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INTERVIEW 5

Network Societies 2.0: The extension of computing into the social and human environment

Ulrik Ekman

Ulrik Ekman is well known in the field of digital studies as editor of the 2013 MIT Press compendium *Throughout: Art and Culture Emerging with Ubiquitous Computing* and co-editor of the 2015 Routledge anthology *Ubiquitous Computing, Complexity and Culture*. His main research interests are in the fields of cybernetics and ICT, the network society, new media art, critical design and aesthetics, as well as recent cultural theory. His publications include research articles and chapters such as ”Editorial: Interaction Designs for Ubicomp Cultures” (*Fibreculture* 19), “Design as Topology: U-City” (*Media Art and the Urban Environment*; Springer 2015), and “Of Transductive Speed – Stiegler” (*Parallax* 13.4). Ulrik Ekman is a trained computer scientist who worked for years as a systems programmer and systems planner before studying in the humanities (languages, the arts, literary theory, philosophy, cultural studies). He works now

as Associate Professor at the Department of Arts and Cultural Studies at the University of Copenhagen.

Ulrik Ekman discusses the (assumed) democratic potential of digital technology and social media, the haunting of Turing's ghost, the third wave of computing as its extension into the social and human environment and externalization of psychological individuation in techniques. He talks about the role of algorithms as means of personalization and foreclosure, the affirmative and subversive energy of surveillance art, the transdisciplinary call of media literacy and the 'interpellative' aspect of participatory culture.

Prelude

Roberto Simanowski: If you could go back in history of new media and digital culture in order to prevent something from happening or somebody from doing something, what or who would it be?

Ulrik Ekman: It would be quite interesting to have been in a position to insert some kind of critical wedge in a relatively important situation back in the 1930s when Turing came up with the model of the computer as a universal machine. This notion of a universal machine with the potential to simulate all other machines and their programs almost founds and certainly forms the context for what can be called "digital media studies" and "digital culture." It has been incredibly influential, first as an idea, then as a model and a sort of blueprint, and then not least for the making of ever so many real computers. If I wanted to make different noise and disturbance here, this is motivated by the tensions in Turing's thought, the tendential idealization of the modern computer, as well as by the questions raised by contemporary developments in the culture of ubiquitous computing. I continue to question the tensions between the finite and the infinite, the discrete and the continuous in Turing's work. One cannot but note the tension: all real computers must by necessity remain finite and discrete, but in order to take on all computation

they must have infinite and continuous memory. A disturbance here would almost certainly have deconstructed the ideality so as to afford openings of different epistemologies of computation. These, or some of these, would be less than universal, perhaps general, perhaps particular, perhaps oriented towards the singularity of computation. Some of them would surely also deviate from ideality towards questions of various real embodiments of computation in machines.

RS: What would have changed through such a disturbance?

UE: In a sense, my wish to disturb stems from having just one apparently simple question in mind: are the computational units of current developments in the culture of ubiquitous computing still modern computers of which one could say that they are truly Turing heirs? If the heuristic idea of ubicomp today is supposed to be one of computation qua embodied virtuality in operation, if the diagram today is supposed to be a human-oriented, context-aware, and calm computing, and if such a diagram maps out in practical concretizations as multitudes of wired and wireless computational infrastructures with decentralized distributions of sometimes highly specialized units demonstrating mobility and ad hoc networking... are we then still talking about modern computers? Do you still want to think of the link between a sensor and an actuator in a dynamically connective and mobile network dealing only with the temperatures of 200 square feet in a forest or a field as something involving a universal machine? So, my wish to make different noise with and against Turing has quite a bit to do with seeing a need for a revised set-up of theoretical ideas. I also see a need for recognizing another set of existing blueprints or diagrams for computation and computers. Not least I affirm a need to observe that saying “digital culture” today often implies that we are already living with an enormous and growing set of real computers that might be becoming different together and have us exist differently, too. I am still not done with the intricacies of Turing machines, but perhaps we can return to this later.

Politics and Government

RS: From early on the Internet has been attributed with democratic value as a new public sphere of radically liberated communication, an update of Habermas' model of deliberative democracy. With the Web 2.0 the promise even increased with keywords such as participation and transparency. During the last years, however, a critical turn in digital media studies has pointed out the perils rather than the promises of the Internet, Web 2.0, and mobile media. How do you see this matter?

UE: How can it be that one can come across arguments during the 1990s that the 'information society' and 'cyberspace' are more or less inherently 'democratic,' that they in and of themselves offer a new kind of 'community' in a way that earlier social and cultural studies had apparently left as an unresolved matter; and that they give us the kind of 'public sphere' presumably requested in the wake of the semi-demise of much Frankfurt School theoretical work? I am still amazed that critical engagements with these kinds of lines of argument have either tended to be too absent or to peter out relatively fast. One of the things behind my wish to have been inserted as a critical wedge at some relevant point in this broad discursive development is that it seems to repeat itself without enough of a difference that makes a difference. When we get to the period around 2005, we see much the same kind of statements being made, only now it is in the main a question of the positive potential versus pitfalls of social media, blogging, micro-blogging, and then mobile media.

Of course, it is not that critical efforts are entirely absent – I recall self-reflexive efforts in the media and in journalism, alongside research articles discussing this critically, and a number of reconsiderations of the work of Durkheim, Raymond Williams, Habermas, Giddens, Castells, and more. However, these efforts were inconclusive, did not lead to any consensus, and dwindled away within a five-year period. In the next cycle, from 2005 onward, the critical engagement is actually much weaker, smaller in scale, and even less influential. Considering the demise of the Left, the broad socio-historical developments

after 1989, and the impact of liberalisms on globalization processes in a broad sense, this is hardly surprising. Nonetheless, I would still like to have disturbed this tendential silencing of critical or alternative or differential thoughts.

RS: Maybe it was even this, the declared end of Grand Narratives and of History, as competition between different socio-political models, that made all desire for a better world emigrate into new media, hoping technology would save us from post modern and post historical frustration.

