COMPUTER SCIENCE: STUDENT MYTHS AND MISCONCEPTIONS*

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ABSTRACT

This paper discusses common myths and misconceptions about the field of computer science. It addresses and attempts to dispel these notions in an effort to provide prospective computer science students and the general public with a more realistic view of the field.

INTRODUCTION

People outside the field of computer science often have misconceptions about the nature of the field and the types of activities involved. One can often hear comments such as "my grandson is a whiz at computers," when in fact, he simply knows how to use the computer to surf the internet or to install new peripherals. Most people are simply computer *users*. They know how to use the computer to accomplish the small subset of tasks necessary for their jobs or entertainment purposes. It is common, therefore, for people who use computer applications to be unaware of the many layers of complexity that are abstracted away by the computer's hardware, operating system, and interfaces. Because these systems work so seamlessly, it is easy to acquire the false impression that it is a simple machine or that "application fluency" is synonymous with knowledge and skill in computer science. This is akin to believing that because one can drive a car that it is something can be built in an afternoon in the driveway. Computer users typically do not realize that the reason it is easy for them to use computers is because of the hard work of software and hardware engineers who designed good user interfaces and reliable code.

Students might be drawn to the field of computer science because they have found enjoyment in using the computer for such things as socializing on the web or playing video games. Maybe they have some ideas for enhancing such applications, but the reality of the work involved to make such software is beyond their comprehension. Enjoying the various interesting aspects of computers such as game playing and email leads prospective students to believe that a being computer professional is little more than their computer pastimes.

There are many misconceptions and myths surrounding the field of computer science, and students majoring in the computer science field need to be enlightened about the true nature of computer science in collegiate studies and as a profession. This paper discusses several common misconceptions of students and addresses them.

NATURE OF COMPUTER SCIENCE

Young people—and everyone, for that matter—tend to be attracted to interesting fields of study where one can make a lot of money, not work too hard, and have fun doing it. This is usually the case for the "future game programmers." Flashy games and applications combined with the prospect of a good salary draws students to the field, yet they are unaware of the fundamental math and science upon which the field is built. The problem, as De Palma states, is that "computer science is more difficult than many aspiring young millionaires expect,"[5] so they opt for more traditional, yet less rigorous professions. Obviously, computer science can be fun, but there is much more to it than entertainment. It takes a great deal of study and hard work to realize the benefits of a career in computer science, and many students do not have the patience and discipline to work through it all.

Beginning computer science students and non-majors may hold the misconception that computer science is boring, viewing computer science as large machines producing reams of reports and screens of data input fields. They may not realize that these necessary applications represent only a subset of the field. Such mundane applications as report generation and inventory control lead some people to think that field is dull; they don't realize that computers are in and around almost every aspect of modern society, some of which are depicted in Table 1. Examples include telephones, thermostats, toasters, cars, televisions, remote controls, stereo equipment, toys, etc.

Table 1: **Selected Applications of Computer Science in Modern Society**

Commerce	***Entertainment***	***Communications***	***Manufacturing - Industry***	***Health Care***	***Military***
Banking - records	Video games	Telephone switching	Quality control, process monitoring	Records	Guidance systems
Transactions – credit card scanners, secure transfers	Music – instruments, mixing, recording, noise reduction	Cell-phone – tracking, voice compression, data transfer	Design – CAD, CAM, Circuit layout, simulation, etc	Prosthetics design, control	Planning – weather forecasting, simulations

Inventory	Movies – animation, editing, filming, effects	Digital broadcasting	Robotic Manufacturing, Welding, Painting, etc	Scans – CT, MRI, Ultrasound imaging	Inventory, Payroll, Personnel
Stock Trading – failsafe trading, financial modeling prediction	Sports – screen effects (yellow line that shows where the 1st down lies in football broadcasts)	Computer networks (Internet, ethernet, token ring)	GPS Location and Navigation – Construction sites, agriculture, forestry.	Human Genome, Drug research, Protein folding,	Environmental data bases – historical data bases of world environments, land, sea, air, and space
Shipment Tracking	Competition aids (racing)	Multiplexed signals - automated power meters, etc.	Embedded systems – cars, copiers, etc.	Treatments – Radiation Therapy	Data acquisition

