Computer Personnel: A Brief Historical View of the People Who Make Digital Things Work

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Abstract

Our objective with this study is to compare three distinct periods of CPR development. We contrast the original concerns regarding computer/information systems personnel from the early days of computing with emergent concerns reflecting the accumulation of evolution of both computing technology and IS management in the subsequent years. In order to accomplish our goal, we review the proceedings of the Computer Personnel Research (CPR) group analyzing the very first proceedings (1962), the next five proceedings (1964 to 1969), and the most recent five proceedings (2006 to 2011). Our intention is to present and analyze a broad picture of trends illustrating them with vignettes from practice and observations derived from particular studies. Finally, we identify and comment on the array of themes and topics that the CPR conferences have addressed in the most recent five years.

1. Introduction

Much has been written about the history of computing technology. The study of computing can logically trace its history to the invention of the computer in the 1940s and following rapid evolution since then. As hardware and software capabilities and the number of people and roles of the those working with them have expanded it stands to reason that the skills needed to operate, maintain, and continue adding features would also increase.

The purpose of this study is to better understand the evolution of what were originally called “computer personnel” along with the issues that have arisen over the years, remained relatively constant, and declined in salience. Although not comprehensive to all of the knowledge pertaining to computer personnel that has been generated, the annual conference on Computer Personnel Research (CPR) has been concentrated on this topic and provides a systematic look at the changing nature of issues in practice through the progression of research topics examined. Learning about computer personnel and how their concerns have changed over the years promises the potential to gain insight about computing in its many aspects over and above consideration of the changes in technology itself.

As pointed out by Mason et al. [1], [2], MIS as a discipline has been slow to develop a tradition of historical research. Learning from the past can help to (1) avoid repetition of unsuccessful actions and decisions; (2) suggest opportunities for replication of successful actions and decisions; (3) show trajectories of change and help for planning future actions and decisions; and (4) provide an opportunity for debate and consideration of the significance and applicability of past lessons.

Thus this paper addresses the research questions: what initial insights can be drawn about the progress of computer personnel through examination of research from early days of computing to the present? In this paper, we contrast the early with later concerns in the field and provide our view of implications for the future. We use the proceedings of key CPR conferences to target three perspectives as viewed through Social Shaping of Technology perspective to guide our study. The first perspective targets issues raised during the first CPR “conference” in 1962. The second presents themes and topics in the first five conferences from 1964 to 1969. Finally, we identify themes and topics have addressed in the most recent five years, 2007-2011.

A comprehensive history of all aspects of computer personnel is beyond the scope of any one study. It is recognized that the CPR conference does not represent all knowledge about this topic, but does provide a concentrated resource that should provide initial insights and a basis for further study. We conclude with acknowledgement of limitations and presentation of future research recommendations.
2. Method

For examination of the first proceedings, both authors read and discussed this document in its entirety. For subsequent proceedings, we used MaxQDA to code and analyze our data. We downloaded all articles from the ACM database and the first author "scanned the data for categories of phenomena and for relationships among the categories."[3] As she found similarities of units, she assembled them into folders of look-alike, feel-alike groups. Both authors then developed a coding scheme, based on which we ended up with nineteen categories, into which the data seemed to fall naturally. Each author then, independently coded a total of ten articles (five for each time period) and any differences were resolved by discussion. We then discussed the appropriateness of our initial set of categories and reached our final set of twenty-one categories.

3. Theory

The social shaping of technology (SST) serves as a foundation for our observations in this study. The SST approach views the trajectory of technology development as a social product conditioned by its creation, use, purpose, and interpretation as well as the affordances and limits of its capabilities[4]. This view differs somewhat from Pinch and Bijker's social construction of technology framework [5] and Callon and Latour's actor-network theory [6] particularly in the attention it pays to the effect of the development context shaping innovation choices. SST explores the material consequences of different technical choices, but criticizes technological determinism, which claims that technology follows its own developmental path, outside of human influences, and in turn, causes specific societal influences. In this way, SST theorists conceive the relationship between technology and society as one of 'mutual shaping'.