UE: I think we agree on now being able to identify a certain historical and theoretical rupture here. Perhaps you are right that some of the perceived losses in this have fueled some of the remarkably strong interest in new media as well as science and technology studies. It might be an exaggeration, however, to say that all desire and all hope emigrated to these fields. Perhaps it would be more accurate to say that one finds here a rather strong tendency to idealize and emphasize rather one-sidedly what appeared to many as the positive potential in these developments. To my mind this still calls for different critical reevaluations. Today it remains interesting and non-trivial to ask in what senses computers, computer science, and cybernetics as the discipline of steering and control could be said to afford media, mediations, and communicational platforms for 'democracy,' 'community,' and 'public spheres.' Something analogous goes for the ethico-political potential of networks, network (dis) organizations, and network protocols to be 'democratic,' 'social,' and capably open to differentiated debates with a certain reasonableness and egalitarian influence. Network societies, decentralized networks, and the overriding concern with security and control of infrastructure and information with a view to survival originated not least in post-WWII military-industrial complexes alongside a small number of university research centers in the Western hemisphere. The numerous ethico-political and sociocultural tensions and differences inherent in this have neither been resolved nor yet been treated thoroughly and convincingly in existing research nor in the media, in my opinion. If that

were the case, we could not today be witnessing in the media a late outcome of the post-9/11 ethico-political coupling in 'democratic' network societies of terror, security, and surveillance. I am thinking not just of the quiet acceptance or affirmation of the 'need' for surveillance by the people in many 'democratic' nations, nor just of much needed momentary alternate wake-up calls like Snowdon's, but of how disturbingly exceptional it is to see influential prime ministers object publicly to foreign intelligence services tapping their cellphones.

RS: If you allude to the German Chancellor Angela Merkel, I am less surprised than you that she abstained from serious reproaching her ally United States – in contrast for example to the Brazilian president Dilma Russeff who used her objection against the U.S. to overcome the *Vemprarua*-turbulence in her own country. While in the 1990s, regarding the Internet, the government in the Western World experienced itself "at war with our own products," as Klaus Lenk put it in the 1997 edition *The Governance of Cyberspace*, today all governments of the world are certainly relieved that the anarchy of the early days has morphed into the regulation and control we experience now. 9/11 is only an excuse for what was already clear after Perry Barlow's 1996 *Declaration of the Independence of Cyberspace*: That the "Governments of the Industrial World" will *not* leave alone "the new home of mind" as Barlow describes the cyberspace.

UE: In my earlier remarks my focus was somewhat more limited. My attention was on one part of the political axis, notably the post-9/11 developments concerning intimate linkages among terror, national security, and surveillance – up to and including the current operations of the NSA. Today some of the more critical and heated exchanges among the U.S. and several European nations concerning the politics of surveillance appear to have worrisome potential outcomes. The messages from Germany, France, and others make it clear that the Internet and the WWW as we have known them should perhaps not be taken for granted. We might see the reappearance of strictly regional and not least strictly national politics of informational security and

surveillance that will imply so many deconstructions of the very idea of a decentralized global network of networks such as the Internet. Of course, such politics have always been there, but increasingly strong general strictures of this national sort would still mean an incredible loss of potential for the development of network societies on a global and more cosmopolitan scale. The "new home of the mind" that you mention could very well come to stay much closer to your physical national territory and its political governance.

RS: As for the "new home of mind" these 15 years later, your collection of essays *Throughout. Art and Culture Emerging with Ubiquitous Computing* 2013 with MIT Press presents almost 700 pages with essays by more than 40 leading researchers on digital media and cultural theory from a vast array of academic fields with quite different perspectives on the promises and perils of computing. What are the most interesting or challenging aspects to you about this topic?

UE: During the period we have worked on the book (it started in 2008 via a Danish but very internationally oriented research network), ubicomp, pervasive computing, ambient intelligence, things that think, and the Internet of Things have become much more of an empirical fact. Enough so that we have net addresses and a net protocol with the capacity to deal with the billions of computational units involved, enough so that these major lines of development are becoming solid parts of the latest editions of the standard textbooks in computer science, hardware engineering, software development, and HCI. And enough so that a great many people in the world are beginning to notice that the ground is shifting here and there underneath network societies that now begin to move from a phase one to a phase two, expanding and intensifying networking problematics along the way.

RS: Can you illustrate this shift to a phase two and the problems it contains?

UE: For example, even in a very small country like Denmark one finds a handful of research groups at work on 'pervasive

healthcare,' something whose massive distribution and use of smart computational things and wirelessness might well soon alter our notion of the home, healthcare, and how to address the elderly in nations with a demography tilting in that direction. Or consider the first dozen intelligent cities, smart cities, and u-cities now being built with some kinds of ubicomp capacity from the ground up. These are experimental projects in South-East Asia mostly, but also factual developments in an epoch with an intensive interest in the development of edge cities, megacities, and new kinds of urban regions. But I should still start by stressing that on the other side of the initial visions from Mark Weiser and his Xerox Parc colleagues along with many others in Europe and Asia, multitudes of technical issues remain unresolved. The cultural dimension remains very much more underdeveloped both in research and in cultural practices. This is an asymmetry that this book is trying to address and change a bit by focusing somewhat more on the cultural and human sides of this.

RS: Ubiquitous computing furthers the information society we live in by extending the presentation and processing of information beyond computers. The new buzzwords, you already said it, are *Internet of things* or *programmable world* referring to objects that talk to each other and process information even without presenting themselves to us. Advocates speak of the swimming pool that heats up when it sees there is a Barbecue on the calendar, they project the fridge that automatically restocks, and they hope for sensors attached to asthma inhalers mapping their usage to communicate areas of risk as part of that 'pervasive healthcare' you mentioned. Skeptics, on the other side, warn of even more loss of privacy as well as of malicious hacks into shopping lists, cars, and pacemakers. How do you see this development? Are the perils worth the benefits?

UE: Thank you for your insistence on pressing these issues of critical evaluation. I hear more than a faint echo of your last question here, so let me return to the interesting and the challenging, the benefits and the perils... Perhaps there is only one issue, perhaps Simondon saw this already. It might be he was

right that the organization of complexity is a phylogenetic aim which belongs to biological species but finds interesting analogies in the way technical objects and systems exist. The most interesting and the most challenging, the benefits and the perils are but flip sides of this: ubicomp cultures design complexity and this is their frontier. Technically speaking, the passage of time and all the repeated design processes make ubicomp objects and systems pass through successive modifications. This tends to have them develop from more abstract and diagrammatic states to more concrete states, something we are approaching today in rudimentary ways. The benefit-peril here is that ubicomp systems are called upon to move from a more or less self-referential performance structure (not entirely unlike what you tend to find in Turing machines) to one that is hetero-referential.

