequence-based ethical theory

The user has final control regarding the agent's activities and existence and is thus subject to the user's discretion. In this respect the agent does not influence the user, whereas the user determines the life-span of the agent. We can thus conclude that the impact of the agent on the (single) user is limited, and as the agent interacts only with the Office applications of the (single) user, general impact is also limited. Therefore Clippy's actions are not in conflict with utilitarian principles.

Just consequentialism

We are reminded that just consequentialism implies that the end, however good, "do not justify using unjust means" (Moor, 2001). We again note that the default design of the agent is that it is always present and active in an attempt to provide the user with assistance. This action of the agent compromises the user's right to privacy and is an instance of using unjust means towards a good end. Clippy's actions can thus be viewed as a violation of just consequentialism.

We conclude that the majority of ethical theories applied in this step, suggest that Clippy is a relatively benign agent that does not pose malicious (autonomous) intentions towards the user.

Step 4: application of relevant laws

Not applicable.

Step 5: application of informal guidelines

We only apply the Other Person's Shoe test for illustrative purposes.

The Other Person's Shoe test: Clippy's obtrusive and even intimidating character may be demonstrated by its continual intrusive

animation in order to offer unsolicited assistance, its continued presence and monitoring of the user's actions and keystrokes, and the fact that Clippy sometimes also goes to sleep when a period of inaction on the part of the user is detected. These inherent character flaws imply that Clippy would have difficulty in passing the Other Person's Shoe test.

Step 6: make a defensible decision

From the above it is apparent that the unethical aspects of Clippy's behaviour can be counteracted or managed by the (expert) user. Although some may view Clippy's actions as irritating or distracting, the above ethical analysis clearly demonstrates that on the whole, Clippy's actions towards the user cannot be regarded as unethical.

5. Quo Vadis?

As ubiquitous computing technology matures and as increasingly intelligent, often invisible computing devices make their way into the lives and bodies of human beings, the ethical, moral, social and technical issues become blurred. Are we as computing educators, scientists and professionals ready for the complexities and challenges of responsible decision-making in the cyberspace of the future?

We contend that it is the responsibility of present-day computing instructors to familiarize themselves with ethical issues and moral quandaries posed by cyberspace, and that they then impart this information to their students in a rigorous manner. This will ensure that the computing professional of the future, will not only be more aware of issues relating to cyberspace, but be able to proactively counteract unethical activities in order to ensure the continued integrity of cyberspace.

Moor (2001) warns that "*[w]ith policy vacuums and conceptual muddles galore, finding the right connections between computational practice and ethical categories and principles can be extraordinarily difficult.*" Regarding ubiquitous computing in particular, Langheinrich (2001) maintains that what "*lies at the intersection of privacy protec-*

tion and ubiquitous computing is easy to imagine: the frightening vision of an Orwellian nightmare-come-true, where countless "smart" devices with detailed sensing and far-reaching communication capabilities will observe every single moment of our lives, so unobtrusive and invisible that we won't even notice! Ron Revest calls this the "reversal of defaults": "What was once private is now public", "what was once hard to copy, is now trivial to duplicate" and "what was once easily forgotten, is now stored for ever." Clearly, "something" needs to be done, as nearly all work in ubiquitous computing points out, yet little has so far been accomplished."

Unless we as computer professionals take ownership of the domain in which we practice whilst affording a commensurate degree of sensitivity to social and ethical ramifications of the technology we develop, some of the bleak predictions of Moor and Langheinrich may become a reality. Indeed, in the words of Chuck Huff (2004): "*Software engineers should take responsibility where emerging methods allow them to, and should be humble about their ability to guarantee perfect functioning where they cannot measure or test performance in real conditions. By increasing knowledge about the social effects of software, and by adopting methods that allow us to anticipate these effects, we may be able to decrease sorrow ... But we will do so at the expense of our own simplistic approaches to software design.*"

6. References

Act No. 25 2002. The South African Electronic Communications and Transactions Act.

Barnard, A, E Cloete, & L Pretorius 2004. A Framework for Performing Security and Ethical Analyses in Agent Computing. *Challenges for the Citizen of the Information Society: Proceedings of the Seventh International ETHICOMP Conference.* Syros, Greece. (eds.) T.W. Bynum, N. Pouloudi, S. Rogerson & T. Spyrou; 1:81 - 93.

Barnard, A, C De Ridder, L Pretorius & E Cohen 2003. Integrating Computer Ethics into the Computing Curriculum: A Framework for Implementation. *Proceedings of IS2003, Informing Science + Information Technology Education Joint Conference.* Pori, Finland; pp. 265 - 279.

Barnard, A, L Pretorius & L Venter 2004. The ECT act and Its Impact on a Typical Computing Curriculum; SACLA2004.

Beck, S 2003. History of Ethics Volume 1 - To 30 BC Ancient Wisdom And Folly, *Chapter on Ethics.* Accessed June 2004 http://www.san.beck.org/EC1-Ethics.html.

Bolandse Broers Voor na 'Opruiende' e-Pos 2001. *DieBurger*, September 17: 1.

Coetzee, H 2001. Broers in Hof oor VSA-e-Pos. *Beeld*, September 17: 4.

Damon, J 2001. Hoax e-Mail Suspects Due to Appear in Court Today. *Cape Times*, September 17: 3.

Floridi, L & JW Sanders 2001. On the Morality of Artificial Agents. Forthcoming in *Ethics of Virtualities - Essays on the Limits of the Bio-Power Technologies*, (eds). A. Marturano and L. Introna. To be published as part of the series *Culture Machine*, Athlone Press: London. Accessed July 2003 http://www.wolfson.ox.ac.uk/~floridi?pdf/maa.pdf.

Floridi, L & JW Sanders 2003. Internet Ethics: The Constructionist Values of Homo Poieticus. Invited chapter for *The Impact of the Internet on Our Moral Lives*; (ed.) R. Cavalier (SUNY: Fall 2003). Accessed June 2004 http://www.wolfson.ox.ac.uk/~floridi/.

Fou, J 2001. Web Services and Mobile Intelligent Agents: Combining Intelligence with Mobility. Accessed May 2003 http://www.webservicesarchitect.com.

Gleason, DH & L Friedman 2003. The Social Construction of Cyberspace. *Proceedings of the Fifth International Conference on Computer Ethics — Philosophical Enquiry.* Boston College: Chestnut Hill, MA, 41-51.

Gleason, D.H. & L Friedman 2004. Proposal for an Accessible Conception of Cyberpsace . *Challenges for the Citizen of the Information Society: Proceedings of the Seventh International ETHICOMP Conference.* Syros, Greece; (eds.) TW Bynum, N Pouloudi, S Rogerson & T Spyrou 1:318 - 329.

Gruba, P 2004. A Framework for Ethical Decision-Making. Accessed June 2004 http://www.cs.mu.oz.au/343/2004/ETweek02/ethics.pdf.

Huff, C 2004. Unintensional Power in the Design of Computing Systems. In *Readings in Cyberethics;* (eds.) R.A. Spinello and H.T. Tavani. Jones and Bartlett Publishers: Sudbury, MA.

Kemerling, G 2001. Aristotle: Ethics and the Virtues. Accessed June 2004 http://www.philosophypages.com/hy/2s.htm.

Kraut, R 2001. Aristotle's Ethics. *The Stanford Encyclopedia of Philosophy* (Summer 2001 Edition); (ed.) EN Zalta. Accessed June 2004 http://plato.stanford.edu/archives/sum2001/entries/aristotle-ethics/.

Langheinrich, M 2001. Privacy by Design – Principles of Privacy-Aware Ubiquitous Systems. *Ubicomp 2001, LNCS 2201*; (eds.) GD Abowd, B Brumitt and SAN Shafer. Springer-Verlag: Berlin.

Lemos, R 2000. Microsoft's 'Clippy' a Security Nightmare? *ZDNet News.* Accessed May 2000 http://zdnet.com.com/2100-11-520809.html?legacy=zdnn.

Lenarcic, J 2003. The Dinosaur and the Butterfly: A Tale of Computer Ethics. *IEEE Security & Privacy*, September/October. Accessed June 2004 http://computer.org/security/.

Lessig, L 1999. *Code: And Other Laws of Cyberspace.* Basic Books: New York.

Maner, W 2002a. Heuristic Methods for Computer Ethics. *Metaphilosophy* 33(3):339-365.

Maner, W 2002b. Rananu, Davies and Rogerson: The Five-step Process of Ethical Analysis. *Procedural Ethics.* Accessed November 2002 http://csweb.cs.bgsu.edu/maner/heuristics/1996Rananu.htm.

Momberg, E 2001. Anti-SA Govt 'Flash' Was a Hoax. *Citizen*, September 14: 5.

Moor, JH 2001. Just Consequentialism and Computing. *Readings in cyberethics;* (eds.) RA Spinello & HT Tavani. Jones and Bartlett Publishers: Sudbury, MA.

Moor, JH 2001. The Future of Computer Ethics: You Ain't Seen Nothin' Yet! *Ethics and Information Technology*, 3:89-91.

Pretorius, L & A Barnard 2004. E-mail and Misinformation: A South African Case Study. *Proceedings of the Informing Science and Information Technology Education Joint Conference;* Rockhampton, Qld, Australia; 123-142.

Smith, E, MM Eloff, LM Venter, A Barnard & L Pretorius, 2003. Agents, Security and Ethics: A Framework for Analysis. *South African Computer Journal*, 31:18-24.

Spinello, R.A 1997. *Case Studies in Information and Computer Ethics.* Prentice Hall: Upper Saddle River, NJ.

Spinello, RA & HT Tavani, (eds) 2001. Preface, *Readings in Cyber-Ethics.* Jones and Bartlett: Boston, MA.

Spinello, RA 2003. *Case Studies in Information Technology Ethics,* second edition. Prentice Hall: Upper Saddle River, NJ.

The Shorter Oxford English Dictionary on Historical Principals, third edition. 1955. (ed.) C.T. Onions, Clarendon Press: Oxford, UK.

Van der Merwe, DP, L Pretorius & A Barnard 2004. Cyberethics and the South African Electronic Communications and Transactions Act. *Challenges for the Citizen of the Information Society:* Proceedings of the seventh International ETHICOMP conference. Syros, Greece; (eds.) TW Bynum, N Pouloudi, S Rogerson & T Spyrou; pp. 860 - 870.

Wagner, DN 2000. Software Agents Take the Internet as a Shortcut to Enter Society: A Survey of New Actors to Study for Social Theory. *First Monday*, 5(7). Accessed May 2003
http://firstmonday.org/issues/issue5_7/wagner/index.html.

Web Hosting Directory 2005. Accessed July 2005
http://www.webhostingrank.com/glossary/Cyberspace.html.

Wu, X, S Rogerson, & N Fairweather 2001. Being Ethical in Developing Information Systems: An Issue of Methodology or Maturity in Judgment? *Proceedings of the 34th Annual Hawaii International Conference on System Sciences* (HICSS-34)-Volume 8. Accessed June 2004
http://csdl.computer.org/comp/proceedings/hicss/2001/0981/08/0981toc.htm.

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Only the Flexible will Survive: Research Production in Informatics in South Africa

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Abstract

The article discusses the impact of research on tertiary activities in Southern Africa. The article starts off with reviewing the literature and came to the conclusion that many of the overseas universities use research output for promotion and tenure whereas the same is not happening in South Africa. Most of the research output in South Africa stems from established people who are involved in postgraduate research supervision. This is a problem because there are not many local journals available for IS/IT/CS researchers to publish their work in. The paper proposes that the research approach will have to change – junior staff must be motivated to produce more papers (maybe a trans-disciplinary approach would be advisable for these researchers). The benefits of publishing are many – especially with the new approach of the Department of Education where researchers are subsidised to publish articles in approved scholarly journals.

> *All of us are travellers lost,*
>
> *Our tickets arranged at a cost,*
>
> *Unknown but beyond our means.*
>
> **(Dean Koontz, accessed 2003)**

Introduction

The idea for this paper started while the authors were looking for an appropriate place to publish their articles. Presently there are not many Academic journals in South Africa that scholars in IT/IS can use

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to publish their manuscripts. There are also some universities and technikons that continue to view the publication of articles as a key component of any academic's duty. The evaluation of the quality and quantity of the articles can therefore become important for promotion purposes (especially in South Africa where promotion to a chair can become a reality if the person has enough[1] publications).

However, little research had been done in South Africa in terms of defining the journals that could be used for publication purposes. At the same time there is very little to note who had been publishing in these journals and from which university they are. The key variables for this study would therefore be to discover what academic journals exist, how many IS/IT articles have been published by them, analyse which universities are doing research in terms of articles published in South African journals and look at university affiliation by journal. Some of the overseas academic journals had been ranked using different surveys and this ranking should be kept in mind by research administrators. The problem is to streamline the research administrative process at tertiary institutions in South Africa. These research administrators should also keep in mind that there should be a bridge between formal metrics and the activities of the researchers.

This article will therefore attempt to discover the top academic publishing journals for the IT/IS field in South Africa, look at how many articles in the IS/IT field have been published by them and at the same time, look at which universities publish in them and who the top authors in these journals in terms of IS/IT are (future studies). These journals would be visited at a later stage for another article, the articles counted and the phog factor calculated. The results would be listed in tables and conclusions, based on these tables would be drawn.

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[1] Enough' publications is a rhetoric used by some managers in higher educational institutions if they do not want to promote a member because no number is allocated to the word enough.

Review of Previous Research

The literature review deals in detail with some topics that can help to explain the research productivity of academics in South Africa. It discusses various aspects of research productivity such as first research then teaching policy, journal quality, university and personal outputs and promotion and tenure. It displays some statistics and concludes that there are not many journals available for IS scholars to publish in South Africa. The payoff from social investment in basic research is as clear as anything is ever going to be in economics. The basic picture is that 50% of economic progress since WWII is due to technology and that much money (about 33%) of the budgets are spend on research and development. This creates opportunity and cultural quality of life for all and adds value to graduates.

It is also important to note that lack of research funding could lead to unproductiveness of scientists. The researchers should therefore ensure that the balance of functions of change, efficiency and good will are met. Also research leadership at every level is essential for institutional research productivity.

Citations

The only way to keep track of the importance of research is to investigate how many times a researcher's paper or article was cited. This could be done with the application of functional rather than structural administration. The job of functional administration would also be to help researchers apply behavioural principles correctly and effectively in direct management of research projects. Sauer (1988) notes that it is clear from the estimates in their paper that citations and journal articles are the most important productivity indicators in determining salary for academics. In other words, we become what we measure – all researchers should strive to be cited and this could be the measurement of the productivity of academics.

Podgursky (2001) states that the effect of citations and publications is non-linear and variables demonstrate diminishing returns. The rankings in the USA are strongly associated with objective measures

of productivity such as total citations or total pages in refereed journals. Rushinek and Rushinek (2003) argue that search engine citation is a useful supplement to the traditional academic ranking of journals and in some cases it might even be superior for litigation support. It would thus be a useful exercise to discover how many times the South African journals were cited in overseas journals – this could be a further motivation for local authors to publish in the local journals.

Doctoral Program and Productivity

Hu and Gill (2000) argue that it is no surprise to see a growing interest in studying the factors affecting research productivity because of the growing importance of doctoral studies. They state that any institution that offers a doctoral program influences the research productivity positively. The length of the doctoral programs also influences research productivity. The longer the doctoral program, the more productive staff members become. The problem is to maintain the research output. An increase in doctoral studies should also therefore show an increase in research. A good number of research outputs, on the other hand, would also draw more post-graduate students. The problem is that it does not always portray student outcomes as well. Barnhill (2001) notes that because postgraduate studies are few and supervisors even fewer; the *Law of the Few* illustrates that some people have exactly the right connections while other cannot produce because they do not have the resources.

The Importance of Teaching and Research

There are lecturers who are talented and their students and admirers wait anxiously for the masterpiece worthy of the lofty opinion they have formed of the teacher. The problem is that the great work is never written, and the teacher remains silent. Part of the development of academics is that they should remember that education (research and teach) is their focus (principal) and if this should be broken then they will loose the principal donor for their existence (the state). Substantial attention has been paid to the determinants of academic earnings, and

it was noted that the publication of scholarly articles are the major determinants of salary differences (Hamermesh *et al.*, 1982). They also argue that personal experience should also be taken into account in order to measure the publication of academic journals properly. They state that citations should be brought into account while measuring the personal contribution of any academic.

Mabert (1993) argues that research for personal prestige is important at any academic institution. It can be applied to a wide variety and need major decisions to motivate the need for inquiry. There is a need for faculties all over the world to contribute to the growing body of knowledge. The need for business research might supplant the need for teaching as there is a small link between the two in the real world. All of this research should enhance the quality of life although she notes that pure research is not the mission of the academic. Much of the research in the past has been affected by a narrow focus and limitations which eventually impacted on the teaching and the quality of the teaching.

Baker *et al.* (1998) note that there is controversy regarding the issue of empirical research productivity and quality teaching. They argue that in Florida, teaching effectiveness was rewarded in terms of money. Even with the reward for effective teaching, they have discovered no link between research productivity and teaching effectiveness. Xie and Shauman (1999) state that female scientists prefer to do more teaching than research. They argue that woman is less likely to work at research universities and that they tend to spend more time in the classroom. In order to maximise intellectual resources it is important that the ranks of researchers include woman and people from disenfranchised communities.

Hu and Gill (2000) investigate why some academic were more productive than others and note that some of the factors (such as the number of years in service, the teaching load, other non-academic experiences) do not have such a big impact as one would expect. There were some factors that come to the attention of researchers; that is the time allocated to research activity and the existence of a doctoral pro-

gram. Hu and Gill further argue that productive faculty not only further their knowledge in their professional fields by integrating their findings with those of other via scholarly publications and this could help in attracting more research grants and better students.

Kemper (2001) *cites* Cajal from a work he did in 1897 and note that this is still relevant today. Cajal recognises that excellence in teaching and research are complementary, requiring similar traits. It can be emphasised that research productivity results from a passion for reputation, for approval and applause and a taste for the original. Kemper argues that research productivity in individual's peak in the 30s and declines afterwards.

Fulford (2002) also argues that many normal people believe that universities exist to teach the young and prepare them for life. He notes that many professors consider teaching at best as a secondary activity. Fulford argues that no university in Canada has hired a professor because of teaching ability. He notes that the statement that good researchers make good teachers have never been demonstrated. It is believed in academia that this is the case and is purely anecdotal. The obstacles (tenure, labour issues, politics and politicians, narrow-minded administrators) to reform are so intimidating in South Africa that the authors do not think that any change will occur soon.

Journal Quality

It can be argued that the journals not always define what constitutes an article and what not an article is and this could affect the quality of the journal and the number of articles that each one publishes. The Journal quality can help researchers over all of the spectrums to improve their chances of obtaining research funding and to target articles to appropriate journals. It is important that researchers concentrate on the quality of life issues to ensure that academic freedom is sustained. Lightner and Nah (1998) state that theory building for use is being emphasised by 81% of the academic journals. Only 18% emphasises theory testing. More than half the papers in these journals use field studies as a methodology. This is because IS as a science is

young and growing. Theory testing, however, would help advance the maturity of the science.

Babbar *et al.* (2000) argue that academics author the majority of the academic journals in operational management. The main idea is that academics produce these papers for fellow academics as not many practitioners read these journals. IS and its products had been enriched by the contribution of various other research disciplines. This should be kept in mind by researchers when they collect information that they want to use for publication purposes as this could affect the acceptance of a quality product for publication.

The journal quality list assembled by Harzig (2000) and Kateratta-nakul and Han (2002) contains no SA journals. A list assembled by Mylonpoulos and Theoharakis (2001) on global perceptions of IS journals also did not contain the names of any South African Journals. This could be because people do not know about these journals or do not regard their quality as high enough.

Katerattanakul and Han (2002) note publications in prestigious journals have significant influence on academic peer recognition, departmental and institutional rankings, tenure and promotion rankings and the merit increase of faculty compensation. They argue that there is a need to compare the European journals (the same could thus be said of South African Journals). Katerattanakul and Han conclude that the quality of European Journals has been underestimated and that these should have been included while ranking the journals.

Many parties have an interest in the quality rating of IS publications because some people use these ratings as selection criteria for new staff members and some overseas universities use them as promotion guide. This can also be a guide to indicate how the IS field matures (Walstrom and Hardgrave, 2001). The problem in South Africa is to provide some consistency in the evaluation of the quality of these journals. There should be an indication on the appropriateness as publication outlet, as well as the significance of the journal(s). At this stage, no research was conducted in South Africa to rate the SAPSE accredited journals and how these journals are supported by the schol-

ars in the field of IS. Walstrom and Hardgrave, for example, did not rate any South African journals in their article – it is thus not known if any of the journals in South Africa can be rated at the same level of their overseas counterparts. This statement is supported by Athey and Plotnicki (2000).

La Manna and Young (2002) note that it is easy to launch a new journal but more difficult to create a high-quality journal. The new journal should reward authors with the knowledge that the key elements required of a journal are in this journal (e.g. reputation, high-quality research, editors, etc.). The strictest form of control should ensure that only submission that at least matches the quality threshold should be accepted for publication. The contents should at least have passed the peer-review test and readers should be able to comment on these articles. These journals should be listed on the list of the top 50 journals in the world.

Measuring Success

It can also be noted that tertiary institutions have two ways of measuring success – numbers and stories. Most of the time student achievements are highlighted, departmental discoveries are blown into the press and the services the institution delivers are printed in the universities publications. In the USA, the NRC ratings can be some help in evaluating the performance of the researchers but no such study exists in South Africa. Sanklin (2001) argues that many factors could be used to measure success and productivity. Some of these could be: individual attributes, institutional and departmental attributes and the culture and working conditions. She noted that there is a link between departmental culture and the research success that some individuals portray.

Niche Area

The Government in South Africa does support niche area research more than any other research at tertiary level. The niche strategy is important and needs to be investigated- niche areas generate more pro-

ductive researchers. The niche area helps to make the research part of the departmental agenda and at the same time mobilise research opportunities, thereby ensuring survival of the productive researchers. This will also promote the competitiveness of the institution. The overall success of the individual researchers on any tertiary institution depends basically upon the quality and success of the niche area that is being presented. The ultimate 'egalitarian' method, however, holds that all niche area researchers are equal in both need and merit and therefore should all receive the same consideration for distribution of resources.

Personal Aspects

Fowler (1998) notes that the value of thinking and the value of inventing ways by personal researchers should be done in such a way so as to free the researcher from elementary operations. By doing it creates positive feedback and produces an information explosion. The problem with research is that the volume of information has increased but the capabilities of our brains have not increased much. The information overload can lead to stress, and stress, as Sapolsky's work cited by Fowler (1998) has shown, can actually kill brain cells that are crucial for memory and thereby reducing productivity. Fowler states that the size of articles has increased since 1968 and that the number of references has increased more than 4-fold showing that people are more productive.

Fowler notes that salary decisions should be linked to research productivity and this linkage should be explicitly stated and helps maintain levels of activity by principal research investigators. It may even renew personal research efforts but the amount of information available might be overwhelming. The downside of this is that the linking of salary decisions to research productivity could be expensive and this could be food for the anti-research brigade to note (for example that salary differentials could be even greater than the present ones in tertiary education).

Rice (1998) in a keynote speech argues that new opportunities are always on the horizon and that researchers should develop personal roadmaps on how to reach their research objective. Xie and Shauman (1999) state that female scientists produce research at a much slower rate than male scientists and researchers. They argue that could be because woman might take longer than man to earn their doctorate degree. They further stated that married researchers are slightly more productive than unmarried researchers. Hu and Gill (2000) note that factors such as teaching load and time allocation for research all affect productivity and that this does not affect the level of the person (senior or junior). They also state that it becomes more important for academics to do research. One negative aspect they also note is that the older a researcher gets, the fewer his articles become (especially if they had reached tenure). They did find that tenure-earning staff is more productive. People like Deans, Head of Department and other higher positions also do less research. Hu and Gill (2000) however, argue that good researchers all manage their time effectively. Professors produce, according to them, the most articles.

Claver *et al.* (2000) argue that personal judgment on the quality of the sources be done by the researcher. Each researcher will have a personal preference for a research topic (e.g. IS development, DSS, IS evaluation, IS implementation, e-Commerce, etc.). la Manna and Young (2002) state that the personal role of the researcher should be restored as content providers, quality assessors and champions.

Shanklin *et al.* (2001) note that to maintain research productivity, it is important to encourage participation at all levels, faculty at all stages of their development, pre-doctoral and post-doctoral training programs, and mentoring and support of the most productive people so that the institution do not loose them. There is a notion that bigger institutions are more productive because of intellectual synergy. People should, however, be personally motivated to remain active as scholars by the intrinsic rewards of mentoring their post-graduate students.

Walstrom and Hardgrave (2001) note that it is a personal problem for authors to decide where to publish their work. This is becoming more complicated with the arrival of electronic journals and the increase of journals worldwide. Rushinek and Rushinek (2003) also argue that the importance of journals is especially relevant for people who are also expert witnesses or are interested in becoming experts. The way to become an expert is by your publication record in reputable journals.

Promotion and Tenure

Hamermesh *et al.* (1982) argue that a better framework should be designed for the evaluation of promotion and tenure of academics. The complete picture had not been evaluated and it is therefore of importance that academics be evaluated on the same level as other universities to ensure satisfaction. Sauer (1988) states that the existence of incentives capable of promoting the growth of knowledge and the consequences of competition amongst scientists require a reward of some form – whether it is promotion or tenure. The publication of an article appears to be a measurable impact on salary independent of citations. The figures they have indicate that there are significant (3.80% increase in salary in 1982!) monetary returns to high-quality research in the economics profession.

Universities and Technikons in South Africa should remember that to increase research opportunities salary decisions should be linked directly to the desired research outcomes (the goal of the researcher) to create incentive systems that would enhance research productivity. The fact in South Africa is that the personal research and development budgets are likely to remain relatively flat.

Rosenquist *et al.* (2001) note that some overseas universities quantify research output for all investigators, an average is derived and each researcher is compared with this average and then rewards are distributed. Researchers who perform well thrive under this system but the weakest are weeded out. The problem that research administrators still sit with is the quality of the research output of each academic. Research administrators have agreed that they must be careful to measure quality and impact carefully. Rushinek & Rushinek (2003) note that

the importance of a computer journal should be taken into account when seeking tenure at an academic institution. They also noted that the information available at http://www.isworld.org/csaunders/ rankings.htm may be useful in preparing promotion and tenure packets. It should, however, be noted that one method of evaluation does not apply everywhere (Rushinek and Rushinek, 2003).

Time to Publication

The average submission to report time-lag ranges from four to fifteen months and a quality journal should ensure that this is substantially shorter (la Manna and Young, 2002). The problem that affects productivity is that it takes quite a while for articles to appear in the top journals.

