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INFO.634: Information Technology in Sociocultural Context

13 December 2004

v3.2

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Critical Technical Practice: Selected Practitioners

Those who do critical technical practice are an enthusiastic bunch. The field is young enough to present a unified front, with happy practitioners meeting at conferences, referencing each others' papers and generally spreading the gospel of critical technical practice to colleagues, students, and collaborators. However, a closer reading of the papers points to some discontinuities in the field, and misunderstandings about the relationship of different domains of work within the field. In this paper, I hope to show at least part of these complex relationships, and explore the varying ways those who do critical technical practice do what they do.

Studying critical technical practice by examining the products of its practitioners requires reading a great deal of papers: as successful academics, these practitioners publish slight variations on the same work, refining and adapting their arguments each time through. (Rota 1996 #3). They describe their fields of

work as being (variously and simultaneously) artificial intelligence, human computer interaction, computer science, narrative intelligence, digital media arts, expressive AI, socially situated AI, artificial agents and robotics. To tease apart these widely varying assumptions and methods, I propose a system for differentiating varieties of critical technical practice through a survey of a selection of current practitioners, using their arguments to tease apart and question my own proposals, building what is hopefully a reflexive and coherent picture of the field and its directions for the future. I begin by looking at a previous analysis of critical technical practice, and then continue by looking at how the practitioners characterize their own work by what and where they publish.

First and Second Wave CTP

The reflectivity that critical technical practice encourages its practitioners to employ with respect to their home technical disciplines results in a readiness to apply this reflection to critical technical practice itself. This is perhaps clearest in Noah Wardrip-Fruit & Brian Moss's *The Impermanence Agent* (Wardrip-Fruin, Moss et al. 2001), which includes a look at the practice of critical technical practice. Wardrip-Fruit & Moss delineate first- and second- waves of critical technical practice: they distinguish between the primary use of CTP to solve technical impasses in a technical field, as originally defined by Agre, and by the use of CTP to bring attention to impasses that were not recognized by the technical field. In a discussion of Sacks' *Conversational Map*, they write:

> Agre's work clearly proceeded from a technical motivation, and was caught in a technical impasse, which was worked through using the insights of CTP. But Sack's work, like Sengers's on information appliances, did not begin with an impasse recognized by the technical community. Rather, it began with one explicitly not recognized by the technical community – one to which the technical means of proceeding were blind, but which could be identified via social and critical engagement, and then (like Agre's technical problem) only effectively grappled with using the insights of CTP.

They later conclude:

> Whether the philosophical/critical issues come into play upon running into an impasse in the technology, or the technical issues come into play upon running into an interesting critical/philosophical problem, if the motivating problem is addressed through a creation of technological artifacts and a cultural engagement that are pursued *as one activity* – informing each other, and calling any set of assumptions (however recent, however "technical") into question, then the practice can be called CTP.

Thus, in essence, first wave CTP is fundamentally rooted in technical practice; second wave can start inside or outside the technical discipline .[1] As a good, enthusiastic graduate student, my natural reaction upon seeing a four-year-old paper describing first and second waves is to attempt to characterize the third wave that has, of course, risen up since the fuddy-duddies writing and written about in this now-archival piece did their work. On the way to finding out if this foregone conclusion is useful or necessary, instead, I propose two sets of distinctions that I think may be instructive to make in the aggregate set of work done by those calling themselves critical technical practitioners.

The first distinction is precisely the distinction Wardrip-Fruin et. al. make between first and second wave critical technical practice: the rootedness of the initial approach in the technical field. The second distinction is a little more tenuous, and concerns itself with the disciplines that these practitioners see themselves drawing from and contributing to. In particular, I make a distinction between those who do and do not see themselves as artists. I suggest that there are two perfectly valid ways to do critical technical practice: the two-footed approach, drawing from the building-work of technical practice and the reflexive work of critique, and the three-legged approach, again utilizing technical practice and reflexive critique, but incorporating artistic and creative skills.[2]

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[1] When do waves stop? I googled successive ordinal numbers of waves: "first wave", "second wave". Results scale down from 993,000 to 6,100 hits for 1st through 6th waves, with a surprise return to 44,100 results with 7th wave. Back down to 800, 31, 833, and 121 hits for 8th through 11th waves with near-extinction at only 2 uses of "twelfth wave", but it limps on in the double digits until eventual demise at 17th wave. There is no seventeenth wave.