RS: That means the systems are open to their environments?

UE: Ubicomp systems are precisely not to remain disconnected from the context but are to become gradually *more* contextualized in a process of mutual adaptation of system and context or environment. This is a route that leads towards the more complex – the solution of complexity is a phylogenetic aim, as Simondon liked to say. It is interesting-challenging that adaptation to context is still truly difficult for computational systems, and that 'context' here tends to mean both the real/virtual environment *and* its human inhabitants. There is a reason for the nicknaming of these main lines of development (ubiquitous, pervasive, ambient, etc.): they are all taking names to suggest the expanded character of computation and computing. So, pressed by your questions I would point to these two main sources of beneficial-perilous complexification: context-awareness and adaptation to the *anthropos*, both of which will demand the production and recognition of meaning.

RS: As for the expanded character of computing, this reminds me of McLuhan's take on media as extension of man. Since the computer is already such an extension, are we then talking about the extension of extension and should we, since McLuhan considered such an extension at the same time an amputation of human

capacity, also talk about the expansion of amputation? With the words I used before: What about malfunctions and hacks in complex context-oriented computational systems?

UE: One large part of computing in the expanded field concerns such extensions of man. But perhaps your remarks stay a little too close to the anthropocentric. For approaching current developments along this path might often lead to blindness or forgetting of the more singularly technical relationalities, including those of autonomous agents communicating among themselves without any human interception. Naturally, this might be what you have in mind when referring to McLuhan's notion of amputations of human capacity. To my mind, the use of this term would then tend towards a too one-sided and negatively critical approach. Moves towards autonomous technical individuations also involve inventions of the other that might be less of an amputation than an augmentation, for technical as well as human systems. So, amputation is obviously one important dimension in this, but only one of them. Something similar goes for malfunctions and hacks. It is obvious that an increase in complexity of human and technical systems and their interrelations paves the way for what can become an exponential rise in the number of malfunctions and possibilities of hacking. Moreover, if the ideas of the invisible computer and calm or embedded computing are privileged in research and development, malfunctions and hacks can become extraordinarily difficult to recognize and counteract as such. Nonetheless, all malfunctions and hacks come freighted with potentials for invention and positive improvement.

I would like to affirm the initiatives to move towards a human-oriented computing, and I am excited about the challenges and difficulties of having technical and human context-awareness co-develop. Still, I am deeply unsettled and disturbed by a range of the ethico-political implications in both the visions for this and in a range of the kinds of implementation we can already find and follow today. It should be obvious reason for concern that the ongoing work on new technical infrastructures with something like ubicomp processual capacity also means infrastructural

and infraprocessual acceptance on a societal level of monitoring, surveillance, tracking and tracing, information gathering to a degree and with an intensity we have not yet known. The cultural theoretical uptake and the broader social debate are lagging behind or might be almost missing. But even the engineers and system planners know and make explicit that trust, security, privacy and the secret, ownership of information, and transparency remain major issues still to be dealt with. I look forward to seeing the development in tandem of the technical systems and the sociocultural dimensions to go with and against these.

RS: I completely agree with your notion about the lagging and lacking theoretical uptake of the technological development. Let me press you a bit more on the new technologies' ambivalence of great opportunities and unwanted but perhaps inevitable consequences in the ethico-political regard. Pervasive computing has found its own popular movement in what is known as Self Tracking, Quantified Self and Living by Numbers. Of course, the pervasive data aggregation in the name of self-knowledge and self-optimization facilitates big data mining and helps paving the way to pervasive control and algorithmic regulation. Here we encounter a problem similar to Simondon's phylogenetic desire for complexity: the desire for knowledge. A major method of gaining knowledge is to measure and survey, which in the age of digitization and datafication leads to a boost of empirical sociology beyond the academic field. The flipside of conducting measuring, however, is taking measures. No government, no health department, no insurance company or credit institute can afford not to react – or, better, take preemptive actions – if certain patterns and correlations of behavior are established. Knowledge obliges. The results are regulations justified by algorithmic analysis enforced by ubiquitous computing – unless society decides, for ethical reasons, to forbid certain knowledge or its utilization. But who would argue against the desire to know?

UE: It is obviously unrealistic, unnecessary, and also to a large extent undesirable to argue against a desire to know. Your question appears to me to be one respecting the status of the relation

between current technics and the political economy of subjectivation and governmentality. This appears to be a question that is partly motivated by recent empirical developments, but also one posed in a theoretical vein not all that foreign to Deleuze's short text on control societies plus the last parts in his Foucault book, the work of the late Foucault, as well as a considerable body of sociological and critical theoretical work in recent surveillance studies picking up on this heritage. However, the empirical developments you mention are still far from being widespread and strong enough to be able to claim any kind of sociocultural significance. At most they are particular examples, perhaps some relatively weak social chains that may have generalizable potential a bit further down the road. This should itself warn against proceeding too fast, against drawing conclusions.

Second, I register a certain vacillation, or actually a slide in your question, moving from 'ambivalence' through 'facilitation' to 'control,' 'regulation,' as well as 'enforcement' by ubiquitous computing. It appears to me to make quite a difference whether you point to an undecidability, to a facilitation of actualizing a certain potential, to a normative mode of regulation, to a stronger notion of political control, or to something like a technological determinism. I am sure that a number of readers of Foucault and Foucauldian work, for example, will immediately recognize both the issue of how to distinguish among these and the ongoing difficulty of actually doing so in practice. I think all of these are in play in the parts of the history of the present that have to do with ubicomp and its enculturation via social and personal individuations – except the last one. That is, I do not subscribe to the notion of technological determinism that seems to lurk in your question.