Williams and Edge argue that "Central to Social Shaping of Technology (SST) is the concept that there are 'choices' (though not necessarily conscious choices) inherent in both the design of individual artifacts and systems, and in the direction or trajectory of innovation programs.'"[7]

If technology does not emerge from the unfolding of a predetermined logic or a single determinant, then innovation is a 'garden of forking paths'. Different routes are available, potentially leading to different technological outcomes. Significantly, these choices could have differing implications for society and for particular social groups. However, while Williams and Edge [7] look at the technology and its direct users, we are looking at an additional group, the people who build and support the technology. While we are neutral about the schisms and issues that are unresolved in SST streams, we agree that there are elements of determinism and constraint in the technology itself as well as some opportunities for individual innovation and choice in explaining the co-evolutionary development of information technology and IS personnel.

4. The First Conference

"I don't conceive of this group being much larger than it is now or with much different representation"[8]

Interpreting the comment of the conference participant quoted above makes more sense when considering that it was made before the invention of the personal computer, the electronic spreadsheet, relational databases, the cell phone, the internet, open source, electronic commerce, ITIL, ERP, and on and on.

Thus began the first CPR conference, originally called the Computer Personnel Research Group, in 1962. This first conference was convened by the RAND Corporation for its client the US Air Force to consider human resource management problems pertaining to what were called computer personnel, consisting primarily of programmers, systems analysts, and managers.

Although we have come to define a number of discrete IS personnel issues it is noteworthy how difficult it was for participants to sort these out. For example, without defining the tasks of a programmer, how would one know what hiring criteria to use? Without defining expectations, what would be the basis for performance evaluation? Participants were aware that computer personnel worked in different environments and exhibited varied profiles each of which might contribute to positive outcomes but present difficulties in developing single scales for evaluation. For example, one programmer might be able to knock out many small coding solutions quickly but not handle long-term projects while another may have the reverse talent.

Much concern was expressed about evaluation, which remains to this day a concern, often framed in terms of IS productivity metrics. Without naming it, the discussants approached the idea that problem solving and coding known problem solutions are distinct tasks, though sometimes the same people perform them, sometimes they do them.
simultaneously, and sometimes it helps to break them into discrete smaller pieces.

The participants seemed attuned to how general HR principles did not provide useful answers to unique aspects of IS personnel. For example, there was awareness of personality types and general principles of motivation, but there were no answers to how these applied to computer personnel. Moreover, skills and requirement pertaining specifically to work with computers was central to these early discussions. Generic selection tests or evaluation methods were not viewed as sufficiently helpful without addressing the distinct characteristics of IS work and people. Seeming dilemmas such as needing individual concentration and problem solving versus interaction with clients to solve the right problems are also noted.

During the 1960s most of the leadership in the field derived from the non-programmers, thus raising the question about programmers’ leadership qualities and the training they were provided at that time. Programmers were seen as “non-leaders” and as people who “do not like to work on their own problems” [9].

Other themes of recurring concern include balancing quickness and accuracy, optimizing knowledge of a particular system versus transferring knowledge to other systems, and assessment of problem solving versus generation of code related skills. Additionally, the degree to which we might say creativity is an attribute to the programmers was discussed. In terms of SST, the people developing and maintaining IS can be viewed as intermediating between technology and users, infrequently in terms of “fixing” technology when it is “down”, but more in terms of translating desired organizational activities or support needs into technical products and in terms of interpreting ways to employ the given affordances of technology to addressing particular problems. It is clear that the early students of computer personnel understood that such a role had many potential facets and finding a single means of rewarding, much less defining, that role would be challenging.

5. Setting the Agenda (1964-1969)

In the next portion of this paper, we present observations about the topics raised in the early conferences.

After the first meeting in 1962, no meeting was conducted in 1963. No formal sessions were held during the first two conferences. Papers submitted were highly practitioner oriented and focused on immediate problem solving. Only 19 out of the 62 authors in these proceedings were academic researchers, with 8 being government representatives.

The 1966 conference was the first meeting to have formal sessions in place; however, the researchers were still predominantly from industry and government. Of 10 papers presented, 4 were authored by practitioners and 2 by representatives of U.S. government agencies. During this meeting the first empirical reports and the first instrument validation paper were presented [10].

