CDLTI Synopsis: Computational Thinking

Justin Lincoln & Albert Schueller

Theme and Execution

This workshop examined our contemporary networked environment, and its effects on our working habits, thoughts, and daily lives. The group members were **Sharon Alker** (English), **Bill Bogard** (sociology), **Sarah Hurlburt** (French), **Justin Lincoln** (art), and **Albert Schueller** (mathematics).

To explore this theme, our group met for weekly discussions in the Fouts computer lab. Each session was one hour. We used *The New Media Reader* (MIT Press) edited by Noah Wardrip-Fruin and Nick Montfort as an overarching guide. Group members took turns leading the week's session. The session leader for the week picked a reading out of The New Media Reader and also provided supplemental literature or online viewing to support the particular topics. To prepare for each week's session, group members reviewed the suggested literature in advance. As the semester progressed, we used The New Media Reader less and relied more heavily on supplemental material. As an aid to this process and to collect commentary outside of the discussion sessions, we created and used the blog http://compthink.wordpress.com. Though the formal phase of the group has ended, we continue to introduce and discuss topics through the blog.

Impact On Teaching and Learning

Based on the individual assessment documents received from the group members, we highlight the major ideas and themes related to teaching and learning that were discussed in the group.

Networked technology pervades every aspect of life and allows information to cross academic disciplines. Students come into the classroom with a background of ubiquitous networked technology. Encouraging courses in different academic areas to connect and interact during the course of a semester, with the goal of sharing information, is desirable.

We all developed a greater awareness of the positive and negative impacts of technology in the classroom. Like any pedagogical tool, technology must be used judiciously and be assessed as it is used. For example, we debated the future of distance learning. Some in the group feel that video conferencing cannot replace the classroom experience, while others feel that the question is still open.

Impact on Scholarship

Here we mention some of the recurring themes that arose in the workshop with respect to scholarship.

Several members noted that exposure to ideas and perspectives from different disciplines have contributed or will contribute to their future scholarship. Some of the ideas mentioned are: the effect of technology on notions of space and time, the use of augmented reality and its effect on society, novel ways of gathering, organizing, and representing information.

Scholars increasingly rely on computers to organize information. We discussed the notion of *verifiability*. How does a scholarly community confer legitimacy upon conclusions that are a result of massive computation that, even in theory, a human could not reproduce?

Specific Outcomes
Here we list some specific outcomes that resulted directly from the workshop.

Albert and Justin are discussing ways in which students in introductory programming and art classes can interact during the semester. Albert is committed to using the Processing programming language, introduced to the group by Justin, in his introductory programming course.

Sarah and Sharon are developing courses in 18th century literature (French and English) that, while taught separately, would overlap in a few common meeting times throughout the semester.

Bill is currently incorporating some of the notions of topological spaces into is own scholarly work.

Recommendations
Some ideas of relevance to the CDTLI program and the College at large.

Since technology was an important part of our workshop theme, including a member of the WCTS staff might have improved the discussions. More generally, allowing relevant staff to join CDTLI groups would provide an additional source of expertise to the workshops.

In a time of limited resources where committing to a team taught interdisciplinary course may harm the missions of two departments, we propose an *interdisciplinary hour* kept distinct from all of the usual time slots. In this hour, coordinated meetings between different classes could occur.

Assessment of Digital Humanities Workshop

Sharon Alker

I entered this course with a solid pedagogical goal – to gain solid information on digital systems that would help me teach the last section (digital culture) of a specific course centered on print culture in Spring, 2012. This course is a naturally cross-disciplinary one, as it focuses on the medium of the culture and knowledge we receive, and thus is relevant to all divisions. I also am working to involve both the fine arts and library staff in teaching the course. What I hoped to gain was a sense of what new technologies were being used that would be relevant to literature and culture, and to acquire a broader idea of theories of new media. What I actually took away from this workshop far exceeded my expectations.