Computer science pervades all areas of research, business, science, and industry, and plays a vital role in all aspects of society. Everyone, no matter what his background or expertise, can find some area of computer science that interests him, whether it be in robotics, the movie industry, web applications, communications, aeronautics, weather prediction, emergency preparedness, military applications, bioinformatics, astronomy and space travel, health care, education, fashion design, or general business to name a few. No other field of study offers so many avenues of specialization as does computer science.

The technology aspect of computer science, that is the setup and maintenance of systems, leads some people to believe that the field is more of a “handyman” occupation. This often discourages females from entering the field. Sure, computer technicians “work on” computers. However, these technicians represent a different area of the computer field. Computer scientists often do not take apart machines and connect networks, unless it is something in which they are interested.

It is this “tinkering” aspect of the field, according to DePalma [5], that tends to repel women from entering the field. He believes that women are more drawn to the mathematical and logic aspects of computing than to the hardware aspects. There are numerous reasons for high attrition in computer science for all students [4], and in current years there are many fewer women entering the field of computer science, leading some to believe that it is a field more geared toward men. In reality, because of the diversity of computer science and the variety of skills necessary, there is no real reason for either men or women to perform better in this area; it may simply be that the interest in computer science overall has dwindled among women, which is disappointing since today there are often only a couple female students in some computer courses, and yet they tend to score the highest grades. Another thing that may keep female enrollment in computer science and engineering fields low is that when they are young, they may not have been encouraged to take things apart, build things with their hands, modify cars, etc. So when they get older they do not have a natural curiosity about machinery and sometimes are afraid of working around it. A faculty member once suggested that the reason for not having many female students was because the lab was plain, and that perhaps if the female students were given money to decorate it and paint the walls pink,

then it would be more inviting to them! There are many factors contributing to lower female enrollment and lower enrollment overall in computer science, and much work needs to be done in the area of recruitment and retention of a diverse student population.

Another common misconception is that most self-taught programmers can easily do the same jobs as skilled trained professionals. This is like saying that people who are familiar with car maintenance (changing oil, washing and waxing and minor tune-ups) can successfully rebuild engines and transmissions. These programmers often lack the insight and theoretical background of computer science graduates that allow them greater perspective when approaching new and difficult problems.

MATH AND SCIENCE SKILLS

A common misconception is that a degree in computer science is somewhat trivial, and some people, therefore, believe that computer science is easy—everyone can use a computer, right? Moreover, people in some professions erroneously think that because a computer scientist uses a keyboard that it is a clerical profession. To the contrary, most areas within computer science require good problem solving skills, a disciplined procedural approach, and a good knowledge of a sub-field.

Even if students are uncertain as to the difficulty of computer science, and likely undecided about their interests and aptitudes, they may be convinced by family members or high school guidance counselors to major in computer science because "everything is going to computers." The reality is that computer science involves a great deal of math [2], and students must be disciplined enough to work at learning required math skills. Some of these skills involves general problem solving skills, and many students do not have enough experience in this area [3]. Like any skill, however, there are ways to learn new techniques and to gain practice in this area if the student remains interested and diligently tries to master problem solving.

Other math skills are necessary for understanding mathematical foundations of logic, computer theory, networks, databases, and programming languages. In computation, numerical analysis, and the analysis of algorithms, a good math background is also imperative. One cannot evaluate results or assess the efficiency of systems and software without an understanding of the fundamental math concepts on which the methods and algorithms are based.

Business oriented degrees require study of economics, accounting, and databases; information technology programs lean towards networking and databases; and scientific concentrations require extensive study of math and usually a physical science such as physics or chemistry. All of these areas of expertise require math skills, and as with all subject areas, some students tend to be more talented in this area, and it comes easier for them, than for others.