University and Departmental Output

Part of university output can be classified as outreach and service. Outreach can be classified as the dissemination of knowledge, public programs, and cultural enrichment to business, government, educational and communities. Outreach has payoffs in 3 areas: publicity, recruitment, and development. Productivity will therefore be measured in terms of goodwill created by productive researchers. The tertiary institutions should also look to mobilise flexibility and effectiveness in addressing new research opportunities, eliminating at the same time, any emotion-laden and archaic remnants of irrationality. The department should focus outwardly and the University should focus inwardly because the university has not identified niche areas – just the departments. This can be a problem if the university also has niche areas and centres of excellence.

Hamermesh *et al.* (1982) note that some universities reward faculty and departmental reputations but at the same time warn against social-welfare maximisers. These faculty and departmental scholars consists of a community of scholars who might sit in different offices but who participate together in the production of knowledge and this might affect productivity overall. The growth rate of universities in

developing countries will have to keep pace with the mega-universities overseas or developing countries will fall behind.

Cost of research literature increases every year and the results could be that some subscriptions to research literature will have to be cancelled by the universities resulting in a decrease in productivity by the academics. The authorities at universities and technikons should remember that these scholars have to pursuit non-scholarly activities that would affect productivity and would affect comparisons across institutions. There should be no separation between university research and emerging technology.

Barnhill (1998) argues that variation and not replication is the key to tertiary survival. He further notes that regional distinction is important and universities should move into the central role of societal transformation through students and research productivity. By conducting research, a strong foundational academic core can be build – especially if niche areas can be focused for research purposes. This might cause the tertiary institution to take more risks to move into these new roles and directions.

Barnhill (2001) notes that strategic intent by top leadership, coupled with natural advantages and local expertise, can lead to research enhancement that lifts the entire tertiary institution. He also argues that there will always be research competitiveness and the public face of research would include governmental help, jobs from research and quality graduates. He states that research as a topic should be promoted on the campus and that departments should collaborate and tackle bigger projects. The one factor that researchers will remember is that they have to work autonomously.

Shanklin *et al.* (2001) state that large departments tend to have people in a variety of fields, which would seem to discredit the strategy of building a "unique" niche. There are some administrators that are concerned about the tertiary institution's return on investment in terms of research. Education is also being regarded by these people as value-added product and technology transfer helps with research and value-creation.

Shanklin also argue that institutional and departmental attributes influence research productivity. She notes that there is a tendency for bigger departments to be more productive than smaller departments. A reward for a person is to be invited to present papers at national and international meetings or serving as a chair for review panels, etc. The aspect that should be kept in mind is that administrators must acknowledge the contributions of researchers to the profession and to their disciplines.

Tertiary institutions should ensure that their institution reach for a high ranking within a world class research area (niche areas). Achieving this, would ensure enough money for research, the fullest utilisation of tertiary communities and value added to the society. The literature notes that there were many aspects that needed attention in terms of the research productivity of academics. The following questions remained unanswered:

1. Why are there no rankings of any South African academic IT/IS journals
2. How are South African IT/IS Journals ranked within South Africa?
3. Who publishes in them?
4. Which university or Technikon supports the SA IT/IS Journals?

Summary

The biggest challenge facing researchers in the academic environment is to create learning communities. Universities and technikons need to become entrepreneurial to draw money but they should not adhere to a single format. The need for research money is relevant and will have to come from indirect cost reimbursement such as private donations. On the one hand, this could result in an improved recruitment of research scientists. This could result in obtaining extra resources but on the other hand, it can be unproductive as stated earlier.

Reputational rankings do reflect well on academic CV's but does it help the productivity of the department or the tertiary institution? This can in a way help to measure quality but all tertiary institutions should use the same rankings and same quality measures that articles noted. Tertiary institutions should be able to reflect that they are productive and that full cost had been recovered in terms of research. The problem is, however, to prove how their contributions are unique and that students benefit from it.

Research Methodology

The authors had some initial interviews with people who publish or plans to publish. These interviews were unstructured and helped the authors by giving them an insight on how the prospective respondents felt and what their research views are. These interviews were not analysed but used to supplement some of the findings while analysing the questionnaires.

The survey instrument is based on the theory that were discussed above and the SABINET website. The first part covered demographics and what research and teaching loads these authors have. The next part covered the assessment of the quality of South African IS Journals and the last part the importance of these journals while publishing. The questionnaire consists of 18 questions, and two columns with rating requests. The data were collated into an EXCEL spreadsheet and some graphs were drawn and basic statistics conducted.

Data Discussion

The first phase of the research investigated the publishing trend of academics at South African tertiary institutions and the Journals they prefer. The next two phases will investigate the journals and the IT/IS articles they prefer. The figure below explains the jobs that the respondents are doing in academia. The population consisted of all academic people in the IT/IS field in South Africa teaching at universities. The final sample includes at least 7 professors. Of these respondents, 79% were permanent and the rest had contract appointments. It was important to determine the type of job the respondent was doing and if they were appointed permanently. Permanent employees with no threat of contract appointment renewals were under no threat to conduct re-

search. This agrees with the statement by Fulford (2002) who argued that professors in permanent positions were more active in terms of research.
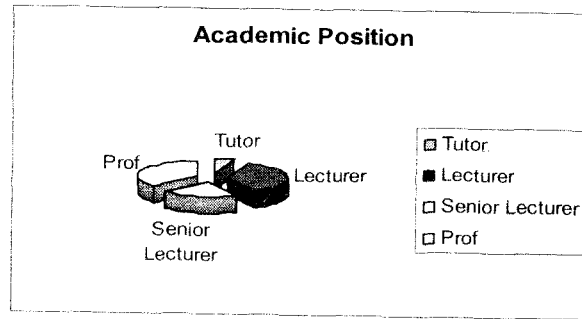

Figure 1: Types of positions of the respondents

The other demographic that was determined was what type of qualification these people had. The figure below demonstrates that most of the people had at least a postgraduate degree (6 Masters and 7 Doctorates). What was interesting from the sample was that there were some people with only a B-degree (2) and 3 people with an honours degree. It was noted on the survey instruments that the better research productivity comes from people that already had a doctorate (maybe some of the research stems directly from their doctoral dissertation. This is in agreement with the Shanklin *et al.* (2001) statement where they argue that most postdoctoral positions produce a good research output.
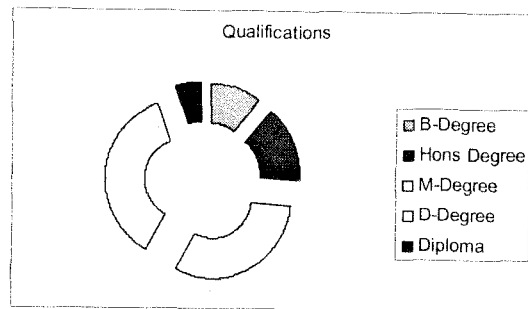

Figure 2: Qualifications of the respondents

Question 5 produced out of the ordinary results because it showed that there were none of the respondents that produced only research or just teaching. Most of the people do teaching with an even amount of research (63%). There were some instances where people did teach with some research (21%). It seems to the authors that the academics in South Africa do research out of their own accord and most of the times this is done on their own accord with little support from the university. This is maybe because of some form of research reward as noted by Sanklin (2001). Most of the people participating in the survey stems from the academic environment in the Western Cape, Gauteng and Kwazulu-Natal. The respondents have indicated their participation in teaching and research as follows:

	Teaching	Research
0 – 5 Hours	37%	32%
6 - 10 hours	11%	16%
10 - 15 hours	26%	26%
More than 15 hours	26%	26%

Table 1: Link between teaching and researching

As can be noted form the table above, there is a high correlation between the two (more than 90%). This means that in South Africa, academics regard a link between research and academic excellence. It could be speculated that there is a link between the work they do and the end-product of their students because they use the students to help with their research. It also shows a link between the response of question 5 (where respondents have marked equal amounts of research and teaching) and questions 6 and 7. Most of the people (nearly 70%) have been in academia for more than 10 years (see figure below) and will out of habit produce research.
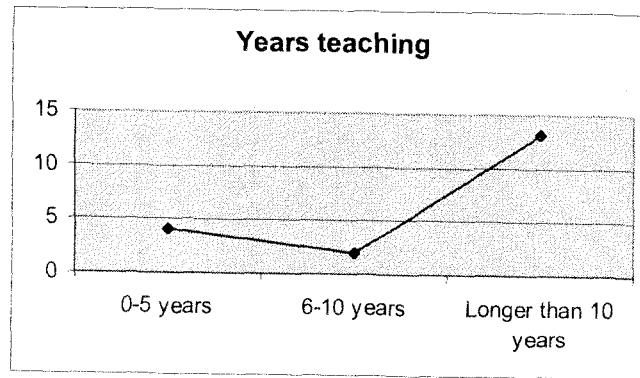
Years teaching

Figure 3: Number of Respondents and years lecturing experience

Nearly 90% of the institutions that participated had a master's degree program and nearly 80% had a doctoral program. This also links in to the fact that many had teaching and research combined and this further supports the responses from questions 5, 6 and 7 and supports the statement by Hu and Gill (2000) who argue that research output is better if a postgraduate programme exists.
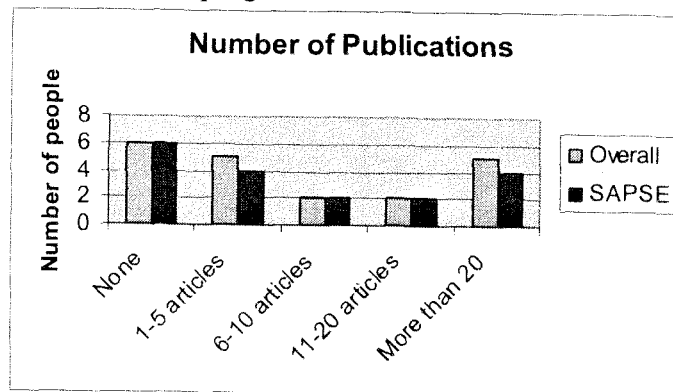
Number of Publications

Figure 4: Respondents and the number of Publications published

There is a good correlation between the publication list and the SAPSE accredited publication list. Many of the people had published

in accredited journals and it seems from the responses that many people had published in the SAPSE journals as their only layout. Most of the articles were published in the fields of Information Systems and e-Commerce/Business (nearly 70%). More than 50% of the respondents argued that there were enough outlets to publish research in South Africa. More than 63% of the respondents noted that their institution uses the number of publications for decisions such as promotions. Nearly 75% of the respondents agree that there should be a new updated list available and nearly 80% indicated that the new list should include e-journals.

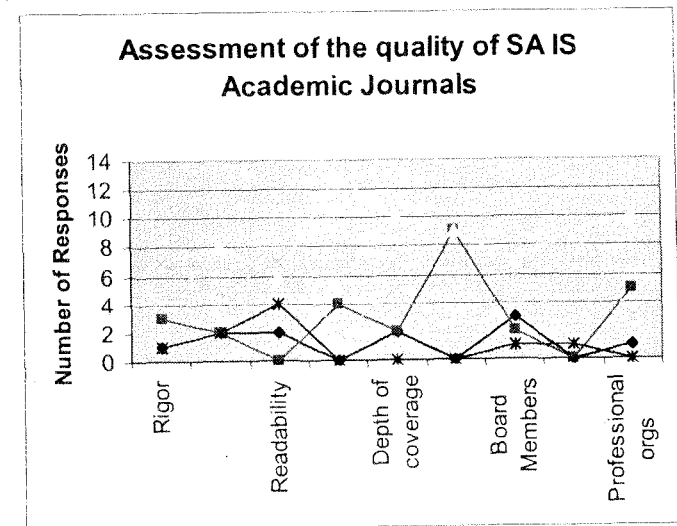**Assessment of the quality of SA IS Academic Journals**

Figure 5: The quality of IS Academic Journals in South Africa

Most of the respondents argue that the journals in South Africa is poor to neutral in terms of rigor because they do not publish items that do not meet their stringent scope. More than 60% of the respondents argued that the journals in SA do not publish practical applications readily. About 60% of the respondents noted that the article contents are readable in South African IT/IS Journals. More than 80% argued that the breadth of coverage could have been better in the journals

available in South Africa while more than 70% of the respondents noted that the depth of coverage could have been better.

Most of the people were either neutral or lower than neutral in their view of the contents of the journal in terms of teaching applications. While only a little more than 30% indicated that the board members of these journals were appropriate. Most of the respondents agreed that the authors were appropriate and suitable for the journals but must of the respondents were acknowledging that they are neutral in terms of the professional organisations that these journals support. This agrees with the statements by Babbar *et al.* (2000) and La Manna &Young (2002).
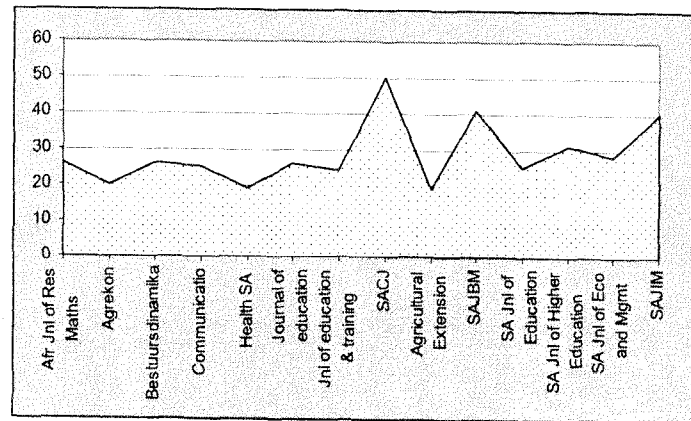

Figure 5: Journals for publication

Most of the journals have received only about 19 points (1 point each) allocated as being useful for research. The maximum each journal could have reached is 95. None of the journals received such a high figure. The top journal in this regard is South African Computer Journal (SACJ) (50 points) followed by the South African Journal of Business Management (SAJBM) (41 points). It would be interesting to repeat this exercise in two years time and see if there were any differences from the list portrayed above. A newer journal (SA Journal of Information Management (SAJIM) (40 points) had not been advertised

as much as the editorial staff would have liked to and they could change position.

Conclusion

This paper has addressed am issue that has not been addressed in South Africa and can become the subject on debate within Information Systems and Computer Science in South African academic circles. The issue were dealt with in two ways. The journals had been rated and some general comments had been made on them. The top journal rated by the IT/IS academics in South Africa is the South African Computer Journal (SACJ) with the South African Journal of Business Management (SAJBM) second.

Few IS/CS researchers have developed competencies that span major paradigms. The authors expect that most IS/CS articles will continue to be published in the well-known journals to ensure that their own skill sets will be improved. It is expected that most articles will still come form the tenure type academics with the teaching being done by the junior staff. The problem is to ensure that there are enough qualified people to supervise doctoral research ensuring at the same time that the research will pick up. Past prejudices of researchers from different traditions will not be removed by quickly and people will still support the more established journals.

The research questions that were answered were:

5. Why were there no rankings in South Africa of academic journals?
6. This is mainly because nobody has thought to rank the journals or investigate the quality of these journals.
7. What was the top IS/IT journal in South Africa?
8. The top journal was SACJ with SAJBM second.

The last two questions will be answered in a forthcoming article.

References

Athey S & J Plotnicki 2000. An Evaluation of Research Productivity in Academic IS, *Communication of the AIS*, Vol. 3 No. 7.

Babbar S, S Prasad & T Jasmine 2000. An Empirical Assessment of Institutional and Individual Research Productivity in International Operations Management, *International Journal of Operations and Production Management*, Vol. 20 #12 pp 1392 – 1410.

Baker E, H Bates, JV Garbacik-Kopman & J McEldowney 1998. A Preliminary Investigation into the Correlation between Teaching and Research in the Florida State University System, *Management Research News*, Vol. 21 #9 pp 1-9.

Barnhill RE 1998. Response to the Keynote Address, *MASC Report No. 102*, University of Kansas.

Barnhill RE 2001. Response to the Keynote Address, *MASC Report No. 105*, University of Kansas.

Claver E, R González and J Llopis 2000. An Analysis of Research in Information Systems (1981– 1997), *Information and Management*, 37 pp 181 – 195.

Fowler SC 1998. Enhancing Successful Researchers amidst the Information Explosion, *MASC Report No. 102*, University of Kansas.

Fulford P 2002. Forget teaching, Research is King, *National Post*, September 17.

Hamermesh DS, GE Johnson & BA Weisbrod 1982. Scholarship, Citations and Salaries: Economic Rewards in Economics, *Southern Economic Journal*, 49(2), October pp 472-481.

Harzig AW 2003. Journal Quality List, *White Paper*, University of Melbourne, Australia.

Hu Q & TG Gill 2000. IS Faculty Research Productivity: Influential Factors and Implications, *Information Resources Management Journal* Apr-Jun.

Katerattanakul P & B Han 2002. Quality of European Journals: A Comparative Study, *Decision Sciences Institute Annual Meeting Proceedings* pp 1352 – 1357.

Kemper S 2001. A Passion for Reputation, a Taste for Originality, Evaluating Research Productivity Conference, *MASC Report No. 105*, University of Kansas.

La Manna M & J Young 2002. From Journals as Documents to Journals as Knowledge Exchanges, *ELSSS* June.

Lightner NJ & FH Nah 1998. Methodology and Theory Building in MIS Research, *Americas Conference in Information Systems proceedings*.

Mabert VA 1993. Business Research: A Pragmatic Perspective, *Research Issues* May 24/3.

Mylonopoulis NA & V Theoharakis 2001. Global Perceptions of IS Journals, *Communications of the ACM*, Vol. 44 No. 9 September pp 29 -33.

Podgursky M 2001. Statistical Analyses of Economic NRC Scores, Evaluating Research Productivity Conference, *MASC Report No. 105*, University of Kansas.

Rice ML 1998. Introduction to Mobilising for Research Opportunities in the Next Century, *MASC Report No. 102*, University of Kansas

Rosenquist TH, S Ortega & KM Welch 2001. First Panel of Research Administrators, Evaluating Research Productivity Conference *MASC Report No. 105*, University of Kansas.

Rushinek A & S Rushinek 2003. What Makes a Publisher Important, *Ubiquity*, vol. 4 #12.

Sauer RD 1988. Estimates of the Returns to Quality and Co-authorship in Economic Academia, *Journal of Political Economy*, Vol. 96, no. 4.

Shanklin C, M Podgursky & S Kemper 2001. Panel of Researchers, Evaluating Research Productivity Conference, *MASC Report No. 105*, University of Kansas.

Sanklin C 2001. A Faculty Perspective, Evaluating Research Productivity Conference, *MASC Report No. 105*, University of Kansas.

Walstom KA & BC Hardgrave 2001. Forums for Information Systems Scholars: III, *Information and Management*, 39 pp 117 – 124.

Xie Y & K Shauman 1999. Commentary: Gender Differences in Research Productivity, *The Scientist* 13[19]:10 Sep 27.

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Supporting Part-Time Masters Students towards Successful Research Dissertations: A Case Study

Shaun Pather
Geoff Erwin
Corrie Strümpfer

Abstract

Experience at many Higher Education Institutions (HEIs) is that a large percentage of registered Masters students never complete their research dissertation. A number of reasons have been suggested for this. Coursework and dissertation mixed Masters degrees have been introduced in order to attract more Masters students, but the rate of completion is still low. The Faculty of Business Informatics (FBI) at the Cape Peninsula University of Technology (CPUT) has implemented several approaches to part-time Masters students' support, including the most recent one of offering a Structured Study Program (SSP) that is directly supportive of the skills and resources that a Masters student needs to complete a dissertation. This paper reports on various modes of offering Masters degrees, FBI's Masters student history, a survey of FBI's Masters students to assess factors influencing progress with research dissertations and the implementation of SSP.

Key Words

Masters-degree; information technology; post-graduate; higher education; South Africa

Introduction and Background

South Africa emerged from the pre-1994 political dispensation with two distinct types of tertiary educational institutions: Technikon and University. Technikons were created as career-orientated, practical-

content institutions with an emphasis on producing skilled graduates to meet specific needs of the country. Universities provided a broader educational offering with more research-focused outputs. This scenario is currently undergoing rapid transformation, as a result of a number of policy changes in the education arena that have been instituted by the post-apartheid government. The new dispensation for higher education now includes Universities of Technology, Universities and Comprehensive Universities. In 2002, there were 15 Technikons and 21 Universities in South Africa (NWG, 2002). This however was soon to change with announced incorporations and mergers planned for 2004 and 2005 (Ministry of Education, 2003). Major thrusts of this activity are: broadened access to tertiary education, altered relative subsidy values emphasizing Science, Engineering and Technology (SET) and increases in research capacity building and output. One of the mergers resulted in the formation of the Cape Peninsula University of Technology (CPUT), which is the outcome of the merger of Cape Technikon and Peninsula Technikon in January 2005 in the Western Cape Province of South Africa.

Given the imperative for academics to "publish or perish", the Faculty of Business Informatics at CPUT embarked on a process towards increased research activity and research output. This process aligned with CPUT's institutional mission, which was informed by the National Plan for Higher Education (Department of Education, 2001).

The National Plan for Higher Education in South Africa is described as "far-reaching and visionary in its attempt to deal with the transformation of the higher education system as a whole" (Department of Education, 2001: 2). Section 5 of this plan focuses attention on the sustenance and promotion of research in the higher education sector. Several priorities are listed, amongst which it is stated that there is a need "to increase outputs of postgraduates, particularly Masters and doctoral graduates as well as increase research outputs" (Department of Education, 2001: 63). Concern is expressed about the low enrolments in Masters and doctoral programs. It is stated that between

1995 and 1999 there was a "marginal decrease [in postgraduate enrolments in the Technikon sector] from 0.3% to 0.2%" of total student enrolments (Department of Education, 2001: 65).

Given the priorities reflected in the national policy, the Faculty of Business Informatics (FBI) recognised that a major mechanism for improved volumes and quality of research output was to grow the post-graduate program, particularly at Masters level. FBI, for a number of years, had offered a 4th year Bachelor of Technology in Information Technology (BTech IT). However, 4th year graduates were aimed at work-ready status, rather than progression to Masters level. To attract post-graduate Masters students a mixed coursework / dissertation Masters degree program (MTech Information Technology with e-Business specialisation) was designed. The first intake of students for this degree was in July 2002. However, after eighteen months, the first batch of students registered for this program had only completed the coursework and not made noticeable progress towards completion of a research dissertation.

In light of the priorities and concerns expressed in the National Plan for Higher Education (Department of Education, 2001) regarding research, the mission of CPUT, and the slow progress towards dissertation completion within FBI, this paper reports on a study of factors influencing throughput rates in post-graduate programs. The part-time Masters program in the FBI was used as a case study to investigate this issue. The authors reflect on FBI's experiences with this post-graduate offering and present summaries of Masters student surveys. The surveys and focus groups aimed to seek indications of student acceptance and blockages within various aspects of the Masters degree. The authors suggest some possible contributions to the identification of Masters students' difficulties in completion of a research dissertation. The paper concludes with discussion on possible ways to improve throughput rate and to reduce the time lapse between registration and graduation of Masters degree students.

Research Design

The objective of the study was to investigate influential factors contributing to low throughput rates in post-graduate programs, specifically the part-time Masters program in FBI in Information Technology and related areas. In particular, the study aimed to identify factors contributing to progress to completion of the research dissertation.

The principal research question was formulated thus: *"What are the factors contributing to the slow rate of progress towards the completion of the research dissertation at Masters level?"*

The authors conducted a review of secondary data that would inform the study. An intensive literature search in 2004, and then again in March to May 2005, indicated a paucity of literature dealing with the issue of throughput in research-based Masters programs. Several studies have been conducted into post-graduate programs – see for example Barnacle & Usher (2003), Skinner (2003), Dinwoodie (2001), Okazaki-Ward (2001), and Hackette & Gee (1998). However, none of these studies provided any insight or background to issues aligned with the principal research question. For example, the study by Skinner (2003) presents the findings of a study into the learning styles of international postgraduate students. In contrast, the FBI context was the development of student research capacity. Bearing in mind this lack of related literature the authors decided to use the Masters Program within FBI as a case study to gain some insight into the research problem.

Harrison (2002) contends that case study research is about engaging with the complexities of the real world, and making sense of them. Yin (2002) states that as a research strategy the case study approach covers more than data collection and data analysis techniques, and that subunits can add opportunities for broader analysis and increased insights into the problem, calling this approach an embedded case study design.

In this study, one case with three embedded units (each group of students being a unit) was identified, and two types of data collection activities took place.

Firstly, there were two sets of student surveys, to produce quantitative data. A questionnaire was used for the survey to ensure that students (who completed these anonymously) provided candid and honest responses. Questionnaire items were generated by analysing previously completed FBI student/client surveys (of 2002 and 2003). These client satisfaction surveys provided an initial set of items for the questionnaire. Additionally, the Masters programme coordinator, conducted several interviews with other academics involved with the Masters programme. This process assisted in verifying and extending already identified questionnaire items. Finally the questionnaire was subjected to a quality check, by using graduate research assistants in a pilot survey. The final set of questions were organised under the following headings in the questionnaire: Demographics; Students Research background; Progress on the Research Proposal; Barriers to completing the Proposal; Student's understanding of Dissertation Requirements.

Secondly, to gain further understanding of the problem, qualitative data was collected during three focus group sessions with the students. Focus groups are often used to explore a new product or concept, but are also valuable in a research strategy where evaluation of ideas or needs assessment is an objective. The focus group participants can usually grasp the relevant issues quickly, and can respond in an unfettered manner, reacting to each other's comments (Cooper & Schindler, 2003). Cooper & Schindler (2003) also stress that separate focus group interviews should be conducted for different subunits of the population to promote freer discussion and interaction. Further details regarding the implementation of the survey and focus groups are provided under the section *"Conduct of the Study"*.

The Case Study Context

Case study research sets out to address the understanding of a phenomenon within its operating context Harrison (2002: 177). In this section the operating context of the case study is outlined in three sections *viz.* 1. Various modes in which Masters degrees are offered; 2. An overview of the FBI Masters program that was the main subject of this case study; and 3. a description of the Structured Study Program (SSP) that forms an integral component of FBI Masters program.

Modes of Offering Masters Degrees

A Masters degree by research dissertation requires the candidate to demonstrate a mastery of the subject area being researched, as well as a comprehensive understanding of the research methodology being used (Remenyi *et al.* 17, 1998). By investigating the post-graduate programs on offer (in 2004) of a number of South African higher education institutions, via each organisation's web-site, the authors identified a number of ways in which Masters programs with a research component are offered. See Table 1 below for a summary of these typical modes of offering Masters degrees, with authors' comments.

