A Retrospective on the Information Systems Discipline in Australia

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Version of 9 November 2007, with an addendum lamenting the passing of Cyril Brookes on 3 January 2008

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Abstract

Information Systems emerged as a discipline in the 1960s. It has struggled to define itself, its scope, and its relationship with its neighbouring disciplines in the computing and management arenas. Despite that, it has grown into a diverse and busy community. The discipline in Australia numbers some 700 people, and it has had impacts on the international stage. This paper charts key events in its first four decades, identifies what appear to the author to be the key themes, provides a body of references for future historians to consider in greater detail and from other perspectives, and raises questions for the future.

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1. Introduction

The Information Systems (IS) discipline has mostly been far too concerned about ensuring its future to spend much time celebrating its past, or even understanding, it. But, as pioneers retire, the time has come to consolidate sources and memories and provide some historical background to this vibrant but often-troubled field.

Research into the discipline's birth led to 1965 and 1967 as the most tenable start-dates. The analysis reaches beyond 1995 only selectively. This is partly because of the scale of the undertaking, and partly because lack of perspective makes it much more difficult to write convincingly about 'recent history' than about 'ancient history'. For further comments on author bias, see the Acknowledgements section.

A history can be approached from a variety of directions. Because it is something of a 'trail-blazing' exercise, this paper is intentionally eclectic. It blends (or perhaps muddles) the approaches of the chronicler (who did what when?), the historian of ideas (where were concepts, models and theories appropriated from? what scope has been evident? what topics have been important? what propositions were debated?), and the political historian (what power bases existed? what skirmishes were fought? who won?). Little time is spent on historiography or critical thinking (who wrote what, with what biases, and for what purpose?). First we need some sources. Only then can the battle to own history begin.

The author's own perspectives and biases regarding the scope of the IS discipline will become apparent progressively through the paper, but two aspects need to be addressed at the outset. Rather than

commencing with a discussion about 'what is IS?' and 'what should IS be?', this paper sets out with the pragmatic approach that 'IS is what IS does'. Only at the end does it attempt to reflect the rich and at times tumultuous debates about those questions. The second limitation is that the traditions with which the author is most familiar are those of Australian IS, US MIS (management information systems), UK IS and IM (information management) and Wirtschaftsinformatik in German-speaking countries (which is most appropriately translated as 'business information systems'). These provide ample evidence firstly of different flavours but secondly of a measure of unanimity about the discipline's scope-in-action, and the matters that, at any given time, have been proper topics to be considered by the discipline's members.

The research method adopted was heavily based on secondary research, starting with the author's own substantial archives dating from 1970, followed by searches for relevant published resources. This was supplemented by face-to-face interviews with a number of key players during the early years, and email interchanges and telephone conversations with a substantial number of people, both in Australia and overseas. Many of these sessions resulted in further references that needed to be reviewed. The Acknowledgements section lists the individuals on whom the author has placed greatest reliance. The now-compulsory 'web-trawl' delivered some hits of consequence. The intended review of IS departments' sites for historically-relevant material was not proceeded with, because the sampling that was performed suggested that there were more promising avenues in which to invest the available time. The only formalised departmental histories that were unearthed were Greig & Levin (1989) regarding Computing at Caulfield/Chisholm (1965-88), Dreyfus (2004) regarding the University of Melbourne's IS Department (1994-2004), and Burrows (2006) regarding the same University's Accounting Department (1925-2004).

The 'IS in ANZ' team reviewed and provided substantial and substantive feedback on the proposal in March 2005, on a sketch in May 2005, on an interim report in November 2005, and on a draft in January 2006. The version of May 2006 was released with a Request For Comment sent to about 40 senior members of the discipline in Australia and overseas. This elicited important feedback, which has been reflected in this version. An article-length version was extracted and published (Clarke 2006).

The paper commences by considering the intellectual origins of the IS discipline. Building on this foundation, key events are identified that are associated with the establishment of the discipline, both overseas and in Australia. The development of the discipline is then traced, using a variety of metrics. The latter parts of the paper identify some key themes, both of a political and an intellectual nature.

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2. Origins and Nature of the I.S. Discipline

The foundations of IS can be traced back to the late 19th and early 20th century rational management stream of thought, associated with Fayol and Taylor. Although usually interpreted as being about efficiency in the use of physical resources through understanding of the 'time and motion' of agents, the movement is easily re-interpreted as also being about the use of information. Drucker (1968) included a large section on what he called 'the knowledge economy' - would currently be referred to as 'the information economy'. He argued that "the idea that knowledge, systematically acquired, could be applied systematically to work is no more than 200 to 250 years old" (p. 328), and first occurred in tool makers and tool designers in the eighteenth and early nineteenth century, who laid the foundation for the industrial revolution.

Automated equipment, in particular punched-card handling devices, had been in use in large-scale applications at the very beginning of the 20th century, in particular for the U.S. Census (e.g. Kistermann 1991). The invention, articulation, application and rapid improvement of electro-mechanical and then electronic computers during the period 1935-50 is well-documented (e.g. Campbell-Kelly 2003, Norberg 2005). These initiatives were motivated by the processing of ephemeral data into significant results, rather than what we would now call data management. Technologies to provide permanent storage quickly came

to be seen as an important adjunct to computation, and the complex of technologies needed to support what became computer-based IS quickly emerged.

The use of electronic computers for the processing of administrative data brought a very substantial impetus to the emergence of the IS discipline. Applications of this kind commenced simultaneously in the U.K. and the U.S.A. in 1951, with Leo at the Lyons Tea Company, and Eckert and Mauchly's Univac 1 at the U.S. Census (e.g. Caminer et al. 1998, Land 2000b, Johnson 2006). The first installation of a computer in a U.S. company expressly for administrative purposes appears to have occurred only in 1954, for payroll at GE in Louisville KY (Mason 2005).

To extract a comprehensive history of the early years of business applications of computing, it is necessary to read beyond the substantial U.S. literature on the subject. Many U.S. publications subscribe to the myth that very little of consequence happened outside the U.S.A., and merely footnote German and particularly British work, even though it was vital from the 1930s into the 1960s. On the other hand, the tempo in the U.S. picked up very quickly, as banks and airlines recognised opportunities, and even more quickly after the emergence of computer architectures designed for business applications, particularly the IBM 360-series from 1964. From about 1960 onwards, US energy has dominated innovation in information technology (IT) in Australia, as elsewhere.

The emergence of the IS discipline was in historical terms brisk, but to an observer at the time would have appeared laboured and wayward. It appears to have followed somewhat different paths in various countries and regions, with distinct flavours discernible in the USA, the UK, Germany, Scandinavia and Australia. The myopia of the author, and of English-language cultures generally, makes it likely that critical ideas from other countries have been overlooked, or inaccurately attributed.

Differences also occurred within countries, particularly those of substantial geographical size. The term 'the tyranny of distance' (coined by Australian historian Geoffrey Blainey in his 1966 book of that name) may seem quaint to post-Internet generations, but it afflicted countries the size of Australia, Canada and the USA. During the early years of the IS discipline, with no coordinative mechanisms such as an information infrastructure any more sophisticated than the voice-only services over the Public Switched Telephone Network (PSTN) and textual data over the telegraph and telex networks, and with no accreditation panels, no curriculum committees, no text-books, few conferences and relatively high airfares, there was ample scope for strong, energetic and visionary individuals to have significant local, regional and national impact.

It was natural that the new interest in information would draw both on existing disciplines and professions for which data and its processing were already an interest, and on emergent disciplines that were adopting new approaches made feasible by the new technology. The dominant strands appear to have been **Accounting** and the emergent **Computer Science**, together with threads arising from a range of other sources. The following were of particular importance:

- **Organisation & Methods (O&M)**, a branch of Industrial Engineering that applied a form of 'rational management' to organisations' internal operations. This was particularly influential in the UK, and in some areas of Australia;
- **Operations Management**, although this was far less influential in Australia than it was in the USA;
- **Operations Research**, as it developed in the U.K. and the USA during World War II, and its applications in the business arena as management science and decision sciences. Particularly influential authors were Simon (1960), Miller and Starr;
- **Management Accounting**, particularly Anthony (1965) and Prince (1966, 1970). Similarly traceable to Taylorism and industrial engineering, this approach focusses on applications of micro-economics that are useful within the organisation, measurement schemes to enable the discovery and analysis of exceptions, and ways to manage measurements and communicate them to the

managers who need them;

- **Systems Thinking**, drawing originally on von Bertalanffy and Boulding and the Society for General Systems Research in the U.S. from the mid-1950s onwards (Mason 2005), Emery, Churchman, Jay Forrester, and Katz & Kahn (1966), and in the UK von Bertalanffy in 1950, and later Peter Checkland. Closely related to this movement was **Cybernetics**, as pioneered by Norbert Wiener, further developed by Ashby and applied by Stafford Beer. This focussed on the feedback and control aspects of systems. There was much interest in these bodies of theory in Continental Europe as well, centred around the International Institute for Applied Systems Analysis (IIASA) conferences in Schloss Laxenburg south of Vienna. The emphases and patterns of development on the two sides of the Atlantic, and within Continental Europe, were rather different, and no history has been located to date that integrates them;
- **Socio-Technical Systems**. This thread developed in the U.K. from the 1950s onwards, initially at the Tavistock Institute, and was adopted and extended particularly in the U.K. and Scandinavia. It represented a reaction against the reductionist thinking inherent in the previous strands, and that resulted in (sophisticated) mechanistic designs: "If a technical system is created at the expense of a social system, the results obtained will be sub-optimal" (Enid Mumford's web-site, attributed to the Tavistock Institute). The **Soft Systems** school of thought followed. Publications that documented and consolidated this movement included Mumford & Banks (1967), Bjorn-Andersen (1980), Checkland (1981), Mumford (1983), and Wood-Harper et al. (1985);
- **Management Theory** placed expectations on the new and expensive technology. Drucker was particularly influential, and Ackoff and Likert, and Macfarlan and Scott Morton (1971) at the Harvard Business School. A range of what could be called 'thinking manager's gurus' had substantial influence on DP/IS/IT Managers, including EDP Analyzer (later I/S Analyzer), Dearden, Auerbach, Infotech 'State of the Art' Reports, and James Martin. Their impact on IS academics was less substantial; but Martin in particular provided syntheses of material that were much-used as IS text-books.

Beyond the intellectual sources were those dictated by pragmatics. The application of computers to administrative, commercial, industrial and government purposes required the development of software. The required rapid production of new software developers depended upon the expression and structuring of 'know-how' into what would now be called 'codified knowledge' about what came to be called analysis, design and programming. During the period from 1967 until about the mid-1980s, this practical need had a substantial impact on the conception of the scope of the IS discipline. Since then, it has drifted away from the mainstream of IS, and IS from it. It has become either or both of the independent, cognate discipline of software engineering, or a substantial component of the adjacent discipline of computer science. To many IS academics, the perspective typified by the Institute of Electrical and Electronic Engineering (IEEE) is far too narrow and mechanical, with its reductionist conception of systems analysis as 'requirements engineering'.

As a frame within which the remainder of this paper is developed, some clustering of the themes and topic can be suggested, as follows:

- **Technology as Enabler and Driver**, including computers, EDP, applications, applications development, the Software Development Life Cycle (SDLC), the systems life-cycle (SLC), computer usage, usability, technology adoption, and impediments to adoption;
- **Organisations**, as the primary context within which information systems are developed and operated, and for whose purposes they are applied, including organisational behaviour, requirements elicitation, business process analysis, usability, technology adoption, and impediments to adoption;
- **Systems Thinking**, including O&M, GST and cybernetics leading from SDLC to SLC, socio-technical theory, soft systems methods, incorporation of human factors, usability, adoption, and merging with human behaviour and communications into semiotics and perhaps ontological foundations;

- **Business School Thinking**, including OR/MS, management accounting, controls and audit, management of DP/IS/IT/IC&T, information management, usability and adoption; and
- **Data and Information Management**, including database management systems (DBMS), data modelling, data dictionaries, information resource dictionary systems (IRDS), and later the absorption from librarianship of key concepts about metadata.

It is stressed that this clustering is a clumsy classification, not a clean taxonomy. As evidenced by the appearance of such terms as 'adoption' in multiple clusters, there was continual cross-feeding, and co-evolution of thinking. Particularly during the formative years, the process and the product were highly eclectic, as each local leader sought to make sense of the domain, and contribute to progress.

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3. The Foundation Years Overseas

This section briefly reviews the beginnings of IS in Europe and North America. It is not intended as a contribution to a broad IS history literature (because that would require much deeper treatment). Its purpose is to provide a backdrop to the early years in Australia.

The dominance of North American contributors in the published literature suggests that the USA was first in the field. But the evidence as a whole actually suggests that the emergence of IS may have been slightly earlier in Europe, and only slightly lagged in Australia. No material has been located at this stage in relation to the early years in Canada.

3.1 Europe

Borje Langefors was appointed Professor in Information Processing at **the University of Stockholm in 1965**. He proposed a theoretical basis for IS based on "the infological equation I = i (D, S, T), where I stands for information, D data, S the recipient prior knowledge as result of the individual's life experience, T the time, and i the interpretation process" (Shen 2003). His early texts (Langefors 1963, 1966) were translated into English, although it is not easy to judge the extent of their impact on thinking in English-speaking countries. The 'infological equation' is reflected in Mason (2005), which refers to information as "data interpreted within a point-of-view" (p. 14), and in this author's own explanation of information as "data that has value [that] depends upon context" (Clarke 1992b). Both also appear to relate to Wiener's conception of information as 'data that an organisation could employ for the direction of its activities' (Mason 2005). It is in stark contrast with the Shannon & Weaver conception of information as 'a measure of one's freedom of choice when one selects a message'. That works brilliantly when applied to the transmission of data over a noisy channel, but very poorly in the contexts addressed by IS. Scandinavia has also had a long and strong association with the organisation and human behaviour aspects of IS, including Niels Bjorn-Andersen who, following completion of his PhD with Enid Mumford in Manchester, returned to Copenhagen in 1972.