SST is not a single well-defined theory but rather a number of related approaches sharing some common philosophical outlooks. One major approach is that of Social Construction of Technology (SCOT) where Pinch and Bijker [5] argue that technological artifacts are socially constructed by social groups and that ‘success’ and ‘failure’ are interpreted and evaluated differently by ‘relevant social groups’ with differing and sometimes entirely conflicting objectives, goals and intentions. We reflect this view in our analysis that follows in terms of recognizing that each issue may be viewed from multiple perspectives.

During the 1967 conference, the issue of privacy invasion was raised for the first time. This issue arose as a response to a new technology affordance resulting from networking of systems. One conference participant asserted that “the Bureau of the Budget has proposed the consolidation of all these records in one central location, computerized, unified and integrated into what I have called a "Dossier Bank"...and also pointed out that, “The information ... collected in this data center would be personal, evaluative, easily integrated and, consequently, highly suspect. Whenever Government records contain personal information, they create serious problems of public policy and justice for the individual.[11]”. In the context of computer personnel, we see the capabilities of technology triggering policy issues, which ultimately result in HR consequences including jobs in security such as privacy officers and added privacy responsibilities in more general job designs.

The 1968 conference introduced the issues of system design for human factors (p.112), and man-computer communication [12]. Over time this issue has migrated to Human Computer Interaction (HCI) groups focused on interface design and usability. Such discussion, in the context of IS workers, however, might focus on how IS workers both translate affordances of the technology to users (helping them take advantage of the technology’s built in capabilities) and providing requirements input for designers to more directly address user concerns.
We found evidence of two divergent viewpoints used to appraise programmers. One of these viewpoints we have labeled the "potential" approach, the other the "results" approach. The "results" viewpoint evaluates a programmer based on how valuable he is in getting the work out on a day-by-day basis. The “potential” viewpoint adds consideration of how valuable a programmer is likely to become in the future. It became evident at the onset that simple criterion measures for computer positions could not be created until the complexity of job requirements had been addressed.

Table 1. Emergence of Issues during the Early Years (Topics presented all 5 years are highlighted).

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<tbody>
<tr>
<td>Defining professionalism in computer personnel</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<td>Effects of evaluation on salary</td>
<td>X</td>
<td></td>
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<tr>
<td>Evaluating new languages</td>
<td>X</td>
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<tr>
<td>Evaluation/Instruments</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>Extension of interest from programmer to system analyst</td>
<td>X</td>
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<tr>
<td>Job analysis/design</td>
<td>X</td>
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<tr>
<td>Listing skills and measures of each</td>
<td>X</td>
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<tr>
<td>Performance and Retention of IT Workforce</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>Privacy invasion</td>
<td>X</td>
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<tr>
<td>IT Workforce Management</td>
<td>X</td>
<td>X</td>
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<tr>
<td>IT Workforce Development</td>
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<tr>
<td>Programmer selection/tests; Supervisor selection</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Promotion</td>
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<td>System design for the human factor</td>
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<tr>
<td>IT Careers, competencies, training</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
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</table>

One unexpected view of the nature of programmers held: “Programmers, as a class, seem to me to be non-leaders, non-writers, and they don't like to work on their own problems….I would say that, in general, programming supervision is nonexistent. It's my observation that, although programming is indeed a scarce resource, leadership in the programming field is much dearer.” [9]

In 1968, a representative of the State of California presented a synopsis of its selection and training program. Emphasized were the need for continuous training and self-development. They applied the same program for their own graduates [from programming training they offered] and external candidates.

Although not as targeted a subject of research in the early days, retention of key personnel was already appearing as one of the concerns of the field. One particularly intriguing study showed that large proportion of the programmers was selected from within the organization, which led to reduced attrition rate (6%) vs. programmers transferred from outside the organization (38%) [13]. The researchers not certain why data staff employees who are recruited in-house are so stable, as they had not done any in-depth studies on this topic.

6. Recent viewpoints (2007-2011)

In the next portion of this paper, we present observations about the topics raised in the recent conferences.

We identified the following topics (see Table 2), some of which mirror topics presented in the early years, and a number of which have arisen subsequently. For this time period, 19 out of 385 authors were practitioners and only one was representative of a government organization. Just as the early practitioners had some difficulty sorting out interrelated issues, a number of the papers in these later years also addressed multiple topics. For example one paper explores critical success factors (CSF)s for global software classroom work thus addressing both global and IT curriculum issues.