RS: Your impression is correct. My question aims at the central issue in media studies: whether media have their own agenda or whether they are just tools serving the demands of people. Though I do not follow technological determinism à la Friedrich Kittler, I do share McLuhan's belief that the medium itself "shapes and controls the scale and form of human association

and action." However, since we first shape technology and technology then shapes us, as McLuhan would say, I am especially alerted if representatives of a big technology company declare that technology is neutral but people are not. For example, this was claimed by the former Google-CEO Eric Schmidt and the current director of Google Ideas Jared Cohen in their 2013 book *The New Digital Age. Reshaping the Future of People, Nations, and Business.* I consider such an objection to technological determinism less a theoretical perspective than a strategic statement, a self-serving denial of any responsibility for the social and cultural changes that a mega player on the Internet such as Google no doubt brings to society. But you are right, if I slide from 'facilitation' to 'control' I am shifting from the message of the medium to the characteristic of social systems: Autopoiesis. I see the control and regulation I am addressing with respect to pervasive data aggregation as a means of the social system to regulate, stabilize, and reproduce itself – as discussed for example in Foucauld's concept of governmentality. Can we expect administrative and intelligence apparati not to use every technology available to improve their work?

UE: This substantiates your question considerably and makes it easier to address. We agree that neither human nor technical systems and agents are neutral. We are misunderstanding each other part of the way since you point towards media and I most often address questions of technics prior to discussing media. Moreover, however, I think we disagree as regards determinism and causation. I do not believe that we first shape technology only then to have technology shape us. I think of technics and the sociocultural as co-existing and co-developmental, and I tend to press this quite far towards a relational ontology, not unlike what you find in Simondon and his thought of transduction. This means I also very often, but not always, will parenthesize anthropocentrism (something at work also in Simondon's thought of the mode of existence of technical objects). Sometimes I do this by insisting that 'we' *are* relating as technological beings and entities (Leroi-Gourhan comes to mind), and that distinctions or

binary oppositions such as human/machine, culture/technics, and lifeworld/system are always already off on the wrong kind of track. So, ubicomp is not really the technological Other (capital 'O') for 'us' humans but rather how we currently tend to exist and live on with technics, how technics exists with humans, among other things. To put it a bit provocatively: there is always something machinic in me that could be made operational, there is always something preindividually human in technics that could be put into operation.

RS: Agreed that the (technological) Other is somewhat part of us, agreed that technology is also the response to and result of certain socio-cultural patterns of behavior. However, society is not a uniform factor sharing the same values and ideas. We know that for example 'digital natives' see the issue of transparency and privacy quite differently as compared with older generations. Given that the younger generation is driving the development of the new technologies that sooner or later affect all of society, the Other may in fact less be a problem of the culture/technology-opposition than of differences within a culture or between cultures within a society respectively.

UE: I think we have less than a disagreement here and more of a misunderstanding of terms or conceptual armature. Perhaps I have failed to make clear the extensional reach as well as the interior character of my notion of technics. The differences within a culture and the differences among cultures that you gesture towards here always already involve technics and mediation, as does your gesture here (and any human gesture). If there is not really a culture/technology opposition, in my view, this is because human cultures exist technologically. This goes for relations concerning interior as well as exterior environments, and these involve social and cultural others as well as otherness more generally. It could well be that the main part of the misunderstanding here is due to my attempt to stick with the more general problematic of technics. Of course you are quite right to point to the need for a finely differentiated analysis of the socio-cultural values and ideas at stake in the development of current

technics and I would be very interested to see this fleshed out in future work.

Let me try to get back to your earlier question concerning surveillance in an epoch with ubicomp. To my mind the techno-cultural potential of ubicomp is still undecidable, and there is nothing 'inevitable' about actualizations of self-surveillance – or, for that matter, sousveillance, or inverse surveillance. I do agree that an immanentist and critical approach to a history of the present is called for, but that still permits me to be at a remove not only from a determinism and a control, but also from pushing any notion of a normative regulation in one specific and more and less worrisome or negative direction. Your question is highly relevant and points to pressing concerns. But that does not prohibit me from affirming quite some faith both in a radical democracy and a cosmopolitanism to come *and* in existing democracies, their laws, institutions, and populations. Subjectivation with ubicomp, governmentality with ubicomp, -- these are extremely interesting questions. Nonetheless, general second-order self-control and massive, invisible, proactive code-regulation are not the only open doors here, nor even the most likely to be or stay actualized in the slightly longer run. Certainly they do not actualize the best value-systems, nor do they even pave the way for the stronger politics of sensation and mediaesthetics, the one with a better chance to survive with other means.

Algorithm and Censorship

RS: One buzzword of the present time is „smart things," objects such as my refrigerator, my coffee cup, and the windows in my building, that communicate among each other in order to process information that I had to take care of myself earlier. Hence, computers not only do more than just computing; they also do it with a much wider scope and have become much smaller than the computers of the 20th century. How do you see the future of computing?

UE: What a truly impossible question! But, in a sense, the impossible invention is the only one of interest, the only invention; so

let me try to answer... I could just say to you that smart things and ubicomp will largely be the same as modern computing because computers are still modern. Or, I could say that ubicomp will certainly change modern computing and this decisively because smart things and smart materials are smaller, mobile, massively distributed, materially and environmentally embedded, wireless, context-aware, and ad hoc connective. But let me instead try to move alongside just one such formal and undecidable opening.

Actually, we were already moving towards something like this very early in our conversation when we discussed Turing's work. Perhaps smart materials, smart things, and ubicomp units already have altered the tendency to idealize the modern computer unduly. Even today, though, I am hearing Turing echoes: Turing machines are as powerful as real machines; they can execute any program that a real computer can; they can simulate all other computers, etc. These echoes remain – but perhaps they have in fact begun to die out. Smart things certainly remind us that real computers need electricity and run into unexpected conditions (just a little dust, or a user armed with a bottle of Coke). Smart materials have a finite number of configurations, have finite internal storage, and they are disturbed by input/output. Ubicomp systems can only manipulate a finite amount of data, remain delimited by processing time concerns, and solicit algorithms that are not general and indifferent to the actual limits imposed on memory... Or, inversely, ubiquitous computing systems do remind us of their difference from Turing machines because they do much more than permit of procedures: they are perhaps really good models of a great many important programs which assume continuous and unbounded input over time, and ongoing computation rather than halting. Perhaps the numerous units connecting and collaborating on and off in ubicomp environments are different enough to remind us that Turing machines should be *more* continuous and infinite. But that this should take place down along the more unpredictable and often complexity-generating axis of the context: peripherals, I/O, interfaces, and

interaction design, meaningful human lives and their kinds of context-awareness…

When you are involved in, move through and engage with (consciously or, more often, unconsciously) mixed realities with multitudes of computational units dynamically organizing and disorganizing context-aware and human-oriented mixed reality environments around you, do you then still live with real computers reminiscent of Turing machines? If computation is increasingly embedded and increasingly becomes a question of microscopic MEMS, so that the very form and materiality of your cup, the texture of your clothing, the pigment of your wall and wallpaper are computational, does that bespeak a modern computer heritage?

