

**Professionalization in Computing-Related
Occupations: Canada, the
U.S. and Britain**
WANE Working Paper #8

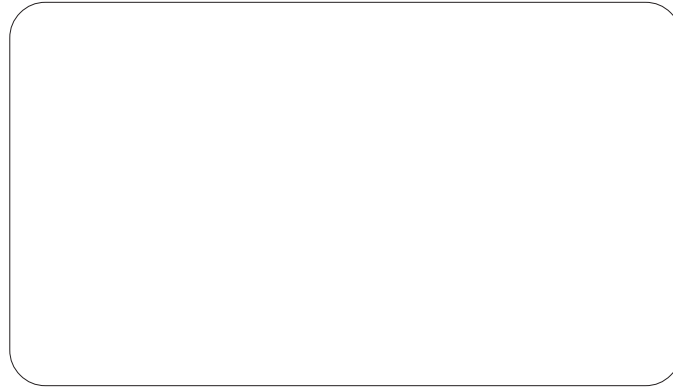
Tracey Adams, Ph.D.
Workforce Aging in the New Economy



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A Comparative Study of Information Technology Employment



WORKFORCE AGING In The NEW ECONOMY (W.A.N.E.) explores the relationships among workforce aging, employment growth in information technology (IT) labour markets, and the transformation of employment relations in the new economy. This work involves a multi-disciplinary, cross-national comparison of IT employment and workforce aging in Canada, the United States, the European Union, and Australia.

Principal Investigator:
Julie McMullin, Ph.D.

Project Manager:
Terri Tomchick, MA

Workforce Aging in the New Economy

The University of Western Ontario
Social Sciences Centre, Room 3207
London, Ontario CANADA
N6A 5C2

t: 519-611-2111 x.81236

f: 519-661-3200

e: wane@uwo.ca

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Tracey Adams¹
Workforce Aging in the New Economy
University of Western Ontario
London, ON CANADA

Tracey Adams, Ph.D.
Professor, Department of Sociology
University of Western Ontario

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Introduction

This paper traces the important organizational, educational and professional developments within computing organizations and occupations over the past 55 years.² Efforts to define computer-related work as 'professional' can be dated from the formation of the very first computing organizations in the late 1940s and 1950s. Organizations such as the Association for Computing Machinery (ACM), the Institute of Electrical and Electronic Engineers' (IEEE) Computer Society, the British Computing Society (BCS), the Association of Information Technology Professionals (AITP, formerly the Data Processing Management Association or DPMA), and the Canadian Information Processing Society (CIPS) have sought to outline and develop a computing body of knowledge, to establish credentials for computer workers, and to raise the status and social importance attached to computing work. Their efforts have met with mixed success. The ability of computing leaders to advance professionalism has been consistently hampered by a number of factors, including the extensive employment diversity in the field, the lack of prestige attached to computer science as a discipline and university subject historically, and computer workers' ambivalence towards professionalism.

Taking an historical approach, this paper reviews the key issues and events affecting the professionalization of computing and IT occupations in Canada, the United States and Britain. Through much of the last 50 years, British and American organizations have been leaders in the drive to advance IT occupations professionally. Canadian efforts have lagged behind those of their counterparts in these nations, but have been influenced by them. Because professional

activities in all three regions are linked, and in many ways similar, I discuss them in tandem, focussing on a few central processes and issues. Particular attention will be paid to issues at the heart of professional projects within IT: most notably, (1) organizational and employment diversity, (2) efforts to establish a computing body of knowledge and establish education standards, (3) efforts to create credentials, accreditation mechanisms and codes of ethics. Intra- and inter-professional conflict in computing has also shaped professional projects in this field, but will be addressed in a follow-up working paper. Throughout this present paper, important international differences in professionalization will be highlighted. Efforts to professionalize the field of IT are ongoing, and have, thus far, achieved only partial success.

Professionalization

Simply stated, professionalization is the set of processes through which occupations come to acquire professional status. Many studies have attempted to delineate the nature of these processes. In the past, researchers outlined a specific set of stages through which, it was believed, occupations had to pass to become professions (Abbott, 1988): these stages included forming associations at the local and national level, establishing journals, codes of ethics, formal education and credentials, and achieving government legislation. Others have contended that professionalization is better seen as a process through which occupations establish a market for their services (Larson, 1977), organize and control a high status body of knowledge (Collins, 1990, pp.18-20), and establish cultural and occupational authority (Friedson, 1970; Starr, 1982). Central to a professional project is the establishment of social closure, through

which an organized occupation closes off access to education, skills and credentials; thereby achieving a privileged place in society (Murphy, 1988; Witz, 1992).

Overall, professionalization is best seen as a social movement (Adams, 2003). In this social movement, organized occupations draw on a variety of organizational, socio-political, cultural and economic resources to achieve professional status. In particular, they seek to have their claims to professional status recognized and respected by the public, other occupational groupings, and the government (Adams, 2003, p. 6). The aforementioned processes of social closure, knowledge definition, market creation, and efforts to establish cultural and occupational authority are some of the central means through which claims to status are advanced. Aspiring professions seek to imitate the structure and authority of dominant professions like medicine and law. Occupational leaders' success in their professional project is influenced by their access to and use of resources, and the willingness of the state and the public to accept their claims. However, what it means to be a 'profession' shifts across social-historical context, and the professional authority associated with even the most high-status professions like medicine and law may be decreasing (Friedson, 2001).

Traditionally, professionalization has been pursued by leaders within a single occupation (i.e. medicine, dentistry, law, nursing). Many of these occupations have been historically diverse. For instance, in the medical profession, there was no single universal way of practising medicine in the nineteenth century: the occupation was internally divided amongst regular physicians, homeopaths, and eclectics, to name but the few most-dominant strands.

Yet, while these disparate groups had different philosophies of medical care, they shared an occupation and a focus on treating the sick. Moreover, the professional project was most strongly pursued by one sector of the occupation (the regular physicians) and came to incorporate the others – although with professionalization, homeopathic and eclectic medicine soon declined. Among the most internally diverse professions is engineering; even the census counts different branches of engineering as separate occupations. However, despite this internal diversity, an underlying basis for a relatively unified profession has emerged in a number of nations, including Canada. In contrast, within IT or computing occupations, professionalism has tended to be pursued not by a single identifiable occupation, but as a field of endeavour, a discipline. There is no single IT or computing occupation, and in this internally differentiated field, unity has been slow to develop. Hence, the professional activities of computing organizations have implications not only for a wide range of computing-related employment, but also for research into professions more broadly.

A Note on Sources:

To explore professional and organizational issues within IT occupations, archival and document analysis were conducted. In particular, the primary professional journal publications of the most dominant IT professional organizations in the Canada, the U.S. and Britain were examined. Information on professional activities within Canada was primarily gleaned from the various publications of the Canadian Information Processing Society (CIPS). This organization has a chequered publication history, producing four different journals successively between the 1960s and

early 1990s. Despite the many publication changes, however, CIPS' journals cover an important time period of professional activity within the IT sector in Canada. The organization's sketchy publication record is a reflection of its vulnerability and tenuous status during the first 30 years of its history. For information on professional activities in the United States, the primary source used was the *Communications of the ACM*, a journal published by the Association for Computing Machinery from the late 1950s up to the present day.³ While this journal contained articles relevant to computing practice, it was also the primary medium through which ACM presidents and other leaders communicated to the membership, as well as a key forum for the discussion and debate of professional issues. Information about computing in the United Kingdom was obtained from the publications of the British Computing Society, especially their *Computer Bulletin*. For all three countries, additional publications including professional legislation, professional reports, and organization web-sites were also drawn on to enhance the analysis.⁴

While they represent an invaluable source of data on professional activities, these sources are limited. First, while these publications are somewhat representative of the professional projects being pursued in all three nations, they are not entirely inclusive. There were numerous IT-related organizations active in the 1970s, 1980s and 1990s, especially in Canada and the United States (most notably the DPMA), whose publications were not examined. Moreover, the IEEE has also been centrally involved in computing professional projects and its publications have not been examined as closely as those of the ACM. Nevertheless, the major professional initiatives pursued by organizations such as the DPMA and IEEE

were recorded and discussed in the publications of CIPS and the ACM, as well as other secondary sources. Moreover, the ACM, BCS and CIPS were the largest computing-related organizations in each of their respective nations. Thus, the sources used cover the major events in the history of computing professionalization quite well, and for this reason were deemed sufficient for the current research endeavour. In the following sections, I review some of the central issues in the professionalization of IT-related occupations, as recorded in the journal publications of the ACM, BCS, and CIPS.