In **Germany**, Wirtschaftsinformatik (roughly 'business data processing' or 'business informatics') emerged within Betriebswirtschaftslehre (roughly 'business administration') from the late 1950s and was later much influenced by Informatik (computer science). The earliest claim that has been found for the establishment of IS is the Institute for Business Organisation and Automation at Uni. Koeln (E. Grochla) in 1963. The first German-language doctoral thesis in an IS topic was in 1966 (Peter Mertens), the next in 1968 (Lutz Heinrich). The first Chairs in German-speaking countries were at Linz in Austria (1968-69 Mertens, 1970-2004 Heinrich), then Karlsruhe, Erlangen-Nürnberg, Darmstadt, Muenchen and Speyer. The first full majors were at Wien and Linz in 1974-75, and in the 1980s large schools emerged at Berlin, Köln, Frankfurt-am-Main, Mannheim, Münster, Nürnberg and Saarbrücken. A national conference has existed since 1987. The leading German-language journal has been called Wirtschaftsinformatik since 1990, but was established as Elektronische Rechtanlagen (electronic computing systems, 1959-72) and between

1972 and 1990 was named Angewandte Informatik (applied computing).

Wirtschaftsinformatik has had a sustained and strong orientation towards data processing and software development, with substantial practical work, but also a significant information management stream (Heinrich 1993, Avgerou et al. 1999, Mertens et al. 2002). Patterns in other German-speaking countries have been not dissimilar. Distinctions between the German and other styles are drawn out by this quotation: "To what extent will anglo-american researchers adopt the prototypical IS approach being cultivated in Germany and to what extent will German IS research better adapt to the survey-oriented anglo-american research culture?" (Mertens et al. 2002).

In the **United Kingdom**, key appointments occurred in 1967: Frank Land at the London School of Economics (LSE), and Peter Keen at the London Business School (LBS). Together with Enid Mumford, already at Manchester, there were now three separate and rather different flavours. A key publication appeared in the same year: 'The Computer and the Clerk' (Mumford & Banks 1967). This greatly influenced the conception and scope of IS in the U.K., which has generally been attuned to a human-oriented interpretation of systems thinking that reflects the intrinsic ambiguity of the contexts in which information is used and information technology applied, and the existence of a range of perspectives that need to be factored into analyses. This relatively 'soft' nature was noticeable in the contributions of Ronald Stamper at LSE from 1972, Peter Checkland at Lancaster, and later Trevor Wood-Harper. However the discipline in the UK has come to reflect a wide diversity of approaches.

3.2 North America

The history of the IS discipline in North America (and, to a considerable extent, the world as a whole) is associated by many people, within and far beyond the USA, with the appointment of Gordon Davis to a Chair at Minnesota in 1967. The context was accounting within a graduate school of business, but impregnated with systems thinking. The field was described as 'management information systems' (MIS). Mason (2005, p. 21) traces the origins of the term at least as far back as a 1962 book by James D. Gallagher.

Davis had already published an introductory textbook on computers for business students (Davis 1965), but his key intellectual contributions are encapsulated in his 'conceptual foundations' text (Davis 1974, Davis & Olson 1984). Davis spent close to four decades at Minnesota, 1967-2004. Many of the people whose doctorates he supervised have been active supervisors as well, and, by the time of his retirement in 2005, the 'family' had reached the fourth generation and a total count of over 100.

The year 1967 also saw the appointment of Bill King at Pittsburgh, who brought an OR perspective, but grafted on from other disciplines as appropriate. MIS was established at the University of California at Los Angeles (UCLA) by no later than 1968, also growing out of Accounting, but also with a strong 'systems thinking' emphasis (Mason 2005). Dan Couger published on systems analysis and development techniques, also in a manner imbued with systems thinking. Jim Emery published foundation text-books (Emery 1969, 1971). Macfarlan and Scott Morton at Harvard Business School published on management aspects of IS from the late 1960s onwards.

Banker & Kauffman (2004) note that the journal Management Science started a column on 'Information Systems in Management Science' in 1967, edited by Harry Stern, and included IS in the first departmental structure of the journal in 1969. The Society for Information Management (SIM), which has always been targeted at the needs of the senior IS executive (in contemporary fashion, the CIO), was an important supporter from 1968. The Association for Computing Machinery (ACM), particularly through its SIGBDP (Special Interest Group for Business Data Processing) and The Institute for Management Science (TIMS) also provided support and considerable influence, from the computing and the operations research perspectives respectively. A perspective on the origins and evolution of MIS is in Dickson (1981).

In the U.S.A., MIS has been imbued with a rationalist approach to systems thinking. Rationalism may be 'bounded', but 'satisficing' is still rational. There is limited scope for looseness and soft systems, little attention is paid to contexts that lack a single powerful entity that can dictate a requirements statement, and limited credence is granted to serendipity and what Ciborra called 'bricolage'. Strategically successful IS have to be attributed to intelligent management, and cannot be seen to be the semi-accidental result of complex interactions. Tensions between perspectives are in principle capable of being balanced out, but in many cases they are simply over-ridden in deference to some 'greater good'. The 'greater good' is by definition determined rationally, but from some particular perspective - generally that of the most powerful player or alliance of players.

Clearly, this stark juxtaposition of 'hard U.S.' versus 'soft British and Scandinavian' philosophies in IS is an over-simplification that is subject to many qualifications, particularly in recent years as the level of trans-atlantic communications, interactions, and alliances has increased. In particular, a number of U.S. writers have argued the case for interpretivism, e.g. Boland (1978), Lee (1994), Chen & Hirschheim (2004). Nonetheless, the tension between the 'hard' and the 'soft' exists; and it is not infrequent that the distinction is a regional one.

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4. The First 40-50 Years in Australia

A 'retrospective' needs to adopt a largely chronological presentation, and to divide the period covered into digestible pieces. One possibility is to apply an interpretation of the phases of the information technology, such as that in Exhibit 1.

Exhibit 1: Information Technology History and Its Implications

	1940-1980	1980-2000	2000-2040
Processor Technology	Grosch's Law – Bigger is more efficient	VLSI / micros – More is more efficient	Commoditisation – Chips with everything
Network Technology	Star - Centralised	Multi-connected - Decentralised	Wireless - Ubiquitous
Processor Inter-Relationships	Master-Slave - Control	Client-Server - Request-Response	P2P - Collaboration
Organisational Form	Hierarchies	Managed Networks	Self-managing Market/Networks
Software and Content	Closed, Proprietary	Confusion and Tension	Open
Politics	Authoritarianism - Intolerance	Confusion and Tension	Democracy and Frustrated Intolerance

After (Clarke 2004 at Exhibit 3.7)

That would be unsatisfactory, however, because although technology has been a driver, and even the major driver, it has not been determinative of the development of the IS discipline. This section presents what appear to the author to have been the key events in the emergence of the discipline in Australia, divided into three chunks of time that are proposed as being useful rather than decisive. A related but somewhat different division is used by Mason (2005):

- pre-formation - mid-18th century to 1954 (addressed in section 2 above);

- gestation - 1954-68 (sections 4.1-4.3 below);
- birth - 1968-2000 (sections 4.3-4.4 below, sub-divided for reasons specific to the Australian context); and
- rebirth - 2000- (which is addressed in the closing sections of this paper).

4.1 To 1960

Australia has something of a history in automated computation. In particular, the world's first totalisator, for 'totalling up' wagers, particularly on horse-races, and sharing the pool among the winning bets (and extracting fees and taxes) was invented in Western Australia by George Julius c. **1913** (e.g. Bennett et al. 1994, pp. 7, 31-32). Although this was an entirely mechanical system, electrical components were later added. Julius' company enjoyed a worldwide monopoly for some time.

Later, the fourth electronic digital computer, CSIR Mk 1 (**1948**-56), was completely 'home-grown' in Australia, at the Commonwealth Scientific and Industrial Research (CSIR) Division of Radiophysics in Sydney (Pearcey 1988, pp. 12-19, 160. See also Bennett et al. 1994, pp. 15-58, esp. 16-30). Mk I's successor, CSIRAC, ran 1956-64 at the University of Melbourne. The University of Sydney's locally-designed and built SILLIAC ran 1954-68, and the University also designed and built SNOCOM for the Snowy Mountains Authority (1960-67). Adapted versions of imported machines ran at UNSW (UTECOM, 1956-66) and the Weapons Research Establishment (WRE) (WREDAC, also 1956-66). There is a persistent mythology in Australia that the CSIRO abandoned investment in computing in favour of cloud-seeding. This story is all the more poignant when it is appreciated that the last CSIRO-developed computer, c. 1963-68, was called the Cirrus (Pearcey 1988, p. 66). A recent international perspective on the early years is in Chapter 7, 'Wizards of Oz', in Hally (2005, pp. 161-184). The predominant influences throughout this formative period were British rather than American, which derived in considerable measure from John Bennett's work on the earliest machines in the U.K., including the first stored-program computer, EDSAC, at Cambridge.

Pearcey (1988, p. 157) and Bennett et al. (1994, p. 26) identify the first computer conference in Australia as having been held in March **1951** in Sydney, and run by the University of Sydney and CSIRO (in 1949, CSIR had been re-named as the Commonwealth Scientific and Industrial Research Organisation - CSIRO). Bennett et al. (1994, p. 28) cites papers in the Proceedings of an April 1952 Conference on Automatic Computing Machines, run by CSIRO, although this may have been a late publication of the papers from the 1951 event.

The 2nd Conference on Automatic Computing and Data Processing was held in June **1957** at WRE (later re-named the Defence Science & Technology Organisation - DSTO) at Salisbury, north of Adelaide. It had three sections, one of which was 'Business Applications'. The conference chair, John Ovenstone, contributed a paper on 'Business and Accountancy Data Processing' (Pearcey 1988, p. 47-48). This was only six years after the first commercial use in the U.K. and the first governmental use in the U.S., and only three years after the first commercial use in the U.S.

Until 1957, the c. 8 computers in Australia were all in universities and the WRE. But by 1960 there were 34 in government alone, and by 1963 c. 80 computers (Pearcey 1988, pp. 137, 159) or "nearly 100" (Bennett et al. 1963, p. 11). Bennett claimed that the count per million of population was on a par with Sweden, (the then) West Germany and the U.K., and was exceeded only by the USA, Canada and Switzerland.

Few of the computers were intended exclusively for research. Commonwealth government agencies, commencing with the Department of Defence and the Australian Bureau of Statistics (ABS), had installed computers for administrative tasks. In Defence, for example, John Ovenstone, an immigrant from the U.K., was appointed to the new position of Controller of ADP at senior level (Band 2 SES), and drove the

project 1958-64 (Pearcey 1988, pp. 72-74). The organisationally logical way for bureaucracies to integrate programmable computers into their ways of working was to conceive of them as super-tabulators, and manage them in a similar way.

The first Australian companies to install computers are understood to have been the two insurance companies AMP and MLC, both in 1960, nine years after the first in the U.K., and six years after the first in the U.S. In interview, Bill Caelli said that BHP had IBM 1401 and 1440 models installed in Newcastle and Wollongong by no later than 1962, and applied them to a variety of operations management and commercial functions.

4.2 1960-1973

The **Australian Committee on Computation and Automatic Control (ANCCAC)** was formed in 1959, with John Bennett as Chair. It appears that "the First [Australian Computer] Conference was held at the University of Sydney and the University of NSW on 24-27 May **1960** under the chairmanship of Dr. J. M. Bennett of SILLIAC fame" (McDowell 2002). According to McDowell, 43 of the 158 papers at the event were focussed on 'Commercial Applications'.

This was very early in the international history of computing outside the confines of closed military institutions. The first international congress was held only in 1959, in Paris. The International Federation for Information Processing (IFIP) was formed in 1960 - and John Bennett was one of the key instigators of its formation.

Computing was a new field and suffered the classic 'bootstrapping' problem. Very few staff with the necessary background were available for hire - although migrants from the U.K. who could claim some relevant background such as cryptanalysis were in demand. Tertiary institutions could not yet offer courses, because they had no staff who could develop courses and provide instruction. Agencies initially depended heavily on such training as was available from the suppliers of the technology they had purchased, and on the internal training schemes that they put together. A limited set of design techniques was available at this stage; but Bill Caelli recalls Fred O'Toole at BHP Newcastle being a strong fan of decision tables in 1963.

The second conference in 1963 included 20 such papers, primarily case study reports, including one by Ovenstone on the Department of Defence, and others on the Snowy Mountains Authority Stores System, insurance and banking.

Training within the Commonwealth public sector was formalised as **the Programmer in Training (PIT) scheme, commencing in 1963** (White & Palfreyman 1963, Bennett et al. 1994, p. 108, ABS 2005, interview with Gerry Maynard in 2005). This "was oriented toward training staff for establishing and running commercial and administrative applications of computing"(Pearcey 1988, p. 122), and involved "a full year at about twenty hours per week of class time, and effectively more than twenty hours per week of related private study" (p. 121). The scheme was run in at least Canberra and Melbourne. In Canberra, the Department of Defence ran it for its own staff, and the then Commonwealth Bureau of Census and Statistics (CBCS, soon after re-named the Australian Bureau of Statistics - ABS) ran it for itself and other agencies. Melbourne courses were run by the Postmaster General's Department (PMG). Coordination was provided by the Public Service Board (PSB, disestablished in 1987).

The CBCS/ABS variant was what would later be called a 'sandwich course', including "two ten-week stints of on-the-job training". In interview, Gerry Maynard said that the content was about 50% programming and 50% systems analysis and design. The CBCS 1965 syllabus included two languages FORTRAN and COMPASS (CDC's Assembler), and the ABS 1971 syllabus somehow managed to cram in COBOL as well. "Exams at the end of the year included a major systems analysis and design exam for

which a time was allowed of 'up to seven hours if required'" (ABS 2005).

Some hundreds of people entered the industry through these courses, primarily into the Commonwealth public service, but with substantial ripple-effects into State government agencies and the private sector. This author's professional life in IS began in 1971, when he was hired into the Sydney industrial corporation Wormalds by Neville Clissold, a 1965 PIT scheme graduate.