My questions are sincere: I cannot decide, you cannot decide. At most one can begin to trace margins, cracks, some kind of openings that are on the edge of what remains to come in computing, if anything. I do think Turing machines are being marginally disturbed today. It is not just that they do not model continuous I/O and concurrency well, nor that computational complexity theory has begun to point out some problematic kinds of reductionist assumptions. Rather, new ideals, diagrams, and de facto implementations today disturb them. Not a little of this could perhaps be seen as a pull towards anthropological, biological, chemical, and physical 'logics' of computation. I am still with Turing's ghost: I tend to be tempted to ask Turing, not to decide, but how he opens up to thinking, diagramming, and living with human-computer emergence and the complexity of current technocultural (dis)organizations.

RS: The notion of living with*in* a computational environment instead of *with* computers as we knew them, is not undisturbing. Equally alarming is that smart things may conceal the difference that information is said to make, if we don't realize what information all the smart things process, and how. Do we need a new theory of information and communication?

UE: The concealment and the invisibility are not in and off themselves new – computers are doing this all the time, as they

always did. The idealization of becoming *more* invisible, calm, and unobtrusive is perhaps partly new and should be scrutinized carefully, with ethico-political issues in mind. However, perhaps you are right to point towards the need for a new theory since the move towards a human-oriented and human-centered computing might disturb the currently hegemonic theorization.

Would it not have been of interest to disturb the work and the outcome of Shannon and Weaver's work on communication theory in the mid- to late 1940s, so that their notions of 'communication' and 'information' were made to pursue and include a few of those dimensions, lines, and points they clearly saw and knew about but still bracketed quite resolutely? Material machines, embodiment, life, animality, humanity, context, and semantics… the purposeful delimitations and reductions of all these must necessarily be scrutinized again today, considering the development of the third wave of computing and cybernetics. For example, can we stay with their influential work if we are to see a human-oriented, context-aware computing engaging dynamically with the more or less meaningful intentions and interactions of so many humans?

Naturally, this is a question that has been asked before, by Katherine Hayles for example, and so we have seen recent revisitations of the ghosts of Donald McKay's and Raymond Ruyer's competing theoretical work on information, communication, and meaning at the time.

RS: McKay and Ruyer against Shannon and Weaver? What would this contribute to a 'third wave' of computing?

UE: I am trying to point to the need in a third wave of computing for expanded notions of information and communication, notions not necessarily formalized as strictly in terms of mathematics and statistics as were those of Shannon and Weaver. One of the crucial hinges here is the approach to meaning and semantics. In my view, a context-aware and human-oriented third wave of computing must be able to deal differently with meaningful information and communication than did Shannon and Weaver's theory. Ruyer's work on living matter and its influence on Simondon,

Deleuze, and Guattari are largely forgotten today, as are his ideas in *La cybernétique et l'origine de l'information*. But here you actually find an attempt to think cybernetics and information in material, biological, and machinic terms, including an important role for organic productions of sense or meaning. In McKay's work on information, you do find a part that has to do with the value of the probability of its selection, but you also find a structural part which is to assure its correct *interpretation*, a semantic aspect to be decided via the changes effected in the recipient's mind. This more subjectively oriented and clearly semantic notion of information stayed alive for some time in the British school of information theory. But it must have appeared too inconsistent and at any rate too difficult to measure mathematically, judging from the way in which American cybernetics moved on in the 40s.

We never had just one theory of information and communication – there were always many. There is no doubt that also today a large number of researchers are drawing upon notions of information and communication that are considerably softer, looser, or more fuzzy than those formalized by Shannon and Weaver for efficient signal processing. Considering the current developments in network societies that move towards technical self-organization, embodied virtuality, and types of systemic context-awareness that are not just a question of GPS but must operate with a certain human semantic and semiotic reach, there are many good reasons for other notions of information as well as communication. These notions tend to reinscribe some kind of human language and cognition, but this often remains implicit or tacit in current research, and perhaps it is safe to say that these issues remain unresolved and only very partially addressed at this point in time.

Still, one can observe at least two common responses to this challenge. The first is to shy away, noting on the way that one of the seemingly uncircumventable facts is that Shannon and Weaver's theory is the wider and actually works. It has been quite exorbitantly successful as regards proving its worth, and today it infiltrates practically all communication whose operations and

informational messages involve computers. One well-known further transdisciplinary move down this axis is Kittler's insistence, dehumanizing to some, that 'there is no software' – just the hardware objectification of an informational language. Then information works in terms of the probability of materializing certain numerical values of two variables: noise-free signal input and a separate source of noise... Just as the human subject and its agency are a structural function of advanced technical systems, one materialization of their statistics.

The second common response is to acknowledge and affirm the need today for another set of notions and a new mode of operation that can meet the call for a human-oriented and context-aware (smart, intelligent, ambient, pervasive, ubiquitous) computing with semantic and semiotic reach as in existing human languages and cognition. However, on the technical side of the systems involved this almost always means to go on using Shannon and Weaver's work. Only now one inserts on top of that base a higher level theory (program or algorithm) that simulates the solution called for. The vast majority of work in hardware engineering, network organization, and software development I have seen so far takes that kind of layering approach for granted, and an abstract, universal mathematical idealism or formalism tends to stay intact on top of this. The search for abstract invariants and the simplest, most elegant code or algorithm is still altogether hegemonic here.