IT Organizations and Employment:

Computing organizations proliferated in the late 1940s and 1950s with the birth of the computer and the initial growth of the computing industry. In the mid- to late 1940s, work developing computing technology was intense and was being carried out at a number of university research settings in the United States, Britain, and Canada (Adams, 2004). Researchers responsible for engineering and programming these computers kept in contact with each other as they worked on a variety of problems. The first organizations in computing largely grew out of such interactions. People working with computers wanted to communicate with each other and discuss largely technical and technological issues. The very first organizations were formed in the United States. The Association for Computing Machinery was established in 1947. The American Institute of Electric Engineers (AIEE) also formed a computer group in the 1940s, and around the same time, a 'professional group on electronic computers' was formed within the Institute of Radio Engineers (IRE).⁵ With the rise of a

computing industry and the expanding use of computers within business enterprises, membership in these organizations expanded. By the late 1950s, the IRE computer group had 8,874 members while the ACM claimed 5,254 members in 1959 (Alt, 1962, p. 301).⁶ These two organizations appear to have had somewhat overlapping memberships. While, it is tempting to see the IEEE Computing Society as an organization for computing engineers, and the ACM as an organization for non-engineering computer-related scientists, in practice these lines have never been so tightly drawn.

The mandate of these organizations was broad. They were concerned with issues in computing generally, and sought a wide membership base. In keeping with this commitment to breadth, neither the engineering organizations nor the ACM was a strictly American organization. The IEEE has a Canadian arm, IEEE Canada, and Canadians are involved in the IEEE Computer Society. International membership in the ACM is even more extensive. Canadians have been active members of ACM from its early years; indeed, the 1952 meeting of the ACM was held in Toronto to celebrate the arrival of U of T's FERUT computer that same year. Since the early 1960s, geographical boundaries for ACM chapters have grouped Canadian computer specialists with their American neighbours (Alt, 1963, p. 307). The international focus of the ACM continued to grow with the size of the organization more generally: for instance a chapter of ACM was established in Britain (in the 1960s), and in other countries in the world. In 1970, roughly 10% of the ACM membership was foreign-based (Galler, 1970, p. 203), and by 1990, this figure had risen to almost 20% (White, 1990b). A

glance at the letters sent to *Communications of the ACM* indicates a membership and readership located around the world.

The breadth of these two organizations encouraged a great deal of co-operation and collaboration over their 50 year history. Beginning in 1951, the IRE, AIEE and ACM joined forces to organize conferences and other events. As a result, the "National Joint Computer Committee" was formed. With some alteration, and the eventual inclusion of other societies, this committee became the American Federation of Information Processing Societies (AFIPS) in 1961 (Alt, 1963).⁷ AFIPS was the organization that represented the United States IT field within the international organization IFIPS (the International Federation of Information Processing Societies) formed in 1959; this latter organization later changed its name to IFIP (the International Federation for Information Processing).

While the ACM and other American organizations may have begun as 'technical' societies, with the aim of furthering collaboration between scientists and other computer workers, by the 1960s, their focus had expanded to include the definition and advancement of an "emerging profession" (Orden, 1967a, p. 145). However, this endeavour proved to be difficult since the profession did "not even have a name" and the "diverse backgrounds of people in the field and the diverse applications of computers in other professions" made unity near-impossible (Parker, 1968). Nonetheless, the ACM became more concerned with professional issues and advancing a computing profession from the 1960s on. In keeping with this focus on professional advance, the society decided to

restrict full membership to those who possessed a university degree in 1965.

Perhaps reflecting the slower development of a computing industry, 'professional' organizations in Canada and Britain did not develop until the late 1950s. In Canada, organizing efforts began in 1958, when C.C. Gottleib at the University of Toronto, along with others, sought to organize a conference on computing and data processing that would bring together academics and workers in business and industry (Harmer, 1987). The conference was considered a success as many academics and business computer specialists attended (Cartwright, 1983). Out of the conference, the Computer and Data Processing Society of Canada was formed. This organization became the 'Computer Society of Canada' in the early 1960s, and flirted with the name 'Information Processing Society of Canada' (IPSOC) in the late 1960s; it became the 'Canadian Information Processing Society' (CIPS) in 1968.⁸ While organizations in other countries quickly expanded their membership to include a sizeable (if generally a minority) percentage of workers in the computing field, CIPS floundered for decades in terms of membership and focus. By 1970, the organization had only 1,800 members, an estimated 5-7% of all computer-related workers in the country (Fierheller, 1970, p. 6). The organization largely consisted of several local (and largely technical) societies, loosely connected by a national governing structure. In the society's early years, the principal sections were located in Toronto, Montreal, Winnipeg and Ottawa (Cartwright, 1983, p. 12), but with the spread of computing employment, sections in other cities were founded, especially in the western provinces. CIPS' sections tended to have a local focus, and they came to differ greatly

over key professional issues, especially certification and accreditation. This local structure did not help the expansion of CIPS in its first several decades as every member had to be affiliated with a local section, and these were limited in number and location. The existence of a number of other related organizations, vying with CIPS for members, likely also limited the expansion of CIPS, especially in the 1970s and 1980s. These organizations not only included the American-based ACM and IEEE, but also included DPMA Canada and other smaller organizations such as The Association for System Management (ASM), The Canadian Operational Research Society (CORS), and the Computer Science Association (CSA) which eventually became a special interest group within CIPS. Nevertheless, CIPS was the largest wholly indigenous computer-related organization in the country and represented Canada in the IFIP.

Like CIPS, the British Computer Society was established in the late 1950s through a conscious effort to bring together computing academics and scientists with business users of computers. At the first (and only) general meeting of the London Computer Group (LCG) in June of 1957, it was resolved that a national organization should be formed. A committee was established and it approached "scientists, mathematicians and engineers" who agreed to join the LCG in establishing a British Computer Society (Kiasmus, 1957, p. 5). In acknowledgement of the society's founding interests, the first council reserved seven places for members of the LCG, which became the foundation for the 'business group' in the society, and seven places for scientists and mathematicians, who would represent the society's 'scientific and engineering group' (Kiasmus, 1957, p. 5). In contrast to CIPS, the British Computing Society expanded

over a very short period of time to become a large, active, national organization, representing many computer workers. Moreover, to an extent greater than its American counterparts, the BCS became a vigorous and somewhat exclusive professional society, actively seeking to extend and expand its professional status. A few years after its establishment, in 1960, the BCS had 2,118 members (BCS, 1960). This figure had grown to 6,100 by October of 1966 (Banks, 1966).

By the late 1960s the society began to explore changes to its organization that would “introduce professional qualifications” and “turn the body into a professional group” (Gill, 1968, p. 3). In 1968, academic and experience requirements, and examinations were instituted (see pages 31-3). Rather than limiting membership, these changes increased it, and by 1972, the BCS had 17,000 members (Morris, 1972). At this time, its commitment to professionalism arguably turned the BCS into the pre-eminent professional society of computing and data processing workers in the world. It was amongst the first organizations to draft codes of ethics and set professional examinations, and it influenced many other associations through its activities. The BCS was also influential within the IFIP, in which it represented the United Kingdom.

While all three of these organizations centrally influenced professional development within the field of computing in their respective countries, they were distinctly different in their activities. The ACM blended a focus on technological advance and practical applications in the field, with the advancement of the discipline of computer science and related fields. While the organization did much to advance

“the profession” worldwide, members were somewhat internally divided on issues of professional education, certification, and government regulation. As noted, the British Computing Society was the most explicitly “professional” organization of the three, actively pursuing and discussing the pursuit of professional status for computer occupations. In contrast, CIPS was fairly ineffectual in its early years in advancing its occupation in Canada, and the membership was very ambivalent over whether CIPS should even be a professional society until the late 1980s and early 1990s. Despite these differences in the foci of the three societies, their publications reveal that all three of them were grappling with the same major professional issues from the 1960s through the 1990s.

Furthermore, all three organizations shared a widely varying membership that was reflective of the diversity within computing employment. This internal diversity is a key characteristic of the field and has been a central factor shaping professionalization within IT. Computing-related workers are employed in firms in all sectors of the economy, although in the past, as in the present, they were disproportionately located in the manufacturing, financial and other services industries, and in government (Adams, 2004, p. 14; Gagnon et al., 2003). Few other ‘professional’ occupations have a similar industrial distribution. Those that do, like accounting, are not as internally diversified in terms of their job descriptions, as IT workers seem to be. For instance, a 1969 CIPS salary survey identified over 30 distinct computing-related occupations that ranged from engineers and operations researchers, through university computer teachers, to computer programmers and keypunch operators (IPSOC, 1969). These occupational categories varied widely in

terms of salary and skill levels. This employment diversity remains characteristic of the field as evidenced by the recent efforts of the Software Human Resource Council (SHRC) and Human Resources Development Canada (HRDC) to create more detailed occupational classifications for IT workers. Although these categorizations differ, they identify between 15 and 24 distinct IT occupations (HRDC, 2001; SHRC, 2002). What workers in these many categories have in common besides the fact that their work is computer-related is frequently difficult to ascertain. Computing organizations traditionally had difficulty unifying and meeting the needs of such a diverse constituency.