Mode of offering	Pros	Cons
1. **Research only with supervisor as the major support / mentor structure**: Match a student with an appropriate study leader, and student works alone	Part-time student works at own pace, and fits the study in with work and personal schedule	Student needs extreme dedication and perseverance to succeed. No peer-group support. Low success rate

Mode of offering	Pros	Cons
2. **Coursework & Research mix:** Student registers for a series of courses (contributing various % to final mark), which must be completed successfully before a dissertation can be submitted.	Student has a peer group support environment; Student is enriched by being exposed systematically to new knowledge in the field. Student has many deadlines and targets.	Student sees Masters degree as a series of taught courses with focused outputs, and expects the completion of the research dissertation to have the same style. CPUT experience indicates that the transition from taught courses to dissertation is very difficult.
3. **Research only,** but progress to dissertation is supported by a Structured Study Program (SSP) with research milestones supervised by a team of academics.	See discussion below.	See discussion below.

Table 1: Typical modes of offering Masters Degrees

Cape Peninsula University of Technology Masters Degree Program

Efforts by the Faculty of Business Informatics (FBI) to increase research output and foster the beginnings of a culture of research amongst staff have been reported on previously (Pather & Erwin 2002; Pather & Erwin 2003). FBI academic focus emphasised post-graduate programs. Historically, there has been very low throughput from the Bachelor of Technology degree (4 years) to the Masters degree. FBI designed and implemented a Masters Degree in Information Technology with specialisation in e-Business using several approaches. Table 2 below shows registration figures, and the progress of students as at mid-2004.

Date of first registration	Mode of offering (See Table 1 above)	No. Of students first registered	Currently Registered	Drop-out rate	Student Progress
July 2002	2	17	9	47%	▪ All 3 course-work modules completed. ▪ Only one research proposal for dissertation submitted for consideration by April 2004.
Jan 2003	2	15	11	27%	▪ Students are completing the last of 3 coursework modules. ▪ Only two research proposals for dissertation submitted for consideration by April 2004. ▪ However, research proposal now included as a compulsory output for the 3rd module by **ALL** students.
Jan 2004	3	13	12	7%	▪ Four months into the program, and all students are actively completing a research paper. This serves as a topic discovery exercise. ▪ All students are beginning to identify research problems for the dissertation. Preliminary work towards the proposal has commenced.

Table 2: Summary of Student Progress on Masters programs The Masters Degree by Research Only: Supported by a Structured Study Program (SSP)

The Masters Degree spans approximately twenty-four months. The objectives of the SSP are twofold:

- To expose the student to current e-Business topics, trends and issues so that he/she is enabled as a conversant and versatile practitioner in the field; and,
- To prepare the student to undertake a sound research project that culminates in a Masters Dissertation.

The phrase "course-work" was intentionally avoided to describe any activities during the SSP as a way to dissociate the student from the (teaching) paradigm of knowledge transfer and examinations. No credit-earning examinations occur during SSP. The student is supported throughout the dissertation process, with published milestones (each one semester approximately). See Fig. 1 below.
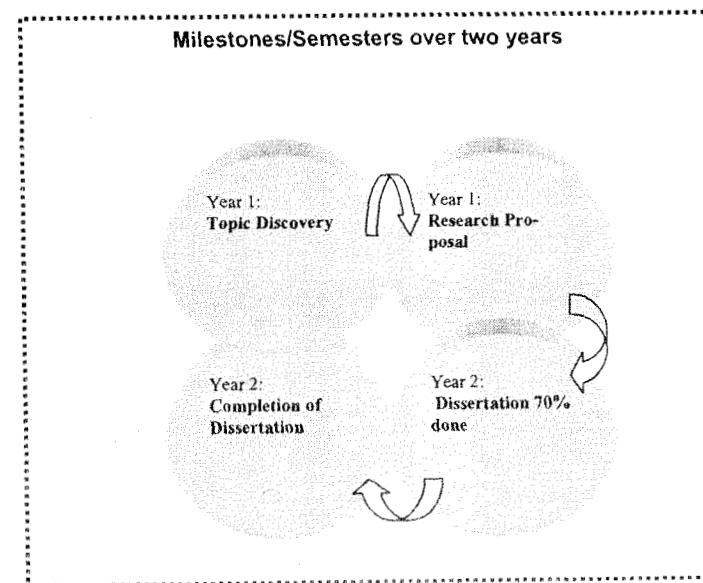

Milestones/Semesters over two years

Year 1: Topic Discovery

Year 1: Research Proposal

Year 2: Completion of Dissertation

Year 2: Dissertation 70% done

Fig 1: Milestones/Semesters in the Structured Study Program (SSP)

Implementation tactics of the SSP were:

- The first section of SSP is academic writing in a series of workshops, readings, analysis of research articles, and systematic exploration of the contents of an issue/topic.
- Each workshop/seminar facilitator issues projects/assignments (all compulsory) and a student is moved through the stages of writing a

paper with reviews along the way and papers as outputs/milestones. A compulsory paper (suitable for a conference or first phase towards a journal submission) is required at the end of the first semester.

- Students are paired with a study leader within the first five months, as the SSP proceeds. Topic discovery for dissertation starts within 4-6 weeks after first registration. A list of topics that the Masters student must master is issued to every student. This is like a shopping list in a supermarket. The benefit of this method is that most of the workshops/seminars can occur in any order any time. For each topic (such as Cyber Law, Web server implementation ++) there is a reading list (mix of compulsory, recommended and interesting) with suitable warnings re: academic sources only.

Conduct of the Study

To gain insight to the research problem viz. what are the factors influencing the perceived slow rate of progress towards the research dissertation, a case study research design (as described in the Research Design section of this paper) was chosen.

In the first phase of data collection, currently registered Masters students were surveyed from the three intakes of Masters students registered during and after July 2002 (refer to Table 1 above) up to January 2004. A questionnaire was used for the survey. The first two groups of students were surveyed in November 2003 and May 2004. The new intake of students in 2004 was also surveyed. Together this made up the survey of the three case study subunits. The surveys aimed to identify factors that contributed to slow progress onto and during the research dissertation.

Following on the surveys, focus group sessions were conducted with each of the three case study subunits in May 2004. These sessions were held with the 2003 and the 2004 intake of students to elicit data regarding their expectations of the Masters degree. In an effort to convene these sessions with an unbiased facilitator, a very new member of the Masters program staff, who had no previous interactions with the students, facilitated the discussions. The choice of the facilitator was made in order to ensure that students were more open and frank during the focus group sessions.

Results of the Survey

Of the 27 students, 18 took part in the 2004 survey. Five students were from the 2002 intake; five from the 2003 intake and eight were from the 2004 intake. Five out of the total of 18 students reported that they had no research methodology course in their previous studies.

Year of Intake††	2002	2003	2004
Prior	4	5	4
No Prior	1	0	4

Table 3: Prior Research Methodology Course

Eight of the thirteen students that attended previous research methodology courses completed these courses more than two years (the gap) before their Masters registration.

Year of 1st registration †† Gap▯	2002	2003	2004	Total No. of students
<1yr			1	1
1 to 2yr		2		2
2 to 3yr	2	2	1	5
3 to 5yr	1			1
5 to 9yr		1	1	2

Table 4: Gap since attendance at Research Methods courses prior to Masters degree registration

Progress on the Research Proposal

Table 5 shows student progress in commencing the research proposal.

At what stage is your research dissertation currently?	Year of Intake	Not started yet	Have a broad idea of the topic but have not started	Have a good idea of the topic and a clear research problem is identified	Have commenced working on the research proposal	Research proposal is completed
	2002	0	1	0	4	0
	2003	0	1	1	3	0
	2004	2	6	0	0	0
	Total	**2**	**8**	**1**	**7**	

Table 5: Progress towards completion of dissertation

Barriers to Completion of the Research Proposal

Table 6 shows the statements regarding perceived barriers towards completion of the research proposal completed by the student respondents, using a five-point Likert scale.

Only five statements' responses showed a clear aggregation towards either the top or bottom end of the scale viz. statements 5, 6, 7, 8 & 9 (shaded). Out of the 18 students eight indicated that not being able to decide on an appropriate research problem was relevant as a barrier. In addition to this, four of the five students from the 2002 intake indicated this as a relevant barrier. Five out of the eighteen students rated "lack of guidance" as a barrier for completing the proposal. Five more students rated "lack of guidance" as having had medium relevance. Of these five, two were from the first intake in 2002.

Nine of the eighteen students rated an inadequate understanding of research methodology as a barrier to completing the proposal for a dissertation. Three of these were from the 2002 intake.

Research Barrier	Student response
1. Not being able to decide on an appropriate research problem.	No clear response; spread across the scale
2. Finding a study leader.	No clear response; spread across the scale

Research Barrier	Student response
3. Pressure at my workplace.	No clear response; spread across the scale
4. Lack of guidance.	No clear response; spread across the scale
5. Inadequate writing skills.	Not relevant
6. Access to academic literature.	Not relevant
7. Pressure in my personal-life (e.g. family, children, etc.)	Not relevant
8. Lack of personal motivation to complete the degree.	Not relevant
9. Poor time management.	Not relevant
10. Inadequate understanding of research methodology.	No clear response; spread across the scale

Table 6: Barriers to completion of the Research Proposal (Shaded statements indicate statements for which summarised aggregate responses were clearly positioned on the scale)

Students' Understanding of Dissertation Requirements

In the section on the Dissertation two students indicated that they did not clearly understand the purpose of doing a dissertation. One of these was from the 2002 intake of students.

Significant majorities of respondents expressed understanding of the Masters structure, dissertation protocol and the role of Masters academic coordinator, study leader, academic staff and student in progressing the e-dissertation. 72% felt they would complete the dissertation in an 'acceptable timeframe', and all respondents estimated they would finish their Masters dissertation (not necessarily graduate) within 30 months of starting the Masters degree.

Focus Group Sessions: Students' Expectations from the Masters Degree

Detailed field notes were compiled during the focus group sessions, which were help separately with the different intakes of students. The session notes were analysed using the technique of open coding (Strauss & Corbin, 1998: 119-120.) Some of the pertinent issues that were evident after analysing the session notes are:

- The 2003 intake of master's students expected more management, as well as practical-oriented course work, whereas the group of students from the 2004 intake expected to do course work, instead of a SSP.
- Both groups expected more focus on technology.
- Students from the 2004 intake indicated also that they expected more presentations by e-commerce/e-business experts.
- Only one student from both groups mentioned enhanced research skills as an expectation.

Discussion of Survey and Focus Groups

Statistical treatment is necessarily limited due to the relatively small number of respondents. The aim in conducting both the survey and the focus group session was to determine factors influencing the slow rate of progress towards the research dissertation. From the analysis of the data presented in the previous two sections, we were able to make the following observations:

- Under one-third of the students had no prior formal exposure to research methodology even though all had four year degrees.
- More than half of the students who did undertake formal instruction in research methodology, did so between three and nine years ago.
- The authors statistically processed student data (see Table 7 and Table 8) to see if there were any significant differences:
  i. between the groups of students who had no formal instruction and those who did; and

ii. between those who had formal research methodology instruction within the last two years, and those who had formal instruction a longer time ago.

No statistically significant difference was found between these groups of students.

- Tables 7 and 8 on the next page show calculations done by the statistical software program SPSS for Windows; Cross-tabulations and Chi-Square.

Three of the eight cells in Table 7 have expected counts less than 1. The expected cell counts of about 1, or less than 1, in Table 7 would only be permissible if about 80% of the cells had expected values of above 5 (Cochran, 1954). Therefore, the chi-square probability value of 0.057 in the Asymp. Sig. column of Table 8 is inaccurate, which means that there is no statistically significant difference between the groups of students who had previous formal Research Methodology instruction and those who did not, in responding to the given statement.

The current structure of the MTech programme supports my development towards completion of the research dissertation			Strongly Agree	Agree	No Opinion	Disagree	Total
ResMethn	No	Count	0	3	0	2	5
		Expected Count	0.8	2.8	0.8	0.6	5.0
	Yes	Count	3	7	3	0	13
		Expected Count	2.2	7.2	2.2	1.4	13.0
Total		Count	3	10	3	2	18
		Expected Count	3.0	10.0	3.0	2.0	18.0

Table 7: Crosstabulation of Previous formal Research Methodology instruction vs. the perception of "The current structure of the MTech program supports my development towards completion of the research dissertation"

	Value	df	Asymp. Sig 2-sided)
Pearson Chi-Square	7.532 [a]	3	0.057
Likelihood Ratio	9.053	3	0.029
Linear-by-Linear association	2.997	1	0.083
N of Valid Cases	18		

[a] 7 cells (87.5%) have expected count less than 5. The minimum expected count is 0.56

Table 8: Chi-Square tests

The progress of students on the SSP as opposed to formalised coursework was examined. None of the students registered in 2002 and 2003 had completed their research proposals (even after being exposed to the formalised coursework for between 18 and 24 months). Yet, at least six of the students registered for the SSP in 2004 had a broad idea of a research topic. This indicates that formalised coursework was a barrier to (some) students completing their dissertations.

- No major surprises were apparent in the responses to the barriers to completing the research proposal. Only five out of the ten statements yielded some indication of relevance or irrelevance. From the responses of the longest-registered group of students (registered in 2002) to the question of whether an "inadequate understanding of research methodology" was a barrier or not, the responses were distributed evenly across the five point scale. This indicates that this group of students, even after being exposed to 18 months of course work, still do not have a uniform view of the value or importance of research.

- The lack of understanding of the longest-registered group of students with regards to the dissertation was highlighted. Not all of the students indicated that they had a clear understanding of what was required to complete the dissertation. One student in this group indicated that s/he did not clearly understand the purpose of doing the dissertation. This suggests that a formalised coursework program was a barrier to students gaining a proper understanding of the nature and scope of the dissertation.

- From the focus group sessions it is apparent that for all groups, expectations of the Masters program and the actual design of the program were mismatched. It was expected by most students that the Masters program would be a deeper (than fourth year) level of exposure to Information Technology concepts. None of the students (including those in the SSP) had any expectations that one of the principal outcomes of the program was to provide them with a solid foundation on which to conduct applied business research.

Limitation

The response rate to the survey was 67% (18 out of 27 responses). This response rate is considered excellent in general survey situations. However, a small number of respondents prevent rigorous statistical

treatment such as making inferences from cross-tabulation or finding correlations in the data.

Future Work

The students registered on the FBI Masters program via the SSP will continue to be closely monitored and evaluated in order to establish the success of this mode of offering and to publish results. Collection of data from other Faculties and institutions may provide guidelines for the design of Masters degrees.

Conclusion

The objective of the study was to determine factors influencing the slow rate of progress towards research dissertation, and to examine the possible impact on Masters success by introducing the SSP. It was not possible from the collected data to make any significant comparison between various modes of offering research Masters degrees. However, some interesting observations were made from the survey.

Students' exposure to research methodology needs to be carefully examined - especially where students had studied in institutions other than the registering institution for the Masters degree. Some anecdotal evidence does present itself in terms of students in the SSP being more research oriented, in a shorter time frame than those students on the course-work program. However, it is still too early to tell if the student registered under the SSP mode of delivery will be more successful that this first group of students.

Finally, a large number of the Masters students expected (or preferred) a more coursework-oriented degree with IT knowledge transfer. This could be an indication that there is a dwindling demand for research-only Masters degrees. However, it is incumbent on academics at tertiary institutes to focus on degrees with research focus towards meeting national research output targets, as well as to create a more fertile ground for Doctoral studies.

References

Barnacle, R & R Usher 2003. Assessing the Quality of Research Training: The Case of Part-Time Candidates in Full-Time Professional Work. *Higher Education Research & Development* 22,3: 344-358, November.

Cochran, WG 1954. Some Methods for Strengthening the Common $\ddot{y}^2$ Tests, *Biometrics* 417-451.

Cooper, D.R. & P. S. Schindler 2003. *Business Research Methods.* McGraw-Hill. New York.

Department of Education, 2001. *National Plan for Higher Education.* Pretoria.

Dinwoodie, J 2001. Motivational Profiling of Logistics Master's Students in Great Britain. *International Journal of Physical Distribution & Logistics Management* 31,3: 187-202.

Hackett, M. & H. Gee 1998. Developing Postgraduate Medical Education for Trust: A Secret to Long-Term Success. *Health Manpower Management*, 24,3: 109-113.

Harrison, A 2002. Case Study Research. In D Partington, (ed.) *Essential Skills for Management Research.* London: Sage.

Ministry of Education 2002. *Funding of Public Higher Education: A New Framework.* Pretoria.

Ministry of Education 2003. *Higher Education Restructuring and Transformation: Guidelines for Mergers and Incorporations,* April. Pretoria.

NWG 2002. The Restructuring of the Higher Education System in South Africa. *Report of the National Working Group to the National Department of Education,* 31 January 2002.

Okazaki-Ward, LI 2001. MBA Education in Japan Its Current State and Future Direction. *Journal of Management Development* 20,3: 197-234.

Pather, S & GJ Erwin 2002. Motivations for research Activity of Information Technology Academics. *Proceedings of Southern African Institute of Computer Scientists and Information Tech-*

nologists (SAICSIT) Conference, Port Elizabeth, South Africa.
16-18 September.

Pather, S & GJ Erwin 2003. Motivations for Research Activity of
Information Technology Academics. *Proceedings of Southern
African Computer Lecturers' Association (SACLA) Conference*,
Pilansberg Reserve, South Africa. June.

Remenyi, D & B Williams, A Money, E Swartz 1998. *Doing Re-
search in Business and Management*. London: Sage Publica-
tions.

Skinner, H 2003. *First Experience: A Study into the Learning Styles
and Educational Experience of International Postgraduate
Students*. University of Glamorgan. Accessed on 21 March
2005
http://www.business.heacademy.ac.uk/resources/reflect/conf/20
03/skinner1/skinner1.pdf

Strauss, A & J Corbin 1998. *Basics of Qualitative Research:
Techniques and Procedures for Developing Grounded Theory,
2nd Edition*. California: Sage Publications.

Yin, RK 2003. *Case Study Research Design and Methods*. London:
Sage Publications.

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Challenges in Postgraduate Research: How Doctorates Come Off the Rails

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Abstract

Worldwide the completion rate for doctorates ranges from poor to abysmal.
The responsibility for this must be shared by candidates, supervisors and the in-
stitutions to which they belong. In particular, postgraduate students create a
number of problems that cause their studies to derail. While supervisors can
change particular supervision protocols to improve doctoral throughput rates,
the extent to which postgraduate students themselves take ownership of their
research, will ultimately determine their degree of success. This article will dis-
cuss some of the problems that frequently occur and present some insights from
the supervision experience of the authors. We hope that our contribution will
create more light than smoke, and that it will help to improve the postgraduate
performance of students as well as supervisors.

Key Words and Phrases

Research candidates, postgraduate research, doctoral studies, mis-
takes, project management, stress, and supervisors

Introduction

Research suggests that up to half of the students who begin doc-
toral studies do not complete their studies at all (Golde, (2001)). If
completion time is included in the equation along with completion
rate, then an even smaller percentage of PhD candidates in the social
and human sciences complete their doctorates within the three year

window which current funding regimes (certainly in the UK) reflect. This is because there are a wide variety of problems that doctoral students face, while little attention has, historically, been given to helping them with these challenges. Although the issues that are addressed in this article derive from Informatics, the article has been written generically with Alternation's trans-disciplinary readership in mined. Furthermore, although the authors have specifically taken note of postgraduate supervision in the South African context the observations presented here pertain to problems that doctoral candidates experience worldwide.

Little discussion is taking place, and little research is being been done about the low completion rate of postgraduate students, possibly because it is an embarrassment to supervisors. Poor postgraduate performance however should be discussed in the open because it is reducing the entry of well qualified junior staff members into academia, an issue of fundamental concern particularly given the greying age profile of established academics worldwide. The authors have realised, from their experiences as supervisors, examiners and in running doctoral programmes, that many of these mistakes are not idiosyncratic but systemic, because they are occur in many different settings. This article has drawn on available literature, as well as on the experience of the authors. It also synthesizes the panel discussion that was held at the European Conference on Business Research Methods that was held at Reading in 2005. No actual empirical research was done as this article reflects the general discussions held at the conference. The Reading Conference discussion panel included supervisors, normal faculty members, prospective and present doctoral candidates. The authors intend following up the conclusions presented here with empirical research among supervisors located at different international institutions of higher education.

In the view of the three authors the challenges that doctoral students face are:

- Misunderstanding the nature of doctoral research

- Unreasonable expectations of University or Departmental managers
- Drifting focus on the doctoral work
- Lack of project management skills
- Not finding the 'right' supervisor
- Under-resourcing
- Lack of control over research documentation
- Lack of management of the research process
- Inadequate status or recognition
- Inability of students to cope with postgraduate stress
- Inadequate quality control

This research concludes by placing doctoral research in context and explaining the implications for supervising doctoral research. As stated before, since this article reflects the discussion held at the panel discussion, no research methodology section was prepared since this article is a synthesis of the general discussion held at the conference.

Challenges Facing New Researchers

It would be wrong to trivialise the problems experienced by new researchers. A PhD is relatively easy to complete if one has 20:20 hindsight but when the average student begins their research, few seem to have any realistic idea about, generally what management research is, and, specifically what a PhD is. While some might know that their success or failure depends on them making 'significant contribution to knowledge', but how many would understand, at that point, precisely what process you have to go through to be able to make these claims. While ageing academics always say that things are getting worse, it is our view that in the field of business and management, things is actually getting worse. This we contend is due to several factors: first, the rise of modular programmes that lack disciplinary coherence; second, the stripping out of 'difficult' modules such as statistics and research methods from under-graduate programmes (or students' ability to

avoid them in their modular choices); and, the focus on modules that are more functional and instrumental than reflexive and critical.

Students generally do not initially have a clear understanding of research methodology, in general, or of the ontological or epistemological choices that they need to make in order to frame their research. Few of them have a deep understanding of how to select the most appropriate methodological framework to allow them to research their own topic. Perhaps the most important specific challenge a newcomer to doctoral research faces is to understand the complex nature of management research. Some students think that it is largely about data collection or doing case studies while others think it is about discovering something entirely new and original when a well focused but marginal addition to our knowledge of a field would suffice. Besides such vague and partial conceptualisations of what research entails, the problem is further compounded because some students do not pick – or are unable to pick - an appropriate topic for their research, or who end up with a supervisor with whom they cannot establish a meeting of minds.

Research students could for instance look back at their previous studies to identify an area about which they were passionate. When you are passionate, you will be committed to your work. It is only at postgraduate study by dissertation that students get to actually choose what they want to do, rather than being constrained by the dictates of a curriculum and a syllabus. When you have options, why chain yourself to a topic in which you have no real interest? Research involves not only hard analytical skills, it also requires a strong degree of emotional commitment.

In a study on experiences of doctoral students, Golde & Dore (2001) note that more than 40% of the postgraduate students reported that they would pick a different topic if they could start all over again, while 36% stated that they would select a different supervisor if they were given the opportunity to do so. About a third of the respondents noted that they would select a different field if they had to redo their postgraduate studies. Clearly, the selection of the right topic and the

right supervisor are crucial because postgraduate study is supposed to optimise a doctoral candidate's future career and research options. A carefully considered process of explicit topic analysis is required to ensure that the correct topic is picked, based on the candidate's prior knowledge, past work experience and future career desires.

Another important part of topic analysis is that the supervisor and researcher should establish from the outset that the research project is empirically doable and ethically sound. All too often students pick a topic that it could take a research team of ten people, five years to complete; or they pick an interesting topic for which it would be impossible to collect appropriate data due to problems of access or confidentiality or they pick a topic that looks far more like a work-based project than an area for doctoral work   The student might underestimate the complexity of the research and pick a topic that is too broadly focussed, that cannot be researched in the required time frame, that may not get the compliance of respondents, or which is too expensive to research.

In order to select a viable topic the researcher has to engage in a careful and systematic process of research design that we briefly outline here:

- Determine your research interests within a specific field of inquiry and within a specific domain in that field primarily by reading the extant literature in that field – by so doing, you will locate your project within the current discourse that is being conducted in that area.
- Begin your literature survey to identify at least one specific problem that you want to solve by means of your research. If there is no problem that needs solving, there is no research to be done.
- Use the electronic resources of your institution to survey ongoing and completed research to ensure that your topic has not been, or is not being researched already.
- Determine the most appropriate research method to solve the problem, e.g. grounded theory, case study, ethnographic research,

survey research. Determine what your modus operandi would be for each method.

- Specify the key concepts that you will use in your research. Each key concept cites an authority on the subject gives a definition of the concept and shows relevance to the problem being researched.
- If you are conducting survey research, identify the following: Who is target population from whom you want to select your respondents? How many completed questionnaires do you need to have in order for your results to be valid for the whole target population? Whose permission has to be obtained to access the respondents? How will the questionnaire be disseminated? Under whose supervision will it be completed? How will it be retrieved? How will your results be analysed? What tests of significance need to be conducted in order to validate your results?
- If you are doing observational research, determine the following: Who is target population from whom you want to select your subjects? How and for how long do you have to observe your subjects in their natural surroundings in order for your results to be valid for the whole target population? Whose permission has to be obtained to access the subjects? How will your results of your observations be analysed and presented?

Many students are also unaware that their original research question(s) could and should be refined during the research process as they gain better insight into the problem that they are researching: this can only be done successfully if the students engage with the literature in their field a seek to keep themselves appraised of the debates that are developing in their area of study. Over a period of 3 to 4 years full-time or twice that part-time, it must be expected that the precise focus of study will change and the student must realise that they will have to take steps to manage the currency of their research. A good supervisor will make sure that a student continues to address the range of issues listed above.

To rank these challenges might mean that we have to rate one problem above the other and this might cause some confusion. It for this reason that we elected to discuss the issues alphabetically.

Student Expectations of Departmental Support

Golde & Dore (2001) state that the training that postgraduate students receive is not what they want and it does not prepare them for the jobs that they take. This is often a crucial problem for the student and one that means that much of the first year can be wasted as students are often just not equipped to begin doctoral work without the provision of substantial training in research methods and research design. In the UK, there is now much discussion about the creation of what is known as the 3+1+3 approach. In which the 1 year element between undergraduate studies and doctoral level study is in effect a grounding year for research training often resulting in the degree of Master of Research Methods (or some such appropriately titled award) which can be conferred on those who decide to exit their studies at this point. The fact that considerable effort is now taking place in the UK to improve the quality of research training by the imposition of 'standards' through the Quality Assurance Agency (http://www.qaa.ac.uk/public/cop/ cop/contents.htm) seems to indicate that steps are considered necessary by the QAA to set out what is considered to be an appropriate framework for the running of doctoral programmes. Presumably, if the UK's universities were perceived to be delivering a high quality PhD experience across the board, these steps would not have been considered to be necessary. The fact that the report finds it necessary to point out that 'Research opportunities should only be offered where students can be trained and supported within an environment which is supportive of research' might be taken as indicating that there are concerns that there are departments that are currently hosting doctoral programmes and students that clearly do not have the capacity so to do. These issues are of acute importance and perhaps explain why about half the respondents of the Golde & Dore (2001) study notes that they would change institution if they had to redo their post-

graduate study because of the lack of departmental involvement and the existence of an environment that was supportive to them. The QAA also points out that 'Research students should have access to training sufficient to gain the skills they need to design and complete their programmes effectively and to help prepare themselves for their subsequent career'. The fact that issues like these have to be made explicit is clearly an issue of some concern perhaps related to the very low completion rates in many UK HE institutions. As a contributor to the British Academy of Management's annual doctoral symposium, one of the authors has been disturbed by the obvious lack of training and institutional support that many doctoral candidates seem to be receiving. In the UK, the QAA stipulate that:

- Supervisors should possess recognised subject expertise.
- Supervisors should have the necessary skills and experience to monitor, support and direct research students' work.
- Research students should receive support and direction sufficient to enable them to succeed in their studies.
- The progress made by research students should be consistently monitored and regularly communicated to the students.

