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Reflection Paper

Creativity and Innovation in Computer Science

It is a fact that computing continues to shift our world. For example, while computers were first used in weather forecasting as no more than an efficient way to assemble observations and calculate, today our understanding of weather is almost entirely mediated by computational models. Each wave of new computational technology has tended to lead to new kinds of systems, new ways of creating tools, new forms of data, and so on, which have often overturned their predecessors. What has seemed to be evolution is, in some ways, a series of revolutions.

Arguably, the most dramatic of these innovations is the web. During the 1970s and 1980s, there were independent advances in the availability of cheap, fast computing, of affordable disk storage, and of networking (LiveScience). Compute and storage were taken up in personal computers, which at that stage were standalone, used almost entirely for gaming and word processing. At the same time, networking technologies became widespread in university computer science departments, where they enabled, for the first time, the collaborative development of software (LiveScience). This was the emergence of a culture of open-source development, in which widely spread communities not only used common operating systems, programming languages, and tools, but collaboratively contributed to them. As networks spread, tools developed in one place could be rapidly promoted, shared and deployed elsewhere. This dramatically changed the notion of software ownership, of how software was designed and created, and of who controlled the environments we use. The networks themselves became more uniform and interlinked, creating the global internet, a digital traffic infrastructure. Increases in computing power meant there was spare capacity for providing services remotely. The falling cost of disk meant that system administrators could set aside storage to host repositories that could be accessed globally. The internet was thus used not just for email and chat forums, but, increasingly, as an exchange mechanism for data and code. This was in strong contrast to the systems used in business at that time, which were customized, rigid, and isolated. With hindsight, the merging of networking, compute, and storage at the start of the 1990s, coupled with the open-source culture of sharing, seems almost like a miracle. It was an environment ready for something remarkable, but without even a hint of what that thing might be. It was to enhance this environment that then US Vice President Al Gore proposed in 1992 the “information superhighway”, before any major commercial or social uses of the internet had appeared. Meanwhile, in 1990, researchers at CERN, including Tim Berners-Lee, created a system for storing documents and publishing them to the internet, which they called the world wide web. As knowledge of this system spread on the internet (transmitted by the new model of open-source software systems), people began using it via increasingly sophisticated browsers. They also began to write documents specifically for online publication – that is, web pages. As web pages became interactive and resources moved online, the web became a platform that has transformed society. But it also transformed computing. With the emergence of the web came the decline of the importance of the standalone computer, dependent on local storage. The value of these systems is due to another merging: the arrival on the web of vast numbers of users. For example, without behaviors to learn from, search engines wouldn’t work well, so human actions have become part of the system. There are (controversial) narratives of ever-improving technology, but also an entirely unarguable narrative of computing itself being transformed by becoming so deeply embedded in our daily lives. This is, in many ways, the essence of big data. Computing is being fed by human data streams: airline trips, traffic data, banking transactions, social media and so on. The challenges of the discipline have been dramatically changed by this data, and also by the fact that the products of the data (such as targeted marketing and traffic control) have immediate impacts on people. Software that runs robustly on a single computer is very different from that with a high degree of rapid interaction with the human world, giving rise to needs for new kinds of technologies and experts, in ways not evenly remotely anticipated by the researchers who created the technologies that led to this transformation. Decisions that were once made by hand-coded algorithms are now made entirely by learning from data. Whole fields of study might become obsolete. The history and evolution of computing has caused many recent innovative trends in software development to spring up and reach tipping points. These trends are machine learning, speech recognition, automation & digitization, services on demand, intelligent assistants & chatbots, data science & analytics, blockchain applications, Internet of Things Applications, Progressive Web Apps, mobile apps for Android, iOS, and Microsoft, and wearable apps such as for the Apple’s iWatch (Kreyon) (DevOps). Most of these were created from the new rise of wearable tech, and also from searching through Big Data to find out what is popular, what customers like or would want, etc. All of these are very positive changes for our future that will make our lives a little bit easier, all because developers/inventors researched what the people want, and they delivered.