Perhaps Herbert Simon was right when he argued that complexity often takes the form of hierarchical systems and that often one can be quite resolutely pragmatic about reductionism and remain with weak notions of emergence and complexity. I am not yet convinced, though, that this will altogether do with respect to the informational, communicational, semantic and semiotic dimensions of context-aware and self-organizing computing and their embodied virtualities of today. In addition, I find it interesting that important recent efforts in philosophy and systems theory can be seen to resist this kind of reductionism, quite insistently. Derrida's way of making cybernetic programs subservient to the trace is one such insistence – an insistence on a

moving internal differential complication and complexification of human consciousness. Luhmann's work in social systems theory is another interesting example, one that actually echoes clearly McKay's work on information. I am thinking of Luhmann's argument to the effect that 'meaning' remains the basic concept of sociology. On his view, 'meaning' is a functional concept, one that must be presumed working in order for experience processing to be able to decide among different possible states or contents of consciousness. What does not get chosen here is not altogether eliminated but memorized and in some way kept accessible. For Luhmann, this made 'meaning' irreducible to 'information.' Its function is not to eliminate system-relative states of uncertainty about the world or environment. It is special and basic… It is not just that 'meaning' is a selective *relationship* between system and environment, but that it enables both reduction *and* preservation of complexity…

RS: Let me turn the question of information, meaning, and system to the experience of the Internet today. It is a known fact that Internet companies use personal data and personalizing algorithms to customize the websites they show us, the ads they send us, and the information they give us. One metaphor to describe the digital media age may therefore be 'narcissism' which in digital media studies translates to "daily me" (in Cass Sunstein's book *Republic.com*) or "you-loop" (in Eli Pariser's book *Filter Bubble*). The fate of Narcissus is well known. The personal and cultural cost of personalization in digital media is the loss of chance encounters, the preclusion of the unfamiliar, the removal of diversity and of what we are not (yet). The algorithm is the censor people more or less approve of and even desire. This becomes problematic once people are addressed not as consumers but as citizens expected to be open to others instead of cocooned in their bubble. Hence, personalization, driven by economic force, is political. Hence, are the actual policy makers in the digital media age those who program ego-loops, inadvertently undermining the foundation of a democratic society? Or is the alert regarding personalization hyperbolic and rather the

clandestine update and comeback of the claim of critical theory that the cultural industry impedes citizens' release from their self-incurred tutelage?

UE: There is not all that much metaphorical about the narcissistic plane in this development – it is in a sense quite literal and real coding, something which makes your question all the more relevant. But I also have to admit that I tend to find this to have a more double face. I agree that in certain ways the corporations, the programmers, and the web designers deploying codes and algorithms are most often asymmetrically favored in medial as well as politico-economic terms, at least on obviously corporate sites. However, even though this most often goes for blogging and social media as well, here such asymmetries can be reversed to a certain extent, mostly on the medium-specific and communicational planes. Personalization becomes interactive in the other direction as well, and sometimes it becomes a genuinely social affair, so that Internet mediation also becomes socialized rather than just having people become 'personalized' and normatively 'socialized' by the web medium.

Algorithms exist on many planes in this, and altogether generally speaking I still find them to carry individual and social affordance-potential as well as potential for what you call 'censorship' plus loops and foreclosure (perhaps rather strong terms in a great many cases and contexts). I agree that the study of the role and status of algorithms and code is gradually becoming a much more pressing concern in contemporary network societies. I am truly glad to have seen a first little series of initiatives during the last five years or so to establish culture-oriented software studies as a legitimate sub-discipline. This is far too new a development that one can estimate its reach or outcome, but I am very glad to affirm it.

Let me return to your question. I think you are, much like Stiegler for instance, perhaps a little too worried and too critically disposed with respect to the socio-political and personal implications here. The tendencies with respect to normative personalization and socialization you are diagnosing are, of course,

very recognizable to me and to many others. I do have critical questions here, but perhaps my focus tends to be on narcissistic processes other than the corporate normative overdetermination by algorithmic coding that you have singled out here.

RS: OK, let us come back to the myth of Narcissus that somehow also is about media literacy. The reason Narcissus dies is, according to one of the many sources, that he does not know that still water functions as a mirror and that he has no concept of a mirror. As a consequence, he falls in love with his own beauty after he just rejected the love of Echo who is doomed to only repeat the last words she heard, i.e. be a sonic mirror instead of a visual one. Thus, Narcissus' tragedy is actually that he was not content with being confined to himself. He was narcissistic against his own will and good. How is the situation with digital media?

UE: This myth is open to a great many readings and rewritings, including yours, and perhaps that is why it is so insistently with us today still. However, the speculum and the mirror stage are now surely somewhat differently externalized, not least via contemporary technics and their digital media platforms. Here I am particularly interested in the more insidious movements directed at using available algorithmic environments as the medium for potential self-surveillance, self-coding, and self-control. Most often this happens privately or in social silence, and it is usually not articulated or conceptualized as such. But quite frequently, especially the last five years in many countries, you find this turning into an explicit process of attempted medial self-presentation on coded and coding planes. Let me give you just one rather sharply delimited example: contemporary male and female self-portraits in the semi-nude, captured with a cellphone camera in a bathroom with a mirror, subsequently uploaded to a social media site. These you can today find on the Web in the hundreds, if not thousands. They solicit mediaesthetic analysis because they undertake partially experimental remediations and re-aestheticizations of the self-portrait as painting (van Eyck, Dürer, Michelangelo, Rembrandt…) and as photo (Brady, Nadar, Rimbaud, Eakins, Muybridge… Woodman, Sherman…). They

typically draw upon hypermediation rather than the mirrorings in early painting, and they differ from photos taken in a mirror or taken with a camera held in front of oneself. They are rather to be approached as a new type of explicit staging of the cell-phone and the mirror and the social media site as the technical apparati for narcissistic processes. More importantly, I find here an expressive explicitation of the hastily increasing import of technics with mobile and social media-intimacy. This is becoming much more important for performative attempts at self-affective, self-sensing, and self-perceiving identity-formation.

Art and Aesthetics

RS: You give a great example of how new technology creates a new genre of aesthetic expression. It may be premature to call these bathroom-mirror-self-portraits art. However, it leads to the question of how technology and reflection relate to each other: Is art (or aesthetic expression for that matter) that is based on technology and draws attention to its procedures, also inevitably an act of reflection or education?