[2] My deliberate mixing of bodily metaphors is to remain consistent with various practitioners' terms. Phil Agre (1997b) states that critical technical practice will

I do not pretend to provide a full and complete list of those who do critical technical practice; such a survey would be impossible to do at all well in a work of this size. Instead, I present a sampling of those I consider particularly relevant to defining the field: Philip Agre, Noah Wardrip-Fruin and Brian Moss, Simon Penny, Phoebe Sengers, and Michael Mateas.

This indeed misses out on researchers who are doing excellent and important work, and who consider themselves to be actively engaged in critical technical practice, such as Paul Dourish, Warren Sack, and Mark Bohlen. It also misses many digital practitioners whose work could instructively be characterized as critical technical practice, such as Natalie Jeremijenko, and Brenda Laurel. I also leave aside a discussion of practitioners outside of digital practice at all, such as Martha Crouch's work incorporating cultural studies with botany, or the late Gian-Carlo Rota's incorporation of Heideggerian philosophy with mathematics. These would all be useful additions to a more in-depth look at this issue, and areas of research for a further paper. However, I hope the sampling I have chosen is sufficient to provide a sense of the field.

"require a split identity – one foot planted in the craft work of design and the other foot planted in the reflexive work of critique."

Simon Penny is quoted by Wardrip-Fruin et. al. as saying that

"...digital media art demands a tripod structure... These parts are: cultural studies (particularly science studies) and critical theory; technical knowledge and skills in both hardware and software; and artistic and creative skills."

Philip Agre

As the now-departed founding father of the field, Agre's work serves a particularly defining function. The development of critical technical practice was in many ways in reaction to the environment of classical artificial intelligence at MIT's AI Lab. It was necessary for Agre to ground his own reflexive and critical work in the technical practices around him as so to be able to relate to or converse with his fellow researchers. Critical technical practice was not conceived as a lofty ideal, or a theoretical construct, but as a way to justify his own intellectual practices in the eyes of his colleagues.

Agre defines critical technical practice as 'a technical practice for which reflection on the practice is part of the practice itself.' (Agre 1997 xii), but his implementation is somewhat different. It focuses on learning from another discipline, and taking advantage of the way that other discipline views the world. It's this situation in a highly technical argument that produces the conditions necessary for the development of critical technical practice in the first place, and it arguably necessitates Agre's conception of critical technical practice as a tool to produce meaningful change in a technical practice blocked by reoccurring impasses.

The need for both a working explanation and a working practice is explicit in much of Agre's work on critical technical practice. In his dissertation (1988) and

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Alas, I have no control over my subjects' choice of bodily metaphors.

later in his book (1997), Agre presents Pengi. Pengi is a program that plays the game Pengo according to notions of deictic representation: it's a specific implementation of an artificial intelligence theory. (Agre & Chapman 1987) It's also, practically speaking, a successful implementation: "...it is a little better than I am [at playing Pengo], which is to say it wins from time to time and usually puts up a good fight." (Agre 1997 265)

It's clear that the rhetorical force of Pengi is a powerful way to communicate to a technical field in which the way to demonstrate the power of an argument is to solve a problem better than anyone else. (1997b Section 6) In the same paper, he states recognizes that such an argument is 'wrong' for a variety of reasons, but nevertheless Pengi is a key part of his argument's strength.

In our schema, Agre is easy to place: he is doing first-wave critical technical practice, grounded in technical practice, and far away from any thought of digital media art.

Noah Wardrip-Fruin & Brian Moss (with a.c. chapman and Duane Whitehurst)

Let us return to Wardrip-Fruin et. al. and try to categorize their work, *The Impermanence Agent*, in terms of our schema.