Grover (2001) correctly argues that if a department or school wishes to run a postgraduate program it must require the full involvement of the department in the form of clear institutional support. Just as the student must be supported by the supervisor, so the must the supervisor be supported by their head of department and by an institutional commitment to research that is manifest in the form of adequate resourcing. Senior faculty are being put under increasing pressure to teach, to publish and to generate income. Quite often a research student will be well down the list of priorities of senior faculty: this is a reality of contemporary life in the higher education sector in most countries. Again, the QAA document indicates that 'The entitlements and responsibilities of a research student undertaking a postgraduate research programme at the institution should be defined and communi-

cated clearly'. The fact that this has to be so clearly set out in the report, again, seems to imply that this fundamental element of good practice might often be overlooked.

The supervisor has a major role to play in the coaching guiding and mentoring of the postgraduate student. However, postgraduate students must take personal responsibility to ensure that they meet deadlines. At undergraduate level, everything has a time and place and one merely conforms to the timetable. By contrast, at postgraduate level, the student has to develop their own research timeframes, set their own deadlines and monitor their own progress. What is very clear to us it that the relative responsibilities of the student, the supervisor and the institution are often left unstated and implicit when they need to be made explicit. A failure to make these issues explicit - and to make them the basis of a formal document or learning contract - might be an unwise omission by any supervisor in 'the age of the litigious student'. Certainly, in the UK, the number of (failed or unhappy) PhD students who seek to resolve their issues through the courts is increasing with several institutions having been the subject of legal action where it has been argued that they have shown an insufficient 'duty of care' to their students. Featuring of the front page of the Times Higher educational Supplement in the UK for an infraction such as this does little for the University brand at a time when league tables and public image are much in the mind of vice chancellors.

Some postgraduate students expect their supervisors to supervise the research project, while it actually is their own responsibility to do so (Davis, 2000). A central task of all examiners is to test that the thesis is the students 'own work' and not the work of the supervisor. Though clearly, with weaker students there is always a tendency as a supervisor to over supervise when a more sensible option might be to counsel the student to discontinue their studies. Supervisors are mentors whose main duties are to guide students in intellectual matters, namely the appropriateness of their research design, the validity of their research problem, the quality and progress of their literature sur-

vey, the development of an appropriate theoretical framework for interpreting the results of their research, how to deal with unanticipated problems and the overall production of the written output. Generally, a good supervisor will pay as much attention to a student's research program as the student does but while the supervisor is responsible for guiding the student, it is clearly the student's responsibility to manage their project.

Postgraduate study by dissertation is often a lonely undertaking, unless the researcher makes a conscious effort to identify fellow researchers in her/his discipline and forms a mutual-support community of learning with them. It is in this area of networking, that the supervisor should be directing their students towards good conferences in their fields and identifying the lead researchers in particular fields as it is often people drawn from these networks who will be called upon the examine the thesis. Discussion forums and mailing lists on the Internet enable students to form such communities of learning with fellow researchers regardless of where they live.

Lack of project management skills

Doctoral research students are sometimes snowed under with work because they are not good project managers: this is often because the student has been insufficiently precise in how they have scoped their project. The student does not always have the capabilities to be a good administrator. The role of administrator involves the management of a wide range of activities from managing data collection activity, archiving material, organising interviews, identifying key milestones and ensuring that they achieve them.

Davis (2000) supports this by stating that they should take control of the management of their dissertation process: indeed, if the research student is to become an accomplished researcher, this is a skill that they well have to learn. While the question of skills development has been addressed at undergraduate level, it has not been addressed at doctoral level. In addition to producing knowledge, researchers should also be able to demonstrate that they have required research and research management skills. Some students forget that they should also manage the 'productivity gap' and have ideas on how to manage the problems they will experience.

A student should also be able to manage source documentation that he/she is using. Project management is a skill taught to almost all IT students. Students, however, do not realise that the dissertation is a project; hence, they do not apply the time management and contingency-planning skills learnt at undergraduate level. Whenever they reach a barrier or encounter a problem, many students are unable to cope because they did not plan adequately in advance and develop contingencies at the same time.

Kearsley (1998) argues that students are not getting enough time with their supervisors because the supervisors are overworked and there is an acute shortage of qualified supervisors. It costs the student time and money to see the supervisor regularly. However, it might not be viable for both parties to meet one another face-to-face too many times for consultation sessions, especially if the student has other commitments such as a permanent job. Historically, it was a way to get interaction going and this was accepted as the norm.

However, things have changed with access to e-Mail and videoconferencing. Students need regular contact with their supervisor and the use of electronic media could form part of the solution. However, some students lapse into periods of inactivity. Students who put their studies on the back burner struggle to get the pot on the boil again. Golde & Dore (2001) argue that many students do not clearly understand what doctoral study entails, how the process works and how to navigate it effectively and how time-off aggravates the situation. When a student falls into a lull, it takes a great supervisor to help him/her get out of it and stay focussed. Many doctoral theses are abandoned due to "work pressure" when a consistent three hours a week would have been adequate to keep the project momentum to an acceptable level. Golde & Dore (2001) note that 23% of the students

said that they changed their decision about their postgraduate studies while they took time off before the studies. More than 30% of the students regretted that they did not take time off before their studies. Nearly 90% of the students will not take time off during their studies if they had to do their postgraduate studies again.

A student needs to attend to certain aspects of her/his study in good time. Many students are poor in estimating the amount of time required for particular tasks. Some students think that they can take as long as they want to – e.g. taking more than ten years to finish a dissertation. However, in the UK there is a concerted effort now taking place to ensure that fulltime students complete in fewer than four years, and that part-time students complete in around six to seven years. Whether this focus on completing within time is successful remains to be seen.

The 'long gestation PhD' is a problem for both examiners and supervisors. After ten years your supervisor will have become interested in new problems in your discipline (and may even have retired) while the research question on which the thesis was based will, no doubt, have been answered by someone else or no longer be a focus of discourse and debate in your fields. However, if a student has worked consistently and the project is set to take more than three years, s/he should request that supervisor gives better support. Some supervisors have an outdated approach and expect the student to first read for two years before embarking on writing: ideally, the student should be scanning the databases for new articles and publications right up until final draft stage. Most successful doctoral candidates start the overall planning of their project as soon as they start their literature survey. However, given the mentor-mentee/ master-student power structure ethos that surrounds the PhD, many students who should be questioning their supervisor's methods and supervisory skills, are often reticent to do so.

Not Finding the 'Right' Supervisor

Finding the 'right' supervisor is a negotiated process. As a customer of a higher educational institution, a prospective student has the right to select a supervisor with a good supervision track record, provided that the supervisor is satisfied with the applicant's academic track record and provided that the supervisor has the time to take on the student Prospective students should consult the other 'clients' of the department before they decide on a supervisor. At some institutions departments are managed in such a way that bureaucratic procedures are used to allocate supervisors (Davis (2000)).

Unless you consider the reputation of the institution to be more important than the reputation of your supervisor, try to avoid studying at an institution where you are disempowered in important matters such as negotiating with a prospective supervisor. Many students who have ended up with supervisors with whom they cannot establish a meeting of minds, end up never receiving proper advice on their dissertation and thereafter make the mistake of just accepting such bad supervision (Arenson (2001)). Some students then make the mistake of rather keeping quiet and trying to finish the dissertation on their own. If the student and the supervisor do not get along, the head of department or programme coordinator should step in and help resolve the problem. In some UK institutions, annual monitoring and feedback systems have been put in place in which a 'neutral' member of staff (i.e. perhaps the head of the doctoral programme who is not supervising a particular student) will contact each member of the programme for a discussion of their progress in which specific questions will be asked about the frequency and effectiveness of supervision. This provides the student with an opportunity to raise their concerns with a senior member of staff who might intercede on their behalf.

Due to the commoditisation of higher education worldwide, budget constraints require that postgraduate supervisors are also involved in undergraduate teaching, which makes it increasingly difficult to find committed supervisors who will have enough time to over-

see postgraduate research. This means that a prospective student should determine which supervisor's research expertise coincides with the area of research that the student wishes to pursue. They should also find out how many other doctoral candidates the person is supervising. While there are differences of opinion on the maximum number of students a supervisor should have three to four seems the norm while anything over six should indicate to the prospective student that the supervisor is already overloaded. As a rule of thumb, an overloaded supervisor, even though well-intentioned, is unlikely to be an effective supervisor.

Utilising Electronic Resources from the Outset

New students do not always know which resources are available and how to use the ones at their disposal – such resources include electronic interlending library databases that would enable you to borrow books from off-campus libraries via your local library, searchable databases of resources available on campus, or direct access to e-journals. Subject librarians and other senior students will usually be able to assist newcomers in acquiring the required research skills.

The student also makes a mistake by thinking that the dissertation is the only real-world task they need to do. It could be expected from them to do presentations, publish in journals, etc. Students fail to see their supervisor is a resource. Instead, many students depend on the WWW as source of information, but fail to realise that huge quantities of disinformation, misinformation and poorly written works exist online.

Poor Management of Research Documentation

The poor control of documentation can seriously hinder doctoral research. This happens when postgraduate students do not structure their studies properly. A badly structured dissertation and supporting documents will affect the final product. The student should have a proper documentation system that will help him/her and the supervisor

to manage the content of their endeavours. It is amazing how many students do not index references properly and then spend valuable weeks at the end of their studies trying to rediscover that lost reference.

Referencing software is essential and students should use a consistent referencing system such as Harvard and use resources such as those developed by the American Psychological Association which prescribe very tightly how material needs to be presented. Very often, students start reading to get a broad picture of their subject matter and write down quotations for later use. However, these quotations often only have the authors name and year of publication as students forget to write down the entire reference and end up producing inaccurate bibliographies that do not tie in with the text. Examiners can get very angry at badly presented work and so they should as this is an insult to their professional standing.

Students often do not know in which sequence to write the chapters of their dissertations. A dissertation essentially is an act of written communication and a narrative. This means that the writer should see the supervisor and examiners as knowledgeable co-communicators. While the thesis appears to be a document with a clear sequence, they are almost always written out of sequence. The first chapter, which introduces the topic to the reader and which gives a preview of what is to be encountered in subsequent chapters is often written last after the researcher knows what s/he had written in the rest of the dissertation. Students who fail to realise this, waste months trying to write the abstract, and end up having to rewrite the introductory chapter in any case. One does not write a dissertation from a to z.

Well-written dissertations are built organically rather than written sequentially. While working on one section, a good student might gain a new insight from his/her continual scanning of the literature and will adjust another section of the dissertation accordingly. The literature survey chapters are often written in two phases, an initial phase where you determine what is current in your field of study and a subsequent

phase where you do a critical assessment of theories put forward to account for particular problems in your field.

A common fault with theses is that the literature review is presented as a catalogue of the literature. This is characteristic of a poor student as the examiner will be looking for a student who has developed their critical skills sufficiently to be able to synthesis the literature to expose and discuss the key themes. In doctoral research one has to interpret one's results within the framework of either an existing theoretical framework that you have critically assessed or within the framework of your own particular theory that you must contextualise within the broader framework of current theories in your discipline.

Because you have to follow an organic approach to writing your dissertation, be wary of a supervisor who thinks linearly and expects of you to complete one chapter at a time, and who will not permit you to subsequently edit and add to chapters which s/he has already signed off. Writing a PhD is an organic and iterative process and much of the final stage of the thesis will be concerned with 'knitting the thesis together' by ensuring that arguments and propositions in the earlier parts of the thesis are addressed and that your findings a discussed within the context of theory and the extant literature. Examiners are looking for cogent discussion and it is amazing how many students fail to interpret their findings adequately.

Many students do not make enough backups of their work, or they store information on media that is easily lost or inaccessible. Imagine you have used the computer of your girlfriend to write your dissertation. How accessible will your data be if you break up! Part of the documentation is to ensure that enough backup copies exist of the drafts of your dissertation because a computer can easily be stolen or data lost. The problem some postgraduate students have is that they do not build an asset base (Grover (2001)) of data. However, the converse also happens. Due to paranoia, some students over-backup, and have multiple copies and versions on hard disks, CD's and now on memory sticks. When they update on one medium, they often don't update the others, and end up with several intrinsically different files with the same name. Sometimes they open an earlier version of work and save it over a more recent version. Learn to manage you media!

Some students make the mistake of not organising their studies in an orderly manner. To render a good thesis the student should remember that the thesis is a scholarly endeavour and should be supported by documentation. A mistake many students still make is to destroy documentation after they have earned their degree. The student should keep scarce references, questionnaires and interview schedules available for the purposes of an academic audit as part of the examination process.

Another problem can occur because of infrequent meetings with the supervisor. The student could make the mistake of cramming too much information into one session. On the other hand, the supervisor could also be under pressure and discuss too much in one session with the student. If you have a good supervisor, expect to do most of the talking, in the form of answers that you have to provide in response to critical questions. e-Mail can help to reduce the information overload between supervisor and postgraduate student, but don't expect your supervisor to respond to your e-mail messages right away.

Inadequate Quality Control

Students often mistakenly assume that the mythological unicorn "the perfect dissertation" really does exist. Because humans have different points of view, and because we consistently underestimate the complexities of the problems that we ourselves cause, perfect knowledge is an illusion. Many students are afraid to think qualitatively because they fear having to manifest originality. All research entails a leap of faith because all theories are belief systems that have to be critically assessed.

A lengthy dissertation does not necessarily determine intellectual boundaries. Quantity does not equate to quality. It is a mistake to think that a dissertation has to be a certain length. A dissertation has to be as

short as possible and as long as necessary. The length of a dissertation does not determine its quality, how one engages with one's topic does.

Some students and supervisors do not measure quality against standards that characterise a written scholarship. Some of these are that work should be based on expert findings reported in peer reviewed literature in the field, that research demonstrates the workings of a thorough, careful, critical and analytic mind, looking at the advantages and disadvantages of the argument and presenting one's findings in an orderly fashion.

Inadequate Status or Recognition

Doctoral research students sometimes feel that they are invisible ghosts roaming the campus, unrecognised by others. This is even worse if the doctorate is presented at a distance or if it proposes radical change to existing protocols that may be costly to implement, causing authorities to look at it with their eyes closed (Kearsley, (1998)). Another mistake is that some students expect too much after they have received the degree. Graduating is giving birth to ideas—ideas on a landscape of knowledge where only the fittest survive.

Students should realise that the thesis is their work, driven by their questions. The other problem is that the student forgets that the thesis is in the public domain and the real test of one's ideas comes when they are critically assessed in public. Students heave a huge sigh of relief at the end of the dissertation and expect to be considered specialists in the field and to be consulted on the subject matter. However, post dissertation research is what gets recognition. Many graduates, especially those outside academia, fade into obscurity because they do not pursue further research in the field, because they do not publish, because they do not present at conferences, and because they do not network with other researchers in the field and. To gain recognition for one's work, one has to be visible. Use it or lose it. While peer respect is the greatest accolade an academic can achieve, it is difficult both to win it and sustain it.

Unable to Cope with Postgraduate Stress

Aronson (2001) notes that students need emotional support to cope with study-related stress. Postgraduate stress is a reality which students and faculty have to cope with. Sometimes students feel that they do not need any assistance in this respect. Many students do not realise that they will spend about twenty percent of their time when they are young on postgraduate studies while their friends earn money and acquire all kinds of material benefits. Students also must be willing to have their ideas criticised without feeling that they are under attack. While supervisors will be critical, it is what they are there for; they should have sufficiently developed inter-personal skills to ensure that their comments to students are constructive and not destructive. The role of the supervisor is to develop talent and not destroy it. Students, however, must acknowledge that no one's ideas - even theirs - are perfect and that they might sometimes have to face comments that they do not want to hear (Golde, (2001)). One way of coping with stress is to associate with others who are successfully coping with similar pressures. Students who have proceeded further along the track without having derailed are a good source of advice and consolation.

The Need to Set Time Aside for Oneself, Family and Friends

Humans essentially are gregarious beings who need to interact and bond with family members, friends and relatives. It is a serious error to neglect one's leisure time requirements and one's family. New knowledge can only be committed to one's long-term memory during sleep and recreation while you are not focusing on your research. Allocating time for oneself forms part of working smarter instead of working longer. Students who do not allow time for themselves with their family and friends invariably experience the law of diminishing returns—the longer they work, the less they get done.

Endpoint

In supervising a PhD a supervisor can face the full range of emotions from deep concern and anxiety as the student misses the point yet again through to elation as the chair of the viva committee tells the student 'congratulations you have got it'. As experienced supervisors and examiners, we have both faced these emotions. But, the PhD and the institutional setting in which the student and the supervisor have to operate are changing. In earlier years, universities existed more as craft industries in which the master (the senior academic) had to endure very little scrutiny and students were assumed to be quiescent and voiceless.

The world is changing and the spectre of managerialism is materially changing the terrain of the PhD. Students are now seen more as paying customers or as potential litigants and our assertion that the PhD was/is often very badly supervised seems to indicate that the craft mode of production had not delivered. Whether increased managerialism improves the quality of the PhD is a moot point. While actions are clearly needed to counter the inadequacies of the past, some would argue that over-engineered managerial solutions might be even more harmful.

We have identified two key issues that supervisors and prospective students need to bear in mind. First, the decision to register for a PhD and the decision to take on a research student are both non-trivial decisions - they are major commitments on both sides and commitments that can bind both parties for several years. Increasingly, a failure here might end up in court. Second, students are well advised only to countenance registering for a PhD within an institution that is committed to research and which provides an environment where the supervisor-student relationship can flourish. Those institutions that see the PhD - and increasingly the DBA - as a way of making money should be avoided at all costs.

Essentially, we see a successful PhD emerging out of a triadic relationship between student, supervisor and institution. Unfortunately, the way in which this triadic relationship can be made to work more effectively is not well known and is, perhaps, an area where there should be more cross-national comparative work undertaken so that better models and frameworks for supervising and mentoring the senior faculty of tomorrow can be developed.

References

Arenson JE 2001. Working on the Doctoral Dissertation, *Decision Line*[1], September/October.

Davis GB 2000. Writing the Doctoral Dissertation: A systematic Approach, *Decision Line*, March.

Golde CM 2001. Questions to Ask when Thinking about Pursuing a PhD, http://www.phd-survey.org/advice/advice.htm accessed 14 October 2003.

Golde CM & TM Dore 2001. At Cross Purposes: What the experiences of today's doctoral students reveal about doctoral education, *A survey initiated by the Pew Charitable Trusts.*

Grover V 2001. 10 Mistakes Doctoral Students Make in Managing Their Programs, *Decision Line* May.

Kearsley G 1998. Doing Doctoral Work at a Distance, http://home.sprynet.com/gkearsley/doctoral.htm accessed 14 October 2003

Lubbe S & R Klopper 2004. *Introduction to Research Design in Information Communication Technology.* Durban: Dolphin Coast Publishers.

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[1] *Decision Line* is a scholarly academic journal.

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The Thinking Styles of a Group of Information Systems and Technology Students

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Abstract

This research reported in this contribution identifies the thinking styles of second year students in Information Systems and Technology on the Westville Campus of the University of KwaZulu-Natal, situated in Durban, South Africa. The article explores whether there is a relationship between student thinking styles and their examination marks. The subjects were 134 second year IS&T students. Harrison & Bramson (1984) identified five primary thinking styles, the Analyst, Synthesist, Pragmatist, and Realist styles. Most of the findings in this study support those of Harrison & Bramson (1984). Implications of these findings for both teaching and research are discussed.

Keywords

Thinking styles, multiple styles of thinking, IT students, InQ, IT educators, IT professionals

Introduction

IT expenditures and organisational performance have been disconnected in the past, due to an economic transition from an era of competitive advantage on information to one, based on knowledge creation. The earlier era was characterized by slow change that could not be interpreted by most formal information systems (Lubbe, 1997). During this period, information systems were based on programmable recipes for success that were able to deliver their promises of effi-

ciency, based on beliefs about particular business contexts (Lundin *et al.*, 2002).

IT managers therefore need to develop a greater appreciation for their intangible human assets (e.g. knowledge and inquiring styles). In other words, an investigation into knowledge creation needs to be done more than knowledge management (Lundin *et al.*, 2002). According to them, attention should be paid to the human aspects of knowledge creation in current formulations of IT enabled knowledge management.

This research report will therefore provide guidelines in overcoming these challenges. It will be structured and supplemented in such a way that it can be used by students and professionals, marketers and IT personnel. Hence the population for this study will be people in the Information Systems and Technology discipline, which include a normal distribution of all Information Systems and Technology students. The students' thinking styles will be matched with their final examination marks.

Characteristics of the Five Inquiring Systems

The Five Thinking Styles

Harrison & Bramson (1984) state that the technical name for Styles of Thinking is Inquiring Modes. Inquiring Modes are basic sets of purposive methods for making sense of the world. They are built on early-acquired preferences, on learned values and on concepts about the world and the nature of reality.

Harrison & Bramson (1984) conclude that in Western society there are five distinct styles of thinking. Most people showed a preference for one or two of the styles. Consequently they devised a test called the "InQ" which can be used to rate preferences for the different thinking styles. People are subcategorized as being the Synthesist, an Idealist, a Pragmatist, an Analyst or a Realist.

Taking Harrison & Bramson (1984) as a point of departure, this study will report the results by comparing it to the results reported in Harrison & Bramson (1984). The reason for using this study was because the ideas in this book are based on years of research into people's thinking patterns. Thinking about thinking will improve an individual's ability to communicate and improve their skills as IT students and professionals.

Kienholz (1999) argues that one effective means by which to leverage knowledge is for those involved to be or to become mindful of the various ways people actually go about gathering data, asking questions, solving problems and making decisions. This is where Harrison & Bramson's Inquiring Mode Questionnaire (InQ) and their related education materials could help, through their application in developing the ability to use each of these inquiring modes appropriately and in working more effectively with each other (Kienholz, 1999).

The Synthesist: According to Harrison & Bramson (1984), to "synthesize" means, essentially, to make something new and original out of things that by themselves seems different from each other. Hence, they noted that Synthesists are integrators; they like to discover two or more things that no other people may appear to have little of or no relationship at all and find ways to fit them into a new, creative combination. Facts to them are not as important as the interference the people make from them. They also found that Synthesists tend to be interested in conflict and also like change – often for their own sake. Synthesists tend to pride themselves on their "creativity," incisiveness and often secretively on their cleverness (Harrison & Bramson, 1984: 11).

The Idealist: Harrison & Bramson (1984) state that the idealist mode of thinking is used by people who like to take a broad view of things and tend to be future-oriented. They also think about goals and are interested in social values. Idealists are like *Synthesists* in their focus on values rather than facts. Idealists like to be seen by other people as useful, supportive, open and trustworthy. They tend to have strong

ethical sense and pride themselves on their high standards, though they are not always aware of just how high their standards are. They can become angry at and resentful of those who seem to care little for others, who lack integrity or who will settle for less than the best. The thought process of *Idealists* is receptive, that is, they welcome a diversity of views. When it comes to solving problems, *Idealists* are at their best in situations where the important things are values, judgment, feeling and emotions. Idealists especially pride themselves on their "intuition" (Harrison & Bramson, 1984:12).

The Pragmatist: The motto of the Pragmatist is "Whatever works." They excel at finding new ways of doing things with the materials that lie at hand. They tend to approach problems in a piecemeal, incremental fashion, one thing at a time. Pragmatists tend to be less predictable than people who prefer other styles of thinking. Facts and values have equal weight for them. Again, "whatever works" is what is important. They are also apt to be interested in formulating strategies and tactics for getting things done and they often like to be liked, approved of, or at least accepted. The pragmatist approach is flexible and adaptive. They also take pride in their adaptability (Harrison & Bramson, 1984:13).

The Analyst: The Analyst approaches problems in a careful, logical, methodical way, paying great attention to details. Analysts see themselves as factual, down-to-earth, practical people. They also tend to have a theory about almost everything. They analyze and judge things within a broad framework that will help to explain things and arrive at conclusions. Analysts see the world as logical, rational, ordered and predictable. More than anything else, *Analysts* want to be sure of things, to know what's going to happen next. They take pride in their competence, in the sense of understanding all the facets of whatever the situation in which they happen to be (Harrison & Bramson, 1984:15).

The Realist: The Realists motto is, "facts are facts." Or maybe, "What you see is what you get." Realists firmly believe that any two

intelligent people, properly equipped with eyes and other sense organs, will at once agree on the facts. Without agreement on the fact, *Realist* believes, things don't get done. They also want to do things surely, soundly and firmly and to be assured that once something is done it will stay that way. The Realist always wants to get things done by proceeding on the facts that are at hand, rather than by gathering ever more data as Analysts do (Harrison & Bramson, 1984: 17).

Combined Thinking Styles

According to Harrison & Bramson (1984), no individual thinks with purely one style. Most people show preferences for a single style and some show equal preference for two styles. It is those latter people with which this section deals.

Idealist-Analyst (I-A): The I-A is characterized by a broad, comprehensive view. They are careful, thoughtful people who want to achieve the ideal goal using the best method possible. They are unlikely to make quick decisions and possess a future-oriented, planned view of things (Harrison & Bramson, 1984).

Analyst-Realist (A-R): The A-R person is highly task-oriented and objective. They like facts and structured approaches to problems. They are interested in achieving concrete results and finding the best methods for achieving them. The A-R does not like situations that defy analysis and when confronted with such a situation they tend to freeze or be unable to cope (Harrison & Bramson, 1984).

Synthesist-Idealist (S-I): The S-I thinking style is in many ways the exact opposite of the A-R. The S-I will tend to focus on ideas and inferences rather than structure and facts. They are perceived as being conceptualizes and theorists by other individuals and therefore not very practical (Harrison & Bramson, 1984).

Idealist-Realist (I-R): The I-R is characterized by the twin thrust of high standards and concreteness. They know how things should be done and also have the skillset to carry them out. They don't seek a lot of recognition for their efforts (Harrison & Bramson, 1984).