First, I received a plethora of information that will help me with the course. I have a better sense of how we might theorize the influence of new media on the configuration and dissemination of knowledge (and more specifically of culture). Thus this workshop will have a direct influence on the way I teach the final section of a course offered in Spring, 2012. **Second,** by working with colleagues from all three divisions, it became clear to me that we shared common interests albeit not the same language for talking about them For example, the themes of time and space emerged as important, particularly in relation to new media, but also in general. It does seem clear to me that a course (with a thematic constellation) could be designed, perhaps one that could be applied to any one of a number of majors (and in which the student chooses how to apply it), centered on such a theme (Time or Space, or Digital Culture) or that one of us could teach a course on this theme that is primarily centered on our discipline and have others in the group attend as invited lecturers to introduce the ideas of different disciplines into the course.

Third, because Sarah Hurlburt and I (though in different departments) work in similar historical periods, this workshop also gave us a little time to discuss the logistics of designing a course that could cross over our disciplines. Sarah has mapped this out in more detail in her workshop response, but in brief, what it would involve would be teaching different courses (centered on the eighteenth century) with overlapping sections. We would schedule the courses at the same time, and would schedule a series of joint sessions whether the two classes attend lectures together (or I suppose where teachers could also change places). This would allow students not merely to understand what was happening in French or English culture during the period, but also in how the two cultures intersected and interacted.

Finally, I began to see the possibility not merely of cross-disciplinary alliances, but also of more substantial faculty/WCTS staff alliances. In hindsight, it might have been useful to have a WCTS member in our group. I am hopeful that WCTS can become partners with faculty not just in

keeping our systems running smoothly, but also in researching and developing new technologies that fit the needs of the classroom (though I agree with many of my colleagues in this group that technology for technology's sake is problematic). We spend some time discussing technology and pedagogy, and this helped me to affirm my belief that if students are to be able to fully engage in a rapidly changing culture and to understand how the medium through which they receive and respond to information shapes their individual and social identity they need to have some experience with the way new technologies transform culture.

Computational Thinking
Bill Bogard

I thought the workshop was a great success and thank Justin Lincoln for providing the initial idea and stimulus for the workshop. It brought together faculty from quite diverse areas (math, art, humanities and social sciences) to explore the different ways computational systems, digital networks and information technologies have affected not only our research and teaching, but the larger sociocultural environment in which we all work. We discovered we had many common interests in the impacts and potentials, both good and bad, of new media. Presentations and ensuing conversations were stimulating, ranging from pedagogical implications of emerging technologies to discussions of how these systems more broadly affected our epistemological and ontological perspectives. We learned to become more familiar with online resources like blogs, virtual communications environments, and design software. We talked about issues of privacy, intellectual property, knowledge production, social control and the potentials for collaborative learning that new information technologies open up. Our discussions of how information and networks are changing our concepts of space and time and the nature of how we communicate ideas, even ways of perception and affection, were especially interesting and illuminating.

My own academic interests (technology and society, surveillance, social control and communications, contemporary social theory) are already closely aligned with many of these issues, and I currently teach many of these topics in my classes (my course Technology and Society, for example, focuses on information networks, and my theory courses deal broadly with the impacts of digital technology on society and culture). What this workshop did, however, was expose me to a much wider range of resources and perspectives that I can now incorporate into my courses. For example, our discussion of mathematical aspects of digital spaces (their topology, boundaries, structure, etc.) will enhance the accuracy and relevance of the information I provide students in my classes on social networks and communications. Before this workshop, I was not very well acquainted with the use of blogs and augmented reality resources (e.g., Second Life) and their potential uses in classroom instruction. Some of the mathematical/topological concepts we discussed in relation to networks also have interesting applications to theories of social organizations and their structure that I would like to explore further with students and apply in my theory courses. A number of the presentations in our workshop also focused on aesthetic uses of digital resources (e.g., new ways of representing historical timelines that could be very useful in getting students to explore the relations between personal spaces as they have developed over time, new ways of representing those spaces that mix social science, demography, locational identification, art and literature, historical images, etc.). Many of the new technologies greatly enhance the speed and range of information that student

sociologist will be able to access in classroom settings. All these things have interesting implications for exposing students in different ways to get at what C. Wright Mills called “the sociological imagination,” i.e., the connection between personal troubles and public issues that provides the context for much of the empirical research done in sociology.