> The Impermanence Agent is an artwork that operates as functions of the user's Web browser... the artwork becomes a peripheral part of the daily browsing experience.
>
> When *The Agent* is engaged, user browsing causes a story to be told. This story is experienced in a corner of the PC screen, over a period measured in days rather than minutes. And while it is presented in a small Web browser window, *The Agent*'s story does not act as other Web content. It will only move forward as the user clicks on *other* websites (those not associated with *The Agent*), and there is no way in which to "click on" or navigate *The Agent*'s content directly. Simultaneously, *The Agent* monitors the user's Web traffic, and... continually alters its story using material from the user's browsing. Over the time *The Agent's* story is told, the story's contents are altered until they are nearly entirely determined by browsing actions of the individual reader. (13-14)

It's clear from this description that there are both interesting technical and critical elements occurring here. On the technical side, there's the production of a story that is dynamically modified over time. As the paper continues, the authors describe the complications of the story through automatic techniques such as hyponym replacement, sentence recombination and image customization. There's clearly some degree of a drawing from and a contribution to technical practice, even if it is not fully substantiated in the paper itself.

There's also an interesting cultural critique happening here, about the role of narrative, questions of mass-production, mass-customization, and the space for individualized and yet un-user-controlled art when other experiences are so user-controlled. More specifically, there's a critique of the rhetoric around agent architecture:

> We talked about agents as anthropomorphized maps, mediating our interactions with digital space, and giving us a means of circumventing these problems ["too much" information, no "quality control", impermanence] of digital culture. We thought we'd... provide an experience emphasizing, rather than hiding, the supposed problems of the Web – broken links, the fictitious data, and things that don't interest us (or make us uncomfortable)... We set out to construct a Web artifact that we would describe as an agent, that would function as an agent engaging in a discursive practice of our design, and that would simultaneously serve to question the grounds and goals of other Web artifacts that are presented as agents. (14-15)

So how does this work fit into our schema? Unlike, say, Pengi, *The Agent* is clearly draws from cultural critique, technical practice, and art. But its contributions are harder to judge. It clearly does contribute to digital media art practice. The paper on the project is relatively widely cited, and with its

unconventional mixture of personal narrative and project discussion is clearly written with the intention of conveying at least some of the experience of using *The Agent* to the reader.

It's harder to decide whether we can define it as contributing to technical practice: there are clearly novel technical parts of the work, but it's fundamentally an art work, and the authors do not publish their contributions in technical journals or to technical societies. As such, I'd characterize it as second-wave critical technical practice, with contributions from and to digital media arts.

Simon Penny

Perhaps the practitioner most easy to place in this schema is Simon Penny. His work is tightly defined by his drawing from cultural studies, technical practice and artistic skills: Wardrip-Fruin et. al. quote him, speaking in 2000 on a panel about critical technical practices:

> I've maintained for some years that well informed and productive digital media art practice demands a tripod structure, three legged things being inherently stable. These parts are: cultural studies (particularly science studies) and critical theory; technical knowledge and skills in both hardware and software; and artistic and creative skills, by which I mean not simply how to wield a

> paintbrush, but the basic skills of idea development, project design and development, aesthetic reasoning and self criticism.

This combination can be seen clearly in his research, such as *Petit Mal*. *Petit Mal* is an autonomous robot that uses minimal hardware and processing to interact with its audience, moving back and forth. (Penny 1999) It questions our assumptions about machine behavior, and indeed our assumptions about the motivations and worldviews that must produce complex behavior in general. Penny admits – even asserts – that the hardware and software to produce this behavior is as simple as possible, a quick-and-dirty solution that works 70% of the time. It places the technical robot in a cultural environment, and cements the notion of agent- and robot- building as a cultural, and not just a technical act.

Penny's work is clearly both second wave technical practice and digital media art. It contributes to critical theory and to digital art practice, but he does not present his work as a contribution to technical practice in any way other than through its existence. He does not publish in technical journals nor attend technical conferences, but, importantly, Penny is in many ways at the forefront of using critical technical practice as a means for building digital media art.