Unification was partly achieved in the BCS, and perhaps to some extent the ACM as well, through the minimum education and/or examination standards established for membership. Nonetheless, internal conflict and tension still remained. In the BCS, despite continual efforts to balance a membership divided between academics and scientists on one hand and business people on the other, tension was evident. For instance, some commentators noted that businesspeople disdained what they believed was an academic bias amongst many of the leaders of the BCS (d'Agapeyeff, 1970, p. 371; Morris, 1972, p. 593). Internal debates over professional issues, education, and unionism similarly reflect a divide between academic and business computer people. In the United States, the division between business interests and academic/scientists was reflected both organizationally and internally. With respect to the former, many 'business' computer people found a home in the DPMA, while the ACM was seen as an organization dominated by computer science academics, at least until the 1980s (Abrahams, 1987). At this point, computing

practitioners were seen to have become more dominant not only amongst the membership but the leadership as well. Denning estimated that 3/4 of ACM members were practitioners, and held that many researchers feared that their needs were being forgotten (Denning, 1988). In 1987, ACM president Paul Abrahams argued that ACM would thrive only if "both communities [academics and practitioners] were well-served" and if the two continued to interact with each other (1987b, p. 807). Within the ACM, continual debates over the balance of 'theory' and 'science,' on the one hand, and practical computing skills on the other, within computer science curricula; in part reflect this division between academics/scientists and business people. Although the academic-industry divide also affected CIPS, it was, somewhat ironically, probably less central to this latter organization. While CIPS had been founded by both academic computer scientists and business users, the latter came to dominate the organization by the 1980s. In 1990, academics/educators comprised only 2% of the CIPS total membership (CIPS, 1990). The majority of CIPS members at this time were data processing managers (49 per cent) and programmers/analysts (25 per cent) (CIPS, 1990). The ambivalence of CIPS' members towards professionalization may be partly explained by the distinct nature of the organization's membership.

Despite their internal diversity and different foci, by the 1960s ACM, BCS, and CIPS were all involved, to varying extents, in a professional project. Given the newness of computing-related work, this project first centred around defining computing as an occupation and a scientific endeavour that was distinct from other, more traditional, sciences. This was particularly difficult given the fact that most early computer

workers came to the field from other science disciplines, and later from business roles. Defining computer science as an independent scientific discipline was an activity particularly pursued in the ACM. Establishing education and training programs in the field, was another, related, early endeavour, and one that continued to be prominent for decades. Organizational leaders sought to determine what the basis of a computer professional's expertise was, and who exactly was a computer professional. These questions were the subject of debate for decades. Given the diversity in the field and the prevalent shortages of computer workers through the 1960s, 1970s and 1980s, establishing credentials for computer 'professionals' also became a key endeavour. Members in these organizations also sought to extend their influence on a social level, from the 1960s through the 1990s. In the 1980s and 1990s, organizations such as the BCS and CIPS sought to entrench their professionalizing efforts through the pursuit of government legislation, a subject about which ACM members were more ambivalent. In the following sections, I look at the efforts of IT organizations in Britain, the U.S., and Canada to advance a computing profession through defining a knowledge base, establishing education, credentials and codes of ethics.

Establishing a Body of Knowledge:

Computing organizations have long been concerned with educational issues. Modern electronic computers are the product of university scientists working in collaboration to produce machinery that could perform complex calculations for the military, governments, and for scientific research (Adams, 2004, pp. 2-6). During the 1950s, the benefits of computing technology

for businesses and government agencies became obvious and computing spread accordingly. However, during the same period, computers came to be seen as a critical tool for scientific research, and universities invested in computing technology. Until 1964, IBM produced a line of computers specifically for academic use.⁹ Universities established 'computing centres' within which a small number of workers knowledgeable in computers, would assist members of the academic community with their computing needs. With the expanded use of computers in sciences such as math, engineering, physics and astronomy, as well as the growing application of computer technology in business and industry, universities began to offer courses in computing, generally within departments of mathematics (and often engineering as well). Independent 'computer science' departments followed shortly after. In the United States, the first departments of computer science appear to date from the early 1960s: for instance, the 'first' PhD-granting department in computer science was established in 1962 at Purdue University (Hamblen, 1981; Rice, 1991).¹⁰ Many others quickly followed. In Canada, computer science departments date from 1964; amongst the first established were those at the University of Western Ontario, the University of Alberta and the University of Toronto.

It was with the expansion of computer science departments that the question of a computer science curriculum and a 'body of knowledge' (BOK) came to the fore. What exactly was computer science (CS)? What did students need to be taught to become computer scientists and programmers? What was the scientific and theoretical basis of the discipline? These questions were central to the development and refinement of

a CS curriculum through the 1960s, 1970s, and 1980s, and became a crucial basis for further professional activity. Because knowledge is generally seen as one of the hallmarks of, and primary bases for, professional status, professional advancement could not occur without the development of a BOK and a supporting curriculum (Sidlo, 1961; Orden, 1967; d'Agapeyeff, 1970). Efforts to delineate a computer BOK have been renewed in recent years, and now constitute a major area of activity for the Institute for Certification of Computing Professionals, amongst others.

The first major curriculum effort was produced by the ACM Curriculum Committee on Computer Science (ACM C³S) in 1965. This committee endeavoured to justify the need for a discipline of computer science that was separate from related disciplines of mathematics and electrical engineering, and to provide an outline for undergraduate CS education. This document defined CS as a science “concerned with *information* in much the same sense that physics is concerned with energy.” (ACM C³S, 1965, p. 544, italics in original). More specifically, CS was said to be “devoted to the *representation, storage, manipulation, and presentation* of information in an environment permitting automatic information systems” (page 544, italics in original). The curriculum itself emphasized mathematics, and especially numerical analysis and the study of algorithms, as well as computer programming. The printing of this curriculum in the *Communications of the ACM*, sparked some debate, most of which centred on whether CS was truly a discipline and an appropriate university subject (Carlson, 1966; Oettinger, 1966).

In essence, the 1965 ACM curriculum was a first draft of what was to become the more substantial “Curriculum 68: Recommendations for Academic Programs in Computer Science.” (ACM C³S, 1968).¹¹ This curriculum was designed to expose “the student to a depth of knowledge in computer science sufficient to lay the basis for *professional* competence,” but also to “provide the student with the intellectual maturity which will allow him to stay abreast of his own discipline and to interact with other disciplines” (page 154, italics added). CS education was designed to produce professionals. University programs were not intended to fill the need for personnel in the computing field: the writers of the curriculum recommended that the lower-skilled computer operators, coders and others be trained elsewhere. Moreover, it was acknowledged that business data processing, science and engineering workers would “continue to be specialists educated in the related subject matters,” although these workers would benefit from computer science education (page 154). The curriculum itself identified both core areas within computer science that were required in any CS program – namely, “information structures and processes,” “information processing systems,” and “methodologies” – and related areas, which predominantly included mathematics and electrical engineering. Ideally, computer science education would require courses in all of these areas. The curriculum identified key topics in each area that should be taught and, moreover, constructed a list and description of 22 courses, as well as an annotated bibliography of source materials and textbooks. The curriculum combined an emphasis on mathematics and programming with a consideration of the structure and organization of computer systems, amongst other subjects. This curriculum seems to

have been influential in shaping both the content of CS education, and the nature of CS as a discipline in the United States. According to Denning, (1987, p. 808) this report fundamentally shaped the field by asserting that “computer science embraces elements of both science and engineering.” This definition of the field was criticized at the time. For instance, one educator complained that the curriculum was “highly slanted towards the needs of physical scientists and engineers” while it neglected those of “business systems designers and information technologists” (Wishner, 1968, p. 658). Despite such criticisms, the 1968 ACM curriculum did much to assert that CS was a distinct, scientific discipline that provided graduates with professional-level competence in the field.