Pragmatist-Realist (P-R): The P-R is highly task oriented but approaches things in a less structured manner than the A-R. They tend to have considerable energy and drive and achieve things solely for the sake of achievement. They tend to make quick decisions with a minimal amount of data and as a result can quickly become overextended and may seem impulsive (Harrison & Bramson, 1984).

Idealist-Pragmatist (I-P): The I-P combination is typical of someone who gains agreement on goals and then tolerates a great deal of latitude in method. They have a great concern for "people" issues and more in tune with a person's needs. As a leader, the I-P will appear to be over permissive and be allowing of too much latitude (Harrison & Bramson, 1984).

Analyst-Pragmatist (A-P): The A-P likes facts and structure but also is willing to experiment. They know what they want and how to get there but want to have fun along the way. This can be quite damaging in relationships due to the fact that serious goals and directions will appear to be not taken seriously by the A-P (Harrison & Bramson, 1984).

Analyst-Synthesist (A-S): The A-S respects structure and logic. The Analyst style seems to be more dominant in this combination most of the time. Whereas the Analyst respects structure and logic, the Synthesist understands and values the opposite. This can be the source of great internal conflict and a profound lack of understanding by people around them. They can, sometimes be very difficult to listen to but have a lot to contribute (Harrison & Bramson, 1984).

Synthesist-Pragmatist (S-P): S-P's show the greatest tolerance for change. They strive on ambiguity and uncertainty and have developed the coping mechanisms to deal with both. Their thinking style generates tremendous amount of creativity (Harrison & Bramson, 1984).

Synthesist-Realist (S-R): The S-R is extremely rare due to the fact that the synthesist and realist are at the opposite ends of the thinking spectrum. The S-R is a person with great energy for unorthodox but firm achievement. They can see very clearly what the proper course is and also see that the opposite way is just as acceptable (Harrison & Bramson, 1984).

Three Way Thinkers: People that possess a strong preference for three of the five styles tend to be more creative. This flows from the idea that they have more thinking styles available to them. They are more versatile and can rely on the style that best suits an individual situation (Harrison & Bramson, 1984).

Flat Profile Thinkers: The rarest of thinking style preferences is a person who shows no preference for any specific style. This is where the InQ test shows a relatively equal score for all five thinking styles. These people tend to be unpredictable, less intense and less recognizable than people with strong preference for other styles. They tend to be very adaptable to a situation but also tend not to be leaders (Harrison & Bramson, 1984).

Available Statistics on the Inquiring Mode Questionnaire

According to Harrison & Bramson (1984), the most productive thinkers may simply be those who are capable of thinking well in all five dimensions. He further stated that the Synthesist and Idealist styles are strongly oriented toward the "value" side of the dichotomy or substantive rationality while the Analyst and Realist approaches are clearly more oriented toward "facts" or formal, functional rationality. The Pragmatist, contingent approach either bridges the gap between the two or perhaps ignores the question altogether.

Kienholz (1999) states that the Synthesist and Idealist inquiring modes are substantive, value-oriented ways of thinking and knowing, while the Analyst and Realist are functional and fact oriented. He then went on to state that about half of all people prefer to think in one main way, 35% prefer two or more styles in combination.

Kienholz (2000) finds that a solid understanding and appreciation of the different preferences that people hold for each of the thinking styles can lead to an improvement in the design of information and knowledge management systems.

DeLisi (1998) establishes that the results of his research indicated that IT professionals are less likely than expected to employ an analytic thinking style and more likely to employ an idealist or pragmatist style.

Perpetuation of the stereotype as stated by DeLisi (1998), impacts on the role of IT professionals in the organisation in three ways:

- It limits their opportunities for job assignments that have strategic impact on the organisation,
- It limits their opportunities for promotion to the highest levels of the organisation,
- It affects their relationships with clients and senior executives.

These limits in turn affect the success of IT overall. Before DeLisi (1998) administered the InQ questionnaire, the participants were asked which thinking style they believe will be most common among the sample group. Almost universally, they stated that the analyst style will be most prevalent. This will tend to have a self-fulfilling effect; with IT professionals more likely to volunteer for activities that are detailed and analytical in nature rather than volunteer for leadership positions that require a skill they do not perceive that they have. If the contributions of these IT professionals are predominantly of an analytic nature that reinforces the stereotype and makes it less likely they will be involved in tasks that are truly significant to the enterprise. Hence this study by DeLisi (1998), which deduces that a large percentage of IT professionals tend to have idealist characteristics.

Zhang (2002) states that the styles of thinking contribute to IT students' academic achievement beyond what can be explained by abilities. He also found that teachers could foster students' creativity by using the thinking styles. The understanding of how students think can help teachers in using different instructional styles and different assessment schema to foster creativity by accommodating to and challenging the development of multiple thinking styles.

The Impact of Thinking Styles on IT Students

According to Zhang (2001), there are many reasons why some students get distinctions in their courses because there are various ways of explaining individual differences in academic achievement. He further stated that traditionally, many psychologists and IT educators have attributed IT students' successes and failures in academic achievement mainly to individual differences in abilities, but in recent times, scholars have been examining other factors that affect students' learning outcomes. This could in a way be interpreted as IT students whose individual differences affect their academic successes and failures.

Zhang (2001) believes that the different thinking styles do more than just facilitate IT students' intellectual development. Thinking Style also help enhance IT student development in interpersonal relationships. As a result, IT students will learn how to work and deal with their peers. He also found that the thinking styles were related to IT academic achievement and had implications for teacher training. He suggested that all teacher-training programs include a component that introduces knowledge on thinking styles. Hence, he deduced that an understanding of thinking styles could improve IT educators' teaching and thus, student learning.

Zhang (2001) finds that the styles of thinking contributed to IT students' academic achievement. He found from previous studies that certain thinking styles statistically contributed to the prediction of academic performance beyond ability tests and it also suggested that stu-

dents with particular thinking styles did better on some forms of evaluation than on others. Lin and Liu (2003) further states that the thinking styles could assist IT educators in identifying individual differences among students and help them to consider students' needs in a more individual base.

Zhang (2002) identifies a variety of methods for inducing the use of the thinking styles. One of his methods was that educators should start giving consideration to the fact that repeated studies have found that both school and university curricula around the world tend to penalize creative thinking. He further stated that in order to produce IT students who are going to be capable of adapting themselves to the ever-changing world, educators must start cultivating students' creative thinking during their educational career. Otherwise, the current generation of students' will be overwhelmed by their future world of work.

Zhang (2002) also finds that IT educators who work in an environment, which they are given flexibility and autonomy, would work in an innovative manner. Thus, IT educators could become role models for IT students in using thinking styles.

Bernardo et al. (2002) states that there could be some differences that may be observed between correlation patterns because of the different cultures in the education systems. According to Stuhlman (2004), culture is a combination of organisational history, shared experience, group expectations, unwritten or tacit rules, ethics and social interactions that affect the behaviour of everyone in the organisation. Bernardo et al. (2002) further states that formal educational institutions tend to promote knowledge and skill that are valued by the larger culture or society within which they operate. Accordingly, educational systems in different cultures might also value and encourage different thinking. This may reflect cultural preference for thinking styles. By recognizing such differences in how educational institutions value some thinking styles over others, researchers can better understand how it affects performance in the different cultures.

Research Methodology

Aim of the Research

Khumalo (2002) states that well-defined aims sets in place all other things such as the selection of the most appropriate methods and the management of the research once it has been started. The aim of this research was to determine the thinking styles of IT students in relation to the marks they obtain.

Measuring Instrument

The authors decided to use a Questionnaire as an elicitation instrument to obtain the data. Remenyi et al. (2000) states that the main purpose of questionnaire research is to obtain information that cannot be easily observed or that is not already available in written or computerized form. The purpose for using a questionnaire in this research is because the information cannot be easily observed. The author cannot determine an individual's thinking style without the use of a questionnaire as other forms of measurements may make individuals feel uncomfortable and withdrawn. This can generate mixed responses and may not be a true reflection of how the individual thinks.

The Inquiring Mode Questionnaire (InQ) as designed by Harrison & Bramson (1984) was used for this study. According to DeLisi (1998), the InQ instrument is one of a number of instruments (e.g. Sternberg & Wagner (1993) - Thinking Styles Questionnaire and Grigorenko & Sternberg (1993) - Thinking styles questionnaires for teachers and students) that measure individual thinking styles and related variables but it differs from other instruments in that it looks at how people process information – something to which IT students can easily relate and it stays away from personality measurements, such as introversion or extraversion, thereby avoiding the defensiveness that might result from a discussion of one's personality.

Sample Design

Population refers to the entire group of people, events or things of interest that the researcher wishes to investigate (Sekaran, 2000). The Population for this study consisted of people in the Information Systems and Technology discipline, which included a normal distribution of all second year Information Systems and Technology students.

This study was conducted in School of Information Systems and Technology on the Westville Campus of the University of KwaZulu-Natal. The sample for this study included all second year IS&T students.

Sampling Technique

The samples for the IT students and academics were selected using the simple random sampling technique. According to Sekaran (2000) this technique is where every element in the population has a known chance of being chosen as subjects in a sample. The procedure used for selecting a sample of IT second year students included entering the names of the students into Microsoft Excel and thereby selecting a sample of 144 students from a population of 230 students (as per table for determining sample size from a given population from Sekaran (2002)), by randomly generating numbers statistically.

Data Collection Method

The questionnaire that is used in this study is similar to the one used by Kienholz (2000), in the study entitled "Metaknowledge Management: Global Implications of Churchman's Inquiring Systems for Knowledge Creation and Sharing". The questionnaire was personally administered to the respondents because according to Sekaran (2002) this type of data collection method is less time consuming and less expensive.

This method is most appropriate because if respondents have any doubts on the questions, it can be clarified immediately. As compared to mail questionnaires, this method has a higher response rate. The use of interviewing as a means of collecting data is also not appropriate in this research as it may intimidate respondents into not expressing their true answers to the questions (Sekaran, 2002).

The thinking styles of the before mentioned Information Systems and Technology students was measured using the InQ questionnaire and these scores were then used to determine their thinking style. Once their thinking styles were established, all students with the same thinking style were grouped together and a correlation was established between their ranges of their examination marks and their style of thinking. Students were then asked to provide their gender, age and registration number on the demographic sheet, which was provided. Their examination marks were then verified.

Results and Discussion

A total of 144 questionnaires were given to the second year students and 134 responses were received back for analysis. According to Kienholz (2000) preference for a mode(s) is indicated by a score of 60 or more. Profiles are explained in terms of one-way thinkers, two-way thinkers, three-way thinkers and level profiles. Results for the group of 134 are as follows:

- One-way thinkers = 122 or 91% of the students. (Seven were Synthesists, thirty-seven were Idealists, twelve were Pragmatists, sixty-two were Analysts and four were Realists)
- Two-way thinkers = 11 or 8% of the students. (One was Idealist and Pragmatist, one was Analyst and Synthesist, two were Analyst and Realist, four were Analyst and Pragmatist and three were Idealist and Analyst)
- Three-way thinkers = 1 person had a preference for Pragmatist, Analyst and realist styles of thinking.
- There were no students who preferred level profile thinking, that is, students who preferred four or five styles of thinking.

- All students in the sample were aged between 19 and 28 years old. 35% of the sample was male while the rest were female. The questionnaire usually takes about 30 minutes to complete, but there were some students who took less than 30 minutes. The following table gives an indication of the mean differences as well as the percentage of students who scored 60 or more.

	Synthesist	Idealist	Pragmatist	Analyst	Realist
Range Differences	(57-66)	(56-75)	(58-67)	(59-73)	(61-63)
	9	19	9	14	2
Group Means (N=134)	60.57	63.92	63.08	65.60	61.50
% of participants scoring 60 or above in each inquiry mode:	4	24	8	45	3

Table 1: Respondents' self-reported thinking styles

There were no participants who scored 48 or less in each inquiry mode. As demonstrated in Table 1, the range differences are very close. The author therefore concluded that the students preferred the analyst style of thinking, since 45% of the students had a score of 60 or above in this style of thinking. The range difference also indicates that the scores for each respondent in each style of thinking was quite close
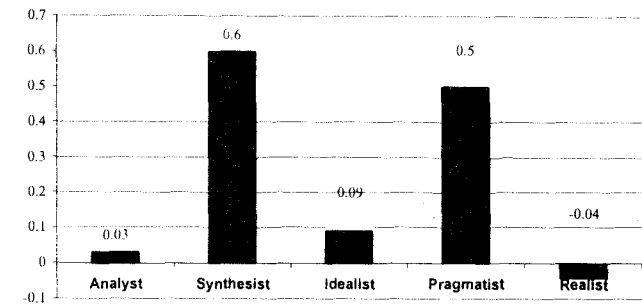
Figure 1: Correlation between students' Examination marks and their Style of Thinking

Figure 1 depicts the correlation between the student's examination mark and their style of thinking. Four of the styles of thinking show a positive relationship between the style of thinking and the student's examination mark. The strongest relationships exist between the Synthesist and Pragmatist styles of thinking and their relevant examination marks. The reason for the Synthesist having the strongest relationship is because they have a tendency to look at a problem from many different perspectives and can usually come up with some pretty creative solutions because they enjoy conflict or being asked to come up with solutions to the "unsolvable problem". The Pragmatist is like the Synthesist that is why their correlations are so close; they are resourceful and creative individuals that are problem solvers and creators of solutions. Their solutions tend to be a bit more risky than those of the Synthesist but are more innovative with a better payoff and therefore support the findings by Harrison & Bramson (1984).

The Idealist on the other hand, has a low correlation because they delay from too many choices and try too hard for perfect solutions. They can also appear overly sentimental (Harrison & Bramson, 1984). The analyst also produced a low correlation as they tend to over analyze and over plan. They can also be overly cautious and try too hard for predictability (Harrison & Bramson, 1984). Therefore these findings support the findings by Harrison & Bramson (1984).

Realist produced a negative correlation because they rush to over-simplified solutions and try too hard for consensus (Harrison & Bramson, 1984).

The correlation between the examination marks and the one-way thinker's displayed a low positive relationship of 0.18, while the two-way thinkers had no correlation between their examination marks and both their styles of thinking. The individual who had a three-way thinking style had a C examination score. This shows that a combination of thinkers might not be able to solve a problem cooperatively and will affect systems building.

Recommendations and Conclusions

The author recommends that IT educators should take note of Zhang (2002) three ways in which IT educators can modify IT students' thinking styles. This can help increase students' academic achievement. They are as follows:

- Firstly, IT educators could re-examine and redesign their instructional models. The new instructional models should be such that they allow multiple thinking styles and that they put together the specialized functions of both the modes of thinking. By making allowance for the different thinking styles, the IT educator is giving IT students an equal opportunity to benefit from their instructions and to experience IT academic success, no matter what the students' predominant thinking styles are.

- Secondly, IT educators could also encourage the use of thinking styles by providing IT students with opportunities for participating in extracurricular activities. This will lead to creativity-generated thinking styles and advanced cognitive development.

- Thirdly, there is also an indirect way of allowing IT students to use multiple thinking styles and to be engaged in both modes of thinking. That is, IT educators themselves should be al-lowed to use creativity-generated thinking styles in their teaching and interaction with students in general.

As can be seen from this research, IT students need to understand their thinking styles in order to be successful. The authors would like to recommend that the same study be done on the first and third year students in order to gain a better understanding of IT students' thinking styles.

References

Bernardo, ABI, L Zhang & CM Callueng 2002. Thinking Styles and Academic Achievement among Filipino Students, *The Journal of Genetic Psychology*, Vol. 163, No. 2, pp. 149-163.

Delisi, PS, RL Danielson & BZ Posner 1998. A CEO's-Eye View of the IT Function, *Business Horizons*, Vol. 41, No. 1, pp. 65-74.

Harrison AF & RM Bramson 1982. *The Art of Thinking*. Berkley, New Jersey.

Khumalo, R 2002. The Importance of Research Methodology in a Publishable Research Paper, *European Conference on Research Methodology for Business and Management Studies*, United Kingdom, April, pp. 173-176.

Kienholz, A 2000. Metaknowledge Management: Global Implications of Churchman's Inquiring Systems for Knowledge Creation and Sharing, *Workings Paper*.

Kienholz, A 1999. Systems ReThinking: An Inquiring Systems Approach to the Art and Practice of the Learning Organisation *Foundations of Information Systems: Toward a Philosophy of Information Technology* http://www.cba.uh.edu/~parks/fis/fisart.htm accessed 1 Sept 2004

Lin, SSJ & EZF Liu 2003. Effectively Accumulating Students' Thinking Styles via the World Wide Web: Experiences of Construction and Application, *International Journal of Instructional Media*, Vol. 30, No. 1, pp. 61-65.

Lubbe, S 1996. *The Assessment of the Effectiveness of IT Investments in South African Organisations*. PhD Thesis in Information Systems & Technology, University of the Witwatersrand.

Lundin, MS, H Herlau & LB Rasmussen 2002. Paradoxes in IT, Education and Citizenship, *Second European Conference on Information Technology* (Education and Citizenship) Barcelona, June.

Remenyi D, B Williams, A Money & E Swartz 2000. *Doing Research in Business and Management–An Introduction to Process and Method*, Great Britain: The Cromwell Press Ltd.

Sekaran, U 2000. *Research Methods for Business – A skill-Building Approach*, New York: John Wiley and Sons Inc.

Stuhlman, D 2004. Important Terms for Knowledge Management, *Stuhlaman Management Consultants* http://home.earthlink.net/~ddstuhlman/defin1.htm accessed 1 Sept 2004.

Zhang, L 2001. Do Thinking Styles Contribute to Academic Achievement beyond Self-Rated Abilities? *The Journal of Psychology*, Vol. 135, No. 6, pp. 621-637.

Zhang, L 2002. Thinking Styles: Their Relationships with Modes of Thinking and Academic Performance, *Educational Psychology*, Vol. 22, No. 3, pp. 331-348.

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Harnessing GIS to Extend HCI Teaching

Patricia Margaret Alexander

Abstract

Visualization of information is an important human computer interaction (HCI) research topic but it is not generally included in university courses. Geographical Information Systems (GIS) are excellent examples of applications where visualization is used to represent information. In addition, GIS require sophisticated interfaces so that the users can manipulate and query the underlying data. Hence, in practical exercises using GIS students interpret information and use interfaces that differ somewhat from standard Windows objects and text. As this context and form of interaction is unfamiliar to typical Information Systems students, this experience can be exploited further to emphasize the fact that end users frequently operate outside their comfort zones when they use information systems. This paper describes a strategy to enhance the teaching of HCI. The learning experience takes the form of an HCI evaluation of GIS software in a usability laboratory. Students play the roles of end-users and researchers / evaluators. The exercise allows the lecturer to demonstrate exactly how usability data, including satisfaction questionnaires, can be collected and analyzed. As a result four separate objectives are met at one time, an important issue when lecture time is scarce.

Keywords

Geographic Information Systems, Graphical user interface, Human-computer interaction, Information Systems education, Software design and evaluation, Usability testing, Visualization of data

Introduction

'Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive comput-

ing systems for human use and with the study of major phenomena surrounding them.' (Hewett *et al.*, 1996)

Human-computer interaction (HCI) studies the way in which information is presented, the way in which input mechanisms (the features that allow the end user to input data or select options) are understood and used, and the way in which a 'conversation' occurs between human and computer as the one responds to the other. HCI is considered to be a critical technology, which accounts for more than half the cost of new systems and is a significant factor determining whether software will eventually be adopted and used effectively (Strong, 1994; Douglas *et al.*, 2002). HCI is included as a core knowledge area in the Computing Curricula 2001 (ACM-IEEE Curriculum 2001).

'Universities should be encouraged to perceive HCI as a 'critical technology' and the accompanying skills and knowledge as fundamental to a student's education and preparation for jobs in the information age.' (Strong, 1994)

The ACM SIGCHI Curricula for Human-Computer Interaction (Hewett *et al.*, 1996) includes an Information Systems curriculum in HCI (as Appendix B of that document).

Increasingly HCI (in contrast with the broader field of Interface Design or Interaction Design where interaction with specially designed artifacts with control panels or other controls is important) is taught using Web-based systems as examples. This can be seen in the examples and emphasis provided in text books regarding GUI software interfaces (see Preece *et al.*, 2002; Carroll, 2002; Stone *et al.*, 2005; Newman & Lamming, 1995; Shneiderman & Plaisant, 2005). However, in practice it is necessary to design and evaluate interfaces of all sorts of software, ranging from that which does very little processing to sophisticated software development tools and customized application software, regardless of whether they are accessed from the Internet or are local. Obviously the complexity of the interfaces of these systems varies. On a straightforward Web page the user's input is generally limited to navigating using standard options. E-commerce sites require forms to be filled in and submitted but also increasingly use standard interaction features. In contrast, custom-developed applications may have a far larger number of input options, use unfamiliar conventions and be less consistent and predictable. Similarly the output, both in terms of the information presented and its format, can vary in complexity. At the same time the user may need to concentrate on demanding tasks in a stressful work environment and hence needs a transparent interface more urgently than a Web surfer does.

This paper will discuss how a graduate HCI course can address these issues by including as examples systems that use visualization to present rich information (large, information-abundant displays). Tools that construct visual representations of information not only produce output that assists the user in interpreting complex information, but also include features that allow complex input instructions to be constructed, and hence allow the user to interact in a sophisticated way with the system. Thus, the primary intention was to develop the students' understanding of interaction issues beyond the standard, familiar options seen on typical Web sites and e-commerce systems to those required on more complex applications to which they will have had less exposure. By demonstrating a wide variety of options the course will, hopefully, stimulate the students to be more creative when designing new systems. As will be seen two additional outcomes were achieved by studying the GIS software within a simulated usability laboratory.

This paper consists of the following sections.

- A section where the underlying learning theories and their application to the subject and learning environment are discussed.
- A section on visualization in which its importance to HCI is explained and the current problems regarding teaching visualization are noted.

- A section on usability testing. This is a topic which is completely separate from visualization but can be demonstrated using GIS software as the software being evaluated.

The case study, which is a detailed description of a series of lectures and a practical session, is then described in detail.

Learning Theories and their Application to HCI

Constructive Learning

The following characteristics of constructive learning are derived from those given by Simons ((in Duffy *et al.*, 1993) cited by De Villiers (1995, p.79)).

- The learner must be *actively* involved.
- The learner will interpret the new information in the *context* of existing information.
- The resulting knowledge will, therefore, extend existing knowledge as additional meaning is *constructed*.
- The learner must be aware of the *goals* towards which he is working.
- The learner must ensure that he is still on course and *progressing* towards the goal.
- The learner must be *conscious* of his way of learning.

There is no real reason why these requirements cannot be achieved in a lecture, but it is essential that the learners actively participate in the learning process. The lecturer can provide the learning opportunity but the co-operation of the learner is needed to ensure that this learning occurs. Constructive learning is particularly well suited for topics where relationships can be determined, multiple representations compared and a real-world context explored. It is not suitable for acquiring a fixed set of preordained, factual knowledge (Leidner & Jarvenpaa, 1995). Hence, constructive learning can be achieved best in HCI by

using a problem-oriented educational approach where the students are actively involved in practical tasks. This is in line with the recommendations made by Gulliksen & Oestreicher (1998) and Strong (1994) but, as both groups of authors recognize, it is necessary to seek feasible ways of achieving these goals.

> '*How can we introduce practical tasks into a HCI task? Without it taking too much time? Using simple and realistic problems.*'
> (Gulliksen & Oestreicher, 1998)

> ' *There is also the challenge of a [sic] setting up a practical context and approach for getting students involved in real world projects. It is often very difficult to set up such situations in a lab.*'
> (Strong, 1994)

The Social Context of Learning

The social interaction of the individual is an essential part of learning and group work is intended to achieve this. Richmond (1970, p. 95) quotes Piaget as follows,

> ' "*... without interchange of thought and co-operation with others the individual would never come to group his operations into a coherent whole ...*" (*Intelligence, p. 163.)*'

Socioculturalists believe that the ideal of the individual's subjective interpretation of reality being as close as possible to a universal objective reality is in fact neither possible nor, indeed, desirable. They emphasise that learners will only readily accept and understand concepts that they can relate to their own environments, cultures and histories. Each individual will have a unique interpretation of reality, which reflects his unique life world. Vygotsky emphasises a social origin for learning. Thought is a form of 'inner dialogue' modelled on interaction between people (Thomas, 2000). Learning is seen as a social process that involves human beings in communication with one another. Hence, teams should be made up of more advanced learners and less

advanced learners so that the learners can learn from one another. This is, therefore, a model that fits in with an intersubjective view of social and physical reality rather than either a subjective or objective ontology. Despite the fact that both sociocultural learning theory and constructivism are both cognitive models, they differ with respect to how closely the subjective interpretation should coincide with objective reality.

Teamwork has been recommended as an important part of the activities in HCI courses with the students adopting roles in 'simulated development team(s)' (Strong, 1994; Gulliksen & Oestreicher, 1998).

'Classes should be broken into teams of four to six students, with each team member assigned a role on the team.' (Strong, 1994)

Visualization

Visual representations of complex data are found in numerous applications in fields as diverse as the health sciences, business and economic sciences, earth sciences and natural sciences. The potential for creating such graphic representations has grown as processing power and computer memory has increased. It is for this reason that visualization is one of the focal points of HCI research (Hartson, 1998). The Human-Computer Interaction Lab of the University of Maryland, for example, has numerous current and past projects where aspects of visualization are researched and they see larger, information-abundant displays as the future of user interfaces (Human-Computer Interaction Lab/ University Of Maryland; North & Shneiderman, 1999). The School of Information at the University of Michigan also has research initiatives in information visualization (Olsen *et al.* 1997). HCI is 'cross-disciplinary in its conduct and multidisciplinary in its roots' (Hartson, 1998) and it is, therefore, not surprising that GIS user interface issues and usability feature prominently as research topics in Geographic Information Science (Cartwright *et al.*, 2001; MacEachren & Kraak, 2001; Slocum *et al.*, 2001). Cognitive issues concerning con-

struction and interpretation of visual representation are related research topics that also combine HCI with applications. This is very valuable when combined with data mining (Schoeman, *et al.*, 2003). .

Information Systems is the discipline where students learn to design computer systems and these may be intended for various application areas. These students need, therefore, to be prepared to address the requirements of the future in a wide range of applications. Gasen (1996) predicted the following HCI educational outcomes for the future (1996+).