Phoebe Sengers

Sengers is recognized as one of the leading critical technical practitioners. Her work is strongly rooted in the cultural studies of science and technology, in

artificial intelligence, and in an understanding of narrative psychology, particularly with respect to schizophrenia. Her doctoral thesis, *Anti-Boxology* (1998) developed an agent architecture called the Expressivator which is designed as an alternative to current schizophrenic, unsituated agent systems by providing context, temporality and motivations in a virtual environment.

In this work, Bruner's notions of narrative psychology are a critical tool to both unpack problems inherent in current agent design strategies and to suggest such an alternate approach. They were originally a critique of different practice (that could be argued as being technical), namely clinical psychiatry; the innovation comes from their application to the domain of agent design. However, it's the combination of this critical tool and the technical domain of artificial intelligence that results in the critical technical practice of socially situated artificial intelligence, or SS-AI (Sengers 2002, 2004), and her work in narrative intelligence.

Her later work has also been in the domain of critical technical practice, even when it is situated in a different technical field than artificial intelligence, namely human-computer interaction. Her (2003) work with Höök and Andersson reversed many of the assumptions around critical technical practice, by using tools from technical practice (again, namely HCI) to question and propose new evaluation techniques for digital media arts. Sengers & her collaborators applied these questions to one of her earlier works, *The Influencing Machine* (Sengers et. al. 2002) which itself questions our assumptions about what technical practice

can consist of, and particular the role that emotion can possibly play in machine intelligence.

So how does Sengers fit into our schema? Her work talks of "the technical practices of computer science and engineering and the critical practices of cultural studies and the humanities" (Sengers 1999), without a mention of digital art practices. Narrative psychology is clearly of importance (Mateas & Sengers 2003 Ch. 1) to her work, but it functions another technique of critique. She contributes to digital art practice – such as her work on evaluation – but it is not clear that she considers herself an artist.[3] I would suggest that Sengers is best categorized as being, like Agre, situated with a foot in both reflexive, critical practice and generative, technical practice. What differentiates her from Agre is her contribution to both technical and critical fields: her publications include both cultural theory and technical journals. As such, I would suggest that this model may well be our sought-after third wave of critical technical practice: drawing from both critical and technical work in the manner of second wave work, combined with deliberate bifurcation of the output into contributions to both disciplines.

Michael Mateas

[3] In the prefacory matter of their respective *Leonardo* articles, Sengers refers to herself as "researcher"; Mateas refers to himself as "artist / computer scientist."

Michael Mateas is a professor in Literature, Communication and Culture, and the College of Computing at Georgia Tech. He refers to himself as "artist, computer scientist" (Mateas 2001), and to his work as 'Expressive AI', which he describes as having:

> 'two major, interrelated thrusts: (1) *exploring the expressive possibilities of AI architectures* – posing and answering AI research questions that wouldn't be raised unless doing AI research in the context of art practice, and (2) *pushing the boundaries of the conceivable and possible in art* - creating artwork that would be impossible to conceive of or build unless making art in the context of an AI research practice.' (Mateas 2003)

It's immediately obvious that we're seeing something a bit different here from Agre's original conception of CTP. In particular, we're seeing the notion of interdisciplinary work contributing to both the technical and critical fields. However, Mateas also says that 'expressive AI is a stance or viewpoint from which AI techniques can be rethought and transformed.

Expressive AI is a description Michael Mateas has developed to explain what it is that he does. In many of his papers, he heads the description his projects as "AI-based Artworks", (Mateas 2000, 2001, 2003) which is indeed accurate but perhaps underemphasizes his contributions to artificial intelligence. For example, he describes his latest work, *Façade* (Mateas 2003), as "an artificial intelligence-based art/research experiment in electronic narrative." This

includes the development of ABL (A Behavior Language) for authoring coordinated, multi-character dramatic action. It's descriptions like this that sound like technical work, not art. However, a look at his publications record[4] shows a focus almost entirely on publications for the digital media art domain, rather than artificial intelligence, particularly in the last few years.

Mateas's Tripod & Critical Technical Practice

In terms of our categories, Mateas takes a three-legged approach to critical technical practice. In his (2004) response to Sengers's essay on electronicbookreview.com, he states that in his work, "Cultural theory serves as the transducer, the relay between art practice and technical practice." However, he then turns our theory on its head, by claiming that "This tripartite structure is visible in Sengers' and Agre's work."