UE: Let me give you just one kind of example: urban software art involving surveillance in mixed realities. Urban software art most often draws upon programmers' competencies and hence remains a relative rarity. However, it follows a curve not unlike that of digital literacy and has begun to permeate cities in network societies. Like these, software art is now concerned with a third wave of cybernetics and its developments of ubiquitous or pervasive computing. Urban software art arrives in a multiplicity of variants. One of the more interesting is making itself felt at and as the critical edge of the surveillance programs and tracking systems already operating as augmentations of the public sphere.

At the Goethe Institute in Toronto you could be subjected to David Rokeby's *Sorting Daemon* installation, along with its display of so many finely differentiated profilings of other people on the street. In the contemporary urban environment of a South-East Asian megaregion, in the agglomerated global economic

command and control center of Tokyo, you might encounter Christian Moeller's media art project *Nosy.* You then accompany its robotic surveillance camera bitmapping what it captures onto three nearby towers. On Trafalgquar Square in London, an old European cultural city center, you might engage with Rafael Lozano-Hemmer's *Under Scan* project. You and others gather with its interactive video portraits and become embedded in an advanced tracking and projection system. In a North American suburban sprawl like L.A., you could step into Electroland's *Enteractive* street level project. You move with its embedded sensors and actuators, its bright LED and video displays of human movements. At the Barbican in London you might well engage in *Rider Spoke*, one of Blast Theory's projects in pervasive gaming. You, your bike, and your handheld computer begin to help co-author an urban mixed reality drama of hide and seek, invisibility and visibility.

Most of the time and in most of these places you will not be conscious of the myriad software processes and wired or wireless movements of the third wave of computing. Today they nevertheless operate with enough complex mediatory ubiquity-effects to subtly influence your notion of reality. Software art projects tend to make this influence a bit less subtle. Global urbanization increases its complexity, undergoing extension as well as intensification. In most urban situations and events the operations of mainframes, servers, traffic and communication systems, personal computers, tablets, smartphones, and not least new variants of out-of-the-box computing with networks of sensors and actuators remain so many infrastructural invisibilities. Urban software and surveillance art projects, however, most often leave them less than unremarkable. They become more than the silently present mediaesthetic contexts of the city qua site, polis, and community.

RS: Tracking software art as a means of addressing the ongoing but hardly noticed surveillance processes? In my 2008 book *Digitale Medien in der Erlebnisgesellschaft. Kultur – Kunst – Utopie* (Digital Media in the Society of Event: Culture, Art, Utopia), I devoted an extra chapter to the issue of digital art and

surveillance, with respect also to Rokeby's installations *Taken* and *Seen*. I was not criticizing Rokeby and others (Simon Biggs, Scott Snibbe) for employing surveillance. However, I was wondering to what extent such art also serves as a kind of beautification of and adaption to the culture of surveillance.

UE: To be sure, since they are partaking of a global market, a porous formation of states and regions, a set of post-industrial urban cultures, and not least cybernetics as a science of control and steering, such software art projects cannot but embrace surveillance. They do so as part of a spectacle of interactivity that appears organized to be superficial, distracting, enticing, and deceptive. It is all too likely that such art projects will remain 'merely' playful celebrations of branded products, part and parcel of leisure time consumption. Only now the spectacle includes individual, social, and ethico-political neutralization via a certain second-order surveillance and a competent overcoding of urban software code. However, perhaps this type of software art includes more. Dramatizing contemporary surveillance complexes is already an unusual feat, as are the interactive movements across limits of programmed urban screening and its visibility. Besides, there are efforts here to deconstruct the distinction between the everyday urban culture for the coded many (low) and the culture of systems design and programming for the elect (high) at work on coding control societies. So, such software art is on its way towards decoding 20th Century centralized state surveillance and its disciplinary panoptic spectacle for the modern city. It is decoding, coding, and recoding some parts of the more open system of control societies with their processes of free-floating soft modulations of coded dividuals on the move in the networks of the contemporary city.

However, it also touches upon another potential: critical edges immanent to software design and programming. A mixed reality pervasive gaming project such as Blast Theory's *I'd Hide You* is well on its way to have tracking processes become more: they involve technical implementation of bio-capacities such as synergy and emergence. Dynamic and mutual streaming video

surveillance among a set of online players and a set of street players trying to obey an apparently simple rule: film other players without being filmed. This kind of programming with and for live play suffices to have inventions of the other arrive. You could say that this project morphogenetically and differentially constructs live an urban mixed reality to come and thus always already functions as a kind of city laboratory. It is an immanent urban transcendence qua a model mechanism or a set of dynamically superimposed maps of relations of urban forces internal to the concrete aggregates that will operationalize these relations. Such software art projects are in contact with a virtuality continuum so as to move towards a technical and human self-organization and emergence of mixed urban realities with tracking. They are not just giving rise to the coding of complexes and the complicated in surveillance. They have produced codings, recodings, and decodings of 'live' surveillant complexities. They are live and moving in the uncoded and the codable city. They are on the move as an entire differential series of diagrams qua embodied thought-experiments in which a simile of the being of the city to emerge may be glimpsed.

Media Literacy

RS: I agree with your observation of insufficient public discussion of the surveillance and privacy issue. I wonder, though, to what extent I need to understand programming in order to understand the "Real Privacy Problem" discussed from a cultural studies perspective like Evgeny Morozov's, to be found in his article of the same title in *MIT Technology Review* in October 2013. Sure, a technological issue can't be understood without technological insights. On the other hand, especially the matters of surveillance and privacy suggest the reason for the deficient discussion is not inadequate information but poor interest. This poor interest, it seems, is caused not primarily by the lack of understanding programming but by ignorance with respect to the cultural and ethical ramifications of technology.