By the mid-1960s, courses which were the precursors to what became 'Computer Science' were emerging in various tertiary institutions in various Departments, including Physics (Sydney), Engineering (UNSW) and Mathematics (Newcastle). The author and several reviewers were subjected to primitive versions and crippled sub-sets of Fortran in and around 1967.

In Australia, as elsewhere, the Computer Science discipline largely avoided applications, particularly those in business and government. This provided space for the emergence of data processing specialisations and the information systems discipline.

In **1965**, the Caulfield Institute appears to have established **the first specialist Department**, called Electronic Data Processing (EDP). The foundation staff were John McClelland, Doug Mills, Jack White and Pearl Levin, joined soon afterwards by Peter Juliff, Bob Grant and Gerry Maynard. Trevor Pearcey joined as Head in 1972. The courses combined instruction about technology with teaching about how to apply it. Programming was a central feature, because all applications had to be custom-built, few utilities were available, and the era of code libraries was yet to arrive (Greig & Levin 1985).

Meanwhile, IS topics were emerging in university **accounting departments**. These were isolated, and the period is poorly documented. From interviews, it appears that the first mover was Ted Dunn, from 1965 to 1973, at the University of Tasmania, using Algol (interview with Stewart Leech). From the author's personal knowledge, Phil Grouse was offering full units at UNSW by no later than 1968, whose purpose was to enable Commerce students to understand computers, software and their applications, programming languages, and software development. At the University of Melbourne, John McMahon and Stewart Leech offered an EDP unit in 1970, but this grew out of earlier fee-paying courses for industry (interview with Stewart Leech in March 2005, Burrows 2006). Interviews have also unearthed mentions of the then Wollongong College of UNSW, and of Douglas V.A. Campbell, of the Monash Accounting Department during the late 1960s.

Sydney and Melbourne were major world cities, and Wollongong was one of the major centres in the then-very-large steel industry. Hobart's early activity was presumably stimulated by the installation at the Tasmanian Hydro-Electric Commission.

Further Australian Computer Conferences (ACC) were organised by ANCCAC in **1963** in Melbourne - the 2nd, and in **1966** in Canberra - the 3rd (Pearcey 1988, p. 130). Meanwhile, various State-based associations of practitioners emerged during the first half of the 1960s. The early movers were generally well-educated, and scientific in outlook. The **Australian Computer Society (ACS)** was formed in 1966 through the federation of those associations.

The PIT scheme was operated by at least the ABS until 1972. In interview, Cyril Brookes said that he arranged for a course to be run in Port Kembla in the late 1960s, to support the BHP steelworks and local industry on which it depended. Commencing in the late 1960s, a transition was begun to several Colleges of Advanced Education (CAEs). For example, the ABS conducted training in conjunction with the Canberra College of Advanced Education (CCAE), with an internal Bureau exam. By **1972**, Caulfield Institute in Melbourne, Bendigo College, and CCAE in Canberra were all operating award courses whose origins could be traced to the PIT scheme (Gerry Maynard in interview, Pearcey 1988 pp. 121-122, Greig & Levin 1989). Caulfield developed the course into a formal Graduate Diploma in Data Processing, and then expanded into a range of other specialised postgraduate courses.

Internal training courses continued to have their advantages (e.g. Fiedler 1969, 1970), but gradually what would later come to be called 'outsourcing' was applied. For new entrants, courses were provided primarily by universities and CAEs, although training in specific programming languages and software products was offered by suppliers. Continuing professional development courses were conducted by universities, CAEs, suppliers and the emergent private sector training companies.

The ACS established the Australian Computer Journal (ACJ) in **1967**, and for many years also published a second-tier, non-refereed Australian Computer Bulletin (ACB). Until the establishment of Austral. J. Infor. Syst. in 1994, these were the only directly relevant domestic outlets for Australian IS academics.

The ACS also took over the Australian Computer Conferences, and ran well-attended events commencing with the 4th in August **1969** and the 5th in Brisbane in May **1972**, then biennially and then annually with the last of the 18 held in 1991 (Bennett et al. 1994, p. 296). By the early 1990s, the computing community had become the Information Technology (IT) community, and had splintered into a great many specialist conferences. With that, the attractiveness of a focal event waned. An annual Computing in CAEs Conference also ran from the late 1960s until the late 1980s. The papers presented at these conferences were lightly refereed in comparison to the ACJ, but the topics are of relevance to an analysis of the preoccupations of the profession and discipline at the time, e.g. this author's own first paper at the 7th ACC in Perth was entitled 'Top-Down Structured Programming in COBOL' (Clarke 1976).

A measure of the **explosion in business applications between the mid-1960s and mid-1970s** can be gauged from the once-fraught area of payroll processing. The earliest payroll applications were written by large government agencies and corporations in the early-to-mid 1960s. In interview, Bill Caelli recalled using the patch-panel of an IBM 407 in late 1962 to program payroll for IBM Newcastle. In 1971-72, working as a systems analyst for an industrial company, this author had little option but to design and write a payroll application to run on the company's GE405. Yet in 1975, working for a shipping company with 400 employees and a Honeywell 2000, there was a choice of several packages, one of which was adapted to satisfy some specific requirements, and converted to run on the company's machine, with little difficulty or delay. In short, the passage from custom-built assembler applications, via custom-built COBOL applications, to a mature market of packaged applications required, for this particular application, little more than a decade. This had substantial implications for the nature of market demand, and hence IS syllabi.

An important step in the maturation of the computer industry was **the 'unbundling' of software from hardware**. Until IBM's announcement in 1969, computers had been purchased for a single price, with such software included as the supplier could offer. As the sophistication and significance grew, software needed to be priced separately. That in turn led to greater visibility, and what would now be called 'openness', such that specialist software developers could offer add-on and replacement software (e.g. Campbell-Kelly 2003).

Although academics in foundation disciplines such as Mathematics and Physics had played a considerable part in the establishment of the ACS, its primary role quickly became that of a professional association. Its most direct relationship with tertiary institutions was as an accreditation body, assessing the suitability of courses as a basis for professional Membership of the Society. As Pearcey (1988, p. 131) put it, "the direction of development of the ACS moved away from its early, more academic style to represent the wider interests of [its] new membership more directly". This nicely encapsulates the way in which the relationship between profession and discipline has frequently seemed to be as much about tension and distance as about mutual respect and cooperation.

ACS has played an important role in the International Federation for Information Processing (IFIP), whose Working Groups ran, and continue to run, important international conferences in the Computer Science and IS disciplines. Several Australians have been major players in IFIP, including Ashley Goldsworthy as

President, Bill Caelli as Chair of TC11, Guy Gable as Chair of WG 11.2, and similar contributions by others to TC8 and its Working Groups. Several major IFIP conferences were held in Australia, including the World Congress in 1980, and major TC8 conferences in 1984 and 1988.

By about 1970, IS was becoming a recognisable disciplinary activity within universities. At the University of Queensland, Computer Science offered a Postgraduate Diploma in IS, and Accounting offered an Honours unit taught by a British academic, Peter Richards. Ross Jeffery and Ron Weber were in the same University of Queensland Honours class in 1970-72, and both submitted Honours theses on IS topics. Ron Weber's, in 1972, was entitled 'An Examination of File Structures for Information Processing Systems'. Other institutions active about this time included NSWIT (later UTS - Philip Stanley) and QIT (now QUT - Alan Underwood).

The author's Honours thesis at UNSW, also in 1972, was on an IS-related management accounting topic. It is noteworthy that, of the strands noted in section 2 above, almost all were represented in the readings set for the UNSW Management Accounting Honours unit in 1972, which was architected by liberal Accounting Prof. Bill Stewart. The exceptions were O&M (which had already been covered in undergraduate IS), management theory (represented by Ackoff and Likert, but not yet by Macfarlan and Scott Morton), and socio-technical and soft- systems thinking (which were yet to make their impact in Australia, and in any case did not fit well to the then strongly numerate and rational patterns of management accounting and the emergent IS/MIS discipline). The author has no record or memory of the Minnesota school having an influence at that stage, although it did soon afterwards; nor is the author aware of contact between the Queensland and UNSW schools until after 1972. Ross Jeffery did, however, move to UNSW in 1975.

Although much of the intellectual basis of the IS discipline in Australia was provided by Americans, the materials used for teaching professional knowledge to undergraduates during the foundation years was much more eclectic. In this author's experience, some came from technology suppliers (mostly American, but some British), much was home-grown, and at least as many texts and articles were from U.K. origins as from the U.S. In interview, Bill Caelli referred to early systems analysis courses deriving from the Leo experience in the U.K., and Cyril Brookes bemoaned the lack of appropriate text-books as late as the end of the 1970s.

It is instructive to compare developments in IS with **the emergence of Computer Science**. Although CS units emerged from the late 1950s in departments of physics, electrical engineering, mathematics and statistics, the growth was very slow until the mid-to-late 1960s. In 1963, there were 18 full-time staff in 8 Universities, with only John Bennett occupying a Chair (Bennett 1963, p. 14). According to Pearcey (1988, pp. 103-118), Departments of Computer Science emerged in the following order: Basser at University of Sydney (out of Physics, John Bennett, c. 1956 and independent from 1959), Adelaide (John Ovenstone, 1964), UNSW (out of Electrical Engineering, M.W. Allen, emergent from 1965), Monash (initially Information Science, C.S. Wallace, 1968), Queensland (G.A. Rose, 1969), Melbourne (Peter Poole, 1972), Tasmania (Arthur Sale, 1974).

Offerings in computer science in most cases migrated from postgraduate diplomas back to final-year undergraduate, eventually expanding into full majors. It appears that the first full Computer Science majors became available only in 1975, at the Universities of Melbourne and Tasmania (Bennett et al. 1994, p. 152). IS units were well-established by then, because demand had ensured that many universities offered IS service units, at least UNSW and Tasmania already offered IS majors and others were emergent, and many CAEs and Institutes offered postgraduate diploma courses in various areas of computing, including IS. As Pearcey put it, "in some institutions special courses which concentrate upon administrative uses in computing are offered outside the formal computing departments and centres" (1988, p. 116).

It was to prove crucial that, by the end of 1973, there were at least 6 Professors of Computer Science, but none of IS.

4.3 1974-1987

The development of Computer Science was explosive. Sufficient full Professorships existed, and more were established. The Australian Computer Science Conference (ACSC) was established in 1978, the Australian Association of Professors of Computer Science (AAPCS) was formed in 1982, and the total academic staff-count more than trebled from 1981 to 1990, to 388 (Sale 1994). By 1988, there were c. 1,200 computer majors graduating from departments of computer science or similar, in 17 universities and 22 CAEs (Pearcey 1988, p. 124). The political development of the IS discipline, on the other hand, lagged computer science by over 15 years, hamstrung by the absence of the political power associated with a department and at least one full professor.

Only in 1974, was **the first Professor of IS** appointed (Cyril Brookes), and the first University IS Department formed (at UNSW). This was almost a decade after the CAE sector had started to form departments of computing and data processing. The move was a strategic measure by UNSW's Dean of the Faculty of Commerce & Economics, Athol Carrington. The Australian Financial Review reported at the time that "the appointment was the first at an Australian university specifically directed towards the financial and managerial applications of computers and operations research technology" (McGregor 1974).

In interview in mid-2005, Brookes said that, in the mid-1970s, there was no body of knowledge, and no clear foundation on which to build it. The SDLC and DBMS had emerged in the late 1960s. But it required years of experimentation and refinement before they matured and merged into structured analysis and design. Only then was a framework available over which project management could be overlaid, as a basis for teaching and research. In addition, no prior student knowledge of technology could be assumed, so a considerable amount of time had to be spent on introductory computing topics. Brookes suggested that UNSW was an innovator in placing data analysis in an entry unit in the mid-to-late 1970s, to establish disciplined thought at an early stage. Many institutions had great difficulty breaking the road-block presented by longstanding and powerful competitor departments that prevented IS from occupying more than one narrow thread in first year.

In interview, Gerry Maynard indicated that curriculum development at Caulfield was largely insular, with little coming in from overseas. Course committees were more effective in communicating what needs industry had. Ron Weber also considered that the published curricula that progressively emerged, primarily in the USA but also the UK, while informative, were not well-fitted to the Australian context. They were comprehensive, and oriented towards either computer science or the specifically U.S. form of graduate schools of business. Because limited time was available within IS service units, topics had to be selected, and integrated into local course environments, particularly 'accounting information systems'.

A major report on computer education needs and resources was published in late **1975** (Smith & de Ferranti 1975, usually referred to as the Barry-Barry Report). The report, for the Australian Commission on Advanced Education, presaged the rapid growth in small business computer systems and packaged software.

Demand for IS graduates, and hence the growth of the IS discipline, were driven by corporate endeavours to exploit the use of computing by individuals. This was associated with **the explosion in the accessibility of inexpensive devices commencing in 1975** (particularly the Apple II in 1977, Visicalc in 1979, and the IBM PC in 1981) through to about 1995. This was reinforced by the rapid improvements in the inter-connectability of PCs from about 1985 (internally) and 1995 (externally).

About 1975, postgraduate contributions beyond Honours began to emerge. This author's Masters sub-thesis, completed at UNSW in 1976, appears to have been one of the first. Its title, 'The Implementation of Functional System Design and Development Techniques in a COBOL Environment', is indicative of maturity in the software development phase of IS, but not of any broadening out towards what IS was to become.

The late 1970s saw progress internationally, with the first IS-specific refereed journals in 1977 (MISQ and I&M), the conversion of the longstanding IS journal Database to refereed form in 1979, and the first ICIS in 1980. (The author's archives and memories of the IS discipline during the period 1977-82 are limited, because he was in professional positions in London and Zürich).

From about 1980, as large amounts of product-related training became necessary, the vocational education sector and particularly Colleges of Technical and Further Education (TAFE) became active in the IT area. A number of private colleges also emerged, a few of which have been active for an extended period.

The first **local text-book** appears to have been Brookes et al. (1982). It had few competitors, and had some success overseas as well. The orientation in Universities was most commonly towards application software development, particularly analysis and design, in order to draw the focus of development away from programming and achieve relevant and effective information systems. There were parallel developments in IS management, and in decision support. Over time, information management became a distinguishable body of knowledge, and intellectual relationships developed with library science.