He describes the former:

> In Sengers' case, schizoanalysis and the critique of institutionalization (critical theory) diagnoses a problem in reactive agent architectures, while Brunner's narrative psychology (psychology) when understood within the heuristic matrix established by the schizoanalysis of agents – produces new knowledge in both AI (a technical solution and, more importantly, a

[4] http://www-2.cs.cmu.edu/~michaelm/general-vita.pdf

> story about that technical solution) and narrative psychology (it says something new about Brunner's theory through concrete actualization.)

And the latter:

> In Agre's case, deconstruction (critical theory) is used to invert hierarchical oppositions latent in AI research (particularly the inside/outside master narrative of mind/world), while phenomenology of everyday life (ethnography, micro-sociology), when understood in the heuristic matrix produced by the deconstructive analysis, produces new knowledge in both AI (a technical solution and accompanying story about the technical solution) and ethnography (it says something new about ethnographic understandings of life routines through concrete actualization)

So do these categorizations invalidate our structures? The first point to note about the tension between these tripartite structures and our categorization of these individuals as doing critical technical practice within a two-legged system is that the third leg is not art practice. In Sengers' case, it is narrative psychology, and in Agre's, ethnography. But neither identify themselves as having a three-part structure to their work. In the title of her (1999) paper, Sengers describes her work as "integrating cultural theory and artificial intelligence"; Agre

describes his work as requiring “the craft work of design” and “the reflexive work of critique” (1997b).

And here, I suggest, lies the essence of critical technical practice. The enormous change that Agre brought to the practice of artificial intelligence was not an ethnographic description of his experience with spoons falling in the sink, but the notion of bringing reflexivity to technical practice. (Bloor 1978 p7) Mateas is correct in that Agre incorporates ethnography and critical theory in his understanding of the practice of artificial intelligence, and Sengers brings both narrative psychology and critical theory to her understanding of the practice of artificial intelligence. Furthermore, it is true that the generative and iterative nature of academic work means that the novel use of a theory arguably invariably contributes to the further development of that theory itself.

But the facilitation that sociological, critical and philosophical practices bring to a technical field is the reconsideration of the core metaphors of the field. Narrative psychology is indeed different from critical theory, but there is almost endless subdivision of the various techniques that can be used engage in reflexive analysis of a technical field: in fact, I suggest that (in common with many systems of innovation), it may not actually matter what thought system is used to critique and question a technical discipline, as long as it is coherently and rigorously applied.

What, then, of the role of digital media arts in critical technical practice? Without diminishing its import in any way, it seems as if artistic practice serves as another input and output into practitioners' working processes. Insights from digital media arts – such as the dramatic persuasiveness of *Family Portrait* cited by Penny (1999) – can feed back into technical projects, which in turn are artworks themselves. There is a richness and vitality that comes from these successive, changing, partial perspectives on such work. The results influence not just the technical projects themselves but other theories, artistic, social, critical or philosophical, that feed into and grow from their use informing technical practice. Digital media art practice is indeed rich and productive in many ways outside of its immediate domain, but it is not the only way to critical technical practice.

Third Wave Critical Technical Practice

Let us return, then, to our bright-young-graduate-student quest for a third wave of critical technical practice. To review, first wave critical technical practice uses one or more critical practices to bring insight and reflexivity to a technical field experiencing repeated impasses, resulting in technical change and innovation. Second wave critical technical practice may start from technical practice, or from 'critical engagement with the culture', but relies on the creation of technological artifacts and cultural engagement 'being persued *as one activity* – informing each other, and calling any set of assumptions (however recent, however "technical") into question.

As such, I suggest that third wave critical technical practice is characterized by a coherent attempt to *contribute to*, and not just draw from, both technical and critical disciplines. Third wave does not suggest that it is inherently better than second wave practice, much as second wave is not superior per se to first wave critical technical practice, but this distinction provides an understanding of the different ways practitioners approach their work, and a decision to be made in doing critical technical practice.

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