Diversity and Cultural Issues of IS Workforce. This topic deals with the array of issues pertaining to the demographics of the IS workforce and the variations in attitude among IT workers that can be described as cultural. This was not a topic found in the initial five years of CPR. Several studies focused on the role women play in the IS workforce[14–17]. In an attempt to address the underrepresentation of women in the information technology (IT) workforce it is important to understand the values and motivations of female professionals. Does the
evidence suggest that women dislike technical work? Do female IT professionals prefer general business careers to highly technical professions? The apparent implication for practitioners is male and female IT workers internalize job-related factors differently, therefore managers should not expect identical responses from IT professionals of both groups. If the organization’s goal is to retain personnel, elements that influence work identity (i.e. technical/business roles, skills variety, and task significance) are critical. In order to be globally competitive, firms need to retain more of their female IT professionals [14].

**Global/Cultural.** This topic deals with the array of issues pertaining to similarities and variances based on national identity. Note that this pertains both to issues such as blending people of different ethnicity in offshoring work groups but also in terms of how different ethnic or national groups react to varied HR policies or technical issues. This is a topic not addressed during the first five years of CPR, though as noted earlier, the first submission from outside the US did appear during that time frame. However, we noticed that data has been collected in relatively few countries. Most studies focusing on international samples of IS workers report findings from either China or India, with sporadic reports from other countries (Venezuela, Botswana, Australia). This leaves much room for continuing work to address exactly on what dimensions all IS workers exhibit the same patterns in contrast to those dimensions where they differ by location, language, ethnicity and/or other cultural factors. Of course, the differing types of IS work (e.g. a preponderance of receiving offshored work in India, a preponderance of security and entrepreneurial IS in Israel) makes for a natural confounding of variables related to IS workers’ personal attributes and the affordances of different types of IS work. This will present significant methodological challenges for CPR researchers.

**Table 2. Themes in Most Recent CPR Proceedings Years (Topics presented all 5 years are highlighted).**

<table>
<thead>
<tr>
<th>Issue</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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<tbody>
<tr>
<td>Diversity and Cultural Issues of IT Workforce</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Global/Cultural</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>IT and Recruitment/HRIS</td>
<td></td>
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<td>X</td>
<td>X</td>
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<tr>
<td>IT Careers, competencies, training</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>IT Workforce Development</td>
<td>X</td>
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<tr>
<td>IT Workforce Education/Preparation</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>IT Workforce Management</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Performance and Retention of IT Workforce</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>The Nature of IT Work</td>
<td>X</td>
<td></td>
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<tr>
<td>The Practice of IS</td>
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</table>

**IT and Recruitment/HRIS.** This topic pertains to the role of information systems in support of general HR activity. Specific studies may target the use of Internet delivered electronic recruiting systems as well as IS support for traditional HR activities including hiring, monitoring, and evaluating within organizations. This topic illustrates the duality of how IS can support work areas that in turn are used by IS. For example, information technologies are used as a set of tools to support HR in general, selection/recruitment, benefits/compensation, and evaluation are applied to IS workers while at the same time information systems and computing tools support each of these processes in many if not most organizations. As a result, it is unfortunately easy to become vague in specifying topics being addressed.

**IT Careers, competencies, training.** This topic pertains to individuals in their choice of IT as a career, what skills are needed to enter the field, and what added skills enhance their career opportunities. Studies, for example, considering the effect of certifications on long-term career goals and achievements would be a central example of this sort of topic. We also see studies regarding the skills sets that employers seek with the implication that these ought to be ones that we teach. Most such studies reinforce the importance of soft skills such as project management, leadership, communication and business skills. Of course Adya [18] and Berkelaar et al. [15] remind us that “programming skills are still needed...” as well. One interesting study considers the role ethnicity plays in students' intention to stay in IT programs [19]. Their findings suggest "...the strength of one’s ethnic identity explains significant variance in a student’s intent to stay in IS. However, while ethnic pride can help students maintain happiness when faced with stress, it may not help students stay in IT programs.” On the same note, a 2009 study of Botswana IT personnel reports "...life style does not feature as a significant career anchor in Botswana. The dominant career anchors include organizational stability (security) and sense of service (service).” [20]. From a practitioner perspective, trainers need to focus on matching...
learners to training methods based on individual differences. A good method for doing this would be to develop a pre-test, and then dynamically combine learning objects to suit an individual’s aptitude. Somewhat counter-intuitively Joseph [21] suggests that job shadowing tends to impede IT as a career choice, while experimental (learning by doing) training aids student in making transition from school into the IT profession.