After UNSW's pioneering move, other early movers at departmental level were QIT (now QUT) and NSWIT (now UTS). But there was a long delay before recognition of the discipline was sufficient for **further full professorial positions** to be created. The next Professorship took until 1981 to emerge, and even then Ron Weber's position at the University of Queensland (1981-2004) was throughout a joint Accounting and IS role. The next appointments were not until 1988 (Bob Galliers at Curtin), 1990, at UNSW (Ross Jeffery), UQ (Maria Orlowska), UTS (Igor Hawryszkiewycz), and Monash (David Arnott, Peter Juliffe and Phillip Steele), 1991 at UNSW (Michael Lawrence) and 1992 at Tasmania (Stewart Leech). Monash, when it absorbed Chisholm in 1988, took over the mantle from QIT/QUT as the largest concentration of computing-related academics in Australia. Snapshots of IS Professorships in Australia are provided in Appendix 4.

The first **doctorate** that was completed by an Australian and was arguably in IS was that by Ron Weber, supervised by Gordon Davis, and awarded by the University of Minnesota in 1978. The first IS doctorates completed in Australia appear to have been those by Errol Iselin in 1982 and Iris Vessey in 1984, both at the University of Queensland and both supervised by Ron Weber. Ross Jeffery completed his at UNSW in 1986 under Cyril Brookes, and Rick Watson at Minnesota in 1987 under Gerardine deSanctis. Appendix 5 lists the IS PhDs known to have been completed by Australians from the first in 1978 to 1995. For most Australian IS academics, however, the first opportunity to become acquainted with American and European Professors was created by the ACS/IFIP TC8 Conferences in Sydney in April 1984 and March 1988.

The **prior computer-usage experience of first-year students** changed significantly from year to year during this period. The author conducted surveys of first-year accounting students from 1984 until 1992. The first commoditised personal computing device (the Apple II in 1977) and the accompanying first spreadsheet modeller (Visicalc) had laid the foundations. But it took a further 15 years, until the early 1990s, before matriculating students entering Australian business faculties had sufficient exposure that computing basics could be switched from core to remedial mode. Although entrants to IS courses tended to have had greater exposure to IT than had entrants to business courses, 'introduction to computing' groundwork consumed a considerable proportion of the limited available curriculum space in IS until at least the end of the 1980s.

Meanwhile, between the 1970s and the 1990s, there was considerable growth in the proportion of matriculants continuing to post-secondary studies, and then in the numbers of mature age candidates returning to post-secondary education, at both bachelors and postgraduate levels. During the next decade, a considerable proportion of these undertook at least some IT-related study, including IS.

By the mid-to-late 1980s, a moderate collection of **text-books** was emerging to encapsulate the mainstream knowledge in the discipline, and facilitate its transfer to the following cohorts of students. Clarke (1987) provides a snapshot of one person's assessment of the list of books that should have adorned 'The Computing Professional's Bookshelf' at the time.

4.4 Since 1988

The orientation in Universities had been, and continues to be, toward theory and the intellectual aspects of disciplines. There was a tension between this orientation and the government's wish to produce rapidly increasing numbers of graduates. The government wanted people whose secondary-school performance had been lower to emerge as graduates who were familiar with the new and rapidly mutating hardware and software technologies, and had an understanding about what to do with them.

The needs of these more practically oriented candidates were mostly serviced by the Institutes of Technology and Colleges of Advanced Education (CAEs), which had existed since the previous sectoral re-organisation in the mid-1960s. The CAE sector performed a role mid-way between the abstract, education-oriented work within universities, and the concrete training provide by technical colleges. This resulted in a wide array of courses and units relevant to IS. On the other hand, staff in CAEs had longer contact-hours (typically 13-16 rather than 7-8 hours per week), were not funded to perform research, and had limited opportunity to attract external research funding. The CAEs accordingly provided a home to only a minority of the research-oriented academics in the IS discipline, and there was something of a cleft within the still-emergent discipline.

Rather than focussing its attention and resourcing on the CAEs, the government chose instead to demolish the highly valuable distinction between institutions with industry-oriented mission statements and those with primarily academic orientation. The **re-structuring of the tertiary education sector**, initiated by the Labor Government in 1987, has been highly disruptive and massively wasteful. The diktat saw the disestablishment of the c. 40 CAEs and 25 other smaller elements and the amalgamation of their operations variously into the existing 19 Universities and 6 sometime Institutes of Technology, or into one of c. 15 new combines (AVCC 2004). Substantial and vital differences among the missions of the various institution-types were ignored, and even now remain confused. The previously more industry-oriented institutions came to perceive substantial roles for themselves in research, and sought better access to research funding. The sector has been in more or less continuous flux ever since, driven by a culture of interventionism by the relevant agency, most recently the Department of Education, Science & Training (DEST). Flurries of additional administrative responsibilities have been imposed on universities, drawing resources away from teaching and research.

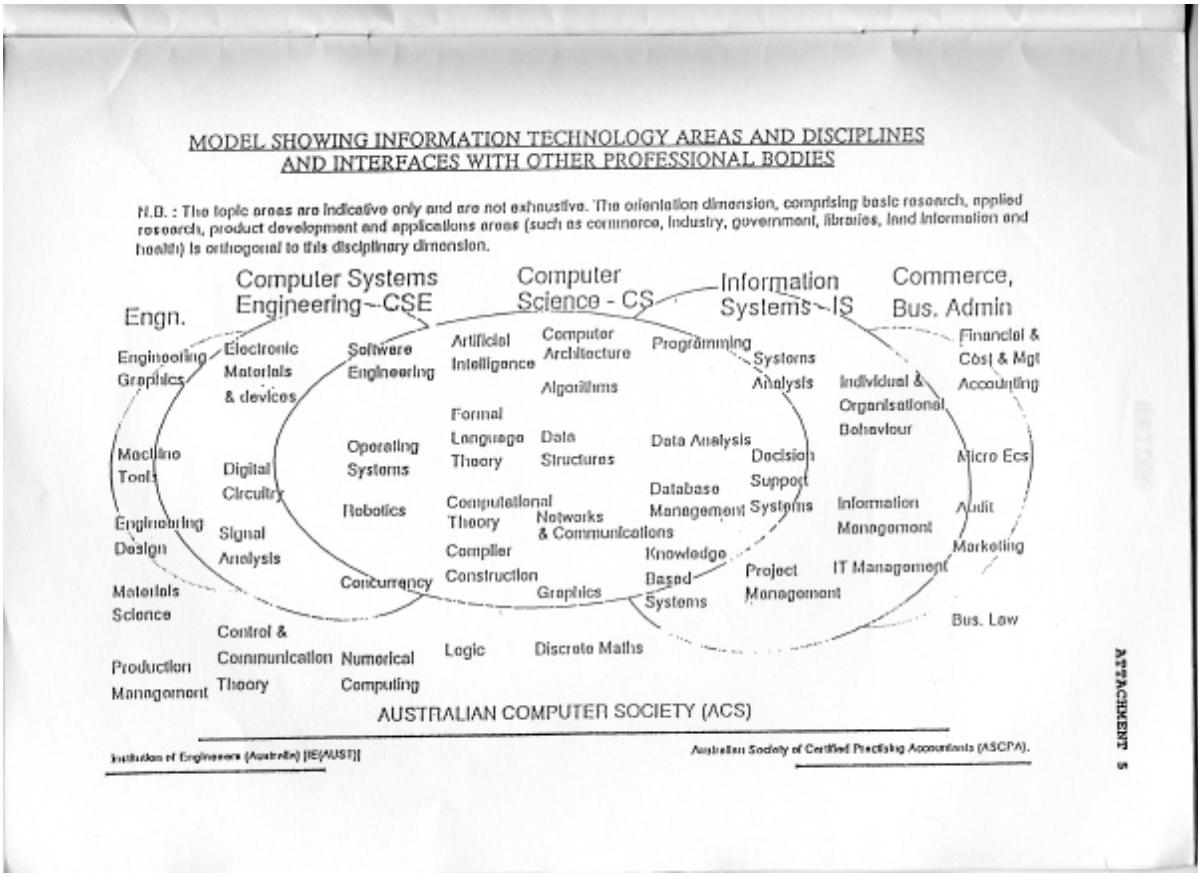
Among other things, the 1990s saw the death of the concept of a university as a collegial undertaking, and the imposition of managerial rationalism. To a considerable extent, profitability and return on investment are now the measures of worth of universities' senior executives. Academic ideals of all kinds (such as the pursuit of knowledge, freedom to research, open access to research outcomes, and tenure) have become constraints rather than objectives. Pluralism has been deeply compromised by 'mission statements', 'key performance indicators' and the simplicitude of 'the bottom line'. Oxford, Bologna and Tübingen wept; the Harvard Business School exulted.

Meanwhile, the per-student funding of all institutions was progressively slashed. Institutions were forced to seek funding from external sources, predominantly by attracting 'foreign fee-paying' (FFP) students

onto their campuses or into their existing distance education offerings, or by earning revenue from foreign campuses in excess of the costs involved in running them or participating in them. Many strategic manoeuvres have been attempted, many in amateurish fashion, with the result that a number of universities are in dire financial straits. Multiple experiments with strategic alliances have been tried (including the Group of 8, Innovative Research Universities Australia, Open Universities Australia, New Generation Universities and Regional Universities), most with limited impact. The dislocation arising from this **massive change in business models** is still being felt, many institutions have worrisome exposures to the vagaries of the education export market, and the quantity of research is less than it might otherwise have been. Meanwhile, with staff-counts down and student-staff ratios much higher than they were two decades ago, it is unlikely that the quality of teaching has improved.

In 1990-92, a government review was undertaken of what were styled the 'Computing Studies and Information Sciences Disciplines'. It was popularly referred to by the name of the Committee Chair (Hudson 1992). The submissions by the ACS and the ANU utilised a graphic, prepared by this author, which sought to convey **the scope of IS and its relationship to the other relevant disciplines**. See Exhibit 2. IS was depicted as occupying vital space between the technical and business disciplines, encompassing a range of applied and instrumentalist topics, and interacting closely with many other disciplines and sub-disciplines. During the intervening 15 years, the topics may have changed somewhat, but the general framework arguably still provides a reasonable representation of the relationships.

Exhibit 2: Location of the IS Discipline, as Perceived in 1991



This version extracted from ACS (1992), Attachment 5

Well into the 1980s, communications within the discipline in Australia were informal and somewhat haphazard. An early step to draw the scattered individuals and groups together was the development of a **Directory** (Clarke 1988a, 1991, Gable & Clarke 1994 and 1996). This was merged, together with the North American Directory (Davis & DeGross 1983) and the European Directory (Bjorn-Andersen & Hansen 1993), into the worldwide online directory that was launched by Dave Naumann at Minnesota in

1995.

A critical initiative was the establishment of a regular national conference, the **Australian Conference in Information Systems (ACIS)**. The first was held at Monash in 1990, chaired by Ross Jeffery, and it has run annually since then. During the first few years, the standing committee comprised Ross Jeffery, Ron Weber, Roger Clarke, Peter Weill and Igor Hawryszkiewycz. The committee was then migrated to the ICIS pattern of rotating membership involving recent, current and near-future organising and programme committee chairs.

The mid-1990s saw maturation of the IS discipline at the international level. As the Internet was grasped as an opportunity for international communications and publication, the **ISWorld mailing-list and web-site** were established, both in 1994. The international Association for Information Systems (AIS) was also formed in that year. The regional fora PACIS (from 1993), ECIS (from 1993) and AMCIS (from 1995), provided a broader geographical frame for ACIS. Australians were active contributors to ISWorld, the AIS and the Directory project, and to ECIS, PACIS, AMCIS and other international conferences.

Meanwhile, the national specialist journal the **Australian Journal of Information Systems (AJIS)** was established in 1994 by Rob McGregor at Wollongong. Liaison among Professors and departmental heads had been emergent, and was formalised through **the Australian Council of Professors and Heads of Information Systems (ACPHIS)** in 1995. An ISWorld page for Australia was established by this author in 1996. A chapter of AIS was established in 2001.

The discipline continued to consolidate and expand through the second half of the 1990s, but it has suffered a substantial set-back since 2000. A later section considers some aspects of this, but to a large extent the focus of this paper is the period from 1965 to 1995.

The early sections of this paper have provided a largely chronological presentation of the development of the discipline. The remaining sections adopt a thematic structure, picking out aspects of the story that appear to the author to have been of particular significance.

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5. Drivers and Scope

Critical among the questions addressed in this section are where the heartland of the discipline is to be found, and why. There can be little doubt that technology has been the biggest driver of change, qualified by organisational concerns. Whether technology is more than just a driver, and perhaps the core of the IS discipline, is considered progressively through the remainder of the paper.

This section enumerates and briefly describes important aspects of what IS has done, and is doing, paying particular attention to changes in flavours over the years. Inevitably, both the themes and the manner in which they are presented reflect this author's perspective on the discipline; but it has been cross-checked for completeness and structure against Culnan (1986, 1987), Land (1992), Barki et al. (1993), Avgerou et al. (1999), Pervan & Cecez-Kecmanovic (2001), Galliers & Whitley (2002) and Banker & Kauffman (2004).

Commencing slowly in the 1950s, accelerating through the 1960s, and exploding in the 1970s, computers were being installed, and organisations were beginning to spend considerable sums of money on them. They needed people to apply them. And the resources committed needed to be managed, in order to contribute to the needs of the organisation. Initially the opportunities were perceived in terms of business operations. Hence, throughout its history, the IS discipline in Australia has had a strong focus on application software and technology-in-use, and seldom on hardware or even systems software.

Because the bare machine had to be oriented to business needs, **software development** was a vital focus

from the emergence of IS, strongly through the 1970s, and until the late 1980s. A long-running strand of the discipline has focussed on **development tools and methods** (often referred to using the inappropriate term 'methodologies', even in the key reference-work, Olle et al. 1988). The software development life-cycle (SDLC) was important in the IS departments of universities, and central to the many computing and (E)DP departments in more vocationally-oriented institutions. Considerable attention has also been paid to the **productivity and quality** aspects of software development, giving rise to specialised strands within the discipline that overlap with, and would be seen by some to have migrated across to, software engineering.