SOCIAL ISSUES AND COMMUNICATION SKILLS

It is often the belief that the computer profession consists of a multitude of computer "geeks" who sit in dark corners somewhere by themselves staring at computer screens. For some, this sounds like a wonderful situation. They would love to work alone

as computer programmers or game testers without having to "dress for business" or interact with others. At the opposite extreme are those students who would find such a position tedious and boring. They abhor the idea of solitary confinement for hours on end, stuck in some basement with stale air and nothing to talk to but a computer. The stereotype of nerd in the closet exists, but is the exception rather than the rule. That being said, it is often easy to pick out the computer science students from the other students, just by their appearance.

The reality is that there are very few such solitary positions. Computer science involves problem solving, and problem solving involves interaction with others: clients, managers, colleagues, and support personnel. The field contains all kinds of specializations, areas to match many personality types, from the outgoing information management, customer service and support personnel to scientific database and system programming to support staff and operations management. All of these areas require some degree of interaction with others, and communication skills are important. A good resume can land a computer science graduate a particular job, but it is her communication skills that will determine how far she advances in her career.

In computer science, it is imperative that one have both good written and spoken communication skills for the conveyance of ideas and concepts. Computer scientists must be able to produce code documentation and user manuals. More importantly, they must be able to communicate with users at all levels to develop system requirements by interfacing with customers. In [1] the importance of all language skills for computer science professionals is discussed, reinforcing the need for such courses as English, speech, technical writing, and even foreign languages. Computer science students need to be made aware of the benefits of such courses in the long run, rather than resenting that they have to take courses "not related to my discipline."

PROGRAMMING SKILLS

A major aspect of the field of computer science is programming. While it is true that computer science includes numerous other things such as design, communication, problem solving, project management, and testing, it is a mistake to think that one can become a successful computer scientist without sufficient knowledge and experience in programming.

In systems analysis one must evaluate current and legacy systems, and knowledge of programming and programming languages is important. It is also critical in system design, as the choice of a programming language suitable for the project is made in this phase, usually before programming begins. Even if a person serves in the role of project manager rather than programmer, knowledge of programming is essential in understanding technical details, communicating expectations, determining feasibility, and allocating human and computer resources to tasks.

Some students majoring in computer science love the field, but claim to hate programming. They hope to make it through programming courses, and then to be fortunate enough to secure a job in the field where they can forget about programming altogether. Some have suggested that they want to be program and system testers, meaning, in essence, that they really want to test video game programs. These students need to be made aware of the fact that programming is a significant aspect of testing. In

order to create massive test data sets, programs are written. Moreover, in white box testing, knowledge of the structure of the code is necessary in order to be able to generate sufficient test cases. If testing were simply running the software and pressing various keys to see if errors result, a degree in computer science would not be necessary. Any unskilled worker can use a system to try to flush out bugs. This is the purpose of beta versions.

Other students hope to avoid programming by being system or database administrators. While these jobs are not usually application program intensive, they still involve setting up scripts for various jobs such as scheduling backups, setting up firewalls, loading data, cleaning data, etc. All of these activities require the ability to program the computer to accomplish a task.

Therefore, good programming skills are essential for computer scientists, regardless of the eventual career path. One must not make the mistake, however, of believing that computer science is nothing more than programming. Programming is only one of many important aspects of the field.

CONCLUSION

Computer science is an interesting and diverse field. It brings together many areas of science, technology, communication, and human relations. Because it is such a broad field, outsiders often have a misguided view of what constitutes "computer science."

This paper discussed several common myths and misconceptions often believed by students and the general public and attempted to dispel many of them. If students have a true picture of the nature of the discipline in which they are enrolled, they will recognize the need for patience, attention to detail, and hard work, and they will be less likely to face disappointment or failure later on in their studies or career. Additionally, with negative myths demystified, many more students might realize that computer science, an exciting and fast growing field leading to many diverse and rewarding careers, is the field for them.

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