The nature of computer science education, and the relationship between CS and other science and engineering disciplines was refined in later decades. A 1978 revised curriculum “overstressed the practical side” of CS education, at the expense of the theoretical, some critics claimed (Bertziss, 1987, p 356; Turner, 1991). As a result, through the 1980s there was a push to bring more theory and math into the curriculum and get it back on track (Bertziss, 1987; McCracken, 1987). These efforts culminated with a joint ACM/IEEE computer society curriculum published in 1991. This curriculum built upon a definition of the discipline as intersecting science, math, and engineering, and identified a curriculum suitable for not only CS programs in a variety of contexts, but computer engineering programs as well. This curriculum provided a broad base in the discipline of computing, situated computing in its academic and social context, enabled different schools to establish a balance between training for the workforce and for

academia, and emphasized ethics, problem-solving and theory (ACM/IEEE-CS, 1991).

While there was always internal dissension over what CS should be, professional leaders tended to assert that computer science lay at the crossroads of mathematics and engineering, and as such was both a ‘science’ and an ‘engineering discipline.’ Like pure science, CS is concerned with abstract scientific principles and theory, and yet, like engineering it uses design and experimentation to create useful and “efficient” products (Denning, 1987). Nonetheless, critics retort, that ‘theory’ within computer science is often heavily borrowed from other disciplines, like mathematics (Denning, 1984, pp. 982-3; McCracken, 1987), while the practical elements are too tied to ephemeral technologies, and/or not very useful to those who employ computer workers (Hanson, 1975; Wishner, 1968). In part, these concerns reflect a long-standing debate in professional education over the balance of “theory” and “practical knowledge” (see for example Gidney, forthcoming). In CS education, however, these debates have been more intense because of rapid technological change. Education that trains people to use current technology, risks providing students with skills that are rendered obsolete with technological change. However, education that trains students more generally and theoretically, risks being criticized for not providing graduates with enough practical skills. Achieving a balance within computer science education is the goal of professional leaders in this area; however, the difficulty of meeting this goal has left CS education open to frequent criticism and debate.¹²

Hence, CS education has been a topic of much work and discussion over the past 35 years. In addition to the definition of

curricula, discussion has focussed on issues such as the order in which courses should be taught, the centrality of math to the curriculum, and teaching methods (for instance, McCracken, 1987; Berztiss, 1987; Ralston, 1984; Phillippi, 1985).¹³ However, as noted, the most long-standing and contentious debate centred around the usefulness of computer science education to computer employment. Business leaders and other computer workers called the computer science curriculum irrelevant and unsuited to the needs of business (Hanson, 1975; Wishner, 1968; CIPS, 1973; Denning, 1984, p. 981; Frailey, 1988). Businesses undertook a great deal of training of new graduates to ensure that they possessed required skills. Moreover, it was not uncommon to hear workers argue that computer science education wasn't even particularly valuable on the job. Education in other disciplines, combined with some practical training in computing, was often seen as sufficient training for computer employment (Morrison, 1970, p. 19; Cole, 1990). Widespread employment shortages in the 1960s, 1970s, and 1980s, encouraged companies to hire people without much formal computer education for computing jobs. As a result, the ranks of computer professionals swelled "with the self-taught and the youthful" (Abrahams, 1987, p. 101). The fact that so many people in the computing field lacked a computer science education appeared to support critics' claims that CS education was neither valuable nor useful.

Shortly after the 1968 ACM curriculum was published, an IFIP committee developed guidelines for a curriculum in "information systems design" (Buckingham, 1975). While the focus of the American organization was on undergraduate education, the IFIP education committee

advocated a program at the graduate level. Ideally, students would attain a broad undergraduate education in a relevant field like science, engineering, business, or social science, and then undertake education in information systems afterwards. Under this scheme, computer education would be similar to a Master's in Business Administration: a degree designed for people with an undergraduate degree and some relevant work experience interested in honing their knowledge and skills. Such a program would perhaps better meet the needs of industry and academia, by producing people who combined a broad general knowledge of a field with computing knowledge and skills. The establishment of training at the graduate level would also put information science on a par with other professions (like business management and medicine) whose practitioners held degrees beyond the baccalaureate level. The program in information systems was interdisciplinary in design and in particular combined an emphasis on computer science, with management science and system design (Buckingham, 1975). Despite the IFIP thrust, computer-related education in the U.S., Canada, and Britain tended to occur at the undergraduate level. At the same time, numerous graduate programs were established to train scientists for advanced positions in business, industry and academia.

Underlying much of the debate on computer science education over the past several decades is the question of whether there is a *single* computing body of knowledge that is relevant for the array of computing careers. If computer science education was intended to produce computer 'professionals' – as journal articles were increasingly arguing was the case – who exactly was a computer professional? Which computer-related jobs

were 'professional' and which were not? Answers to these questions are not entirely clear in the publications of the ACM, BCS, and CIPS. When a specific occupation is mentioned in the literature of the 1960s and 1970s, it is most often the "professional programmer" who is the focus, especially in Britain (Barron, 1975; Orden, 1967). More commonly, writers refer somewhat vaguely to a "computing profession" (Sidlo, 1961; Carlson, 1970, p. 65; Willmott, 1975) or "information processing profession" (Givens, 1967, p. 396). At times, computing was asserted to be not only a profession, but an engineering profession (Oettinger, 1967a; Hoare, 1981). In Canada, the terms most often used were "information processing" professional¹⁴ (in the 1960s) and "data processing professional" (1970s). The use of this terminology reflects the use of "information processing" in CIPS's name, and the organization's membership base data processing (DP) management and related occupations. In this vein, CIPS is similar to its counterparts in the DPMA (and a few in the ACM) who also focussed on the "DP" professional, more than any other (Ensmenger, 2001; Postley, 1960). Variation in the use of terminology reflects the fact that there was no unanimity within or across organizations concerning who was truly a "professional" in the computing field.

Complicating the definition of a computer professional was the fact that job categories and work expectations varied widely and changed with the technology. Rapid technological change, when combined with the "diverse background of people in the field and the diverse applications of computers" made it extremely difficult to unify the field and professionalize (Parker, 1968, p. 198; d'Agapeyeff, 1970). Despite this diversity, many in the 1960s and 1970s identified programming as perhaps the main

computing profession (Orden, 1967; Barron, 1975). This had changed by the 1990s, when leaders asserted that "programming is not a professional level activity," because it required little decision-making (Harris, 1991a, p. 4). It seems that the nature of technological and occupational change altered the skills required in programming occupations. By the early 1990s, the term "software engineering" was increasingly the one used to identify the principal computing professional (for example, Kocher, 1990). In this context of change, the ambiguity associated with the professional project pursued by computing leaders was an asset. Because organizations were generally a little vague on the constituency and the core skills of those they sought to define as 'professional,' they were able to persist with their professional project despite such technological and occupational change. Nevertheless, this ambiguity limited their ability to professionalize successfully.

Notwithstanding the inherent difficulties in establishing a CS body of knowledge and a 'professional' education curriculum, the rapid expansion of computing-related jobs during the 1960s, 1970s, and 1980s ensured that there were many people seeking computer-related training. The result was a rapid expansion of training and education in computing. The nature of this expansion generated problems for computer professional organizations, in two areas. First, courses and enrolment expanded within universities and colleges. This provoked a crisis in computer science education: there were not enough faculty members to teach these students, nor were there sufficient facilities to educate them properly (Denning et al., 1981; CCSDC, 1983). The crisis became particularly acute in the late 1970s and early 1980s, when at regular biannual meetings of CS department

chairs from across the U.S. and Canada, it became clear that PhD-producing departments were generating only a small fraction of the personnel required to staff CS programs (Denning et al., 1981; Yau et al., 1983; Gries, 1987). The fact that one-half of all graduating PhD's sought work in better-paying industry jobs, rather than in universities, made the situation all the more dire. In response, computer science educators sought to improve the working conditions in universities, increase funding for facilities, and seek higher pay for computer science faculty. By the mid-1980s, these initiatives had alleviated the situation, especially in the United States (Yau et al., 1983; Gries, 1987). Canadian departments were less successful in convincing the Canadian government and universities that a major investment had to be made to improve CS education (CCSDC, 1983). The situation was further alleviated in the late 1980s as enrolments in computer science began to decline (Meyer, 1990; Kugel, 1988; Shelton, 1988; White, 1990a). Indeed, by the early 1990s, educators implied that there may be a PhD surplus (White, 1990a). Nevertheless, the problem has occasionally resurfaced, especially in Canada, and some computer science programs are still said to be stretching their resources to meet demand.¹⁵

The expansion in computer education also occurred outside university settings, as the number of private (and public) colleges offering training in computing increased. This created a second problem for professional organizations, especially in the United States and the United Kingdom.¹⁶ The ACM and BCS were concerned about the quality of the programs offered by private colleges in particular. After some investigation, the ACM found that these schools rarely imparted useful skills, and

that their graduates could not find work (Oettinger, 1967). The clientele for these schools tended to consist of minorities and people from a lower socioeconomic background (Oettinger, 1967; Penney, 1975). Leaders in the ACM and BCS were concerned that people spent money on the programs in the hopes that they would acquire some valuable job skills only to be disappointed (Penney, 1975). The fact that people were flooding the job market with a variety of vague credentials and abilities was also a worry. In response, ACM, DPMA, and BCS began to pursue accreditation policies, discussed in the next section.