Through the 1980s, **the 'structured era'** matured. A comprehensive set of methods and associated tools were accumulated, which together ensured completeness across the three dimensions of system designs - procedures, data model, and control structures.

Concern arose, however, about the slowness and resource-intensiveness of development using the structured techniques. Theories emerged about **'rapid application development' (RAD)**. This sacrifices quality in order to gain speed and cost-savings in the development process, and hence some prefer the more descriptive title 'quick and dirty' (QAD). During the 1990s, RAD and 'object-oriented' techniques over-ran the structured techniques, and they remain the technological mainstream.

During the same period, there has been a substantial de-skilling of designers and programmers as their roles have been converted into commodities (as encapsulated by the expression 'everyone thinks they can design an eCommerce web-site'). These changes have resulted in **a reduction in the quality of software**, with large numbers of fragile and ill- and even un-documented applications, continued project failures and over-runs, and (particularly since the explosion of Internet-based applications) seriously low security.

During the 1980s, and in parallel with the rise of the structured techniques, the SDLC gradually matured into a **systems life-cycle (SLC)**. This distinction reflected the importance of non-software elements. It also acknowledged the need for maintenance and enhancement, and not just of software, but also of business processes that integrated the manual, automated and intellectual elements. The area has been re-visited and re-badged from time to time, most successfully during the 'business process re-engineering' phase.

Although programming and software engineering have eased away to the edge of IS, and systems design has become a boundary-topic, **systems analysis** has remained of central concern. The approaches adopted within Australia have tended to moderate the hard-line, technology-driven approaches, which have emanated primarily from the U.S.A., by adopting elements of the more tolerant and ambiguous notions of the U.K. school of thought. Hence texts like the Yourdon series during the 'structured' era, Booch and Rumbaugh during the later 'object-oriented' phase, and Kendall & Kendall, have lined up with and against texts like Avison & Fitzgerald. The extreme end of the mechanistic/reductionist approach, characterised by IEEE 'requirements engineering' and championed by software engineers and computer scientists, continues to have some hold in the IS discipline. At the other extremity, there has been some penetration by participative design notions.

In interview, Cyril Brookes perceived **DBMS, data management and data modelling** to have been one of the key enablers of the separation of IS from computer science in the mid-to-late 1970s - "there was only so far you could go with structured programming". For some years, data schemas, data dictionaries and information resource dictionary systems (IRDS), coupled with more abstract entity-relationship modelling and enterprise data modelling, were central concerns. In recent years, however, these have drifted to the edge of IS, and **information management** has been more prominent, with its emphasis on semantics, meta-data, information retrieval and information architecture.

During the 1960s and 1970s, and well into the 1980s, the work of most IS practitioners was focussed on support for business operations. This involved using data to represent relevant events that occur in the

organisation's world. A useful generic term for these kinds of applications was **Transaction Data Processing Systems (TDPS)**. The first specialist newsletter was launched in 1969, the Data Base for Advances in Information Systems (usually shortened to Database). It was, and continues to be published under the auspices of the ACM Special Interest Group on Business Data Processing (SIGBDP), which changed its name to SIGMIS in 1991. It became a refereed journal in 1979 (Canning 1994). The term 'BDP' was little-used in Australia, the more mainstream expressions being Electronic Data Processing (EDP) in most of the private sector, and Automatic Data Processing (ADP) in the public sector.

Progressively the belief arose that the information needs of managers and executives could and should be served. This gave rise to the **Management Information Systems (MIS)** movement. The term was associated with Gordon Davis and his colleagues at Minnesota, and , and much of the drive emerged from there. The concept reached Australia very quickly (Aiken 1971). The author has always considered that the key text that set the agenda was Davis (1974), entitled 'Management Information Systems: Conceptual Foundations, Structure, and Development'. In its later form, Davis & Olson (1984), it was still listed as a student reference for later-year undergraduates as late as the mid-1990s. MIS Quarterly was commenced during this phase, in 1977, run out of Minnesota, and supported by OR/MS and business organisations.

A key distinction between MIS and TDPS was the extraction of information from data, in particular through aggregation and exception reporting. The original concept is a natural extension of management accounting, but Davis and others quickly developed it much further. As noted earlier, 'MIS' is the common term in the U.S. for the IS discipline as a whole.

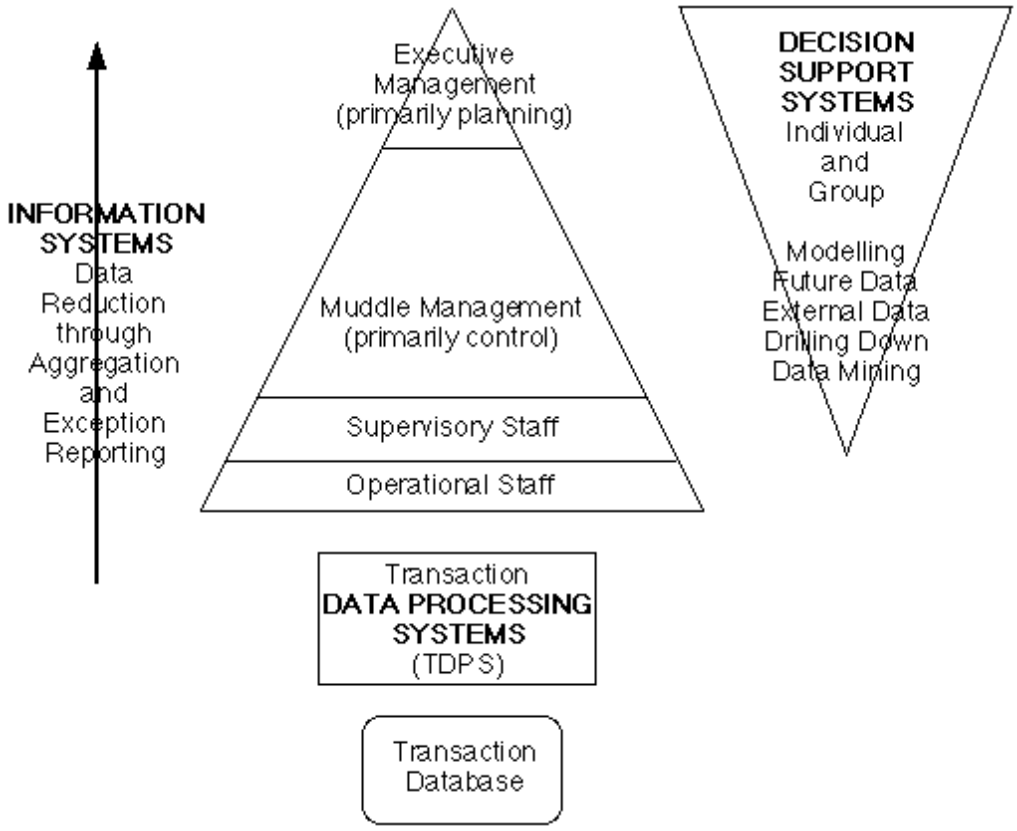
Specialist conferences emerged around that time, with the International Conference in Information Systems (ICIS) commencing in 1980. All of these activities were, and continue to be, heavily US-dominated, although many non-Americans travelled to the event, particularly from Europe and Australia, and the Conference has been more meaningfully international since about 1990, with 5 of the last 15 conferences held outside North America. Since 1983, there has been a Minnesota-run North American Directory of Faculty ('faculty' in the American sense of 'academic staff' rather than the British and Australian sense of a collegial organisational unit).

MIS was then augmented by the **Decision Support Systems (DSS)** movement. The topic was addressed by an ACM SIGBDP Conference in January 1977. See also Keen & Scott Morton (1978) and Sprague (1980) - although Banker & Kauffman (2004) claim that it had been emergent in the management science community since the mid-1950s. DSS can be differentiated from MIS in two main ways. Firstly, data extracted from TDPS and MIS is used in conjunction with models of current and possible future business, incorporating ideas from OR/MS. Secondly, data is used that derived from outside the organisation (such as demographics, and costs of transport and of capital) and 'out of thin air' (as models were applied to 'what if' analysis).

Subsequent developments have included Executive Information Systems (EIS), Business Intelligence (BI) and Knowledge Management (KM). Each has been a fad driven by management consultants - 'new bottles for old wine'; but each has brought focus to particular aspects of the whole, and has drawn insights into the IS discipline from other disciplines and research domains.

Exhibit 3 provides a diagrammatic representation of the relationships among these building-blocks of the IS discipline.

Exhibit 3: Building-Blocks of the IS Discipline



Extracted from Clarke (1990)

A further strand reflected the inter-working of multiple individuals. This was **Group Decision Support Systems (GDSS)** and its correlate at the tactical level, Computer-Supported Cooperative Work (CSCW). This area is a good example of the way in which continual technology-driven re-definition of scope has resulted in disciplinary splintering and scattered alliances. Other examples include Human-Computer Interaction (HCI) and enterprise modelling. That splintering has been a significant contributor to the inability of the IS discipline to build a substantial and stable powerbase.

Project management although always a focus for the IS profession, has been poorly performed. This throws doubt on the quality of the teaching and research performed within the IS discipline. The need for formalised instruction in project management is higher now than ever before, because people in their 20s and younger have grown up with even less orientation towards planning than previous generations, because of their dependency on their mobile phone to perform just-in-time scheduling for everything that they do.

As a consequence of increasing application complexity and low-quality project management, **project failure and application failure** have long been major concerns among executives. Mandata and the Bank of NSW's CS90 were very public examples of failure in the 1970s and 1980s. They have been a less significant focus of research work than might have been expected of a discipline closely attuned to business needs, although Chris Sauer's doctorate and book were important contributions. Much stronger focus has been needed on the balance between quality, whole-of-life cost and risk-management on the one hand, and speed and development cost on the other. But that focus has not been forthcoming, and hence high levels of project failure and application failure will continue.

The **application of information technology** to particular categories of data (e.g. text, numerical data and geographical data), and in particular industry sectors (e.g. logistics / supply chain, health, justice and air traffic control) has tended to be at the fringe of the IS discipline. The intersection with the discipline of Accountancy through Accounting Information Systems (AIS) has been crucial to a minority of the discipline's members, but seen as largely irrelevant by many others.

Applications in the 1960s and early 1970s were conceived within limited functional areas (in accounting contexts, the 'sub-ledgers' such as debtors, creditors, inventory, payroll and general ledger). The 1970s saw more effective interfacing among what had begun as standalone applications. Through the 1980s, applications were progressively integrated into larger products (such as, initially, financial management information systems - FMIS, and, later, the poorly-named enterprise resource planning products - ERP).

During this period, a major change that had implications for the discipline's focus was **the transformation from custom-built applications to packaged applications**. As software became more complex, and more expensive, the focus switched from development to the customisation and integration of pre-written components, and the acquisition of packages. As indicated earlier, this transition occurred in such areas as payroll during the early 1970s, and for larger and more complex applications as late as the early-to-mid 1990s.

Theorists appreciated from the outset that, as the number of elements and the size of the source-code grew, there would be an exponential growth in difficulties (such as bug-content, the incidence of new bugs arising from fixes of old bugs, fragility, comprehensibility, the investment required in application-specific staff training, inflexibility, and non-adaptability). Large-scale products have not reflected these insights sufficiently well, and the tendency away from modularity towards monolithism has resulted in **enormously expensive, highly integrated software products**. The quality of the many large-scale applications has become a progressively larger problem, the lead-time for adaptation (frequently of the organisation and its business processes, rather than the software) has become very long, and project risk continues to be very high.

Progressively, a wide array of IT-related services have come to be regarded as commodities as unrelated to organisations' core competencies as cleaning services. What was once referred to as data centre management, and now as server-hosting, was an early candidate for **outsourcing**. User support, and more recently customer support through 'help centres', have followed them, in some cases off-shore. Inadequacies in service delivery and loss of managerial control have resulted in instances in subsequent re-insourcing. The concept of 'right-sourcing' re-surfaces from time to time.

The **management** of computers, data processing, data centres, and progressively IS, had been a focus in some Schools from the outset (such as Dickson at Minnesota, and Anthony, Macfarlan and Scott Morton at Harvard). It progressively expanded into a broader IT management thread. By the late 1980s, the opportunities that communications technologies had created caused a great deal of attention to be paid to IS that crossed the boundaries of organisations, originally **inter-organisational systems (IOS** - 1-to-1), then multi-organisational (MOS - m-to-n) in various configurations, particular in the form of 'industry value chains'. The combination of DSS and IOS/MOS resulted in increased capacity to contribute towards the work of the most senior executives in large organisations. From the late 1980s, the **strategic information systems (SIS)** strand became important, and 'strategic alignment' became a preoccupation.

Appreciation grew that enormous harm arises from mechanistic application of technology without sufficient attention to its use by people and organisations, and to its first-order impacts on, and second-order implications for, people and organisations. This was investigated by **the socio-technical movement**, associated with Mumford, Checkland, Wood-Harper and Bjorn-Anderson. The tension between the 'managerial paradigm' and the 'humanistic paradigm' is examined in Land (2000a). These have had much more substantial influence in Australia than in North America. A few specialist journals exist, such as Information Technology & People, and The Information Society, but they are somewhat marginalised.

The rationalist correlate of socio-technics and soft systems techniques has been **change management**. This has loomed large in recent years for several reasons. One is the rapidity of technological advance. Another is the inevitable tendency of organisations to fall behind 'the technology curve', and then lurch

into catch-up mode, with equally inevitable negative impacts on staff morale. A further factor is the entrenched distinction between management and operational staff, and the limited involvement of operational staff in the analysis of requirements and the design of new systems. Scandinavian 'participative design' and Japanese 'quality circles' and kaizen / 'continuous improvement' have all made limited headway in breaking down simplistic top-down management notions.