Perhaps the most important pedagogical lessons I learned from the workshop were not simply how to apply new information technologies to my classes, but to reflect critically about their limits and possible downsides. There are many pressures right now to incorporate the latest software, social networking tools, virtual teaching techniques, etc., to the materials we teach, that we do not step back and think about their effectiveness, their consistency and continuity with traditional goals of education, their use in a liberal arts context, how they change classroom dynamics and structure, and so on. New technologies, in addition to providing many positive ways to enhance teaching and research, also change the spatial and temporal contexts of education in ways that may not always be positive or effective. Face to face exchange of ideas and hands on learning can be diminished if we are not careful, it can become harder to evaluate the truth or falsity of knowledge claims in an information saturated environment, and environment where time becomes compressed, complex issues of intellectual propriety emerge, and the value of knowledge production becomes more uncertain as we all become laborers in this process.

For me, then, this workshop proved to be not only a resource for determining ways I could add new technical innovations to my teaching and research, but also how I might actually subtract some of the things I already do, re-explore and perhaps re-institute some older, more traditional practices (e.g., more assignments on paper, more face-to-face individual interactions with students, less reliance on the internet for information, greater emphasis on verifiability of knowledge sources, more personal and less “virtual” interaction). Computational and information systems are like any technology – they have both positive and negative potentials, unintended consequences, and so on. Not all new technology enhances the learning environment, and we must be careful to try to understand all the pedagogical implications of their use before selecting or adopting them in the classroom or our research. Even so, this workshop provided many stimulating ideas for ways to change and enhance my teaching.

Bill Bogard
Deburgh Chair of Social Sciences
Professor of Sociology
Whitman College

Reflections on the cross-disciplinary group “Computational Thinking”

Sarah Hurlburt

For me, this group has been an enrichment, bringing new information, but also a process of distillation, of deepening and clarifying my thinking about a series of topics that have interested me for a while through discussion with colleagues across disciplines. I tend therefore to articulate the results of our group as a series of questions rather than a series of answers, but a series of questions where the topic of discussion is much more completely articulated, and from multiple perspectives. I’ve organized these reflections under a few key-words below. I’ve used the first person plural throughout, but I want to add the caveat that this is the royal “we” – this is my perspective on what “we” the group discussed about what “we” humanity, think, feel, and perhaps know.

Data

What is data? Is it something that happened, or something that happened *and was recorded*? Raw data / capture suggests the possibility of an unmediated stream of information. Surveillance / recording indicates that information is necessarily recorded from a point of view, that the purpose of the capture necessarily impacts the data itself. We humans are not opposed to the idea of point of view, as long as we trust that the point of view represented by the data capture is indistinguishable from our own; that our own judgement is sufficiently harmonious with the choice of data already made so as to render that first choosing invisible. Essentially, we distrust anything that might alter our access to unmodified data, without questioning our belief in the existence of unmodified data.

This anxiety around the completeness of any data set is both a utopian and a dystopian vision of the recorded life. In the utopian vision of complete data, we would fully experience or benefit from something thanks to the data captured (for example, be fully immersed in a virtual experience such as Second Life, or discover the historical “truth” of a past event, or undergo a surgical procedure too delicate to be executed by human hands). In the dystopian vision of data, we fall victim to the unethical, or merely “other” manipulation of information about ourselves or our world, and in some way suffer as a consequence. This second, dystopian vision of the recorded life is perhaps the only overt sign of awareness of the impossibility of unmediated data–our fear is that through either incomplete capture, or incorrectly mediated synthesis, that we will be misrepresented (end up in Guantanamo, not be elected, etc.), that the “representation”, created by another, will be given credence over the “real”, which may itself correspond to nothing other than our preferred point of view.

Can technology render raw data capture possible? In other words, can technology allow us to surpass the fact that the act of recording is inseparable from a point of view, the choice of what will and will not be captured. A camera might capture indiscriminately what is in front of it, but not capture what is directly overhead; but even a camera which captures everything in a sphere around it cannot represent “neutral” data, for its location cannot help but represent a choice, its recording of events linked to a specific combination of time and place.