Summary:

In 1987, Peter Denning (1987, p. 806), then the editor of the *Communications of the ACM*, reflected on the organization's first 40 years by posing some key questions that many computing leaders had been grappling with for some time: "Is computer science a science? Is it an engineering discipline? Or is it merely a technology..?" To this list of questions, could have been added, is it a profession? Virtually since its establishment, leaders in the ACM, like their counterparts in the BCS had endeavoured to assert that computer science was a science and that it was not reducible to the technology it used and developed. The mere fact that Denning could pose these questions in 1987, however, indicates that the leaders had convinced neither all computer workers, nor society more generally that this was true. To Denning, the nature of computer science was clear: "computer science sits at the crossroads between the central processes of science and engineering," and it influences other disciplines and society at large profoundly (1987, p. 809). Computer scientists were professionals, and not technicians. While the members of the BCS

and especially CIPS were less likely to claim a knowledge base highly related to engineering,¹⁷ they certainly joined the ACM in claiming a scientific knowledge base that provided a sound basis for professionalism. Nonetheless, as we have seen, establishing a knowledge base for computing ‘professionals’ in such a broad and diverse field was fraught with difficulty. What these computing workers shared was their reliance on a continually evolving set of technologies. Establishing a broad-based body of knowledge tied to this changing technology – and yet distant enough from it to be adaptable – has been a challenging task. The fact that groups like the ACM and BCS have been so committed to this task, however, is indicative of their commitment to a professional project.

Accreditation, Credentials and Ethics:

There is an extensive sociological and professional literature devoted to listing the characteristics that define professions. While university-based education and an esoteric knowledge base figure prominently in these lists, professions have long relied on degrees and credentials to serve as indicators of their knowledge. Codes of ethics and a sense of social responsibility are also centrally placed on these lists. In general, occupational groups seek professional status on the grounds that their work is so complex that those without the requisite education and knowledge cannot practise safely. Thus, credentials serve to protect the public by letting them know who is qualified to practice and who is not. Codes of ethics serve a similar purpose. They are designed to assist professionals in ‘self-regulating’ their behaviour to ensure that the public’s interests are safeguarded. Many professions have disciplinary mechanisms to ensure that members conform to the code of ethics and

practise in a manner that is not harmful to the public good. In the period between the 1960s and the 1990s, the BCS, ACM, DPMA, and CIPS all endeavoured to acquire these indicators of professionalism, yet in different ways and in different time periods. For the sake of ease, I will discuss the efforts of organizations in all three nations separately.

The organization that first pursued credentials and accreditation in the United States was not the ACM, but the DPMA. In the 1960s, the DPMA attempted to establish credentials that would signify competence and professionalism in the data processing field. There were many factors that encouraged this professional activity. Perhaps most important amongst these was the rapid expansion of computing-related employment, and the resulting shortage of trained computer workers (Ensmenger, 2001). In data processing, the university educated worked alongside the lesser trained, and many had largely acquired their computer skills on the job. Credentials were attractive to DPMA members and many others because they promised to signal competence in a field in which it was hard to determine. Ensmenger (2001) suggests that the culture of IT workers as independent creative thinkers, who were somewhat unsympathetic to corporate rules and deadlines, further motivated some to ‘professionalize.’ Thus, data processing managers in the DPMA sought credentials to signal competence and to distance themselves from a large mass of workers with indeterminate computer and business skills.

In 1962, the DPMA established a credential for DP workers – the CDP or “certificate in data processing.” To obtain a CDP designation, applicants had to possess both

academic qualifications and work experience, and submit to an examination; in the first few years, however, the academic requirements were waived (Ensmenger, 2001, p. 66). The certification program proved quite popular at first: in the first 3 years in which it was offered, a total of 7,000 American workers sat for the exam (Ensmenger, 2001). However, when the DPMA began to enforce the academic requirements, it faced a great deal of opposition, and a dramatic drop in the number of people willing and able to take the CDP exam. When it relaxed these standards somewhat in the late 1960s, applicant numbers increased again, only to drop off again in the early 1970s with the decision to require a baccalaureate degree for a CDP (Ensmenger, 2001, p. 67). Overall, while the CDP designation proved fairly popular with data processing workers, it was not a great success. Employers were uncertain about precisely what knowledge base the CDP purported to represent, and the DPMA workers who were most attracted to the certificate, did not always have the education required for its acquisition. According to Ensmenger, ACM's lack of support for (and indeed outright opposition to) the DPMA certificate, also limited the success of the program (2001, pp. 67-68).

It seems that the computer scientist leaders in the ACM were somewhat reluctant to embrace an exam set by a group of business data processors. As noted, the ACM had its own professional agenda that, in the 1960s, was particularly focussed on defining computer science as a legitimate scientific discipline and an academic knowledge base worthy of a profession. In 1965, the organization furthered its commitment to professionalism by requiring a baccalaureate degree for full membership (at the time, most ACM members already had such a

degree). For them, an examination was not sufficient to demonstrate computing knowledge. Yet, for a number of computing workers with or without a degree, the CDP promised a measure of legitimacy.

Interest in credentials amongst computing workers and employers prompted the ACM, the IEEE Computing Society, and a number of related groups to join with the DPMA for a new initiative. In 1973, these groups, along with CIPS from Canada, created the ICCP – the Institute for the Certification of Computer Professionals. This organization assumed the responsibility for the CDP certification examinations and, reacting to dissatisfaction with the narrow scope of the examinations offered (Pike, 1973), established a certificate in computer programming (or CCP) in the late 1970s.¹⁸ Candidates for examination did not need to possess any academic qualifications, but had to have 5 years of job experience in a computing field; academic qualifications would be considered for partial fulfilment of the experience requirements (CIPS, 1975, p. B2). The co-operation of these professional organizations in establishing the ICCP, however, did not reflect a strong commitment to credentials and certification. Indeed in 1975, the director and vice-president of the ICCP addressed the CIPS Toronto section, arguing that “accreditation in no way guarantees competence,” but also that standards were required in an emerging profession (in Whitsed, 1974). Ultimately the participation of some organizations like CIPS and the ACM reflected a desire to be involved in any certification scheme advanced, rather than a commitment to certification per se.¹⁹ During the 1970s and 1980s, ACM's professional activities focussed less on the certification of individuals, than on the content and

accreditation of university and other educational programs.

In keeping with the ACM's longstanding focus on education issues, and a continuing concern over the quality of CS graduates, the ACM formed a joint committee with the IEEE computer society in 1982 "to set standards and evaluate programs" (Mulder & Dalphin, 1984, p. 330). In this endeavour they had to work around the existing Accreditation Board for Engineering and Technology which accredited programs in faculties of engineering. The joint committee first established standards for accreditation. This was no easy task, given the difficulties inherent in identifying a core body of knowledge for computer science, and the fact that computer science programs varied substantially in focus and content. The committee identified 1200 computer science programs in the U.S., variably housed in schools of engineering, business, faculties of science and faculties of arts. Leaving those programs located in engineering schools to the engineering accreditation body, the ACM-IEEE Computer Society committee identified an essential core curriculum, listing core and elective courses, facilities, and faculty complements. These standards met with a great deal of acceptance, except amongst those CS educators in liberal arts colleges whose baccalaureate programs could not meet the specified number of hours students spent in core CS courses, due to their commitment to providing a well-rounded arts degree (Gibbs & Tucker, 1984; Harbron, 1984).

Accrediting university programs was an attractive initiative as it promised to create a standard in the field, so that CS degrees would be more equivalent, and a standard level of competence amongst graduates

could be more easily attained. The joint committee established a Computing Sciences Accreditation Board in 1984 which, using a revised version of the joint committee criteria, began accreditation visits on a trial basis in 1985-6 (Booth & Miller, 1987). By 1987, the board had gone through 2 cycles of accreditation activities, and met with a fair amount of success (Booth & Miller, 1987); indeed a 1986 membership survey found that the accreditation activity was considered amongst the organization's most useful contributions (Aiken, 1988). ACM's activities in the area of accreditation reflect the continuing thrust of the organization's professional initiatives: rather than emphasizing external certification examinations like the DPMA, the ACM has worked to establish the CS degree as an indicator of professionalism, competence, and professional knowledge in the field.