TABLE I: HCI Educational Outcomes for the Future
Extract from HCI Education in Perspective (Gasen, 1996)

HCI in higher education	1996+
Educational Outcomes	Increased understanding of social needs
What do students learn?	Communication and information
Concepts: knowledge of parts	**Visualization very important** *(my emphasis)*
Skills: techniques for using concepts learned	Further emphasis on process
Processes: Ways of linking techniques, i.e. methods	Greater focus on iterative educational design, evaluation and accountability

There are not many books available that can be used in a graduate HCI course, particularly when studying the development process[1] (Gulliksen & Oestreicher, 1998). (Two are noted by Gulliksen & Oestreicher as being used predominantly in Sweden, namely Preece *et al.* – the newest edition is 2002, and Dix *et al.*, 1998). American university courses use a wider variety of texts (Strong, 1994) and many courses make use of collections of readings. Gulliksen & Oestreicher felt that the books were in general not entirely satisfactory. '... very few books that can be used on higher levels of education ... too shallow' '... no really useful textbook on the market.'

Those that are most often prescribed pay particular attention to general concepts and theories such as cognition, design and evaluation

methodologies - such as user-centered design and iterative development - and HCI principals and heuristics. They often use examples from typical Web pages, computer-mediated communication and groupware, and from dedicated devices such as mobile phones but seem to neglect other software. It is understandable that they rely on examples that the average student is familiar with, but this tends to reduce the significance of the topic and limit its usefulness in preparing students for the full spectrum of applications that they will eventually encounter. The students may be left with only a superficial understanding and the impression that this is a very simple field of study, which is unworthy of the emphasis placed on it. In short, HCI is not simply about designing stylish web pages.

However, the new edition of the well-known book by Shneiderman goes some way to addressing the problem, as it includes a chapter on 'Information Search and Visualization' (Shneiderman & Plaisant, 2005).

Usability Testing

Laboratory testing to evaluate usability is one of a number of complementary methods of evaluating software interfaces. It can be used in both formative and summative evaluation to collect data, specifically times taken to complete set tasks and error frequency counts. It is a typically positivist method, and hence it can only be used as part of the software evaluation. As it takes place in a laboratory the setting and the tasks are controlled, independent and dependent variables are identified, and an attempt is made to exclude all other factors. Hence the participants who are using the software are not interrupted, do not work under undue pressure, and are not required to work for over-long times (unless the evaluation specifically includes one of these factors as a variable). These stress factors are often present when the software is used in the office and by excluding them the evaluation can be simplified and be made more rigorous. The data collected is largely quantitative as times are measured and errors are counted. These data can

be collected automatically by building code into the software that records times, specific input, and error codes (Preece et al., 2002).

The data can be supplemented by asking the participants to complete satisfaction questionnaires, which may include open-ended questions as well as questions that can be analyzed quantitatively. Additional information can be collected by recording the participants' actions on videotape and interpreting this information later. (For example, the recordings can be viewed to detect attitude by analyzing body language). Alternatively, the participants can be asked to explain what they are doing and why, while they carry out the set tasks and this can be recorded as audio, or they can be interviewed after they have completed the lab session.

Students taking our HCI course are told about various of ways of evaluating human computer interaction, including laboratory tests. The whole question of quantitative and qualitative evaluation is discussed in detail and a pluralistic evaluation plan is recommended.

Research Methodology

Since this paper presents a detailed description of a teaching case, this is not a research paper and we cannot claim to use a research methodology in a strict sense. The 'research' is at best exploratory, interpretive research and relies on description rather than on data of any sort.

However, since the author was personally involved as a participant and main decision-maker it can possibly be considered to be action research. The cycle of action, reflection, learning and revision, which is essential in action research, has subsequently become established as the initial presentation of the lectures and laboratory work has been repeated three times. However, this repetition has all taken place since this paper was initially submitted and is not described here. The data collection described in the section on the practical, laboratory session

was not intended to collect research data but rather to illustrate to students how data is collected and analysed in a usability laboratory.

The Case Study

The Fourth Year HCI Course and Students

At our university the fourth year HCI course is one of ten, semester (fourteen week) modules taken by graduate Informatics students. The current class consists of one hundred and forty eight students, some of whom study part-time. This is the only course in the Informatics stream of the School of Information Technology that is devoted specifically to HCI. The course is mainly presented as lectures during which there is time for discussion and some workshop activities but practical classes in computer laboratories are also included where students evaluate different human computer interfaces. The students are not taught to use any web development software nor are they expected to implement designs using any programming language as this course concentrates on interaction design and evaluation. These students have, however, all completed programming courses and can be considered to be highly computer literate.

The students are introduced to HCI concepts while doing the analysis, design and full implementation of a system for a customer as part of their third year project. Design of web pages is also included in the implementation of an e-commerce system in a separate fourth year module, but not all of the students will have completed that particular course.

A graduate HCI course should reinforce these complementary learning experiences but also needs to go beyond them. It is difficult to cover all the recommended material adequately in the time available while including opportunities for active student participation. One needs to design the course and each lecture so as to get the maximum from it without overloading the students with more information than they can assimilate.

A paper (Yeh & Wickens, 2001) that describes a usability test of GIS software, during which the use of colour and intensity and decluttering features was evaluated, triggered this lecture plan. This piece of research was not presented as being intended specifically as an HCI learning opportunity but formed the stimulus for this exercise.

Lecture Preceding the Laboratory Session

The GIS laboratory session was preceded by a lecture presented by a cartography lecturer. He introduced the topic and demonstrated the use of two GIS systems, one of which is licensed software and one that is freeware. Hence the idea of visualization of information and the particular application in GIS was discussed and, since this lecturer actually demonstrated the task that made up the tutorial (see below) the students were given a clear explanation of the purpose and expected results of the exercise that they would do the following week.

Additional Preparation

Prior to the practical session the freeware (SIGIS available on www.sigisco.com/sigis/) was downloaded onto the computers in the laboratory together with the database provided for use in the tutorial. The site also provides detailed instructions for a tutorial and copies of this were printed. The tutorial was subdivided into tasks so as to provide a structured process with specific activities that could be associated with the data that was recorded. This made the analysis of the data easier.

The lecturer created:

* An instruction sheet in which the purpose of the exercise and the procedure to be followed was explained (Given as Appendix A),
* A satisfaction questionnaire,
* Some supplementary notes where she thought additional help might be needed,
* Sheets on which to record the observation data,

- Printed 'banners', which were placed on the computers to identify groups,
- Spreadsheet templates where the data collected during the usability test would be entered. It was an essential part of this exercise that the students themselves entered the data they collected into the spreadsheet (so that this task was not added to the work load of the lecturer). Therefore it was important to ensure that they clearly understood the structure of the spreadsheet and the data entry process.

Arrangements were made for a video camera and an assistant to make video recordings. The whole exercise was given the status of a group assignment and marks were allocated which contributed to the students' module mark.

The Practical, Laboratory Session

This session lasted for two hours. The purpose of the exercise was explained and the idea that this was intended to replicate conditions in a usability laboratory was emphasized. The students were told that it was not important whether the group completed the all the tasks or not and they were provided with all the material that had been prepared. The groups of students were then asked to work through the tutorial. One student took the role of observer and recorded times taken to complete tasks and any problems encountered on the observation sheets provided. The other two worked together as 'end users' (one as operator actually actively using the computer and the other as a consultant who read instructions and helped the operator to decide what to do). The lecturer remained in the class and gave encouragement and minor assistance but primarily tried to keep the process going. Although she was not making notes she was also observing the process and the video recordings captured some of the activity.

At the end of the session each student was asked to complete a satisfaction questionnaire. Some time during the following week they were expected to key in the data from their observation sheets and from their questionnaires into the spreadsheet templates that they down loaded from the course web site. They were asked to attach these completed spreadsheets to e-mails and post them back to the lecturer. No analysis of the satisfaction questionnaire is included in this paper as it was not intended to collect data regarding the learning experienced by the students but rather to give them an example of a typical questionnaire used in an authentic usability lab. The data collected is, therefore, not relevant to this paper.

Discussion of the Laboratory Session

The lab session clearly engaged the participants. This was undoubtedly reinforced by the fact that a mark was awarded for participating. The lecturer had worked through the tutorial carefully herself, and since she had no experience using this software or any other GIS software, and since she had no real problems achieving the expected results, she did not foresee that the students would uncover real interface design problems. It therefore came as a surprise that not only did some of the student groups have real problems, but also that at least one of these could clearly be identified as resulting from an interface design flaw.

The students could not complete the full tutorial in the time allowed and in many cases did not get beyond task four of seventeen tasks. This could not be ascribed to loafing as observation during the session and reviewing the video showed clearly that the students were active at all times and were anxious about lack of progress.

Two common problems that they encountered in the early tasks were:

- The software malfunctioned if data was entered into one of the forms in a sequence other than that the designer had allowed for.
- The required database could not be accessed if the data directory was not indicated correctly early on in the process. This

particular error was not reported at the time when this information was entered or later when the data was supposed to be accessed leaving the student/user absolutely clueless as to why the expected results were not obtained.

Nevertheless, these problems do not fully explain the lack of progress by some students and this highlights an interesting research problem. What additional reasons are there for the enormous variance in the time it took students to complete the tasks despite the fact that they all had exactly the same instructions, prior exposure to the software, and supposed level of computer literacy? The method of capturing data regarding the actual actions of the 'end user' using hand written notes on the observation sheets was not adequate as insufficient detail was captured and the data was unreliable. The wide difference in progress seems to point firstly to a difference in ability to follow technical instructions and secondly a difference in ability to recover from setbacks that may be related to problem-solving ability. This aspect will be followed up in future research.

One of the most experienced groups, who themselves were floored by the first of these problems, took up the challenge and identified the set of events that had resulted in this particular error. The lecturer had to help the students recover from the second problem but this meant starting the tutorial again from the beginning.

The video recording of the session shows the difference in the experience of different groups. This ranges from clear frustration, despair and eventual 'giving up', to a sense of achievement and a desire to complete the tutorials. The team dynamics and work methods of different groups were also noticeable.

The Follow-up Lecture

Data Analysis

There was a break between the laboratory session and the follow-up lecture as Easter and a number of other public holidays intervened.

This allowed the lecturer to combine all the spreadsheets submitted (each student had submitted their own individual data the same spreadsheet layout). This was a simple operation as our students are accustomed to accessing lecture notes and other material from the module site and could easily obtain a copy of the skeleton spreadsheet, enter their own data, and e-mail the data back in the required format. A simple series of cut and paste operations allowed the data to be combined and this completed the task. Thus a realistic set of data was compiled.

Few of the Informatics students take Statistics courses and it is beyond the scope of the HCI course to teach statistical analysis techniques. None of the students had previously done quantitative research so the most elementary processes of checking, correcting and where necessary, discarding data were demonstrated using the data set which was obtained as described above. For example, some students had sent email twice and this had resulted in duplicate data in the data set. The duplicates were discarded. Some formatting needed to be done to achieve uniformity. All of these processes were very simple and did not compromise the data. Next the data obtained was analyzed in a very basic way using averages and graphs.

Very simple concepts such as standard deviation were discussed briefly in order to try to explain what statistical data can be considered meaningful. ANOVA was also explained in order to indicate how the responses of different categories of users could be analyzed. This part of the exercise demonstrated how data is collected and analyzed.

Excerpts of the video that was taken during the laboratory session were shown in the class simply to demonstrate the value of this type of recording and also the difficulties involved with analyzing videoed material. This provided the students with some amusement but there was not sufficient time to do any serious analysis and this section of the lecture did not justify the cost of making the recording. There was no useful audio recording as the general noise in the laboratory made individual comments inaudible. A commentary by the cameraman

might have been useful but this was not an appropriate option as the person who did the camera recording had not been briefed as to what he should be looking out for and was not a lecturer or an HCI expert.

Review of the Usability Testing from the Research Point of View

The follow up lecture was also used to allow the students reflect on their own experience of usability testing as a means of software evaluation and to discuss how this could be improved. The satisfaction questionnaire was evaluated and the actual data collected was examined in order to highlight the weaknesses in the design of the questionnaire itself. Ideas were sought regarding other quantitative data that could have been collected so that the GIS interface design flaws and the actual processing problems (retrieval and manipulation of data from the database) that resulted could be identified more accurately. Since the students now had first hand experience of the weaknesses of the GIS software, we could discuss what interface features had caused problems and how these particular flaws had been identified.

The End User Experience

The final issue that was discussed was the problems that inexperienced end users have using software. The students now had personal, fresh and sometimes painful memories of the typical feelings of inadequacy that novice end users experience. They could recall that they assumed that they had 'caused' the problems rather than recognizing that these were largely embedded in the interface. Hence they were sensitized to some extent to the problems end users have when working with unfamiliar terminology.

Conclusion

The description of this constructive learning experience is intended to demonstrate how a fairly large number of different goals can be

achieved simultaneously in three sessions each lasting two hours (the preliminary lecture on GIS, the lab session and the follow up lecture). Despite the fact that the goals of visual representation of data, complex HCI interfaces, usability testing and analysis of quantitative and qualitative data, and the problems of novice end users are independent, the laboratory session provided an authentic and fairly cohesive experience which allowed for genuine situated learning to take place.

The first of the lecture sessions, the introduction to visualization, GIS and the actual software gave a clear explanation of visualization, emphasized the 'real life' nature of the problem and provided a context for the subsequent work. The laboratory session allowed the students to actively participate as usability lab "researchers" and as "end users". The subsequent lecture allowed the experience to be assimilated and analyzed and also allowed additional aspects, such as data analysis and the discoveries made by some of the groups, to be explained to the entire class.

During these sessions the students were:

- Introduced to the idea of visualization of information
- Used a complex user interface
- Gained first hand experience of all aspects of usability testing including data collection and analysis
- Used an information system in a context where they were outside their comfort zones
- Were introduced to GIS

The lecturer had to do some planning but the load in terms of preparation and marking was not excessive.

This series of classes meets the general recommendations, described earlier, of various groups of Information Systems and Computer Science academics in that it goes beyond discussing the more obvious familiar interfaces and hence addresses the problem of a superficial understanding of HCI. It takes cognizance of some aspects of the in-

terdisciplinary nature of HCI by focusing on the presentation of information in order to increase understanding, the design of interface tools and options to permit the human to instruct the computer easily, the methodologies for evaluation of software and human factors research. It uses a guest lecturer as recommended by Strong (1994). It is outcomes based and uses a constructive learning model. It provides students with a proper opportunity to reflect on the learning experience and to discuss it as a group and therefore specifically embraces a sociocultural approach. This series of lectures was not intended to give students an extensive knowledge of data visualization but this aspect will be extended in future during the first lecture. It is not possible to compare the details of the classes more specifically with theory as this is simply a description of a particular teaching scenario.

Although the teaching case described here was intended to contribute ideas to the educational rather than the research interests of Information Systems academics, it has uncovered some issues that could be explored further in a research project. Firstly, it highlights the difficulties the observer has in capturing sufficient detail of the actions of the 'end users' when simply recording notes on observation sheets. Secondly, it indicates very interesting differences in behaviour by the 'end users' in completing the task.

Notes

[1] Section D of the content of HCI in the ACM curriculum describes the Development process as including Design approaches, Implementation techniques, evaluation techniques and example systems and case studies (Hewett *et al.*, 1996).

Bibliography

ACM-IEEE Curriculum 2001. *Steelman Report, Proposed HCI Course CS250W*. Accessed on 25 May 2004 www.computer.org/education/cc2001/steelman/cc2001/CS250.htm

Cartwright W, J Crampton, G. Gartner, S. Miller, K. Mitchell, E. Siekierska, & J Wood 2001. Geospatial Information Visualization User Interface Issues, *Cartography and Geographic Information Science* 28,1: 45-60.

Carroll J M 2002. *Human-Computer Interaction in the New Millennium*, Boston: Addison-Wesley

De Villiers C 1995. *The Integration of IT in a Co-Operative Learning Environment*. D Com thesis, Univ. of Pretoria, Pretoria.

Dix A, J Finlay, G Abowd, & R Beale. 1998. *Human-Computer Interaction*, 2nd edition, London: Prentice Hall

Douglas S, M Tremaine, L Leventhal, C E Wills, & B Manaris. 2002. Incorporating Human-Computer Interaction into the Undergraduate Computer Science curriculum. *SIGCSE 2002 Special Session on HCI*. Accessed on 25 May 2004 http://www.cs.cofc.edu/~manaris/publications/SIGCSE-2002-Special-Session-on-HCI.pdf.

Gasen, JB 1996. HCI Education, *SIGCHI* 28,1.

Gulliksen, J & L Oestricher 1998. HCI Education in Sweden, Report from STIMDI '98 (Swedish Interdisciplinary Interest Organization on Human Computer Interaction) Accessed on 01 May 2003 http://www.stimdi.se/old_web/web/public/doc/stimdi98/98-12-gulliksen/

Hartson, HR 1998. Human-computer interaction: Interdisciplinary roots and trends. *Journal of Systems and Software* 43,2 : 03-118.

Hewett, Baecker, Card, Carey, Gasen, Mantei, Perlman, Strong & Verplank (No initials provided on the document) 1996. ACM SIGCHI Curricula for Human-Computer Interaction. Accessed on 11 July 2002 at http://www.sigchi.org.

Human-Computer Interaction Lab/ University of Maryland n.d. Visualization at HCIL, Accessed on 25 April 2003 http://www.cs.umd.edu/hcil/research/visualization.shtml

Leidner, D E & SL Jarvenpaa. 1995. The use of information technology to enhance management school education: a theoretical view, *MIS Quarterly* 19,3 : 265.

McNally, DW 1977. *Piaget, Education and Teaching*, Harvester Press.

MacEachren, A & MJ Kraak. 2001. Research Challenges in Geovisualization. *Cartography and Geographic Information Science* 28,1.

Mirel, B 1998. Visualizations for Data Exploration and Analysis: A Critical Review of Usability Research, *Technical Communication* 45, 4 :491-509.

Newman, WM & MG Lamming 1995. *Interactive System Design*. Harlow, England: Addison_Wesley.

Olson, GM, JS Olson, G Furnas, E Soloway & DE Atkins 1997. HCI at the University of Michigan's School of Information. Accessed on 17 August 2003
http://www.acm.org/sigchi/chi97/proceeings/overview/gmo.htm#U11

Preece, J, Y Rodgers & H Sharp 2002. *Interaction Design: Beyond Human-Computer Interaction*, New York:John Wiley and Sons.

Richmond, PG 1970. *Introduction to Paget*. New York: Basic Books Inc.

Schoeman, J, M Ground & M Matthee 2003. Getting a Clearer Picture: a Business Application of Visual Data Mining. 4th International Conference on Data Mining, Including Building Applications for CRM and Competitive Intelligence, Dec 2003, Rio de Janeiro, Brazil.

Shneiderman, B & C Plaisant 2005. *Designing the User Interface*, 4th Edition, Boston: Pearson Addison-Wesley.

Slocum, TA, C Blok, B Jiang, A Koussoulakou, DR Montello, S Fuhrmann & NR Hedley 2001. Cognitive and Usability Issues in Geovisualization. *Cartography and Geographic Information Science* 28,1.

Stone, D, C Jarrett, M Woodroffe & S Minocha 2005. *User Interace Design and Evaluation,* Amsterdam: Elsevier.

Strong, GW 1994. New Directions in Human-Computer Interaction Education, Research, and Practice. Accessed on 25 April 2003, http://ww.sei.cmu.edu/community/hci/directions

Thomas, TA 2000. *A Teaching Environment for Learning Soft Skills Applicable to Information Systems Development*, D Com thesis, Univ. of Pretoria, Pretoria.

Yeh, M & CD Wickens 2001. Attention Filtering in the Design of Electronic Map Displays: A Comparison of Color Coding, Intensity Coding, and Decluttering Techniques. *Human Factors* 45,4:545-562.

APPENDIX A

HCI lab session

Groups of three – NO EXCEPTIONS

Marks – out of 15 but in the following proportion
0 – did not attend
1 – did not participate satisfactorily
2 – satisfactory

Outcomes:
Once you have completed this exercise you will:
Have experienced some aspects of formal laboratory usability testing which will contribute to the discussion next week
Collected some data that I will combine with that of the other groups to demonstrate some basic non-statistical analysis in next week's class
Have personally seen how GIS software is used to assist visualizing data and allowing this data to be manipulated.

HCI Usability lab evaluation

Is controlled
Requires the subjects to do clearly defined tasks
Is done in a lab rather than in the field
The observer does NOT participate
Time taken is measured
Error frequency is recorded
Other aspects may also be noted

Student roles in the exercise

- One is a recorder
- He or she does not participate in the problem solving at all
- Uses the standard sheet to record times and errors
- One is the 'operator' who does mouse and keyboard input.
- One is the 'navigator'/assistant and tries to tell the operator what to do.

In your group you must decide who will fulfill each of the three roles. These roles will be changed (rotated) for the second part (Tutorial 2). The observer will become the operator, the navigator will be the observer and the operator will be the navigator.

Deliverables:

Although the lab evaluation and data collection will be done here tonight, the final typed data must be handed in, in electronic form (e-mail or diskette) by end of day, 5 May. The layouts will be on WebCT by the end of day Tuesday 15 April. **Please use those layouts only.**

Three completed and typed satisfaction questionnaires in electronic format using your student number as **file name** e.g. S1234567
A completed and typed observation record – share the work between the three team members in excel format, combine into a single file and submit using your group number as **file name** e.g. Group1.

Make sure the names of the students in the group are filled in on the electronic form.

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Visual Aesthetics and Its Effect on Communication Intent: A Theoretical Study and Website Evaluation

Kirstin Krauss

Abstract

Despite its centrality to human thought and practice, aesthetics has not played a significant role in human computer interaction (HCI) research (Lavie & Tractinsky, 2003:2). Traditionally, the field of HCI's main emphasis has been on efficiency considerations (Lavie & Tractinsky, 2003:3). Although aesthetics applies to all human sensory domains (think of bad tasting food, revolting smells, cacophonic music, or coarse clothing), this paper mainly addresses the visual domain. Because visual aesthetics exists in everyday life, and it influences many of our choices, it is difficult to justify its absence from web design (Lavie & Tractinsky, 2003:3). Designing a website of high aesthetic quality enables the active communicator to enhance the persuasive appeal of the message directed at the passive fellow communicator visiting the website. With my research I intend to foreground the importance of visual aesthetics in website design, so that it will become a prominent feature of successful website design. I will furthermore apply the theory to demonstrate how visual aesthetics has been applied in a specific case.

Acknowledgements

The Role of Visual Aesthetics in Website Design

The presence of web-based applications has generated a large body of research in web usability and human computer interaction (HCI) re-

garding the design of such applications. With a few exceptions though, research has neglected the aesthetic dimension of websites. In general, the aesthetic criterion should be an integral part of effective interaction design (Alben, 1996 as *cited* by Lavie & Tractinsky, 2003:11), especially when it is about effective communication. It has been argued that modern design has placed too much emphasis on performance issues and not enough on aspects like aesthetics. Studying the effect of aesthetics on communication intent has been totally neglected.

While Neale and McCombe (1997) as *cited* by Lavie and Tractinsky (2003:11) describe how to design a usable and visually appealing website, the emphasis is on the functional and the usability aspects of the design rather than on aesthetics. Similarly, Spool *et al.* (1999) as *cited* by Lavie and Tractinsky (2003:11) assess websites and draw guidelines based on usability as the sole criterion. Nielsen (2000:11) maintains that two basic approaches to web design exist: the 'artistic ideal' that reveals the designer's self-expression, and the 'engineering ideal' that provides solutions to users. From this one can conclude that the artistic ideal is not compatible with providing solutions to the user. However, Zettl (1999:4) clearly states that applying the "artistic ideal" or visual aesthetics is about the process of clarification, intensification and interpretation which serves to provide solutions.

Although "there is a need for art, fun, and [a] general good time on the web", Nielsen (2000:11) contends that "the main goal of most web projects should be to make it easy for customers to perform useful tasks…" Hence, clear and effective communication of ideas is the design principle to follow on the web (Lynch & Horton, 1999 as *cited* by Lavie & Tractinsky, 2003:11). While researchers divorce aesthetics from clear and effective communication, the irony is that, according to Zettl (1999), applying elements of aesthetics correctly could actually enhance communication and support the message.

It is important to apply principles of visual aesthetics correctly. The aim should be to support the message. If aesthetics is used in design but does not support the message or contradicts the intended communica-

tion, then a site may look beautiful but it has missed its goal and will be ineffective communication. In such a case aesthetics or beauty will be a disadvantage, making previous research true. The reason why authors possibly argue that aesthetics could hinder website effectiveness is because they do not understand visual aesthetics and its influence on communication success, or because they do not know how to apply aesthetic principles. The need for applying visual aesthetics also did not arise given the history of low bandwidth and traditional ways in which people used the Internet up till now.

This is the aim of this study: to help the reader realise the importance of visual aesthetics in website design and understand how visual aesthetics can be applied to support the intended message. Obviously visual aesthetics cannot be applied effectively in all cases and does not play a role in all websites, but in certain cases the message or intended communication will benefit from applying visual aesthetics. Examples will be used to explain the value of visual aesthetics and its application in websites.

Overlooking communication concerns, Lavie and Tractinsky (2003:29) relate aesthetics to various other website quality issues. Lavie and Tractinsky (2003:29) note that recent research suggests that aesthetics is the primary factor affecting other perceptions. Aesthetics is related to pleasure and perceived usability. Findings are that perceptions of aesthetics and usability are highly correlated (Kurosu & Kashimura, 1995; Tractinsky, 1997; and Tractinsky *et al.*, 2000, *cited* by Lavie & Tractinsky, 2003:17). The results of Lavie and Tractinsky (2003) not only confirm those findings, but they also shed light on the usability-aesthetics relationships. These observations are important and serve to provide perspective, but fall outside the scope of this study. It is significant, however, to note that they support the argument that dimensions of quality (including visual aesthetics) cannot be isolated from one another. For example, a company's website may have excellent usability but yet have no business case or useless information. Putting visual aesthetics into perspective of overall quality means that all

elements of quality (usability, aesthetics, download speed, information quality, to mention a few) should work in concert to produce a site of high quality.

Although Lavie and Tractinsky (2003) explore how users perceive aesthetics of websites beyond the general question of whether the site is attractive, this has limitations. Many adjectives are used to describe aesthetics, but the impact of elements of colour, screen vectors, close-ups, etc. (as described by Zettl, 1999) on the viewer's perceptions is not investigated. All that this study does is describe beauty/aesthetics using various adjectives. The "how" is neglected, e.g., having a site that is "energetic", "symmetrical" or "clean" (Lavie & Tractinsky, 2003:19) is important, but these aspects are the result of visual aesthetics applied correctly. How to create an "energetic" or "clean" site is not investigated and the effect of a "clean" or "symmetrical" picture on the user's perceptions is not addressed. The reader of such an article will therefore understand that it is important to have a site that is aesthetically pleasing but will still not know how to achieve this. Other limitations include that aesthetic measurement dimensions were isolated without taking into consideration the effect of social issues, user experience, attitude, language and culture. Although rigorous procedures were followed in the development of the measurement instrument, this article is limited in its evaluation of visual aesthetics. It is, however, a good starting point and is a valuable contribution to the body of knowledge.