**IT Workforce Development.** This topic pertains to active efforts and passive responses to environmental factors that shape the collection of IT workers taking part in the IT workforce. Much discussion focuses on issues around enrollment in IS programs around the world and, on the one hand what can be done to increase such enrollment and on the other whether or not the pipeline will be sufficient for those in industry who which to hire IS workers. There is a perception among practitioners that there will eventually be very few programmers with mainframe computing skills and knowledge of legacy systems. This concern results from a perceived shortage of students enrolling in the IT and computer science fields coupled with the large number of IS professionals who are expected to be retiring in the next decade. Practitioner research suggests that these legacy technologies will still be around after the baby boomers are gone, but there seems to be very little interest in current students with programs in these areas [18].

**IT Workforce Education/Preparation.** This topic pertains to educational curriculum and techniques that aid students in developing skills, knowledge, and abilities to enter the IS workforce. This is another area of duality where IT uses education and is in turn used for education. IT is used as a set of tools to support education in the classroom and distributed through e-learning. At the same time, education is a prime mechanism for students to develop IT skills in preparation for an IS career and for those in the workforce to enhance their skills as organizational needs change. Findings indicate programming skills are still needed, and project management skills are both highly desired and lacking [22]. Other soft skills, such as communications skills, business knowledge, and leadership skills are also desired and, like project management, projected to increase in importance. Most of the organizations placed more emphasis on non-technical or soft skills. In almost equal numbers, leadership skills, communication skills, and knowledge of the business were most desired. Communications skills were ranked in the top two required skills in six of ten companies. In today’s IT driven marketplace, leadership skills were most frequently identified as “missing”. Subjects indicated the IS discipline is not doing enough in the project and change management areas. Perhaps more surprising was that three companies view MIS majors as lacking communications skills. Business knowledge was viewed by two companies as most lacking. Other skills missing were programming, analysis, experience, certifications, security, and hardware [22].

**IT Workforce Management.** This topic pertains to managerial interventions that improve or retard successful organizing and deployment of IS workers. An example of such a topic is telework and its potential for aiding IT workers. By extension, this relates to efforts of firms to take advantage of IT tools made available across the workforce to enhance productivity and/or worker benefits. Another example of a topic is the effects of layoffs and outsourcing on the remaining IS workers.

**Performance and Retention of IT Workforce.** This topic focuses on factors that encourage and inhibit IS workers from remaining with a particular employer. Job turnover is yet another well studied topic largely focusing on intentions to leave and precursors such as lowered job satisfaction and lack of organizational commitment. As more baby boomers intend to work longer, issues regarding technological retraining will arise. Organizations will have to determine how they can use information technology to facilitate knowledge retention, mentoring between older and younger workers, and accommodate older workers who choose to remain in a position beyond the traditional age of retirement. We argue that as the workforce ages, it will become even more important to maintain older IT workers, particularly as fewer younger workers become available due to population aging and ongoing shortages of skilled IT professionals.

**The Nature of IT Work.** This topic focuses on the shifting roles and responsibilities of IS workers. With the growing range of IS products that support an increasingly vast array of user functions, the range of IS tasks and how they are organized for workers continues evolving. For example, virtual teams and the way globally distributed groups collaborate in IS development has been an important topic during the last five years [23]. To a significant degree modern virtual teams are not possible without the affordances of telecommunications technologies and particular software support. The result of these technology capabilities, following SST thinking, is a set of new distributed team support tasks (which need people to do them) and new tasks for traditional team leaders to master.
**The Practice of IS.** This topic focuses on what IS workers actually do and what they ought to do. This topic considers better approaches IS workers can adopt for particular tasks such as working in virtual teams or moving through stages in software development. This is another understudied area of CPR, though perhaps because it is addressed in other areas of the IT community. Workplace practices can affect productivity and performance evaluation, thus would have a potentially strong impact on retention and job satisfaction.