The British Computing Society began to pursue professional credentials in the 1960s. Like the ACM, the BCS decided to style itself as a 'professional' organization and limit membership to only those with a specified level of education. However, while the ACM limited membership to those with a university degree, the BCS combined its desire for 'restricted' membership, with the establishment of credentials and examinations to determine competence. That is, membership in the BCS was restricted to those who had met the academic and experience requirements of the society. The climate in Britain was similar to that in the U.S. and Canada: there were workers who had computing employment experience, but no formal educational credentials to signal competence. British workers like their DP counterparts in the U.S., desired a credential that would signify competence to employers and others, and distinguish them from lesser-trained workers flooding the

computing labour market. Thus, in 1968, the membership of the BCS resolved to become a professional group and established 'professional qualifications' for entry (BCS, 1968b, p. 3). People interested in becoming members of the BCS had to pass a two-part examination (or equivalent) and have five to seven years of work experience in the field. Those interested in becoming esteemed 'fellows' of the society had to meet the academic requirements (or their experience/education equivalents), be at least 30 years old, and have worked in the field for a minimum of 8 years (BCS, 1971a). The BCS also created an "associate" membership category for those with only partial qualifications.

For all of these categories, academic credentials were taken in lieu of at least some of the examination components. However, the real appeal of the BCS examinations was to provide a route towards professionalism for those "not wishing to go through the rigours of a University education only partially related to their interest" (Douglas, 1971, p. 420). There was some concern that the BCS standards were too exclusive, and at first, they were not fully enforced. Until 1975, people were allowed to become members of the society (and therefore acquire the credential MBCS) upon demonstrating that they had at least 10 years of experience in the computing field (BCS, 1970, p. 217). The examinations set by the BCS represent its own attempts to outline a core body of knowledge for computing professionals. Examinations were intended to cover both a core of knowledge, and number of specialist areas. This way, the BCS leaders felt, they would cover the diversity of workers in the field (BCS, 1971b). Indeed, credentials could serve to bring these diverse workers together: university educated

scientists/educators and their counterparts in industry and business would share a credential that attested to their knowledge and competence.

By limiting membership to only those who could meet certain criteria for competence and experience, the British Computing Society was pursuing increased professional status. While some may have wondered whether the increased standards would reduce membership, in the end, the opposite was the case. People desired any status that might accompany being an "MBCS" (member of the BCS). Nonetheless, merely setting and enforcing these membership requirements did not immediately raise the status of the society or its members (d'Agapeyeff, 1970, p. 371). BCS leaders in the 1970s and 1980s pursued increased status through a variety of public campaigns, as well as by establishing codes of ethics (discussed below) and incorporating under a Royal Charter in 1984.²⁰ The organization's pursuit of status was more explicit and more successful, than its counterparts' in other nations.

The British Computing Society also played a role in approving university computing programs. The society reviewed programs to determine which were sufficient to meet its standards. Graduates from accepted institutions could have some of their BCS examinations waived. The BCS during the 1980s was also instrumental in setting up an accreditation council for private colleges in an effort to ensure that these latter institutions provided a reasonable education, and did not make claims that would mislead students.

In sharp contrast to the British path towards accreditation and certification – where leaders decided to pursue credentials and

then did so with a minimum of internal wrangling – there was a great deal of hand-wringing and disagreement over the value of credentials amongst Canadian computer professionals. In the 1960s, many leaders within CIPS believed it was time for the organization to follow the lead set by the BCS and DPMA and establish credentials for Canadian computer users and raise membership criteria. In 1969, the “Accreditation Committee” (AC) formed by the CIPS²¹ board of directors produced a set of guidelines “for proceeding towards professionalism” (AC IPSOC, 1969, p. 1). These guidelines not only outlined a structure for accreditation, but defined what an “information processing” profession was and justified the need for one. In defining the profession, the committee was careful to distinguish it from computer technology and technological competence:

While the computer is the central means of information processing, the profession of information processing should in no way be confined to computer technology. It is important to understand that the practice of information processing also involves enquiry into effective ways to represent information, effective algorithms to transform information, effective languages with which to express algorithms, effective means to monitor, to communicate and to display the information, and effective ways to accomplish these at a reasonable cost. (AC IPSOC, 1969, p. 1).²²

Application of IP skills was to be done in an ethical way. The value of pursuing professionalism at this time was said to lie in garnering societal respect, increasing the standards of living of IP professionals, and improving the benefits of IP for society.

The 1969 CIPS scheme involved establishing an examination body, the Information Processing Institute of Canada. Those candidates who had passed the institute’s examinations (or who held an honours baccalaureate degree or Master’s degree in an IP-related area) would be eligible for the status of “fellow.” Those who had passed an “associate” exam (or who had a baccalaureate degree, or a CDP) and had 3 years of work experience, were eligible for “associate” membership. Thus, like their counterparts in the BCS, CIPS established a scheme that would provide a credential for both those with a university degree in computer science, and those without.²³ Their proposed credential would provide a means of formally recognizing workers’ more informally acquired computing skills, and place them on a par with the university-trained. CIPS’ accreditation committee acknowledged that establishing an exam that would tap the “core body” of knowledge for IP professionals would be difficult²⁴ – and reaching a consensus on the content of the “core” would be impossible. What was clear, they contended was that “the computer is at the heart of it” as was the “method of using it [the computer], i.e. programming” (AC IPSOC, 1969, p. 8). Yet the core also included many aspects of ‘information processing,’ more broadly defined. Ultimately, the CIPS plan entailed building on the examinations and procedures already established by the BCS. This scheme was a bold one, that would have put the organization on a par with the BCS, and

ahead of organizations like the DPMA, given the narrow focus of the latter's accreditation exam and its reluctance to become a closed organization. The CIPS accreditation proposal even came with a draft code of ethics.

At the time of the Accreditation Committee's proposals there was widespread disagreement about the value of accreditation in Canada. While some commentators saw its value (O'Connell, 1969; Turner, 1970), others were decidedly more negative. Taking issue with the reasoning of the Accreditation Committee, critics complained that attaining more status and a better standard of living were not worthy goals, and that professionalization was not necessary because computer workers were not in a position to harm the public (in Kerrigan, 1973). Some commentators were more supportive of the idea, but felt that the plan was too vague: how was the examination institute to be funded and financially supported (Boyd in Pike, 1973c). Exactly who was the 'professional' being certified, and what was his/her knowledge base (in Whitsed, 1974; Turner, 1970). In 1971, CIPS held a referendum on the accreditation proposal. It was defeated, with 54 per cent of respondents voting against it (Horwood, 1974, p. 18; Pike, 1973b). However, there was still a 'large minority' of CIPS members who favoured accreditation, and their ongoing professional activities, including promoting CIPS' involvement in the ICCP, kept the debate on accreditation alive during the 1970s. By joining the ICCP, CIPS gained the right to adapt and use the exams in Canada, if ever the mood of CIPS members became more favourable to certification (Pike, 1973b).

Burned on the accreditation issue once, the CIPS national board seemed reluctant to broach the subject again, until the mid-1980s. At this time, CIPS, as an organization, began re-evaluating itself. It remained a small society with only about four thousand members, despite the rapid expansion in computing employment through the 1970s.²⁵ The organization had few resources, and began to re-evaluate how these resources should be directed. While some felt that CIPS resources were best spent on supporting its local sections and services (Fabian, 1981), many began to call for a stronger national organization that would provide professional leadership in the computing field (Bishop, 1981; McLeod, 1985; O'Neil, 1985). For some, the spread of computers and a growing public concern over issues related to computer safety and privacy, demanded greater professionalism in the field. While in the late 1960s and early 1970s some could debate whether computers had a substantial impact on the public at large, few doubted it by the early 1980s. For all of these reasons, in 1984, CIPS raised the issue of professionalism again and prompted a national debate on the issue. In 1985, the CIPS national board initiated another referendum for its members on professionalism and certification. It outlined 5 possible directions for the society, and asked members to choose: should the organization become more professional? Stay the same? Or focus its activities on the local level? The proposals included the following (Glenn, 1985a, 1985b):

1. CIPS should be a collection of local societies in which members get together for dinner meetings and an exchange of ideas (and nothing more).

2. CIPS should stay largely as it is (local societies, linked by a national board with only a limited commitment to professionalism – including a code of ethics).
3. CIPS should introduce a credential for information processing workers that interested parties could acquire on a purely voluntary basis.
4. CIPS should introduce certification for all members.
5. CIPS should actively and aggressively seek professional status, including credentials for computing workers accompanied by professional government legislation and licensing.