Representation

Discussions repeatedly returned to aspects of the representation of knowledge. We discussed mathematical models, and then used those models as metaphors for other kinds of systems. We looked at puzzles as tangible representations of equations, and diagrams as reliable simplifications (every single detail of an object or idea is not included in a diagram, but all details necessary for a particular function or goal are supposedly present). We discussed social, medical, pedagogical and military applications for virtual environments, and whether they are disturbing and insufficient substitutes for "real" world interactions or merely an extension of these interactions, a new media language. We attempted to "denature" narrative conventions and see them as agreed-upon abstractions (which links them back to the virtual) rather than as "real".

Synthesis / Prediction

Synthesis condenses information, and in the process discards and generalizes data. What determines the reliability of synthesis? To what degree is the reliability of synthesis empirical or cultural? In mathematics, this might be represented by the question of whether it is acceptable to create a proof that is not provable by a living human (because it requires too many steps, for example) but that may be executed by a computer.

Our discussions of models of all kinds (note that models generally depend on a process of simplification or synthesis) frequently brought us back to different forms of prediction. Projections of past, present and future systems (systems understood here in the largest sense, social or historical or physical or mathematical or economic etc...) use rule sets to extrapolate beyond what is visible or knowable from the individual present. Our ability to correctly infer the "rules" of a system is dependent both upon our capacity for interpretation (think about the mathematical formula that is unprovable in a human lifetime) and on the quality and completeness of our information – which takes us back to the problem of data. One of the standard tropes in technology fiction is the point at which the computer becomes capable of writing its own rules, thereby taking causal control away from its human designers. At the same time, this trope is merely an expansion of a problem as old as tool-making – the creator of a tool cannot predict or control all future applications of the tool. The blade both reaps and kills.

Examining past and recent-past predictions of present and future times, whose fallacies are now comically (or ruefully) clear, brought us repeatedly to another layer of prediction, which is trying to identify points at which the rules upon which we base predictions are actively changing. Where are our blind spots? What is rule and what is assumption? How can we identify paradigm shifts– points at which the causal forces in the system undergo some fundamental alteration? The speed of technological innovation in the last fifty years has likewise accelerated our prediction cycle, but without necessarily improving its accuracy.

Cross-Disciplinary Learning and Teaching Initiative workshop assessment:

The Computational Thinking Workshop was a weekly highlight of my Spring Semester. Working with, and getting to know, my colleagues in mathematics, the humanities and social sciences was rewarding in personal, professional, and academic terms. I felt like a student again, as well as a colleague, citizen, dreamer, and friend. That combination of roles was invigorating.

Perhaps the single best decision that was made in this workshop was the weekly format that passed the role of moderator/instructor to a different member of the group each week. Occasionally a weekly meeting topic was given a second week to explore a particular issue at more length. While the trajectory of our group research was planned organically, week by week, it seemed to build momentum as we progressed through the semester. Personally I felt like the last month or so of meetings was not simply informative, but also quite stirring.

There always seemed to be a loose and casual consensus about how to move our discussions and workshops forward. In the beginning of the semester we moved weekly from building to building on campus till we settled on regular meetings at the Hickman Digital Lab in the Fouts building. While we borrowed liberally from our listed textbook (The New Media Reader) for pre-workshop support materials, we also provided supplemental reading materials, videos, and experiments. One powerful channel for this is on our group blog : http://compthink.wordpress.com/
Even though our last formal workshop meeting was a week ago the blog continues to be updated. I wonder if it may continue to be updated. Even if the blog is not updated after this point it acts as a wonderful, but partial archive of some of the ideas we explored.

While there was great agreement in how we proceeded I don't believe that there were any particular issues that we all saw from the same perspective. This was neither a necessity nor a goal. While there was great conviviality our group might best be viewed through the idea of a heterotopia, where differences were encouraged, not simply accepted.

The ways that this workshop have found their way into my teaching and research could possibly fill at least a chapter in a book. Most importantly this workshop has helped me articulate a pedagogical position in which I hope to abandon expertness so that I might embrace wonder and learn alongside my students. Technology changes so quickly that by the time someone in my discipline becomes an expert in any particular hardware or software it becomes obsolete. Thus adaptability and a not uncritical openness to the unknown seem to be the best personal means to move my research and my classes forward.