7. **Discussion**

In this section we reflect on the evolution of some issues from earlier to more recent times, notably the IS educational role in development of the IS workforce and issues of diversity.

**The Relation Between Educational Programs and the CPR/IS Workforce.** During the 1960s the idea of specialized CS/IS curricula was debated among CPR participants questioning whether such programs were needed or possible to deliver. One CPR researcher [24] presented the opinion that IS curriculum has no future and there will be no practical benefits of implementing one (in hindsight this may be less about whether computer programmers need skills than about whether they need a separate department or field for acquiring these):

"...I find it difficult to believe that there is an academic base for a computer profession. I can think of only one course of study that truly belongs to the computer programmer -- I would say that is information theory. Everything else, it would appear to me, already belongs to another profession, so that the best you can get is a person who knows a lot of things about a lot of areas, and therefore can contribute in the computer area as a specialty, not as a profession." [12].

In 1966, Wegner called for implementation of undergraduate programs in computer science as noted below: "...a curriculum along the lines of the ACM Curriculum Committee report, even with its imperfections, is likely to fulfill a need in the educational system not currently met by any other curriculum. A well-balanced computer science program is likely to produce graduates who have the training attitudes of mind, and mental agility, appropriate to academic, administrative and technological careers in the computer age." [25]

This was supported more recently by Mahatanankoon who concluded that: "...informal professional development activities had no effect on organizational tenure and career satisfaction, while formal professional development activities contributed most to the progress of an IT career." [26]

Although the need for educational programs for computer or IS professionals has been established, the ideal content and tactics for recruiting students (e.g. balancing coverage of tedious basics while providing a stimulating and exciting program) remains very much a topic of concern today. In recent years, numerous papers emphasize the need of online learning communities (informal online networks, online courses etc.). Some of them report their findings, supporting the claim that students greatly benefit from such learning facilitators. Thus, we can observe how our field shifted from "there is no need to implement academic program in computer science" to "we need to help our students learn better, because they're unprepared for real work life challenges" [27], [28].

**Diversity Issues.** Among the other topics emergent in the later years, has been an increased concern for and awareness of diversity. The issue of gender disparity among computer professionals has been researched frequently. However, findings tend to be varied and inconclusive. Whereas female IS professionals were mentioned only once in 1967, where it was reported that authors found no difference between males and females in systems analysis proficiency, recent years have seen many studies focused on various aspects of gender differentiation or similarity among IS professionals. Ballou [29] reported that "female IT managers were particularly highly satisfied" with their career choice. Buche [15] reported "...the work identity of female IT professionals is noticeably different from their male counterparts. Females show a stronger relationship to job satisfaction but a weaker relationship with intent to leave, relative to males in the IT field". Differences, where they exist, in both attitude and behaviors between female and male workers continue to be a topic of importance considering the relative disproportion of male IS professionals.

In 1969, Gilbert and Mayer [30] addressed an aspect of diversity regarding self-selection of disadvantaged people into a computer operator training program. Another study discusses teaching techniques and quality education/training for the "disadvantaged". This is followed up many years later by Shayo studying students with disabilities writing that:

"...educational institutions may unwittingly foster separate educational tracks for disabled vs. non-disabled students; while simultaneously paying mere lip service to the notion of "making reasonable accommodations" for their disabled student.
population as required by law. In this research project, we intend to use our current understanding of how humans learn in technology enabled environments and findings in cognitive neuroscience, to develop and assess the effectiveness of online course materials that will be made inclusively accessible to both disabled and non-disabled students” [31].

The Future of CPR/IS Worker Research. We are left with the thorny question of: “Where will the field go in the future?” It is always risky to speculate about the future, however, we would envision two primary forces at work toward the continued evolution of CPR studies.