I interviewed two people simultaneously about creativity at Blue Cross Blue Shield Association: my manager, Jeff Norton, and my mentor, Sai Kothuru. Jeff is a Tech Solutions Director and Sai is a Software Engineer III. Both have worked for 10+ years at BCBSA. When I asked them how they define creativity in the workplace, Sai responded: “The work is not art, there’s not too much creativity, but it is valued. There’s a lot of importance. With JaCoCo (Java Code Coverage) being the new thing, nobody knows anything about it, so it is innovative. BCBSA is already a complex ecosystem, and in that you’re trying to plug in something, you need some creative ideas to efficiently do that.” Jeff replied, “Everyday, all the time. Computer science is an art, not a science. There’s no right answer, but many different ways to code, and how u do it is a reflection of you. Creativity is so important.” The next question I asked them was “What are some of the biggest, major innovations you have seen during your career? Jeff answered, “Automation, Cloud, tools, information security Jenkins, automating builds, these have been happening in all aspects of software development. There are tools now that can generate code for you. It’s all automated now. There’s so many frameworks that you can write your code once, build it then automate it. Code coverage testing is automated and saves time for a lot of people. Sharepoint allows workers to coordinate, communicate, and keep everyone alert on what’s going on. It has discussion boards, OneNote, documents, links, acronyms, calendars, and more, all in one spot. I next asked “How do you manage for creativity or communicate change and innovation?” Sai responded, “It’s always good to over-communicate. Use demonstrations and show them a working copy to gain other teams’ trust. There is a lot of communication, both verbal, written, and demos.” Jeff replied, “Giving people respect, understanding, and appreciating their capabilities. Nobody is the same, everybody is an individual, find their strengths, help them grow, identify weaknesses, help them improve. Also, keep everybody trained, exposed to new things, training and seminars so they don't get jaded or complacent. I’m big on training, always looking for new things to learn, watching for trends. We work to live, not live to work, that is not why we're on this Earth." Jeff noted that his leadership style can be described as communication enablement, respect, and leading by example. I next asked them what role urgency plays in the creativity process, if at all. Jeff answered, “Urgency can sometimes hamper/dampen creativity ability. There’s urgency with good stress, and urgency with bad stress like disasters or we need something up and running, quick and cheap, so it depends which type of urgency. If you’re just trying to get something done and there’s constraints, you’re not letting yourself grow as an individual. If the issue is urgent with good stress, you can actually do great work and be laser-focused. In the end it always comes down to the individual.” Next I asked, “What other controlling variables of creativity might you want to call out?” to which Jeff replied, “Early response about training, communication, collaboration, otherwise workers start to falter. Making work fun as opposed to a miserable experience. Making sure the simple things go a long way, like a smile vs. a straight face, good morning vs. walking past without saying a word, little things add up.” Finally, the last question I asked was “What do you predict will be the next big game-changer(s) for your industry/field? Jeff responded, “Without a doubt, Cloud and automation. It’s already happening. Cloud can scale up/down in memory, you pay for what you use, so revolutionary. The Cloud has storage, computing, apps. Now you can build once and deploy it anywhere. Architecting for the Cloud is the future, as well has self-healing applications, which are both happening right now.” This interview was very helpful and even surprising. I wasn’t expecting Jeff’s great answers about how creativity is used in BCBSA. Now I know that in even the least expected companies/industries, creativity always plays an important role for a successful company.  
 Many of the course readings are relevant to my interview and history of innovative change in computer science. We can connect Malcom Gladwell’s The Tipping Point to the evolution of computers. Because of the Law of the Few (that 20% of people do 80% of the work), Mavens were able to inform others of new technology and how to use it, Connectors were able to spread the word of the new tech to many different people, and Salesmen did the persuading to sell the new tech. The Stickiness Factor is applied when positive attitudes are enforced, such as smiling at someone and greeting them while walking by, because a smile evokes an emotion that sticks with you and will make you begin smiling at coworkers. Finally, the Power of Context was applied with the merging of networking, compute, and storage at the start of the 1990s, coupled with the open-source culture of sharing. It was an environment ready for something remarkable: the world wide web. Another reading that intersects with my interview is J. Wheatley’s essay “What is Our Work?” I was surprised to find out that my boss already employs the beneficial and positive strategies of the New Story leader, such as respecting his workers as unique individuals and understanding that they are not machines, but people with experiences, values, and their own personal issues. John P. Kotter’s Increase Urgency ties in with this because he explains how urgency is very important spur on a creative/innovative movement, and I agreed with him. However, my manager gave me a new and interesting perspective that urgency can be good AND bad, and that it really depends on the individual. One more reading that aligned with my research is Richard Florida and Jim Goodnight’s article “Managing for Creativity”. My boss already employs the authors’ 3 strategies for managing creativity: Help employees do their best work by keeping them intellectually engaged and by removing distractions, be responsible for sparking creativity and eliminating arbitrary distinctions between “suits” and “creatives”, and engage customers as creative partners so you can deliver superior products. My manager doesn’t look down on any of his team members. He shows up to all the meetings and even helps them with the tasks to be done, as if he wasn’t even a manager. He draws on their unique strengths and assigns them to a task appropriately, all while respecting their uniqueness and understanding that they have their own lives to live.

Creativity and innovation has always been a huge part of the computer science industry and technology in general. Computer hardware AND software were developed with new customer needs in mind and were further compounded on to evolve into newer technologies, all the way down the timeline until now. To my surprise, creativity plays a larger role at BCBSA than I thought, and probably at other companies as well. I’m glad to be working in a field with so much exciting new breakthroughs and innovations, and in an internship where the boss truly values his employees and their creative potentials.

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