By the late 1980s, **the convergence of computing with communications** was making rapid progress. Local-area networking (LAN) and later wide-area networking changed the scope of the industry that IS was bound up with from 'the computer industry' in the 1970s to 'the information technology industry' in the 1990s. Subsequently, **user satisfaction, technology use, technology adoption and impediments to adoption**, have been major focal-points of IS research. The Theory of Reasoned Action (TRA) and the Technology Adoption Model (TAM) are examples of theories drawn into IS from reference disciplines, and much-applied - although with limited practical impact.

A range of economic perspectives and tools have been applied, resulting in sub-disciplines, or perhaps research domains, of **the economics of IS and of IT**. These include the productivity of developers, of user organisations and of industry sectors; the processes of technology diffusion; and the balances between hierarchies and markets.

Indications of the current structure of the body of knowledge are provided by the current ACS Accreditation Guidelines (Underwood 1997, currently undergoing revision), and current curriculum guidelines, in particular recent references such as Gorgone & Gray (2000), Gorgone et al. (2002) and Gorgone et al. (2005).

From this necessarily brief outline, it is clear that the scope of the discipline has broadened over the years, and has been driven largely by technological change, and to a lesser extent by organisational needs. There has been only limited evidence of leadership by the IS discipline in technological innovation, although somewhat more evidence of contributions to the management of applications of technology.

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6. Political Dimensions

This section draws together some key aspects of the difficulties that the IS discipline in Australia has encountered, in relation to its international context, its organisational location within universities, its relationships with the IS profession and with industry more generally, its political weakness, and the resultant resource constraints.

6.1 International Orientation and Impact

Australians have always been acutely aware of the need to be in contact with the discipline elsewhere in the world, and have been active travellers since the late 1970s, as conference contributors, participants and program committee-members, as doctoral candidates, as seminar speakers, and in short-term visiting positions.

A small number of Australians have held positions overseas for extended periods, particularly in the U.S.A., including Ted Stohr at NYU from the late 1970s, Iris Vessey at Pittsburgh, Penn State and Indiana from the late 1980s, Rick Watson at Georgia from the late 1980s, and more recently Peter Weill at MIT. (All were to a considerable extent Australian-educated, and all except Iris were Australian-born). The flow was been far from one way. Migrants and visitors have included Britons Philip Yetton (as AGSM from the outset in 1976, although active in IS only from 1993), Bob Galliers (1982-89 at WAIT / Curtin, and subsequently Dean of the Warwick Business School) and Janice Burn (1997-2005 at Edith Cowan),

Canadian Guy Gable (since 1995 at QUT), and American Michael Vitale (1995-2001 at Melbourne and subsequently Dean of the AGSM).

Australia has also attracted many visits from leading overseas I.S. academics. The 1984 and 1988 ACS/IFIP Conferences were an important stimulus. Some who have made multiple and/or lengthy visits include Frank Land (LSE, LBS), Bill Olle (London), Neils Bjorn-Andersen (Copenhagen), Leslie Willcocks (Warwick), Trevor Wood-Harper (Salford), Rudy Hirschheim (Houston), Doug Vogel (Arizona, later City Uni. of Hong Kong), Felix Hampe (Koblenz), and Michael Schrefl and Gerald Quirchmaier (both of Linz).

Given Australia's c. 0.3% of the world's population and c. 1% of World GDP, Australia tends to 'punch above its weight' in many fields. For example, 3 of the 13 AIS Presidents have been Australian-born (Ron Weber, Richard Watson and Philip Ein-Dor). But, although the impact of Australia's c. 700 IS academics has been noticeable, it has been dwarfed by the energy of the U.S.A. Appendix 5 provides an analysis in support of that conclusion.

One reason for this is doubtless the slow emergence of **doctoral programs** in Australia. Until the 1990s, most candidates had to either manage their own preparation with support from one or more supervisors but little formal preparatory study, or to leverage as best they could off relevant (and often not-very-relevant) units of study in adjacent disciplines. Even at the end of that decade, however, Metcalfe & Kiley (2000) found it necessary to argue for PhD coursework. Frank Land provided an important perspective, which confirms the author's experience, that at least during the period to 1995, Australian PhDs in IS were generally expected to submit to examination by top-quality international figures. This might be explained by the high standards demanded of pioneers in an emergent discipline, or by the exquisitely Australian concept of 'cultural cringe', or more likely by a combination of both.

A range of institutions in Australia now offer more structured preparation for IS doctoral candidates. There might therefore be an expectation of some acceleration in Australians' contributions in the most heavily-weighted journals and ICIS. That development may be confounded, however, by the ongoing high productivity of American scholars, the higher level of journal-publication productivity of European scholars in recent years, the explosion in doctoral programs in other countries, and the prevalent attitude that there are only about five top-level journals (despite the explosion in IS and IS-relevant journals in the last 15 years - 565 currently according to Lamp 2004 - and the high quality of far more than a mere five of them).

6.2 Discipline Size and Staff Locations

The organisational location of IS staff has been highly varied from the outset. A large proportion of IS academics have always been in Departments dominated by other disciplines, for which IS was, and in many cases still is, perceived to fulfil a service role. The dominant disciplines have been variously hostly and hostile to the IS discipline and the staff working in it.

Almost all institutions had specialist organisational units focussed on IS by the end of the 1980s. The last two of the major institutions to create them are widely regarded as being among the most conservative: the University of Melbourne (1995), and the University of Sydney (2001).

The statistical data in Exhibit 4 was extracted from the various editions of the printed Directories of Australian Academics (Clarke 1988a), of Australasian Academics (Clarke 1991), and of Asia Pacific Researchers (Gable & Clarke 1994, 1996), and the on-line directory as at 2 May 2005 and 22 March 2007. The entries in the printed Directories were managed, whereas those in the online Directory have been, and remain, self-reported and unaudited. There is known to be a substantial 'staleness' factor, with many individuals not amending their entries when they move, and particularly when they leave the discipline

altogether. There is also clear under-reporting, e.g. only 30 of the 52 identifiable Professors had entries in March 2007. The data has been analysed notwithstanding such issues, because to some extent the inaccuracies cancel one another out, but primarily because (in what might be regarded as a parable of the relevance versus rigour debate) that is all that is available to analyse.

Exhibit 4: Institution and Staff Statistics

	IS Depts	Departments	%age	Institutions	Individuals	Professors
1988	9	55	16	41	175	2
1991	22	76	29	39	521	7
1994	32	84	38	38	640	13
1996	39	88	44	39	630	15
2005	28	103	28	42	670	30
2007	24	85	28	41	396	30

Note: The counts of Individuals in 2005 and 2007 have been adjusted to remove PhD students and adjuncts, in order to sustain comparability with the earlier figures

Exhibit 4 shows that, by 1988, when the first Directory of Information Systems Academics was produced, the 175 individuals who could be readily identified were in 55 separate Departments in 41 educational institutions. Only 9 of those 55 Departments were recognisable as Information Systems, with a further 8 in 'Computing' or '(Electronic) Data Processing'. In a pattern that has continued to the present day, 25 of the Departments were dominated by Business disciplines (6 each of Commerce, Accounting and Business, 3 each of Management and Economics, and 1 of Administration); and Computer Science Departments dominated the remainder, with some Information Science (in the technical rather than the librarianship sense) and Mathematics. A significant difference from the patterns that are evident in the US has been the relatively very limited involvement of and interest in IS by Australian Graduate Schools of Business, especially until about the mid-1990s.

The proportion of Departments hosting IS staff that were named IS or similar grew steadily to nearly half, but has plummeted since the end of the 1990s. This followed the 'dot.com implosion' c. 2000, and the external financial pressures on universities, which have encouraged the imposition of departmental amalgamations in the hope that this will result in cost-savings.

Analysis requires care. The count of Individuals in 2005 included people who were no longer active in the IS discipline but whose entries had not been deleted. In early 2007, a purge of old records was undertaken, removing those that had not been updated since 2000 and where a message to the email-address elicited no response, or a bounce-message that indicated it no longer existed. The author (who was an Editor of the Directory until 1996) estimates that the 1996 figures over-counted by 10% and under-counted by about the same amount, whereas, under the subsequent self-managed online scheme, over-reporting increased (until corrected in 2007) and the under-reporting increased as well (with no correction made as yet). Taking these factors into account, the contraction post-2000 would appear to have been 25-35%. This is broadly consistent with anecdotal evidence and examination of a sample of institutions - although there was considerable variance among institutions in both the timing and the scale of the contraction.

The c. 400 people in the Directory in 2007 under-reports the total count. If the under-reporting for all levels of staff is the same as that by Professors, then a factor of 52/30 or 1.73 needs to be applied, suggesting that there are in 2007 close to 700 people for whom IS is their dominant disciplinary affiliation, scattered across at least 85 Departments (of which only 28 are distinctly IS or similar in name), in almost all institutions. This is broadly consistent with the finding in Pervan & Shanks (2006) of 460 staff in 24

respondent institutions of an estimated 36 (after allowing for probable over-sampling of the larger institutions). On the basis of Directory entries in March 2007, the largest concentrations of IS academics appear to be at (in descending order) Melbourne, Monash, QUT, UniSA, Edith Cowan, Deakin, Griffith and UNSW.

Pearcey wrote nearly two decades ago (1988, p. 125) that "The demand for people with computing expertise has always outstripped the capacity of the tertiary sector to supply it, and the situation seems unlikely to change". Based on personal experience, that was the case for at least three decades, from the late 1960s until the end of the 1990s. About 2000, several factors conspired to dramatically reduce demand. The burst of the 'dot.com' bubble about 2000 undermined the attractiveness of all IT-related courses. In addition, offshore outsourcing had been progressively extending from data capture to programming and even detailed design work. And the commoditisation of many skills has resulted in transfer from the university sector to the vocational education and training (VET) sector.

The publicity accompanying this very large 'market correction' was followed by substantial reductions in enrolments from domestic students - although it appears to have had a smaller impact on foreign fee-paying numbers. As is the way with 'the invisible hand' so beloved of economists, it appears very likely that the slump will have been an over-correction, and that there will soon be shortages in graduates, and in IS staff.

6.3 Relationships with the IS Profession

Few members of the IS discipline would regard it as being intellectually remote and abstract. On the contrary, it is generally regarded as a 'professional discipline'. One indicator of that is the fact that major contributions to the foundations of IS by Ron Weber and Canadian colleague Yair Wand (e.g. Weber 1997) have been widely admired, but widely ignored.

A professional discipline needs to be clear who the professionals are that the discipline needs to educate, interact with, and conduct research for. The nature of the profession has changed considerably over the years, however. It began with strong scientific credentials in the 1960s, but many of the people who surged into the field in the 1970s and even more so in the 1980s had no degree in a relevant discipline. The endeavours of the ACS to ensure appropriate preparation for careers in IS have been only partly successful, not least because of the rapid technology-driven changes in work patterns, business needs, and IT management fashions.

Professional job-titles and job-definitions have changed a great deal over the four decades that the profession and discipline have existed. The original roles were computer operator (now largely defunct), systems analyst (now more commonly called business analyst), systems designer (often referred to as systems analyst/designer, and sometimes business process engineer, but diminished due to the contemporary dominance of packaged software), and programmer. The senior staff-member was once called an (Electronic or Automatic) Data Processing (EDP or ADP or DP) Manager. The executive to whom that Manager reported was most commonly the Finance Director.

Chief Technology Officers (CTOs) and Chief Information Officers (CIOs) emerged at executive level only from the mid-to-late 1980s onwards, as the strategic significance of I.T. grew - and as the amount spent on it sky-rocketted. CIOs, who should be a natural connection-point for senior IS academics into the world of business and government, commonly have no qualifications in IS, but rather are generalised executives thrust into a particularly challenging role.

Because graduates from IS courses are intended to move into the profession, the professional body, the ACS, has long run an accreditation program. Most institutions have felt the need to have their computing courses accredited by the ACS, both as a form of review, and as a means whereby graduates can be

assured of qualifying for membership of the relevant professional body. For many years, the ACS's accreditation guidelines mentioned the term 'information systems', but were very heavily oriented toward 'computing' and dominated by computer science thinking (ACS 1985, 1987). Through the 1980s, many IS courses achieved accreditation only through the exercise of the discretion that the Guidelines permitted the assessors. A mature IS discipline and profession needed more than this.

In 1989, this author and Bruce Lo proposed that the accreditation requirements for IS be distinguished from those of Computer Science, and that they reflect both technology and business needs (Clarke & Lo 1989). The proposal was adopted in ACS (1990), and retained in Maynard & Underwood (1996). Underwood (1997) provides a more detailed description of the 'Core Body of Knowledge for Information Technology Professionals', and reflects both the Computer Science and IS perspectives on the domain.

The tension between the technology driver and the organisational aspect was exemplified by the competition between the ACS and the Australian Institute of Systems Analysts (AISA) during the 1970s. In this case, the computing end of the spectrum won by a very wide margin. The AISA, despite its organisational orientation, never grew into an association with significant membership or influence. Nor did any of the larger business-oriented professional associations ever make a significant move to capture the business analysis profession. Despite this, membership of the ACS has remained fairly steady over the last several decades (between 12,000 and 16,000), reflecting a reduction in the proportion of people active in the field who are members.

Influence by the IS discipline on the ACS has been muted. For example, the Presidency has been held by people outside IS for only 6 of the Society's 40 years. For 32 of the 40 years, the President has been a senior IS professional (Ashley Goldsworthy's 5 years preceding the period he spent in academe). For a total of only 2 years has a member of the IS discipline been President (Alan Underwood, in 1990-91).

6.4 Relationships with Industry

The IS discipline needs linkages broader than the IS profession, reaching out to other business functions, and to executive levels of business and government. One form of linkage has been course committees and departmental advisory committees, which facilitate input from industry to the discipline. IS departments have also tended to draw heavily on people within industry for sessional tutors, sessional lecturers, guest lecturers and sometimes adjunct appointments. In interview, Gerry Maynard mentioned the use by Caulfield Institute of 'Pleasant Friday Afternoons', which were used as a means of drawing DP managers in industry and government into contact with staff and students. A primary motivation for employers was the attraction of good graduates, whereas educational institutions stood to gain funding support and intellectual interaction.