First we foresee a continued “filling in” of knowledge regarding core topics. We envision studies considering the similarities and uniqueness of IS workforces around the world. We would like to see continued development of principles that apply generally to all IS workers but with attention to dimensions along which they are likely to vary. For example can we differentiate predictions about the workforce (in terms of recruitment, retention, task performance, skill needs, etc.) where a national IS presence is predominantly software package creators (e.g. like Microsoft) versus consultants (e.g. like Deloitte and Touche) versus industry support (e.g. like Boeing or Nestle)? Do any of these findings carry over to IT workers in open source communities, working as private contractors, or “working” as consumers of IS products? We anticipate that there would be value in increasing our collective knowledge regarding (1) techniques that work or do not (or where they work) to encourage enrollment in IS programs; (2) factors that make application of IS in general education successful (e.g. with e-learning in its myriad formulations); and (3) how jobs are changing as a result of new technologies like mobile computing (and more generally are there principles by which IS jobs have been reacting to technology shifts wave after wave).

Second, we anticipate an acceleration of the trend of a broadening of CPR concerns beyond core HR issues. As computing has become ubiquitous throughout the world, we have all become computer personnel to varying degrees. As such our constituency has shifted from workers in IS departments within organizations to include all workers outside the IS department using computing in their jobs (e.g. end users), and increasingly, to included all individuals using IS for paid work, domestic work (e.g. on line shopping), and hedonic use (e.g. games, social networks) with an increasingly blurred line among these.

We raise the question: Can we apply what has been learned about IS specialists in organizations to these other types of IS users? What new knowledge do we need to support operation of information technology, to address organizational problems, and how to meeting the needs and develop new opportunities for emerging computing users?

8. Conclusion

Over time the concerns of CPR have broadened from how to apply HR techniques in the management of IT personnel and functions to include consideration of the tradeoffs facing individual workers pertaining to their careers and to the placement of organizations in larger IT workforce communities. As educators we may be looking at how to enroll and retain more individuals in IS programs while organizations are looking at how to best compete with one another to assimilate those individuals or alternatively from where to source them. Some topics have come to significance since the originators of the CPR discussion began. For example, the topic of global IS was not yet of particular significance. We now have IS companies such as that sell products globally (and have done for decades now). We also have the offshoring phenomenon and its accompanying issues of global and virtual teams. This topic has implications for teaching students about to enter the field skills that pertain to distributed computing and to interacting with people of varied cultural and ethnic background.

In the spirit of SST, we would project that scholars will want to track the changes in skills and roles of computer/IS personnel as individuals that follow from evolution of the technology itself. In a larger sense we would also recommend inquiry into how movements, such as offshoring (enabled by emergent capabilities in technology), affect requirements and opportunities for IS personnel. Further, we would challenge researchers to consider how evolution of personnel capabilities and structures (e.g. open source communities) may affect the development, delivery, and affordances of new technologies.

We anticipate and call for continued research (1) in the topics that have declined in popularity like selection and evaluation particularly as new knowledge in management suggests innovation for IS practitioners and as specific technologies and practices require revision in these practices; (2) in the topics that have been continual in prompting research such as retention and training where much economic benefit/cost is at stake and complexity of the variety of individuals and situations may create many
contingencies that need to be accounted for; (3) in the emerging topics particularly diversity, global workforce, and extensions of computing and the labor that accompanies it outside the traditional organizational boundaries. We would also call for continued examination and considerations of trends in IS personnel including potential confirmation, elaboration, or rejection of the patterns and explanations we’ve proposed, as well as the potential, for such patterns to prove consistent or at odds with theories of change and evolution.

Readers should of course keep in mind the limitations of this study. By focusing on the proceedings of the CPR conferences, we have underrepresented knowledge that has appeared outside of this setting. We would argue, though, that many if not all of the researchers represented in the proceedings incorporate knowledge from a wide variety of sources so that key materials from top IS and management journals tend to indirectly find their way into the conference content. Most importantly, this writing represents the observations of patterns and trends that are idiosyncratic to the authors’ perceptions and values. The observations and opinions presented should be interpreted as possible rather than validated and proven trends and tendencies.

We believe there is value in understanding both the origins of the CPR field and how these have influenced the current understandings and practices that we observe today. This essay has attempted to describe the first “conference”, some of the themes of the first five conferences as well as the most recent five conferences, and present some observations regarding how we anticipate the field will move forward in the future.

9. References