Visual Aesthetics

Traditional aesthetics concerns itself with beauty and judging beauty but in more modern readings the aesthetic interpretation of beauty is associated with delight and perception (Feagin & Maynard, 1997 as *cited* by Lavie & Tractinsky, 2003). Lavie and Tractinsky (2003:3) explain that aesthetics is the importance of beauty. This study, however, expands the purpose of aesthetics in that it investigates its role in visual communication.

Zettl (1999) provides tools which assist the user to clarify, intensify and interpret events for television, computer and film presentation. He demonstrates how to apply elements of aesthetics to manipulate and influence people's perceptions. Applied media aesthetics considers art and life mutually dependent and essentially interconnected. People perceive aesthetics against the backdrop of their lives and experiences. The major function of visual aesthetics is based on the original meaning in Greek, which points to perception (Zettl, 1999:4; Lavie & Tractinsky, 2003:5). Even this fact has not prompted researchers to investigate visual aesthetics and its role in web design. Little has been done to relate visual aesthetics to website design and even less to learn how to clarify, intensify and interpret events for web pages. With media such as computer displays, you need to give your vision significant form so that you can share it with others (Zettl, 1999:3).

Aesthetics is not an abstract concept but a process by which we examine a number of media elements and our perceptual reactions to them. Film, television and computer displays are no longer considered a neutral means of message distribution but essential elements in the aesthetic communication system (Zettl, 1999:4). The process of clarification, intensification and interpretation is the domain of aesthetics. Although aesthetics impacts more than one form of sensory input (hearing, smelling, feeling), this study is limited to investigating visual aesthetics.

The various elements of visual aesthetics are contextual (Zettl, 1999:5) i.e. they interact to produce the final communication effect. Communication is more than just language and writing. We see our world as changing contextual relationships. Putting the same word or image in a different context could change the meaning significantly. Zettl (1999:7,8) notes that one should not underestimate the power of context. Many of our perceptions are guided by the context in which the event occurs. We tend to take notice of events or event details that fit our perceptual expectations or that interest us highly. Each of us sees

an event from our particular point of view and according to a specific experiential context (Zettl, 1999:7). Experience guides our perceptions.

Zettl (1999:8) asserts that some of our perceptual processes are so forceful that we respond to certain stimuli in predictable ways even when we know we are being perceptually manipulated. Sufficient consistency exists in human perceptual processes that we can predict with reasonable accuracy how people will respond to specific aesthetic stimuli and contextual patterns. This is the power of visual aesthetics, and consequently the power of the knowledge of how to apply visual aesthetics correctly.

By applying visual aesthetics you can help the viewer to see an event from different perspectives. You can advance him from a stage of merely looking at an event, to a stage where he obtains insight by looking into the event (Zettl, 1999:10). This is a process of getting the viewer involved in the message and using visual aesthetics to educate the viewer's perceptions. Creating these different perspectives basically means that you use various visual prompts that aim to build on the experience of the viewer. Each visual prompt creates a scenario (mental space or event) in the mind of the viewer. The difference between success and failure to communicate effectively depends on whether the designer has succeeded in making these visual prompts support the same communication goal. Knowledge on how to apply visual aesthetics correctly will assist designers in making visual prompts support the intended message.

Many communication researchers overlook the fact that the communication medium plays a significant role in the outcome of the message (Zettl, 1999:10). The medium is a structural agent. In some cases the medium is the message. Communication researchers and web designers should consider the combined effect of message and medium. Zettl (1999:11) states that once you are aware of the aesthetic characteristics and potential of the fundamental image elements (light, colour, space, motion, etc.), you can study how they operate in the context of a larger aesthetic field and combine them knowledgeably into patterns

that clarify, intensify and effectively communicate significant experience. Zettl (1999:12) summarises: "Once you have a strong grasp of applied media aesthetics, you can select those elements and techniques that are most appropriate for effectively shaping ideas or content."

The aim of visual aesthetics is to improve the communication situation (Zettl, 1999:123), but it can be associated with more than that. It is about the art of inducement, the art of persuasion. It has convincing powers. The aim of visual aesthetics is to persuade the viewer or user of the message and intensify communication, to support the message, to direct or influence the user within ethical boundaries to believe the message. Visual aesthetics has persuasive power because it alters the value and belief systems of observers. Visual aesthetics aims to create interest. Visual aesthetics can induce the user to unknowingly, unconsciously, and unsuspectingly choose to become involved in the message and the website of concern. This is achieved by involving the user in the communication process using elements of visual aesthetics in concert to support the intended message.

Ultimately the aim of visual aesthetics is to influence beliefs and actions. Here follows a brief explanation of how this happens. Humans have the tendency to seek ways in which to confirm rather than to refute existing beliefs. This will lead them to seek, interpret and even distort information in ways that verify first impressions or pre-existing beliefs. This tendency may hinder our appreciation of others and may also hamper our full understanding of the world in which we live (Sternberg, 1998:470). Beliefs and attitudes are therefore fundamental elements in the communication process. They not only aid or distort our understanding but influence our behaviour (Sternberg, 1998:472). Communicators must take them into consideration. Perceptions influence our beliefs while beliefs bias our perceptions. Hence, using persuasive communication, which is possible through applied visual aesthetics, beliefs may be influenced. Website users may be persuaded to change attitude, become involved in the communication process and ultimately believe the message. Since beliefs and behaviour are con-

nected (Sternberg, 1998:464) successful communication through visual aesthetics may influence user choice and behaviour.

Conceptual Blending

The study of visual aesthetics should be taken beyond statements that we persuade people by altering their values and belief systems. At this point I would therefore like to discuss a prominent theory of concept formation, known as conceptual blending, as a plausible account of how visual aesthetics works and how it contributes to human understanding.

Fauconnier and Turner (2002), the authors of the theory of conceptual blending, argue that a person builds a scenario of understanding or perception by blending or integrating different events or mental spaces (which may include existing experience or known events) and supplied inputs (e.g., a picture on a computer screen) through identification, integration and imagination. A blend creates a new event in the viewer's mind that communicates meaning. As is explained in the next few paragraphs, elements of visual aesthetics can create blends and it is important to let elements of visual aesthetics point consistently to the same meaning or message.

The purpose of visual aesthetics is to build an event that will influence and guide the human mind to construct meaning. Part of building meaning is creating context (Zettl, 1999:5). Incidents in life relate contextually, i.e., we perceive them in relation to one another. These incidents fuse to become an event of significance. Various fields of applied media aesthetics are contextual – they must interact to produce the final communication effect. Many of our perceptions are guided by the event context and this should be an important part of the design process.

Fauconnier and Turner (2002:17) argue that general operations exist for the construction of meaning regardless of the type of person that is involved. These basic mental operations are highly imaginative and produce our awareness of identity, sameness and difference. Framing, analogy, metaphor, grammar, and commonsense reasoning play a role

in the subconscious production of apparently simple recognitions and work no differently in people from different disciplines, ages, social levels and degrees of expertise (Fauconnier & Turner, 2002:18). Conceptual blending is highly imaginative and crucial to even the simplest kinds of thoughts. In this study, the focus is on how visual aesthetics prompts conceptual blending by the creation of visual input spaces that lean on the experience and knowledge of the viewer to construct meaning.

The full details about conceptual blending and the science of cognition in general, are beyond the scope of this contribution. What is important, however, is the fact that conceptual blending does occur in the minds of people who experience things, and that through the effective use of visual aesthetics one can take advantage of this human ability to create meaning or intensify a message. A website should be designed in such a way that elements of visual aesthetics create input spaces in the minds of users that collectively intensify the message and create the blends of new understanding that the site wants to communicate. If all input spaces emphasise the same message, they have succeeded in intensifying the message significantly.

Two examples in visual aesthetics I wish to refer to are the use of *vectors* (Zettl, 1999:106,132) and *psychological closure* (often just abbreviated to *closure*) (Zettl, 1999:101). I'll start with closure. Zettl (1999:101) describes psychological closure: "...in our quest for perceptual sanity ... we continually seek to stabilize our infinitely complex and often chaotic environment. It is our tendency to mentally fill in gaps in visual information to arrive at easily manageable and complete patterns and configurations. This perceptual activity is called psychological closure."

We take the minimum number of mental cues and mentally fill in the missing information by applying psychological closure. Visual cues provided can be seen as input spaces. Mentally filling in the gaps are other input spaces compiled from previous experience and known information. Merging these input spaces into a new message is concep-

formation. Merging these input spaces into a new message is conceptual blending. Through conceptual blending we are therefore completing the picture and creating new meaning.

Figure 1 – Inferring a row of similar houses

Figure 2 – Inferring a single house

In Figure 1, the viewer can't help seeing a row of similar houses. It is because the message is completed in the mind of the viewer through psychological closure. In Figure 2, the viewer only "sees" one house. It is because there are no visual cues that prompt more understanding from the picture, as is the case in Figure 1 (Photo from www.property24.com).

Figure 3 – Inferring a continuous horizon

tures to each other. Since the vector "continues" from one screen to another it forces us to relate the two pictures in our mind. The resulting meaning is created from two different pictures and forms one picture or message in our mind.
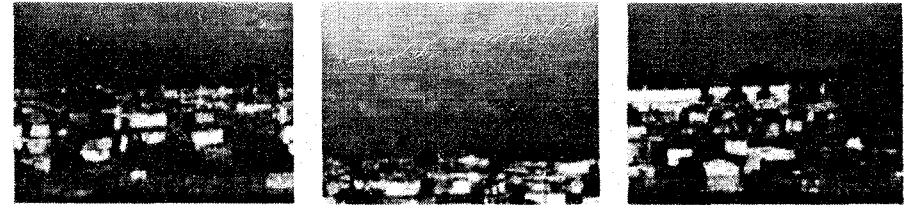
Figure 4 – Inferring separate horizons

In Figure 3 (photo from www.news24.com), the horizon acts as a continuing vector in all three pictures. The result is that the viewer perceives the three pictures as a single unit or a single message. In Figure 4, the graphic vectors intersect at different vertical levels, making it difficult to perceive the three pictures as a single unit.

The success of visual aesthetics depends to a large extent on the human ability to construct meaning. Visual aesthetics depends on the human ability to complete a picture, identify a scenario, relate and other high-order thinking skills. The ability to construct a new conceptual blend from what a user sees on a website and what he knows, makes it possible for designers to create a new picture in the viewer's mind using visual aesthetics effectively.

Importance of Knowledge of Visual Aesthetics

I want to spend some time examining an article investigating a scenario that cries out for knowledge of visual aesthetics and conceptual blending. Klett (2002) sheds on the importance of visual aesthetics in web-based learning environments, but discussed this under the topic of visual communication. In fact, the word "aesthetics" is mentioned once in the introduction to the article but is never elaborated on. The conclusions arrived at relate in many ways to those of Zettl (1999). As in

other literature, the need to study visual aesthetics for the web is insinuated, but the "how" is addressed in little detail. Readers will know that having an interface that portrays unity, harmony and consistence (Klett, 2002:43) is important, but guidelines on how to achieve this are not addressed. Designing a 3D learning environment that limits "cognitive overhead" (Klett, 2002:44) is recognised as important, but the detail of what goes on in the mind of the user and how to facilitate understanding through visual aesthetics is not dealt with significantly. I believe that my research will answer some of the above questions. The reader should, however, keep in mind that at no point is it suggested that this is a comprehensive study addressing ALL issues related to cognition and visual aesthetics for the web.

Writing from the perspective of web-based learning, Klett (2002:38) notes that the support of intelligent interaction between system and learner evolves to a communication issue between author and learner. Hence, there is a need for knowledge of visual aesthetics and its impact on communication success. With any application, the learning system design acts as major factor in the learner's perception, satisfaction, and results. "The problem with shaping learning systems originates in the communication irregularities between author and learner. It can be solved by a competent user interface design" (Klett, 2002:38).

"Visualization concerns the visual representation of data, objects, and systems in order to enhance communication and thus understanding. The visualizations in the Ed-Media (Ed-Media is a virtual learning space studied by Klett, 2002) content library contain 2D and 3D models, 2D and 3D animations, virtual reality worlds and simulations, which effectively support the imaginative process, and spatial knowledge acquisition, allowing the learner's immersion in a hidden world" (Klett, 2002:39). Knowing how to apply visual aesthetics and its effect on the viewer will help to address these objectives as noted by Klett (2002). Visualisations have been described as the most important aid in providing information as well as supporting the learner's knowledge

construction process (Klett, 2002:40). By applying visual aesthetics, visualisations can be created that can be used to teach in a virtual learning environment successfully.

Klett (2002:40) notes that visualisations, which guide the viewer's eye to unimportant parts of the image, may cause significant parts to be overlooked or ignored . This confirms the statement of Zettl (1999:57,123) that elements of visual aesthetics should work in concert to support the message, otherwise it is ineffective communication. The power of context (Zettl, 1999:7) is confirmed by stating that related objects are recognised faster (Klett, 2002:40).

In terms of cognition, the need is expressed but the effect of elements of visual aesthetics on the message is not investigated in much detail (Klett, 2002:43). This supports the need for my research. This article shows that to a certain degree visual aesthetics have been addressed in literature but not as comprehensive as is the case with Zettl (1999).

Research Methodology

Empirical research with an interpretivist approach draws on experience or primary evidence in order to understand a phenomenon. It basically means to learn from experience rather than from making conclusions based on averages (Remenyi, 2004). Taking a critical stance to current perceptions of researchers on the role of visual aesthetics for the web is a further agenda of this study. It proposes a new way of thinking and challenges current ways of perceiving and explaining visual aesthetics for the web.

In an experimental approach, Lavie & Tractinsky (2003:8) report that progress in understanding aesthetics can only be achieved by isolating and manipulating elements (e.g., polygons) or artistic characteristics (e.g., complexity and "interestingness") of works of art and studying their effects on the observers' preferences (Swede, 1994 and Martindale *et al.*, 1990 as *cited* by Lavie & Tractinsky, 2003:8). However, some of the strongest criticisms of using an experimental ap-

proach point out the importance of perceiving whole objects or meaningful forms rather than isolated elements (Arnheim, 1992 as *cited* by Lavie & Tractinsky, 2003:9). These criticisms imply that elements of aesthetics cannot be measured using experimental methods because the whole may exceed the sum of the elements (Osborn, 1968 *cited* by Lavie & Tractinsky, 2003:9). Similarly Arnheim (1988), *cited* by Lavie &Tractinsky (2003:9), argues that dynamic forces, rather than "things" or isolated elements, determine our aesthetic experience.

Supporting an exploratory approach, Fauconnier and Turner (2002:4) note that our time has seen enormous amounts of energy devoted to the discovery and manipulation of meaning through systematic analysis of form. This could lead us to think that scientific knowledge is only a matter of finding deep hidden forms behind perceived forms. On the other hand, common sense tells us that form is not substance, an average is not a holistic view, and a roadmap is not a path. Research indicates that users' interactions with computers are essentially social, and that their responses resemble responses to social situations (Reeves & Nass, 1996 as *cited* by Lavie & Tractinsky, 2003:3) and working with a concept of averages is far too general to do justice to the subjective variety of an individual life (Jung, 1995 as *cited* by Remenyi, 2004). Human perception and conceptual processes occurring in the minds of people cannot be fully explained by numbers and systems. Fauconnier and Turner (2002:5) state that form or quantitative work does not present meaning but rather picks out regularities that run throughout meanings.

An example where quantitative analysis is inadequate is its ability to explain the process of analogy. Analogy has traditionally been viewed as a powerful engine of discovery (Fauconnier & Turner, 2002:14). In the age of form it was disregarded. Analogy seemed not to be precise compared with axiomatic systems, rule-based production systems or algorithmic systems. Analogy was reduced to the status of fuzzy thinking or sheer intuition. The absence of formal systems for analogy and to explain analogy was mistakenly associated with the ab-

sence of analogy as a fundamental cognitive process. Analogy was not considered as a method of discovery and explanation. Analogy, however, as a cognitive process, is an intricate, powerful and fundamental process (Fauconnier & Turner, 2002:14). Research relies on analogy as a means of analysis and explanation. As the limits of a formal approach to explaining and presenting analogy became evident, it was recognised that it posed a challenge to the researcher.

Subconscious introspective abilities, which present similar challenges, are abilities to identify, integrate, relate and recognizing sameness and difference. Others include framing, metaphor, grammar and commonsense reasoning. Using these mental operations in research should be recognised as suitable as long as the researcher acknowledges a subjective point of view. In doing research that investigates issues that impact human perception and that influence cognitive processes, it is necessary to pursue a research methodology that is relevant to the nature of the field of study. Although reactions and perceptions resulting from applied visual aesthetics may, in most cases, have a similar effect on the message received by different people, this type of research is subjective since it comprises observations made by the researcher through the process of analogy and identification. It is, however, likely that in some cases people from different cultures and backgrounds may perceive certain elements of visual aesthetics differently in terms of the impact on the message. Using the interpretation of colour, for example literature shows that different colours have different meanings for different people (Mathews, 1999:3). However, it is expected that the combined effect of the impact of elements of visual aesthetics on the viewer will convey the intended message (provided that these elements collectively support the intended message).

The impact of visual aesthetics mostly has similar effects in different cultures (see Zettl, 1999:97, about the use of diagonals, for example) and in some cases it cannot be explained why. (A possible explanation emerges from Klopper's [1999] writing. In his article on how humans perceive reality, Klopper notes that humans build up concepts

about things around them by combining basic image schemas like *point, line, centre, periphery, circle, square, triangle, long, short, horizontal, vertical, diagonal, close proximity, distant proximity, in front of, behind, smooth, coarse, regular, irregular, move, rest, source, route/path, target,* etc. These image schemas emanate from our physiological makeup and our vertical orientation when we are active.)

Using www.exploremarsnow.org as an example, I shall highlight and explain how visual aesthetics was applied to support the intended communication of the website. By applying principles of conceptual blending (explained by Fauconnier & Turner, 2002) I will explain and predict how elements of visual aesthetics for television and film (explained by Zettl, 1999) may have similar impact on the perceptions of viewers in the online visual communication environment. The reason for using examples to explain the phenomenon of visual aesthetics is because analogy and metaphor are powerful methods of discovery and explanation (Fauconnier & Turner, 2002:14).

In no manner do I claim to have addressed all elements of applied visual aesthetics for the web or the importance of certain elements above others. What is true of this research is that it aims to explore visual aesthetics for the web and lay the foundation for future research with specific emphasis on the impact of visual aesthetics on communication intent. It tries to highlight the importance of recognising such a field of study by referring to examples and learning from what is being done in film and television production (Zettl, 1999). Not all elements of visual aesthetics have been used in the provided example and this study is not comprehensive.

Theory Application and Discussion

Although some screen shots from the website will be provided I advise that the reader interact with the site www.exploremarsnow.org, since the next few paragraphs evaluate the site for applying visual aesthetics according to the criteria proposed by Zettl (1999) and using principles of conceptual blending (Fauconnier & Turner, 2002).

The major intention of www.exploremarsnow.org is to subtly encourage the user to become involved in the communication. Apart from having quality information for many users and having a site that is relatively easy to use (Nielsen, 2000:380), various elements of aesthetics have been applied that make this site a success in terms of visual aesthetics. The aim of this site, aesthetically, is to create cognitive interest and support for exploring Mars in the future.

Text

When opening the site the image or the picture of Mars is desaturated of colour while the introductory text is introduced. The text message unfolds through printing one character at a time on the screen, leading the reader to follow the text (see Figure 5). One problem in terms of usability is that it takes time and the user might want to skip the text. That facility is not available and is probably not there for a reason.

Colour

Figure 5 – The text message unfolds through printing one character at a time on the screen, leading the reader to follow the text.

Although consistency in the effect of colour temperature on the message is commonly known (Zettl, 1999:57), not enough scientific evidence exists to prove the effect of cool and warm colours. The problem is that they never occur in isolation and usually operate within the context of other aesthetic variables.

When the text is complete, the overall colour of the image of Mars gradually changes to a warmer colour and higher saturation (see Figure 6). This increases aesthetic energy since colour saturation is the main attribute of colour energy, while colour energy is the relative aesthetic impact a colour has on us (Zettl, 1999:58). Hence, increasing colour saturation on the introductory image creates aesthetic energy that generates interest, enticing the user to go deeper. The change to highly saturated colours and the use of warm high-energy colours immediately intensifies the event and creates mood and excitement (Zettl, 1999:57,66,70). This aesthetic effect focuses the user's attention, creates interest and leads him to explore further. The general use of colour in this website supports the essential quality of the event (Zettl, 1999:66).
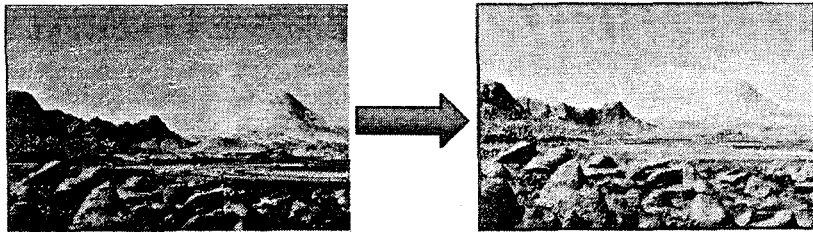
Figure 6 – The landscape gradually change to warmer colours and higher saturation.

In the context of the website, colour is used to add information to the message. It helps the user to distinguish between objects, and makes the scene more realistic (Zettl, 1999:70). As the user moves the mouse pointer over the image of Mars, embedded links appear.

These appear in two colours: red indicating a link to click on to explore further and yellow highlighted areas that are explained in accompanying text. The flashing marker beacons are used to add excitement and intensify the event (Zettl, 1999:67).

Predictive Effect of Visual Aesthetics

Gradually increasing colour saturation in the initial image, warm colours, high-key lighting (see Figure 6), the movement of the landscape on the screen from left to right (see Figure 7), the animation of a man walking in the direction of the habitat and the brief highlighting of embedded links on the image (see Figure 8) all have the effect of predicting excitement (Zettl, 1999:30), creating interest and leading the user to explore further. This is a classic example of conceptual blending. Each of these elements creates an input space; a generic space is formed and a new blended space is created that communicates predicting of excitement. This leads to the viewer's being curious about what is happening next.

The use of bright highly saturated colours helps to intensify and clarify the event (Zettl, 1999:68). It causes the users to look *at* the
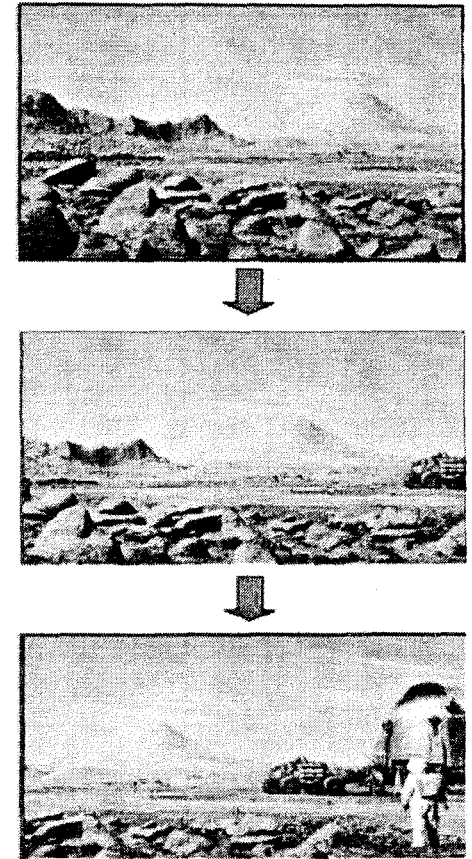

Figure 7 – *Movement of the landscape on the screen from left to right.*

event rather than *into* (i.e., getting emotionally involved). Through applying (or rather not applying) the desaturation theory (Zettl, 1999:68), the site designers succeed in letting the user observe the event in detail rather than feel it or get involved emotionally. In this site, colour mostly has an informational purpose (Zettl, 1999:70).

The desaturation theory (Zettl, 1999:68) means that although bright, highly saturated colours are well suited to enhance an external high energy scene, they can prevent us from getting caught up and involved in a quiet intimate screen event. To reduce the outward effect of high-energy colours and emphasise the internal setting of an event, colours should be desaturated or omitted altogether. Viewers will then have to supply some of their own emotional energy in the communication process. Whether to use or not use high-energy colours depends on the overall communication intent.
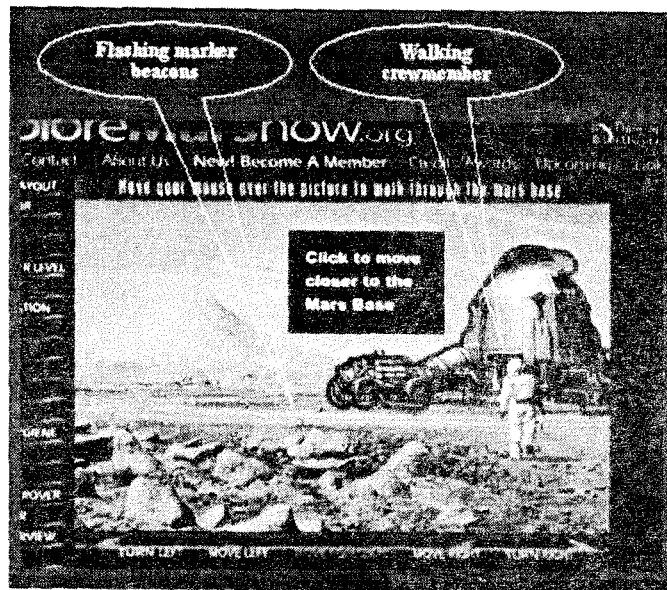
Figure 8 – Flashing marker beacons, animation of a walking crewmember and embedded links.

Lighting

Using a scene that has high-key lighting further emphasises the "up" feeling and excitement of the event (Zettl, 1999:28). The use of flat lighting and slow fall-off supports the theme of efficiency, cleanliness, mechanization and depersonalisation (Zettl, 1999:45). Flat lighting is used to provide optimal visibility (Zettl, 1999:44) and has been successfully applied in this website to support the theme and message, and create interest.

Horizontal Arrangement

The aim of this site is not to create an action-filled dynamic scene, but rather create a feeling of calmness, stability and normalcy. This is supported by using a horizontal arrangement of the initial view of Mars and the habitat (Zettl, 1999:89). This effect of stability is further supported by having a horizon that is not tilted, subconsciously supporting the reliability of the information and content (Zettl, 1999:91).

Judging Size

The image of the crewmember walking on the surface towards the habitat (see Figure 8) has two important functions: 1) it applies the aesthetic principle of using a human as a reference to help the viewer to judge size (Zettl, 1999:82), in this case the size of the habitat, and 2) it directs the eye to the most important image on the screen which is the habitat (Zettl, 1999:106), thus "showing" the user where to start to interact with the website. Another subtle function of the crewmember is to prompt the user to assume the role of crewmember when exploring further into the site.