The ensuing debate on professionalism resembled that which occurred in the early 1970s. Some, and most notably many in CIPS' Toronto section, were opposed, arguing that professionalism in many of its forms was too exclusionary, and that there was no need for professional credentials – the public was not clamouring for them (Woodhead et al., 1985). Moreover, it was argued, once again, that it is too difficult to professionalize a field without a core common body of knowledge (Woodhead et al., 1985). Those in favour of certification and professionalism countered that there was enough of a shared knowledge base to establish a profession (Foyer, 1985), and that public protection was required (Kryt, 1985; Foyer, 1985). Interestingly, some also claimed that CIPS had to professionalize to protect its area of expertise from encroachment by other professionals, like engineers (Foyer, 1985) and accountants (Harris, 1991b).

The results of a 1985 referendum on these possible directions indicated a still ambivalent and divided membership (Glenn, 1985b). Respondents were asked to indicate how strongly they agreed or disagreed with each of these proposals. The two options that received the most support were numbers two and three: 57% of respondents agreed that CIPS should encourage voluntary certification, while 54% supported making no changes to CIPS. Responses indicate some polarization around issues of full certification and licensing, with many members being in favour of it, but more strongly opposed. The CIPS leadership had hoped for a more resoundingly positive endorsement of their professional project; however, following the referendum they contented themselves with establishing certification criteria and procedures for interested members.

Their credential, the ISP or Information Systems Professional, was established in 1987, and fully implemented in 1989. The ISP certificate was open to all of those who had graduated from a CIPS-accredited university program and had two years of work experience, or those who possessed a CDP or CCP plus 5 years of work experience (Hadford & Pulfer, 1989). For the first few years of the program, CIPS also granted certification to members with a minimum of ten years of work experience, those with a college diploma in a related field and 6 years of work experience, and those who graduated from another university program and had 4 years of work experience (Hadford & Pulfer, 1989). This initial flexibility enabled many in the field, who might not otherwise be eligible, to acquire the credential. It also seems to have increased the appeal of the ISP, and in the program's first two years a surprising

number of people (1250) acquired an ISP certificate (Hadford, 1991). Moreover, membership in CIPS increased by 18% with the establishment of the ISP (Bewers, 1990). The ISP was clearly appealing to many IT workers. As with the BCS credentials, the ISP acknowledges competency amongst both those with a CS education, and those without; in this manner, the credential recognizes experience and alternative ways of acquiring relevant knowledge.

In the early 1990s, CIPS began to pursue provincial legislation that would recognize the ISP designation and ensure that only those who had attained an ISP through CIPS could claim it. In 1997, CIPS succeeded in having legislation passed in Alberta recognizing the ISP. Since 1997, legislation has also been passed in British Columbia (1999), Ontario (1998), New Brunswick (2001) and Nova Scotia (2002). The process is underway in Saskatchewan and Manitoba. Pursuing legislation has required CIPS to change its structure somewhat, and establish provincial bodies that pursue and administer the legislation, and regulate and certify ISP holders. The legislation granted does not confer particular privileges to ISP holders, but it does recognize the ISP as a protected title and makes it illegal for anyone who is not certified, to claim that they are.

Like the ACM, CIPS also began accrediting university computing programs in the early 1980s. As in the U.S., the goal was to ensure that computer science programs maintained certain standards. Accreditation was in part a response to concerns that the CS programs were not doing an adequate job of educating CS workers. It was seen as a method of “ensuring that people entering the profession have a sound body of knowledge” (Foyer, 1983, p. 34). A CIPS survey reported in 1982, suggested that employers held fairly negative opinions

about computer science education, and believed that accreditation had the potential to improve the quality of the programs offered (Higgins & Pulfer, 1982). Through the 1980s, CIPS’ accreditation board (the Computer Science Accreditation Council) successfully reviewed and approved a growing number of four-year university programs. In the late 1980s, they extended this activity to college programs.²⁶

Ethics

Efforts to establish codes of ethics were largely a product of the 1960s, just like accreditation and credentials were. During this decade, computer professionals began to consider their social responsibilities, and to argue that they had an obligation to society, not just themselves and their employers. For many computing leaders, establishing codes of conduct was a small but important step towards professionalism. Codes of conduct were intended to encourage professional behaviour amongst computing workers, and ensure protection of the public. Given the suspicion with which members of the public often regarded both computers and those who programmed them, codes of ethics were an important public relations tool. The BCS advocated ethics to “secure competence” and ensure it was exercised properly, and to maintain the society’s professional status through “a high standard of conduct and competence” and “an acceptance of the social responsibility inherent in an occupation endowed with public interest” (Ashill, 1970, p. 45).

In a profession whose activities are the subject of widespread ignorance among the general public it is clearly of the utmost importance that

a hallmark of competence is available against which the integrity of advice offered by the professional practitioners can be adequately measured since the profession is concerned with matters which can closely affect life, property and individual rights. (Ashill, 1970, p. 45).

The code of ethics asserted that professional members must act with integrity, and exercise competence (without claiming more than he/she possessed), act with discretion and impartiality, take full responsibility for work, not seek advantage at another's expense, and at all times act to "uphold the dignity of the computing profession." (BCS, 1970b, p. 82). Members were exhorted to "keep abreast of continuing developments" in the field (Ashill, 1970). In this vein, keeping up-to-date with technological change became defined as good professional practice.

A code of conduct – or "Guidelines for professional conduct in Information Processing" – was introduced by the ACM in 1966. These guidelines held that professional people must "uphold and advance the honor, dignity and effectiveness of the profession in the arts and sciences of information processing" by keeping high standards of competence, and by being ethical in interactions with the public, employers and clients, and other professionals (ACM, 1968, p. 199). While the BCS took immediate steps to try and enforce their code of ethics through a disciplinary structure, the ACM was more reluctant to pursue this path (Parker, 1968). The ACM revised its code of ethics in 1992 to render it more up-to-date. While in this latter version more effort was made to

acknowledge cultural diversity and human rights, the emphasis still remained on issues of honesty, confidentiality, and professional competence (ACM, 1992). CIPS also introduced a code of ethics in 1974 that was seen as an early cornerstone of its professional activities. Codes of ethics demonstrated professionals' sense of social responsibility and commitment to professionalism; they were a central part of the professional projects pursued by computing organizations in all three countries.

Summary:

Ensuring competence through credentials, exams and accreditation, and establishing codes of ethics are activities common to all professions. However, the way in which computing organizations pursued these hallmarks of professionalism was shaped by the particularities of computing work; especially pertinent here are employment diversity, a resulting lack of consensus on a core BOK, and continuous technological change. For instance, computing differed from other, more established professions, which tended to establish credentials based on university education, and the possession of a more clearly-defined body of theory and knowledge. Moreover, while most professions require the acquisition of practical skills and work experience for the attainment of professional credentials, generally this practical work is seen to complement university education, not substitute for it. In attempting to professionalize a diverse and oft-changing occupational field, computing leaders have had to approach professionalization differently, and they have only been partially successful.

Professionalization efforts within computing fields have also been characterized by a great deal of ambivalence, especially in Canada and the United States. As we have seen, CIPS' members were historically reluctant to support accreditation and the professionalization of their discipline. The fact that so many CIPS members were managers may partly explain their reluctance to professionalize.²⁷ In a similar vein, the ACM has tended to pursue a somewhat limited professionalism. While ACM members were generally supportive of the curricular endeavours of the organization, and of codes of ethics, they often bristled at the suggestion of professional regulation, and they demonstrated only limited support for the acquisition of IT credentials. Moreover, ACM members frequently disagreed over what exactly the role of ACM, as a professional organization, should be. ACM members see themselves as professionals, but may be less focussed on raising their professional status, as a group, than are others.²⁸

Discussion:

This paper has explored aspects of professionalization within the field of computing. While professional activities in the field have been ongoing since the advent of the modern computer, organizations have met with varying, and often limited, success. Attempts to define 'computing' as a profession have been hampered by the diversity of work in the field, the difficulty of identifying a common knowledge base, criticisms over computer science education and its relation to practice in the field, as well as internal divisions and ambivalence. The professionalization efforts of the British Computer Society most clearly resemble a traditional professional project. This

organization consciously mobilized organizational resources towards increasing its professional status. It pursued social closure strategies by restricting access into the BCS to only those who had achieved a certain level of competence demonstrated through academic achievement in university courses, BCS exams, and work experience. The BCS also endeavoured to convince the public and government that it was deserving of professional status through its establishment of codes of ethics and its accreditation and public education campaigns. It successfully lobbied for government legislation recognizing its authority in the field.