The Australian Computer Users Association (ACUA) operated from 1968 onwards. Although it was a potential linkage-point for senior academics, it does not appear that it was much-used in that manner. UNSW ran a very successful 'IS Forum' from 1977 onwards, which drew in senior executives from industry and government. This was much easier than for many other institutions because Cyril Brookes had moved into academe from what was arguably the top private sector computing position in Australia (Manager - Corporate Data Processing for the country's then-largest company, BHP). Only a small number of IS departments appear to have been able to build and sustain linkages of this nature, primarily those in the more prestigious Graduate Schools of Management.

The ACS/IFIP TC8 Conferences in Sydney in April 1984 and March 1988, organised by UNSW's Cyril Brookes and Ross Jeffery and the senior IS professional and ACS officer Ann Moffatt, had an express purpose of establishing a bridge between industry and academe. That team's success with industry linkage was reflected in the Institute of IT, run at UNSW for IBM from 1987 to 1992.

During the 1980s, there was considerable emphasis among employers on 'sandwich courses', and flagship degrees were very successful at UNSW and UTS in Sydney, and at Monash and Swinburne in Melbourne. The perception in industry was that, particularly at the more applied end of Computer Science and the technical end of IS, quality graduates were being confronted by real-world problems too late. Sandwich courses provided early exposure of students to the work environment, enabled theory to be leavened with practice, and created the possibility that practice could leverage off theory.

Coursework was originally entirely the responsibility of academics. There has been a drift in recent years towards outsourcing, as resource-pressures in universities increase. A larger proportion of units of study appear to be being taught directly from text-books, chapter by chapter, with less bespoke design to fit local needs. In addition, industry-provided product-specific units have come to be accepted for credit within some universities (e.g. networking by Cisco, and .NET development by Microsoft). The eternal 'relevance versus rigour' tussle in research is mirrored by the 'training versus education' battle in the learning context.

6.5 Political Weakness and Resource Constraints

For an extended period, there was competition for dominance over the IS discipline between Computer Science on the one hand, and business, commerce or accounting on the other. Dreyfus (2004) chronicles the establishment of the last IS Department, at the University of Melbourne, which occurred during the period 1994-96. The Vice-Chancellor, David Penington, requested a report from a committee chaired by Peter Weill (who was a Professor in the Graduate School of Management). The Weill report stressed that there was no one standard structure for IS across the universities, with some courses very management-oriented, others highly technical. Penington opted to put the new IS Department in the Science Faculty, at least for the short term, although housed close to Computer Science. The IS degree was to have five major 'themes': information systems, organisations, information technology, analytic skills and personal competency. Later-year specialisation was to be in one of three streams: Organisations, Information Technology or Custom (Dreyfus 2004, pp. 1-6). As it has transpired, the Department quickly developed a sufficient scale and power-base, and over a decade later its Faculty location remains unchanged.

A comparison between the experiences of the Australian IS and Computer Science disciplines is instructive. In 1990, the numbers of academic staff in IS and Computer Science were comparable. But whereas Computer Science staff were concentrated in departments bearing that or a similar name, IS staff were distributed over many departments, in many cases without a senior academic post allocated to the IS discipline. The diffusion of IS staff has meant that for many years IS has lacked political clout, and even now has less political clout than other disciplines with similar total numbers. Computer Science, for example, has demanded and attracted far greater funding and support staff, and it has always been far more influential and better-recognised than IS.

One implication of the lack of political power has been a lack of resources for educational functions. In most institutions, there was a long-term struggle to gain sufficient funding and staff-positions (and then to find people with appropriate education and experience to fill them). In some contexts, the Computer Science discipline was powerful, and resisted the emergence of IS. In others, economics and management disciplines did the same. The joint majors and double-degrees that the market needed emerged very slowly, and the silo-effects of Faculties, Schools and even Departments resulted in students often having to devise ways to construct programs that suited their interests, and their perceptions of current needs.

Another problem has been the serious difficulty of acquiring sufficient resourcing to support research programs, or even individual projects of significant scale. Members of the discipline in Australia were under-trained in research, they were highly diverse in their orientations, domains of study and research techniques, and they were geographically scattered. The development of consortia to develop quality bids was difficult, and remained so well into the era of widespread email that began with the launch of AARNet in mid-1989 (Clarke 2004).

The primary source of funding, the Australian Research Grants Scheme (ARGS), later Australian Research Council (ARC), created a sub-topic of Information Systems only in the late 1990s. Until then, those few who were successful in their bids had submitted under either Computer Science or Management headings, and were generally assessed by academics with no affinity with the IS discipline.

Since 1998, IS has been recognised within the ARC RFCD Code as one of 139 disciplines and 898 subjects. The 17 most directly relevant subjects are listed in Exhibit 5. The first 13 are in the discipline of IS, within the Information, Computing and Communication Sciences cluster, and the other 4 are applications within particular disciplinary areas, including business.

In 2001, after lobbying by ACPHIS and the then-new AAIS, the IS discipline gained a member of the ARC's College of Experts. Panel members from IS community since then have been Janice Burn (Edith Cowen) 2001-2003, Graeme Shanks (Monash) 2004-2005, and Michael Rosemann (QUT) 2006-.

Exhibit 5: ARC Codes for IS, from 1998

1. 280101 Information Systems Organisation
2. 280102 Information Systems Management
3. 280103 Information Storage, Retrieval and Management
4. 280104 Computer-Human Interaction
5. 280105 Interfaces and Presentation (excl. Computer-Human Interaction)
6. 280106 Interorganisational Information Systems
7. 280107 Global Information Systems
8. 280108 Database Management
9. 280109 Decision Support and Group Support Systems
10. 280110 Systems Theory
11. 280111 Conceptual Modelling
12. 280112 Information Systems Development Methodologies
13. 280199 Information Systems not elsewhere classified
14. 291004 Spatial Information Systems
15. 321203 Health Information Systems
16. 350202 Business Information Systems (incl. Data Processing)
17. 390301 Justice Systems and Administration

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7. Intellectual Dimensions

The IS discipline in Australia faces serious challenges, and this paper needs to offer a greater contribution than a merely historical recitation and analysis. This section addresses important questions about the future, successively 'what do we regard as appropriate domains in which to conduct research?', 'what research techniques are appropriate?', and 'what unresolved tensions remain at the end of the discipline's fourth decade?'.

7.1 The Research Domain

Section 5 above considered the drivers and scope of the IS discipline primarily from the teaching perspective. This sub-section considers the related, but somewhat different question of what IS academics have considered to be appropriate areas of research.

Early endeavours to define the scope included Mason & Mitroff's (1973) 'program for research on MIS', Ives et al.'s (1980) 'framework for research in computer-based MIS', Galliers' 'manifesto for Australian-based research' (1987), and Jeffery & Lawrence's special issue on current research directions in

IS' (1986). Reviews of the research undertaken in IS include Culnan (1986, 1987), Alavi et al. (1989), Alavi & Carlson (1992), Glass (1992), Avgerou et al. (1999), Galliers & Whitley (2002), Vessey et al. (2002) and Banker & Kauffman (2004).

Each of them draws attention to the enormous breadth of the topics addressed. The diversity arises in at least two dimensions:

- cross-sectionally, reflecting:
  - the diversity of origins;
  - the diversity of host disciplines and co-located disciplines; and
- longitudinally, as drift occurs over time, driven by changes in technology, in fashion in management and in management disciplines, and increasingly in fashion within the IS discipline itself.

A few attempts have been made to adopt the encyclopaedists' approach of enumerating the topics that are within-scope of the IS discipline. More adventurously, a few have attempted taxonomies, in order to impose some order on the chaos. The most successful work of this kind was that by Barki et al. (1988, 1993). The second paper reported that articles published in just 7 major journals in 1987-92 identified about 2,000 different keywords. Their revised classification scheme of 1993 included 1,300 keywords under 9 major and 56 minor groupings, an increase of 175 on their original 1988 version. It appears that the Herculean task has not been repeated since. Moreover, the use of the Barki scheme appears to have subsided, as reliance on 'brute force' free-text search-engines has increased. Nonetheless, it is a highly valuable tool of historical analysis.

As Exhibit 6 shows, only about half of the Barki et al. (1993) keywords were directly concerned with the core areas of the IS discipline. One-quarter were associated with reference disciplines, and one-quarter with external drivers and constraints. The discipline could be described, kindly, as being strongly professional in its orientation, and sensitive to its environment and the needs of its clientele. Alternatively, it could be depicted more critically, as lacking confidence, being derivative, lacking in fundamentals, and driven mercilessly by its rapidly changing context.

Exhibit 6: Barki et al.'s 1993 Keyword List for IS

Category		%
Reference Disciplines		**25**
Drivers & Constraints		**25**
- Information Technology	12	
- Organizational Environment	6	
- External Environment	7	
IS Core Research Areas		**47**
- IS Management	16	
- IS Development & Operations	14	
- IS Usage	5	
- Kinds of Information Systems	11	
IS Education, Research, etc.		**3**

A later analysis examined articles published in Information & Management and MISQ from 1981 to 1997, using the Barki high-level structure. Claver et al. (2000) found that the largest concentrations of publications were IS development (13.2% of 1,121 papers), DSS (8.9%) and IS evaluation (7.8%). Avgerou et al. (1999) evaluate research foci and methods in Europe, and Galliers & Whitley (2002) analyse the papers accepted at ECIS conferences.

Studies of this nature conducted in Australia include Galliers (1987), Ridley et al. (1998), Pervan & Cecez-Kecmanovic (2001), Pervan & Shanks (2004) and Pervan & Shanks (2006). Pervan & Cecez-Kecmanovic (2001) reported on the results of a survey of heads of IS groups regarding the research profiles of their groups. The heads of 21 of the targeted 36 IS groups responded. This represented over 400 of the c. 700 IS academics thought to be active in IS in Australia. The responses confirmed that Australian IS reflects the enormous breadth of scope elsewhere. Similar diversity was detected in relation to the unit of analysis of the research conducted. The "primary beneficiaries of the research" were identified as being predominantly IS professionals and managers - consistent with the notion of being a professionally-oriented discipline; although the subsequent data in Pervan & Shanks (2004, 2006) suggests a strong focus on writing for other academics as well. The average publication-count disclosed was about 2 per staff-member p.a., of which one-third were in journals and two-thirds in conferences. The research funding available was generally small, but Pervan & Shanks (2004) suggested that it was growing.

7.2 Research Techniques

The diversity apparent in research topics is just as evident in IS academics' choices of research methods. Taxonomies of research techniques include Alavi & Carlson (1992) and Palvia et al. (2003, 2004). The 1980s saw an extended period of intolerance and mutual distrust and dislike between groups who adopted particular research techniques. The tensions were variously methodological, philosophical and transatlantic. While differences remain, there is sufficient mutual respect and 'agreement to disagree' that little energy has been wasted during the last decade. The discipline has become a 'catholic church', in one of the positive senses of the expression.

In the IS community internationally, Claver et al. (2000) found that 'theoretical studies' (as defined by Alavi & Carlson 1992), fell from 56% to 20% between 1981-83 and 1996-97, while empirical studies rose from 44% to 80%. 'Field studies' (although in many cases mere questionnaire-based surveys) rose from 18% to 52%, while case studies rose to a high of 23% but fell back to their original 18%.

In Europe, Avgerou et al. (1999) found that the techniques used varied widely between countries, and differed from those prevalent in the U.S.A. A large proportion of German researchers focussed on technology development and testing, whereas those in many other countries conducted a great deal more qualitative analysis.

In Australia, Pervan & Cecez-Kecmanovic (2001) reported that "responses revealed dominance of a positivist paradigm, but the interpretivist paradigm was also often used". Further, "the full range of research methods are being used, from survey to action research, to technology development and testing". Pervan & Shanks (2004, 2006) suggest that interpretivist approaches have been growing in popularity. Critical theory approaches remain little-used.

7.3 Unresolved Tensions

This section lifts its gaze from the past and present to the future, and briefly summarises themes that, in the author's view, are currently alive, or need to be. It begins by identifying tensions that have been recurrent through the history of the discipline. In each case, a brief depiction is provided, followed by the author's view on appropriate approaches to its resolution. Attention is then turned to tensions that exist, but that have been far less discussed in the literature. Whether and how the discipline resolves them will be critical to its ability to make contributions, and, ultimately, to its survival.

The borrowing of theories from reference disciplines was essential during the early years (partly because IS is derivative from underlying disciplines and partly because there was no IS theory, and there is still rather little). The borrowing of theories continues to be a major feature of IS work. Some are tested, whereas others are 'convenience theories' whose applicability to the contexts in which they are applied is

unclear at first, and in some cases stays that way for long periods. There remains a predilection for 'reference frameworks', which is a pre-theoretic construct used as a means of organising limited numbers of largely ad hoc observations or clusters of apparently interdependent variables, preparatory to conducting pilot studies.

The **rate of change in the phenomena under study** is sufficiently high that it can be argued that neither the paucity of established theories nor the prevalence of 'exploratory studies' and 'research frameworks' is a defect: the IS discipline is in a permanent state of accumulating evidence about new and significantly changed phenomena, in order to enable existing theories to be adapted and new theories to be postulated (Clarke 2001).

There has been another **recurrent tension between relevance and rigour** (Keen 1980, 1991). Some conferences, particularly in applied topics, seek a balance between the needs and interests of professionals and executives, on the one hand, and the challenges of delivering reliable inferences from empirical research, on the other. But the demand for academic professionalism, particularly in major journals, has driven much of the research undertaken in IS far away from topics and treatments that are useful in business and government. In this author's view, there is currently an unhealthy imbalance between rigour and relevance. High-quality, rigorous research is being performed, but at the cost of delivering results of very limited relevance to the real world. If the IS discipline is to find its way, the quest for research quality must not be permitted to dominate the need for questions to be addressed, and for research methods to be designed, so as to produce results that are useful to target audiences in the real world.