Vectors

Directional forces or vectors that lead the eye from one point to another are probably the strongest forces within a screen (Zettl, 1999:106). A vector has directional certainty and power. In the initial image of Mars, vectors are successfully used to build screen space and event energy. A motion vector in the form of a crewmember walking in

the direction of the habitat entices the viewer to focus his/her attention on the habitat (see Figure 8). The line of marker beacons (see Figure 8) acts as an index vector explicitly pointing to the habitat not visible at that point in time (Zettl, 1999:106). Thus, together with the landscape moving from left to right, both vectors lead the eye and create curiosity about the event that they are pointing at.
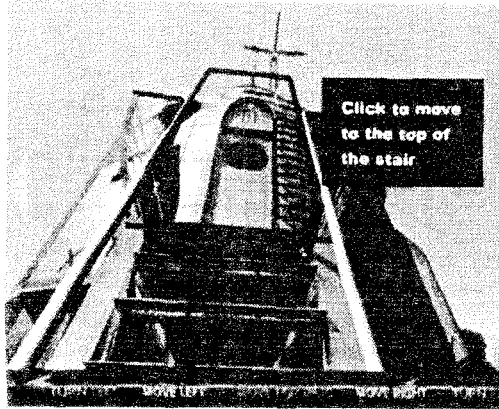
Aspect Ratio

A normal aspect ratio of 4:3 is used for the simulation of Mars. It makes aesthetic sense, because the difference between width and height is not so much to emphasise one dimension over the other (Zettl, 1999:75). Although it is a method applied better in larger screen (Zettl, 1999:83), a deductive approach is used where the simulation of Mars starts off with a wide established shot and then through embedded links focus is placed on close-up detail (Zettl, 1999:83).

Figure 9 – Assuming the role of crewmember.

Although on a smaller screen inductive shooting carries more aesthetic energy than a long shot (Zettl, 1999:85) it is not applied in this simulation of Mars because the pur-
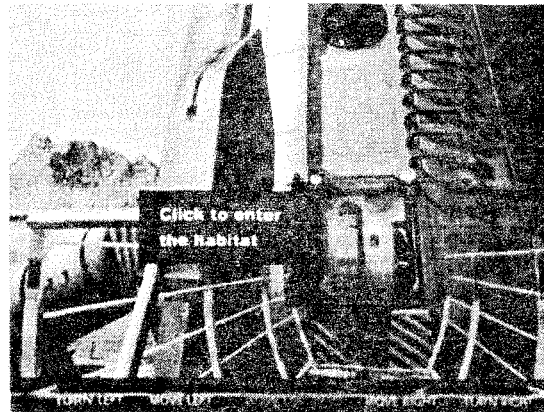
Figure 10 – Enticing the user to participate in exploring Mars.

pose is not for the user to "feel" the event (getting emotionally involved) but rather to create interest and reveal the informational detail about the Mars base.

Although larger images carry more aesthetic energy (Zettl, 1999:83), a relatively small image is used in this website. It is most probably not applied in this site due to limited bandwidth and other technology considerations. Through the development of broadband Internet (e.g. Sentech), this virtual environment can be presented better using a large screen without sacrificing usability and page download time.

Psychological Closure

Viewers have a tendency to mentally fill in gaps in visual information. This is called psychological closure (Zettl, 1999:101,104). When viewers have to apply psychological closure it causes them to work with the event, getting them to participate, thus intensifying the event (Zettl, 1999:104). A low-definition event requires more mental effort *making the user become more involved. These aesthetic principles have not been applied, simply because detail is important to communicate* the intended message.

Magnetism of the Picture Frame

Users tend to pay more attention to an object that is placed on the right side of the screen rather than on the left of the screen (Zettl, 1999:98). Although controversy exists about this aesthetic principle it is definitely applied in the initial view of the habitat. The most important object or event on the screen is placed on the right side of the screen. In that way the designers made sure that it attracts the attention of the viewer.

Enticing the User to Participate in Exploring Mars

The possibility of the viewer's assuming the camera's viewpoint and position has prompted media people to use the camera subjectively (Zettl, 1999:192). Subjective camera, as it is referred to, tries to partici-

pate in the event rather than merely observe it. Throughout the website the user assumes the role of a crewmember and not just a viewer (see Figures 9 & 10).

Intensifying and Clarifying the Event

The overriding principle of visualisation is intensifying and clarifying an event (Zettl, 1999:183). In many scenes on this website various angles (points of view) have been used. This helps the viewer to see an object or event from various positions, thereby providing a more complete picture and intensified screen space.

Conclusion

This paper highlights visual aesthetics as an important contributor to online visual communication. It shows that visual aesthetics has the ability to get the user involved in the communication process. It discusses conceptual blending as a plausible explanation of how visual aesthetics works and how it contributes to human understanding. Principles of conceptual blending are furthermore used to identify and explain the impact of various elements of visual aesthetics that occur in a specific website. This research paper demonstrates the use of visual aesthetics for web pages by referring to examples and explaining their impact on human perceptions and ultimately communication intent.

References

Fauconnier, G & M Turner 2002. *The Way We Think: Conceptual Blending and the Mind's Hidden Complexities*. New York: Basic Books.

Klett, F 2002. Visual Communication in Web-based Learning Environments. *Educational Technology & Society* 5,4:38–48. Accessed on 26 May 2004

http://ifets.ieee.org/periodical/vol_4_2002/klett.pdf

Klopper, R 1999. How Science Reveals the Universe, and How Humans Perceive the Universe to Be. *Alternation* 6,2: 248-272.

Lavie, T and N Tractinsky 2003. Assessing Dimensions of Perceived Visual Aesthetics of Web Sites. Ben Gurion University of the Negev. Accessed on 26 May 2004, at

http://burdacenter.bgu.ac.il/publications/finalReports1999-2000/TractinskyLavie.pdf

Matthews, KK 1999. Aesthetics and Usability. University of Colorado. Accessed on 30 March 2004, at

http://home.att.net/~kiana.matthews/independent_study/Aesthetics_Paper.htm

Nielsen, J 2000. *Designing Web Usability: The Practice of Simplicity*. Indianapolis, IN: New Riders.

Remenyi, D 2004. How to Be an Effective Supervisor. A workshop Presented on 8 April 2004 at the Cape Technikon, Cape Town, South Africa.

Sternberg, RJ 1998. *In Search of the Human Mind*. Orlando, FL: Harcourt Brace College Publishers.

Tractinsky, N 1997. Aesthetics and Apparent Usability: Empirically Assessing Cultural and Methodological Issues. *Proceedings of the ACM CHI Conference on Human Factors in Computing Systems, Atlanta, Georgia, 22-27 March 1997* pp 115-122. Accessed on 26 May 2004, at

http://www.acm.org/sigchi/chi97/proceedings/paper/nt.htm

Van der Heijden, H 2001. Factors Influencing the Usage of Websites: The Case of a Generic Portal in the Netherlands. *Proceedings of the 14th Bled Electronic Commerce Conference, Bled, Slovenia, 25-25 June 2001* pp174-185. Accessed on 29 March 2004, at

http://staff.feweb.vu.nl/hheijden/files/vanderheijden_bled2001.pdf.

Zettl, H 1999. *Sight, Sound, Motion: Applied Media Aesthetics*. Belmont, CA: Wadsworth.

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Applicability of the Technology Acceptance Model in Three Developing Countries: Saudi Arabia, Malaysia and South Africa

Udo Richard Averweg

Abstract

The popular Technology Acceptance Model (TAM) has been successfully tested by several previous empirical studies in North America. Only some studies were carried out to test the applicability of TAM outside this region. The primary objective of this study is to report on the applicability of TAM in the Arab world (Saudi Arabia), Malaysia and Africa (South Africa). Research in Saudi Arabia supports the applicability of TAM to the Arab culture. TAM can also be applied in the Malaysian environment. However, in South Africa the study does not provide any direct evidence to support the applicability of TAM's determinants of usage. While the TAM literature suggests that results are mostly convergent, there are situations where they are conflicting. The author provides new evidence.

Keywords

Developing Countries, Ease of Use, Technology Acceptance Model (TAM)

Computing Review Categories

H.1.1, H.4.2, H.5.3

Introduction

User acceptance of information technology (IT) has been a primary focus in the IT implementation research for the past two

decades where IT adoption and use has been a major goal of modern organisations. Recently, researchers in the field have begun to rely on the theories of innovation diffusion to study implementation problems [5]. Davis' Technology Acceptance Model (TAM) states that perceived usefulness and perceived ease of use are the two factors that govern the adoption and use of IT [12].

Almost all research in Information Systems (IS) originates in Western countries, particularly the United States of America (USA), where conditions are very different from developing countries [25]. For a discussion of the term 'developing country', see [7]. Saudi Arabia, Malaysia and South Africa are developing countries. Conditions in developing countries are often greatly different from those of developed countries. For example, the African continent has the least developed telecommunications network in the world [11]. For a discussion of the challenges to an IT-supported technology transfer to developing countries, see, for example, [31]. There is a need for organisations to adapt to constantly changing business conditions [16].

The TAM has been successfully tested by several previous empirical studies in North America; however, only some studies were carried out to test the applicability of TAM outside this region. The primary objective of this study is to report on the applicability of TAM studies in the Arab world (Saudi Arabia), Malaysia and Africa (South Africa).

Information Systems Adoption and Usage

The study of IT adoption has recently gained new attention after being popularly studied in the 1980s [33]. The more sophisticated computer technology that includes the Internet is perceived to be part of modern organisations [38]. Many cases of technology adoption are direct political or cultural responses to the unwanted effects of globalisation rather than economic pursuits [8] [34]. Little research on IT adoption has been conducted in less developed countries [32]. Developing countries have much to gain from the revolution in communication and information access [41]. Even as IT in business organisations around the world converge, the meanings conveyed through them as well as the outcomes of their use may remain culture specific [28].

Computer or IS usage has been identified as the key indicator of the adoption of IT by organisations [38]. Igbaria and Tan [22] report that system usage is an important variable in IT acceptance since it appears to be a good surrogate measure for the effective deployment of IS resources in organisations. Lu and Gustafson [29] report that people use computers because they believe that computers will increase their problem solving performance (usefulness) and they are relatively effort free to use (ease of use). Given the complexity of data processing for decision support, the perception of a system's ease of use may significantly affect the level of its adoption by prospective users [35]. A person who believes that performing a certain behaviour will lead to mostly positive outcomes will have a favourable attitude towards performing that behaviour [15]. A person who believes that performing that behaviour will lead to mostly negative outcomes, will have an unfavourable attitude.

Technology Acceptance Model (TAM)

TAM was developed by Davis [12] and postulates that two particular beliefs, Perceived Usefulness and Perceived Ease of Use, are of primary relevance for computer acceptance behaviours [14] [24] [23]. According to TAM, system use is determined by a person's attitude towards the system.

The basic TAM model consists of external variables which may affect beliefs. This model is derived from the general Theory of Reasoned Action (TRA) [17] in that TAM is intended to explain computer usage. In IT terms this means that the model attempts to explain the attitude towards *using* IT rather than the attitude towards IT *itself.*

The most commonly investigated variables of TAM by researchers are Perceived Usefulness and Perceived Ease of Use [12] [14] [30] [1] [21] [36] [18] [20] [33]. Straub *et al.* [36] suggest that Perceived Usefulness of computers has a positive effect on the adoption of IT. Davis [12] and Adams *et al.* [1] report that perceived usefulness affects both attitudes and actual computer usage.

Davis' model specifically postulates that technology usage is determined by behavioural intention (B) to use the technology; which is itself determined by both perceived ease of use (EOU) and perceived usefulness (U). See Figure 1.
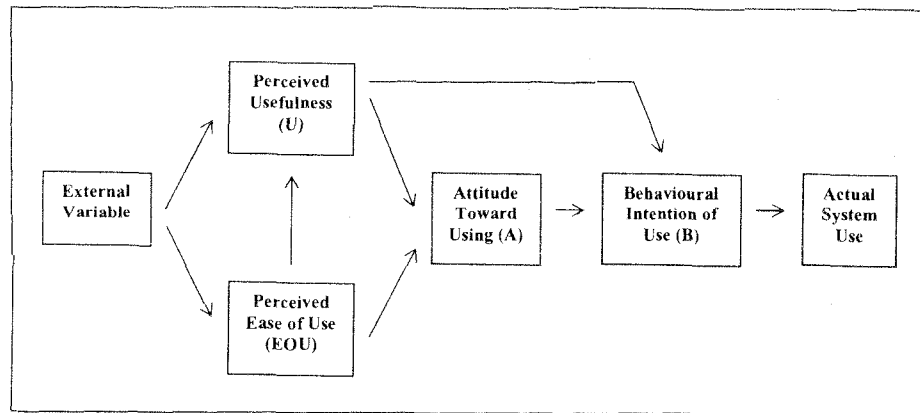
Figure 1: The Technology Acceptance Model (TAM) (Source: Davis *et al.*, 1989))

Additionally, behavioural intention to use (B) the technology is also affected by perceived usefulness (U) directly. Behavioural intention (B) to use the technology is then positively associated with actual system use. The TAM model of IS success relies on Fishbein and Ajzen's [17] and Ajzen and Fishbein's [3] TRA to assert that two factors are primary determinants of system use:

Perceived Usefulness. Perceived Usefulness (U) is defined as the user's subjective probability that using a specific technology will increase his or her job performance within an organisational setting [14]; and

Perceived Ease of Use. Perceived Ease of Use (EOU) is the user's assessment that the system will be easy to use and requires little effort.

In the context of the Internet and the World Wide Web several studies have confirmed these relationships still hold true [39] [26]. However, Straub *et al.* [36] demonstrate that the nature of relationships between these TAM constructs differs across cultures. Agarwal and Prasad [2] show the importance of individual differences as predictors of perceived ease of use specifically demonstrating prior experience, role with regards to IT and level of experience as factors of influence.

TAM Research in three selected Developing Countries

Few studies have been carried out to test the applicability of TAM outside North America. Some of these studies by country are: in Japan and Switzerland [36], New Zealand [23], Hong Kong [10], Singapore [39], United Kingdom [4], Arab world [33] [5], Malaysia [38] and South Africa [15] [9] [6]. The author reports TAM findings from three selected developing countries: Saudi Arabia, Malaysia and South Africa.

TAM Research in Saudi Arabia

Straub *et al.* [37] note that system usage has a notable practical value for managers interested in evaluating the impact of IT. While TAM has been widely applied and tested in North America, there have been rare attempts to extend this work to other regions of the world [4]. It has been argued that TAM may not hold equally well across cultures [36]. Straub *et al.* [37] elaborated that given the rapid globalisation of businesses and systems, there exists a pressing need to

understand whether TAM applies in other cultures. Research was conducted by Al-Gahtani [5] to establish whether TAM, as an IT diffusion model which originated an tested in the developed Western world, would apply to developing countries. Lacking a strong *a priori* basis for the applicability of TAM in the Arab world (specifically in Saudi Arabia), the following question was posited by Al-Gahtani [5] in his study 'why TAM would not apply to Saudi Arabia as a developing country of different culture?' *ie.* the study specifically focused on whether TAM would be applicable to test IT adoption and diffusion in Saudi Arabia (which is an important part of the Arab world). At the end of this survey Al-Gahtani [5] reports that the study 'findings ... confirm that TAM constructs are both valid and reliable', 'was successful as TAM effectively predicts computer technology adoption and use in the Saudi culture' and 'supports the applicability of TAM to the Arab culture'. As Saudi Arabia is an important developing country in the Arab world, South Africa is an equally important developing country in Africa.

TAM Research in Malaysia

The National IT Agenda (NITA) provides the foundation and framework for the utilization of information and communication technologies (ICT) to transform Malaysia into a developing nation. The research by Suradi [38] is similar in concept to Al-Gahtani [5] - the objective was to test TAM in a non-Western environment. Suradi [38] also acknowledges that even though culture has been identified to play a role in the acceptance of certain models developed different from the local culture of a given country (*eg.* USA), TAM was tested to be a workable model in the Malaysian environment. The results were similar to the findings of Davis [12], Davis *et al.* [13]; Igbaria [21]. Suradi [38] reports that TAM can be applied in the Malaysian environment for organisations which intend adopting new IT applications. This research also underscores the author's viewpoint that TAM can be equally applied in the South African environment.

TAM Research in South Africa

South Africa is a low to middle-income developing nation. In the study by Averweg [6], the correlation for the TAM usefulness-usage construct was *lower* than for use-usage and was therefore not consistent with Davis' findings. Furthermore because of this researcher's low correlation values Perceived Usefulness was **not** 'significantly more strongly linked to usage than was ease of use' [12]. Davis [12] emphasises that 'perceived usefulness and ease of use are people's subjective appraisal of performance and effort, respectively, and do not necessarily reflect objective reality'. Averweg's [6] results are not in support of the basic tenets of TAM. TAM has emphasised the importance of perceived usefulness (over perceived ease of use) as the key determinant of acceptance. Empirical evidence has constantly borne out this claim leading to perceived ease of use being treated as somewhat of a 'step-child' [40]. However, results of Venkatesh's research indicates that perceived ease of use **can** be a strong catalyst fostering acceptance. Averweg's [6] results partially support this finding *ie.* perceived ease of use can be a stronger catalyst (over perceived usefulness) fostering IT acceptance. In summary the results from Averweg's [6] study shows that ease of use on intended usage is greater than the effect of perceived usefulness on intended usage.

Legris *et al.* [27] suggest that analysis 'of empirical research using TAM shows that results are not totally consistent or clear'. Clearly, the results found in the TAM studies conducted in Saudi Arabia, Malaysia and South Africa highlights this inconsistency and provides support for Legris *et al.* [27]. TAM has been empirically proven successful in predicting about 40% of a system's use [19]. Legris *et al.* [27] report that although the results are most convergent, there are situations where they are conflicting.

In summary, research by Al-Gahtani [5] in Saudi Arabia supports the applicability of TAM to the Arab culture. Similarly research by Suradi [38] shows that TAM can be applied in the Malaysian

environment. However, the study by Averweg [6] does not provide any direct evidence to support the applicability of Davis' determinants of usage (within TAM) in South Africa. In this study low correlation coefficients were calculated for Perceived Usefulness and Intended Usage, and Perceived Ease of Use and Intended Usage constructs. The correlation for usefulness-usage was *lower* than for use-usage and therefore not consistent with Davis' findings. However, Averweg's [6] results *partially* support Venkatesh's [40] findings that perceived ease of use can be a stronger catalyst (over perceived usefulness) in fostering IT acceptance. Brown [9] reports that it has been shown that perceived usefulness is not a significant influence on usage, consistent with previous studies in some developing countries. Averweg's [6] results support Brown's [9] findings that 'perceived ease of use takes on increased importance, as it influences both usage and perceived usefulness'.

Concluding Remarks

Legris *et al.* [27] suggest that while TAM is a useful model, it has to be integrated into a broader one which will include variables related to both human and social change processes and to the adoption of the innovation model. While Averweg's [6] results are not in support of the basic tenets of TAM which emphasise the importance of perceived usefulness (over perceived ease of use) as the key determinant of IT acceptance, this is a possible indication of a difference in overall contextual factors, such as culture, prior experience and geography, and/or the impact of major user interface changes since the period (1986-1989) in which Davis published his studies. These issues may require further research in South Africa.

References

[1] Adams, DA, RR Nelson, & PA.Todd 1992. Perceived Usefulness, Ease of Use, and Usage of Information Technology: A Replication. *MIS Quarterly*, 16(2), 227-247.

[2] Agarwal, R & J Prasad 1999. Are Individual Differences Germane to the Acceptance of New Information Technologies? *Decision Sciences*, 30(2), 361-391.

[3] Ajzen, I & M Fishbein. 1980. *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, New Jersey, USA: Prentice-Hall.

[4] Al-Gahtani, SS 2001a. The Applicability of the Technology Acceptance Model outside North America: An Empirical Test in United Kingdom. *Information Resources Management Journal*, 14(3), 39-50.

[5] Al-Gahtani, SS 2001b. The Applicability of the Technology Acceptance Model outside North America: An Empirical Test in the Arab World. *BITWorld 2001 Conference Proceedings*, American University in Cairo, Egypt, 4-6 June.

[6] Averweg, UR 2002. Executive Information Systems Usage: The Impact of Web-based Technologies. Master of Science *dissertation*, Faculty of Science & Agriculture, University of Natal, Pietermaritzburg, South Africa.

[7] Averweg, UR & GJ Erwin 1999. Critical Success Factors for the Implementation of DSS at a Selection of Organisations in KwaZulu/Natal, South Africa. *South African Computer Journal*, 24, 95-104, November.

[8] Bird, B 1995. The EAGLE Project: Re-Mapping Canada from an Indigenous Perspective. *Cultural Survival Quarterly*, 18(4), 23-24.

[9] Brown, I 2002. Individual and Technological Factors Affecting Perceived Ease of Use of Web-based Learning Technologies in a Developing Country, *The Electronic Journal on Information Systems in Developing Countries*, 9(5), 1-15.

[10] Chau, PYK 1996. An Empirical Assessment of a Modified Technology Acceptance Model. *Journal of Management Information Systems*, 13(2), 85-204.

[11] Coeur de Roy, O 1997. The African Challenge: Internet, networking and connectivity Activities in a Developing Environment. *Third World Quarterly*, 18(5), 883-898.

[12] Davis, F.D 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 3(3), 319-342.

[13] Davis, FD Bagozzi, R. P. and Warshaw, P. R., 1992. Extrinsic and Intrinsic Motivation to Use Computers in the Workplace. *Journal of Applied Social Psychology*, 22(4), 1111-1132.

[14] Davis, FD Bagozzi, R. P. and Warshaw, P. R., 1989. User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, 35(8), 982-1003.

[15] Du Plooy, NF 1998. An analysis of the Human Environment for the Adoption and Use of Information Technology. Doctor Commercii (Informatics) *Thesis*, University of Pretoria, Pretoria, South Africa.

[16] Erwin, G & U Averweg 2003. E-Commerce and Executive Information Systems: A Managerial Perspective. In S Lubbe (ed), *The Economic and Social Impacts of E-Commerce*, Chapter VII, 103-120, Hershey, PA, USA: Idea Group Publishing.

[17] Fishbein, M & I Ajzen. 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Reading, MA, USA: Addison-Wesley Publishing Company.

[18] Garrity, EJ & GL Sanders 1998. *Information Systems Success Measurement*. Reading, MA, USA: Addison-Wesley Publishing Company.

[19] Hu, PJ, PYK Chau, OR Liu Sheng & K Yan Tam 1999. Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology. *Journal of Management Information Systems*, 16(2), 91-112.

[20] Hubona, GS & S Geitz 1998. External Variables, Beliefs, Attitudes and Information Technology Usage Behavior. *Proceedings of the 30th Annual Hawaii International Conference of System Sciences (HICSS-30)*, Hawaii, USA.

[21] Igbaria, M 1993. User Acceptance of Microcomputer Technology: An Empirical Test. *Omega International Journal of Management Science*, 21(1), 73-90.

[22] Igbaria, M & M Tan 1997. The Consequences of Information Technology Acceptance on Subsequent Individual Performance. *Information & Management*, 32(3), 113-121.

[23] Igbaria, M, N Zinatelli, P Cragg & ALM Cavaye 1997. Personal Computing Acceptance Factors in Small Firms: A Structural Equation Model. *MIS Quarterly*, 21(3), 279-305.

[24] Keil, M, PM Beranek & BR Konsynski 1995. Usefulness and Ease of Use: Field Study Evidence Regarding Task Considerations. *Decision Support Systems*, 13(1), 75-91.

[25] Kirlidog, M 1996. Information Technology to a Developing Country. *Information Technology & People*, 9(3), 55-84.

[26] Lederer, AL, DJ Maupin, MO Sena, & Y Zhuang 2000. The Technology Acceptance Model and the World Wide Web, *Decision Support Systems*, 29(3), 269-282.

[27] Legris, P, J Ingham & P Collerette 2003. Why Do People Use Information Technology? A Critical Review of the Technology Acceptance Model. *Information & Management*, 40(3), 191-204.

[28] Limaye, MR. & DA Victor 1991. Cross-Cultural Business Communication Research: State of the Art and Hypothesis for the 1990s. *The Journal of Business Communication*, 28(3), 276-299.

[29] Lu, HP & DH Gustafson 1994. An Empirical Study of Perceived Usefulness and Perceived Ease of Use on Computerized Support System Use over Time. *International Journal of Information Management*, 14(5), 317-329.

[30] Mathieson, K 1991. Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior. *Information Systems Research*, 2(3), 173-191.

[31] Nahar, N, K Lyytinen & N Huda 2000. Challenges to an IT-Supported Technology Transfer to Developing Countries. *BIT World 2000 Conference Proceedings*, Universidad Iberoamericana Sante Fe, Mexico City, Mexico, 1-3 June.

[32] Prescott, M & S Conger 1995. Information Technology Innovations: A Classification by IT Locus of Impact and Research. *Database Advances in IS*, 26(2 and 3), 20-41.

[33] Rose, G & D Straub 1998. Predicting General IT Use: Applying TAM to the Arabic World. *Journal of Global Information Management*, 6(3), 39-46.

[34] Sherry, J 2002. *Land, Wind and Hard Words*. Albuquerque, New Mexico: UNM Press.

[35] Shin, B 2003. An Exploratory Investigation of System Success Factors in Data Warehousing, *Journal of the Association for Information Systems*, 4, 141-170.

[36] Straub, D, M Keil & W Brenner 1997. Testing the Technology Acceptance Model across Cultures: A Three Country Study. *Information & Management*, 33(1), 1-11.

[37] Straub, D, M Limayem & E Karahanna-Evaristo 1995. Measuring System Usage: Implications for IS Theory Testing. *Management Science*, **41**(8), 1328-1342.

[38] Suradi, Z 2001. Testing Technology Acceptance Model (TAM) in Malaysian Environment. *BITWorld 2001 Conference Proceedings*, American University in Cairo, Egypt, 4-6 June.

[39] Teo, TSH, VKG Lim & RYC Lai 1999. Intrinsic and Extrinsic Motivation in Internet Usage. *Omega, International Journal of Management Sciences*, 27, 25-37.

[40] Venkatesh, V 1999. Creation of Favorable User Perceptions: Exploring the Role of Intrinsic Motivation. *MIS Quarterly*, 23(2),

239-260.

[41] Vinaja, R 2003. The Economic and Social Impact of Electronic Commerce in Developing Countries. In S Lubbe (ed), *The Economic and Social Impacts of E-Commerce*, Chapter II, 22-32, Reading, MA, USA: Addison-Wesley Publishing Company.

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