Professional efforts in Canada and the United States have been less traditional, and especially in Canada, somewhat less effective. The ACM has actively promoted computing as a field of endeavour, and developed it as a scientific discipline. The organization has sought to establish and uphold professional standards through limiting its membership, shaping IT credentials through involvement in ICCP, and creating a code of ethics. Its work with the IEEE has helped to promote a positive image for computing professionals. In contrast, the professional project of CIPS has been a reluctant one. The society has long been divided on issues like accreditation, certification and education for IT professionals. CIPS has recently sought to follow the lead of other IT professional organizations and establish a credential for IT professionals, recognized in provincial law. However, the fact that this organization still represents only a fraction of IT workers, limits its ability to speak for the entire IT community.

Professional and organizational activities in the computing or IT field have many implications for IT work that still remain to

be investigated. For instance, professionalization often entails reducing access to the field, and historically this has affected women, minorities and members of the working class disproportionately (Wright, 2000; Larson, 1977). Did the professionalization activities of the BCS and other organizations limit women's activity in the field? The decline of women's participation in Canadian computer science in the late 1980s corresponds with increased professional activity on the part of CIPS, in the form of accreditation and certification. Are the two directly related? Or are they indirectly related – for instance, did the same negative media attention that prompted further professionalization in the late 1980s and early 1990s also turn women away from the discipline? These questions cannot be easily answered. While the commitment of many women within CIPS to the organization's professional project, seems to cast doubt on the idea that it was professionalization per se that has lowered women's involvement in the field, women are less likely to possess the ISP designation than are men. Nonetheless, the implications of professionalization for the employment of women and others in the field still remain to be fully explored.

The significance of age to these processes is also a topic requiring further investigation. Until recently, age requirements have been explicitly part of the BCS's membership structure. Members have to be at least 24 years of age, while "fellows" must be at least 30. While these age regulations are intended to serve as markers of experience, they also suggest that older workers are the more 'professional.' This association between age and professionalism is significant in a field that has been identified as a "young man's occupation" (d'Agapeyeff, 1970, p. 373), and in which

those who have been in the field for some time are often seen to be 'out of date.' Professionalization seems, at least in part, to be a response to the age-related obsolescence in the field. Professional credentials explicitly acknowledge the value of work experience and they signify older workers' competence. Here 'professionalism' is also defined in terms of a willingness to keep up with the field. CIPS' efforts to promote regular re-certification, and the explicit reference to re-education in professional codes of ethics, are both significant in this respect. Yet, the fact that age still seems relevant for IT employment signifies that the professional project is incomplete. If the professional status of IT workers were fully accepted, then the possession of credentials would be a greater indicator of professional competence, than age.

The impact and relevance of professional activities for education in the field should also be explored. While organizations have attempted to set a standard for the field, there are a plethora of training programs for IT workers, at varying levels. Traditionally, professions are supported by a number of subordinate technical occupations. University education prepares students for professional work, while private facilities, apprenticeship programs, and colleges prepare technicians. The lack of a clear distinction within IT between 'professional' workers and 'technical' workers (especially in Canada), may be taken as a further indication of a lack of professional status for IT 'professionals.' The significance of professional activities in the field of education for IT workers is another potential area of investigation.

Examining efforts to professionalize computing occupations also has implications

for studies of professions more generally. Most notably, it highlights the difficulty in professionalizing a field of endeavour rather than an occupation. Successful professions have generally had a fairly well-focussed, if not well-defined, area of practice. The employment diversity within computing, combined with the lack of conceptual clarity in defining the field's knowledge base, has contributed to a lack of unity that has hindered professionalization in the U.S. and Canada in particular. The fact that the British have been as successful as they have in professionalizing is remarkable in this context, and worthy of further investigation.

Professional projects have both influenced and been influenced by the nature of employment in the IT field. Further research into IT work, needs to consider these professional issues more completely.

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² Throughout the period under investigation, the terminology describing these occupations varied. Nevertheless, through most of the period, the terms “computing” and/or “information processing” were predominant; the former is the term used most often in this paper. There is a great deal of overlap between these occupations and those that today make up the Information Technology (IT) sector.

³ For this investigation, those issues published in the 35 year period between 1958 and 1993 were examined.

⁴ Amongst these other documents are some articles from the *IEEE Annals of the History of Computing*.

⁵ The AIEE merged with the IRE in the 1963 to form the IEEE. At this time, their computer groups were also merged into one (IEEE Computer society, 2003, www.computer.org/history/development).

⁶ The Journal of the ACM (a more technical, academic journal) first appeared in 1954, the Communications of the ACM began publishing in 1957. Membership in the ACM continued to grow in successive decades and the organization had 65,000 members by 1980 (Denning, 1988), and currently has 75,000 members.

⁷ AFIPS was disbanded by the ACM and IEEE Computer Society in 1990, as it had become too inefficient, and a new joint venture was pursued (White, 1990c).

⁸ In 1968, the ‘Computer Society of Canada’ decided to change its name to CIPS and to seek incorporation. However, the Secretary of State suggested that it may have difficulty incorporating with a name beginning with “Canadian,” and recommended a name change to ‘The Information Processing Society of Canada.’ As a result, the society unofficially went by this name and the acronym IPSOC for the better part of a year, before it succeeded in incorporating under its chosen name (Goodfellow, 1968a, 1968b; Kutt, 1969).

⁹ At this time, IBM began producing a single line for both academic and business users.

¹⁰ Most universities created departments of ‘computer science’ but some others used the title ‘computer and information sciences.’ Engineering-oriented departments were also created; these also had varying names such as ‘electrical and computer engineering’ and ‘electrical engineering and computer science’ (see for instance, Gries and Marsh, 1988, p. 985).

¹¹ The ACM C³S committee consisted of 12 university educators, 11 from departments located across the U.S., and 1 (Thomas Hull) from the University of Toronto. Its curriculum primarily focussed on undergraduate education but provided recommendations for the development of Master’s degree programs and discussed PhD programs in the field.

¹² Computer science education has been left with a largely impossible task – to train computer workers for a variety of ill-defined, constantly changing occupations in which workers used frequently changing technology and methods. Thus, it is not surprising that critics of computer science, especially in industry, always had something to complain about.

¹³ CS was also criticized for being too vague and for lacking a “clear statement of [its] conceptual basis” in its core curriculum (Denning 1984, p. 982).

¹⁴ For instance, the main document on professionalism produced by CIPS during its early years focussed on “proceeding towards professionalism in information processing” (IPSOC 1969a, p. 1)

¹⁵ For instance, a recent review of the Computer Science program at UWO conducted by a reviewer from the Faculty of Engineering appointed by the Provost’s Undergraduate Program Review Committee (PRC), mentioned a high teaching load due to high enrolments as being characteristic of both Western’s CS department, and those at many other Canadian universities.

¹⁶ These schools may have been less common in Canada; at the very least they attracted less attention in the pages of CIPS journals than they did in U.S. and U.K. publications.

¹⁷ Many ACM members would have disagreed with Denning as well (for example, Harbron 1984).

¹⁸ For a time, the ICCP through the DPMA also offered a QCP certificate for Qualified COBOL Programmers (Pike, 1973a). The organization currently offers one umbrella certificate the CCP – Certified Computer Professional that covers a wide range of IT specialties.

¹⁹ For instance, CIPS president Grant Boyd (1973, p. 12) saw CIPS’ involvement as a chance to “get in on the ground floor and to be able to make CIPS views known to this body;” at the time the CIPS membership was highly ambivalent to the issue of accreditation.

²⁰ This legislation enconces the BCS aims, structure, and constitution in law, and upholds its right to examine and award certificates and diplomas to computer professionals.

²¹ At this particular juncture CIPS was going by the name IPSOC (Information Processing Society of Canada).

²² Note here, again, that there is no ‘single’ easily definable IT professional occupation, and that the scope of practice of computing work is very broad.

²³ Traditionally most professions have established credentials that are more exclusively tied to university training (Freidson 2001, p. 84). The CIPS plan, though, clearly straddled the BCS, ACM and DPMA routes, in emphasizing university education, experience and credentials.

²⁴ Identifying the core knowledge was to be one of the first tasks the Institute would undertake.

²⁵ While the BCS and ACM similarly represented only a fraction of all computer users, these organizations had built up a much larger, more representative membership base than CIPS.

²⁶ Another response to the criticisms of computer science training, was the expansion of computer-training in business schools. These programs strived to produce graduates who possessed both the business and computing skills employers wanted, especially in their management employees.

²⁷ An informal survey of Toronto CIPS members in 1974 suggested that managers were less likely to support accreditation and credentials for computing professionals than were others in the field (Whitsed, 1975).

²⁸ The ICCP is more explicitly engaged in professional activities including establishing a knowledge base for IT professionals and investigating professional legislation.