Associated with the imbalance of the discipline in recent years towards 'rigour at the cost of relevance', is a tendency to view the audience for all work by IS researchers as being one another, e.g. "we ought to be especially circumspect about continuing to pursue a line of research if we conclude it is not contributing to a theory of the core of the discipline" (Weber 2003, p. ix). In no way should such work be defined as being outside the discipline, or even relegated to a secondary role; but attempts to represent **contribution to a theory of the core of the discipline as a defining characteristic of appropriate work in IS research** must be strenuously resisted. There is a dire risk of withdrawal to the 'ivory tower', of becoming self-referential, self-serving, and focussed on 'angels on pinheads' and of disappearing into an inward spiral.

Related to this inward-lookingness has been the inadequate maturity of debates about 'pure' versus 'applied' research. The term 'pure' is popularly used to refer to research undertaken 'because it's there'. It deals in abstract questions, endeavours to contribute at fundamental levels well beneath the superficial and ephemeral questions about particular categories of information, organisation and technology, and is not directly motivated by needs of professionals, managers or the public-at-large.

The term 'applied' is popularly used in two somewhat contradictory ways. Firstly, it often means 'not pure', in the sense that it is a term for any kind of research that deals in concrete questions and/or is motivated by real-world needs. Secondly, it means 'application of existing methods and tools to real-world needs'. It presumes that some way of working, or some technology, which has been used in some settings, will have benefits if applied in another setting as well.

What is missed in discussions that use the terms 'pure' and 'applied' is that the real-world need is not for researchers to make presumptions about what tools are to be used. To do so leads to the trap popularly described by 'a solution in search of a problem', and 'to a man with a hammer in his hand, everything looks like a nail'. What business, government, and society as a whole need from the IS discipline is **instrumentalist research**, that is to say goal-directed research seeking a solution to a problem, not a problem to apply a pre-written solution to. Without any intention to detract from the need for pure research and for applied research, this author perceives that the need is for a professionally-relevant discipline most of whose work is concerned with instrumentalist research.

A further tension has been what could be described as **existential angst**. This is evident from continuing self-questioning about the worthiness of IS as a candidate to join the pantheon of disciplines. The lack of theory, and in many areas even of frameworks within which theory can emerge, were felt keenly at the outset in the 1960s, but the nervousness persists even now. The debate is traceable to Ackoff's 1967 article 'Management Misinformation Systems' in the journal Management Science, and Dearden's 1972 paper in the Harvard Business Review 'MIS is a Mirage'. Fuel was added to the fire by Banville & Landry (1989), whose proposition was that the IS discipline is a 'fragmented adhocracy'.

Weber (1987) sought to bring **'the IT artifact'** to the fore. More recently, Orlikowski & Iacono (2001) lamented the lack of centrality of IT in IS research. Benbasat & Zmud (2003) responded, proposing that 'the core of the IS discipline' is 'the IT artefact', which they "conceptualize ... as the application of IT to enable or support some task(s) embedded within a structure(s) that itself is embedded within a context(s)" (p. 186). Weber (2003) applauded that approach.

Lyyttinen & King (2004), on the other hand, dispute the need for this 'anxiety discourse'. They argue that academic legitimacy depends not on the existence of a body of theory, but rather on "the salience of the issues studied, the production of strong results, and the maintenance of disciplinary plasticity". On this view, diversity and instability are virtues not vices.

There is a fundamental flaw in the 'desperately seeking the IT artifact' movement. Orlikowski & Iacono (2001) commenced with an assertion that many would dispute: "The field of information systems is premised on the centrality of information technology in everyday socio-economic life". Stimulated and driven though the discipline has been by technology, the discipline is concerned with 'information' applied in 'systems'. Benbasat & Zmud (2003) went even further, and proposed the removal of 'information' and even 'systems' from the core, and their replacement with the very different notion of 'the IT artefact'. The fact that most systems apply various technologies should not blind us to the central feature that technologies are only means to achieve ends: **technology is a second-order question, not the disciplinary core**.

Benbasat & Zmud (2003) compounded the felony by envisioning the artefact as "hardware/software design" and "structures, routines" (p. 186). By adopting the narrow technology-as-thing notion, they overlooked, or perhaps intentionally excluded, procedures that are not supported by hard technology. At the very least, the conception of the 'IT artifact' would need to encompass the use of any tool, nomatter how minimal, hence encompassing the manilla folder, the hand, the pen, human vision, the human voice, the ability to walk in order to change the point of physical view, the ability to look and to focus, and the ability to choose to use hand and voice to effect change in the real world.

But even the broadest notion of an 'IT artifact' would still be too restrictive a scope definition for the discipline. The frame offered by Benbasat & Zmud (2003, p. 187) does extend to 'Usage' and 'Impact', and hence, in their model, technology-in-use is within the scope of the IS discipline. But **the focus on the intersection of technology and organisations relegates individuals to the margin**, as staff-members, users and usees. It is extremely difficult to squeeze into this mechanistic conception of IS such things as values, culture, and competition among values and among cultures. Any consideration of ethics would clearly be banished from the field, as a metaphysical distraction.

Since the explosion of what this author calls extra-organisational systems (Clarke 1992a), particularly since the availability of the Internet, the discipline's scope must be inclusive of individuals as people, not just as factors of production or factors of consumption, and of groups of people, and of societies. The 'IT artefact' movement seriously mis-conceives the discipline's core and scope. The IS discipline must return to **the fundamentals of 'information, and of 'system'**, with 'IT' regarded as a component of systems, and as a facilitator of and barrier to the functioning of systems (Mason 2005). A related argument is that of Bryant (2006), to the effect that a new synthesis is needed, combining information, communications and

technology.

A final issue of serious concern relates to the nature of the outcomes that IS researchers seek. Research outcomes can be of a variety of forms:

- exploratory research provides a first depiction of something new;
- descriptive research depicts a known behaviour or domain;
- explanatory research offers a systemic explanation of how past behaviours arose, and seeks to ascribe causes to prior occurrences;
- predictive research provides a statement of what occurrences will arise, based on a systemic explanation of how behaviours will arise, and of what effects particular interventions will have, depending on key contextual variables;
- weakly normative research provides a statement of the interventions that are necessary to achieve desired outcomes; and
- strongly normative research recognises values and needs, defines desirable outcomes, evaluates the extent to which alternative designs tend to deliver those outcomes and to work against them, and actively searches out design improvements.

IS limits itself to 'exploratory' and 'descriptive' outcomes when it needs to, but it strongly prefers to achieve 'explanatory' and if possible 'predictive' research outcomes. On the other hand, IS shies away from 'normative', seldom even venturing into the weak, Machiavellian sense of 'if the prince wishes to achieve <x>, then he is advised to do <y>', and almost never into strong normative, policy-oriented work. The IS discipline has ceded **policy-relevant research** to other, less timid disciplines. It has lacked the confidence to develop a fully normative component to the discipline, to a considerable extent because we have over-valued rigour, and willingly compromised relevance in order to enable ourselves to achieve it.

A normative component to the IS discipline would declare needs associated with human values, and consider system features that assist in and that militate against the satisfaction of those needs. In part, it would evaluate technologies and technologies-in-use against the needs and values, search for alternative approaches that avoid or ameliorate problems, and even put forward recommendations (Clarke 1997).

This proposition will offend purists, who consider such work to lack 'objectivity'. But there is an important corollary to the assumption that information technology is now enormously powerful: members of the IS profession and discipline must recognise their individual and collective responsibility to identify and draw attention to the negative impacts and implications of what application of IT, and to actively seek ways to exploit opportunities without exploiting and harming people (Clarke 1988b).

The IS discipline, as practised by the majority of academics (and hence as implicitly defined by them) has been drawing away from the high value placed on individualism during the post-Renaissance period. The IS discipline is becoming a tool of large organisations, whether of the profit-oriented private sector, of the State, or of the rapidly-emergent 'public-private partnerships'. (In April 2006, Eldon Li, a full professor in a US university, in a contribution to an email discussion on the ISWorld List, referred to the "mission" of the IS discipline as being "to turn information technologies into business values". The very language chosen to express the proposition represents complete - and apparently willing - subjugation of the academic endeavour to the needs of the rich and powerful).

The IS discipline in Australia has not been dominated by Business School perspectives as has been the case in the USA. Nonetheless, in order to prepare students for a marketplace dominated by business and government employees, many IS departments have focussed on 'business information systems' to the exclusion of other applications in manufacturing, robotics, flight control, libraries, the health and justice systems, and the entire field of IT-mediated social and democratic intercourse.

IS is willingly subsuming individuals into larger combines, and willingly assuming that individuals are

and should be subject to the dictates of large organisations. The spectre looms of the loss of western European intellectual history, of the resurgence of the idea that individuals are mass cannon-fodder, and of the widespread adoption of East Asian / Confucian notions of submission by the individual not just to the greater good, but to the presumption that whoever wields the power knows best.

IS researchers who willingly participate in such debasement of the IS discipline are guilty of the same form of abjectly immoral behaviour as nuclear scientists of the early twentieth century. The so-called 'technological imperative' is a myth and convenient excuse. At this stage at least, human society has the choice to apply technologies or not, and to form technologies as it wants them. As the power and embedment of technology grows, if IS academics fail to adopt a leadership role and factor the impacts and implications of technology into their research, human society will progressively lose that choice.

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8. Conclusions

The purpose of this paper has been to provide a chronicle of the early years of the IS discipline in Australia, in the process identifying important themes. It is arguably inappropriate in a review paper of this nature to 'draw conclusions'. This section accordingly focusses on key questions that confront the discipline early in the 21st century.

The first cluster of questions relate to the discipline's intellectual survival. Is IS really a discipline? And does it matter if it isn't? Is there a core? Is it so heavily dependent on technology and management fashion that it can never have the stable core necessary for a recognised discipline? Put another way, are IS academics destined to wander forever, as Rosencrantz and Guildenstern to Hamlet, backstage bit-actors to host-discipline leads? Is IS not a discipline, but merely a research domain that needs to be viewed through the lenses of a variety of genuine disciplines? Has its value been ephemeral? Does it need to be absorbed by broader disciplines either side of it? Does it need to continue to exist much as it does now, but with less energy wasted on existential angst?

In this author's view, we need to be far less nervous, and far more positive about the quality of our work; to be far less internally-focussed, and far more outward-looking and professionally-oriented; to be far less interested in 'the IT artefact', and far more committed to 'information' and 'systems' as the once and future core of the IS discipline; to be far less mechanistic in our outlook, and far more humanistic; and to be far less servile to corporations and the State, and far more socially responsible.

If IS is a discipline with a long-term future, then further questions arise. In interview, Frank Land said that "We're fragmenting intellectually and methodologically, and our language is becoming confused, because words are increasingly being used in method-specific senses". He sees this as leading to mistaken inferencing and perhaps an outright inability to comprehend what someone from a different intellectual or methodological school of thought is trying to say. This author sees this as being a consequence of the dominance of rigour over relevance, and the resultant research-technique-driven selection of research questions and even research domains.

If the discipline is intellectually worthy and sound, there remains the issue of economic survival. Can a still relatively young and politically weak discipline survive in the face of massively reduced government funding for institutions, and new business models exposed to the vagaries of market-conditions? The market over-reacted to the dot.com implosion, as markets do, and local demand for IT-qualified graduates may well exceed supply in the near future. But the implosion in enrolments confirmed the belief among university administrators that IS is ephemeral and/or unimportant. Will the recovery come soon enough and forcefully enough to ensure that IS survives as a distinct discipline? Political survival depends on many factors, but adjustment of the scope of the IS discipline, and maturation of its orientation, as argued for in this paper, would deliver intellectual integrity, which would certainly help.

The first four decades of the IS discipline in Australia saw progress and growth achieved, but in a context of multi-dimensional change, uncertainty and adversity. The next decade promises more of the last three, but quite possibly more of the first two as well.

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Acknowledgement of Bias

This project was suggested by Guy Gable and Bob Smyth, as an adjunct to the work of the 'IS in ANZ' project team. It was intentionally framed so as to complement the studies undertaken by that team during 2004-06 in relation to the state of the discipline in Australia.

The author has been active in the IS discipline since 1970, that is to say not from the very beginning, but from very shortly afterwards. Because the author was a contemporaneous observer of many of the phases that the paper deals with, and often a participant and even a protagonist, his perspectives are inevitably embedded in the analysis. In addition, the author is not a trained historian. For these reasons, the paper is entitled 'a retrospective' rather than 'a history'. It has, however, drawn on a wide variety of sources, and will hopefully make a contribution to an emergent 'court history' of the discipline.

An attempt has been made to present information dispassionately. The degree to which that could be achieved is qualified, however, partly due to the author's inherent and unavoidable biases, but partly because of the conflicting aim of achieving at least some degree of readability and stimulation.

Acknowledgements of Others

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Responsibility for the errors, the omissions, the unfortunate mis-phrasings, and the judgementally impregnated expressions, rests with the author. The electronic version of the 'paper' is intended to be a living document for a while at least, and suggestions for improvement of all kinds should be submitted to the author. It is intended that this paper and the supporting documents be mirrored on appropriate web-sites.

Vale Cyril Brookes

As this chapter was going to press, word arrived of the death by accident on 15 December 2007 of Cyril Brookes. Among many other things, Cyril was the first Professor of Information Systems in Australia, at UNSW 1974-94. It would appear that he is the first Australian Professor of IS to pass on.

Cyril became the Founding Professor of Information Systems at UNSW after a distinguished decade with BHP, culminating in his role there as Manager, Corporate Data Processing. During his 20 years tenure, the School of IS grew to be one of the largest in Australia, with 30 academics and 1000 students. His practical experience and professional determination to reinforce technological alignment with business and government supported the university's drive into cooperative education schemes with industry. He was involved as well in the design of advanced computer-based production systems, the work later leading to his establishing grapeVINE and BI Pathfinder as successful commercial enterprises. Cyril also worked to promote sound governance of ICT in Australia, being NSW chair of the ACS, an executive committee member for several years, and serving on IFIP's information systems committee for a decade from 1975. He was made an ACS Fellow in 1972, and was founding director and later chair of the Australian Association of Chief Information Officers. His contribution to IS in Australian universities was massive. His untimely passing is greatly lamented.

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