Even after this semester I plan on continuing to stay in touch with all of the members of the group. Sarah Hurlburt and I have started discussing a creative video collaboration that we will be working on this Summer. Bill Bogard's research on "haptics" and networks guarantees that I will continue to be closely following his research. Sharon Alker and I

are both looking forward to eventually pursuing a collaborative project involving the Simpson Center for the Humanities at the University of Washington. Finally, Albert Schueller and I have a great interest in co-teaching a course involving programming and image-making. Currently the staffing of our respective departments precludes creating this course , but we would encourage Whitman to enable such a cross-disciplinary class so that students might directly benefit from this type of initiative.

Justin Lincoln

Computational Thinking Workshop Assessment

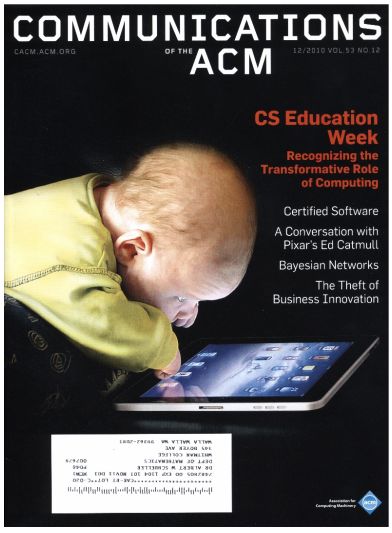
Albert Schueller, Math Dept

May 16, 2011

The workshop was an unqualified success. As stated in our initial proposal, we set out with the goal of exploring the effects of our increasingly networked culture on our professions. There is no question that I now have a new understanding of this issue and that the perspectives of my colleagues from other disciplines acted as a critical component of that new understanding. Rather than recount the specific topics addressed in the weekly meeting I encourage the interested reader to scan our workshop blog.

In addition to this overarching goal, I set personal goals for the workshop:

1. **To prepare for the students we will encounter over the next 10 years like the child pictured here:**



In wide ranging discussions, I learned that our future students will grow up "connected". Their networked lives condense time and space almost to a point and will induce a perspective markedly different from my own.

At the same time, there will be a flattening of information flow. The old top down model of media consumption is being replaced by a vastly more lateralized flow. Everyone is a producer and consumer of media. Our methods of teaching must adapt to this new paradigm. The flow of information in the classroom needs to be lateralized across the curriculum.

Guided creative learning by students that produces work that reaches beyond a mere academic exercise (e.g. creating or editing a Wikipedia article, posting a "mash-up" on YouTube, or writing a web-based applet that demonstrates some scientific concept) and has real-world value will increasingly drive curricula in upper-division courses.

Virtual realities, like Second Life, and video games can be important teaching tools.

Many of the members of the group are incubating ideas that would allow for the creation of new interdisciplinary classes or at least provide opportunities for existing courses to interact with each other.

2. **To understand how new technology affects and may contribute to scholarship in mathematics and in other disciplines.**

   Crowd sourcing research and publication is a growing phenomenon. Data mining the growing mountains of information for patterns and previously unimagined connections using computers is increasingly prevalent. The verifiability of scholarly work is getting increasingly difficult as techniques become more sophisticated and technological. Methods of peer review need to be developed outside of the traditional publishing houses and journal editorial boards as more and more scholars self-publish by simply posting on a web page or blog.

   In this area, I have had discussions with members of my department and other departments about the development of a peer review system for scholarly publications that are released under the Creative Commons license. While growing in popularity, creative commons documents difficult to peer review because traditional publishers are not interested in such documents. As a direct result of this group, I am developing a grant proposal to address this problem.

3. **To engage colleagues from other disciplines in philosophical discussions about technology.**

   I used to think that heavy use of technology was restricted to math and sciences. I discovered that educational and scholarly use of technology in other areas is commonplace. During the semester, I looked forward to and enjoyed my time with Justin, Sharon, Sarah, and Bill and feel that I have developed lasting relationships with each of them.