UE: I hope that it has already become clear that I affirm, subscribe to, and also practice a quite transdisciplinary mode of work in a broad technocultural field. This means that I value and find necessary the kinds of insights provided by cultural studies, sociology, philosophy, semiotics, and critical theory, for example. It also means that I value and find necessary the insights stemming from computer science, human-computer interaction, interaction design, science and technology studies, media and communication studies. Such a transdisciplinary mode of work comes along with several obvious pitfalls and problems, including the great many disciplinary incompatibilities and the impossibility for any one person to master all this in any kind of real depth. However, it also affords a set of transversal movements, some of which I find to be lacking or underdeveloped in current research that very often pays its dues to hyper specialization in one or at most two fields or disciplines. I think this will simply not do with respect to the development we are discussing here – it remains a transdisciplinary project inching towards complexity all along. The corporations and their senior system planners know this all too well, and that is why we tend to see research groups composed of hardware engineers, programmers, anthropologists, psychologists, interaction designers, graphic designers, linguists, philosophers, etc. In the universities we are almost always just lagging behind, but that does not really change or remove the call for such a mode of operation.

All this means I work with a multiplicity of approaches and so consider it a little difficult to say what has primacy, what is the originary source of the problems with seeing to a more extended, well-informed, and critically reflexive discussion of surveillance and privacy. You are right, however, that I may tend to bring into play some of the disciplines in which I have had the more training – in this case computer science and software development. Of course this is not all or enough, but I still think that quite a case can be made for the need to see more of this in areas such as cultural studies and 'digital humanities.' For a great many people ignorance, lack of information, blind trust, indifference,

powerlessness and more are all at play here, and this makes it difficult to approach.

My main reason for ongoing questioning down along the technical axis is the lack of information and the lack of rights plus capacity to do something about insight and ownership. This is very often due to the blockings of transparency via the extended use of hierarchies of privilege and access -- in technics generally, in intelligence and security, as well as in the political economy of information. Specifically, I find it a quite intolerable terror and tyranny that ubicomp projects are pursued with no or far too little misgivings, qualms, or scruples as to their systemic invisibility, inaccessibility, and their embedded 'surveillance' that will have no problems reaching right through your home, your mail, your phone, your clothes, your body posture and temperature, your face and emotional expressivity, your hearing aid, and your pacemaker.

The lack of information can very well be addressed from several angles. Programming is one good vantage point. Insight respecting hardware architectures and the cultural dimension is another. Treatment of interaction designs and their ramifications is yet another. Critical design approaches to digital media studies would be welcome. Generally, I welcome all these moves into deliberation, and even the overload ensuing, for this is already something quite different from taking for granted that informational invisibility, unawareness, inaccessibility, and expropriation is our code.

RS: Let us push the "terror and tyranny" of ubicomp projects a bit further. In a *Wired* article on the Programmable World (issue 21.06) Bill Wasik writes that once connected things become ubiquitous the world of everyday objects will be transformed "into a designable environment, a playground for coders and engineers." Since in a ubiquitous programmed world if-then-relationships are the "blood" of the system, the article also foresees a profitable market of if-then-apps. The result may be that we outsource the if-then-decision of our daily lives to the cultural standards of programmers and the commercial considerations of

the app-industry. How would you approach this issue in a seminar on the social and philosophical implications of technological progress?

UE: Let me be somewhat blunt and provocative. When you press the light switch in your living room, the engineers, the designers, and the companies dealing with electrical systems have been out there for a long time profiting from your everyday cultural tactics and all the strategies relating to the use of electricity (lights turned on and off in this case). Your if-then decisions and the cultural standards with which you live have been technically, practically, economically, and politically pre-programmed in part by the strategies of industry, commerce, consensus re safety standards, political decisions as to infrastructure, etc. It is a real rarity today, however, to encounter strong sociopolitical criticism of technological 'progress' qua electricity and its implications, even though it remains possible and is perhaps becoming gradually more called for in view of our need to be differently concerned about energy, the environment, climate, and sustainability. Since you most often remain happily oblivious to the great many electrical strategies immanent to your everyday culture and form of life, why is it that a smart ubicomp environment should solicit a critically well-informed seminar on its social and philosophical implications?

RS: Maybe because in a smart ubicomp environment we even give up the *experience* of pressing the light switch which, until now, at least reminds us of the implicit if-then-structure of this device.

UE: No doubt you are right. Presumably something different must be at stake, something that does make such a critical seminar warranted. I would certainly agree, but I would then add that perhaps it is not altogether easy to demonstrate that this is a difference in kind rather than one of degree. For instance, both kinds of technological 'progress' depend on energy qua electricity, and they both depend on negotiating a human cultural habituation to a certain set of affordances, some kind of technical envelope or a curtain of technical objects (to echo

Leroi-Gourhan for a second). Still, I think one would be right to stay with the question.

Generally speaking I think the insistence on sensing a difference of import here derives from the drive towards solutions of complexity, as we talked about earlier. You have a sense that somehow a smart ubicomp environment is a far more complex affair than a light switch and electrical wiring and therefore perhaps more socially worrisome or politically more difficult to affirm. If so, the question would become one of thinking, and then evaluating, what is meant by 'more complex.' We evidently have multitudes of relata and relations in both cases, and the interactions among the relata are not altogether trivial, so in both cases we have good mereological questions. We also have in both cases quite some concern respecting complex topologies and temporalities, structural as well as functional complexity. However, something must be urging us to think that smart ubicomp environments do not permit of reductions of complexity as easily and do insist on further internal complication on our side. Is this just a matter of the fate of all inventions of the other (psyche and/or techné), all new phenomena to which we have not yet become habituated? I think you would be right to press the issue a bit further than that…

Actually, in order to fast-forward this some, we could note that we have recent and closely related precedents of this discussion. For instance, I remember being both surprised and interested to read a short, early text by Manovich treating of interactivity – in part unusual due to the explicit ethico-political engagement, in part due to its display of an affective plane with a mixture of fear, anger, and humor. I read this text on 'totalitarian interactivity' perhaps ten years ago, I think, a bit stunned by his analysis of new media art installations as representatives of a relatively advanced form of audience manipulation. Certainly, my attention was caught when he claimed that the spectator-subject-interactant is here placed in a structure reminiscent of a psychological laboratory or a high-tech torture chamber – the kind you might imagine yourself finding in the CIA or KGB.

Perhaps it is a little too easy to shrug this off as hyperbole and let its apparent exaggerations reside with the author's projections -- stemming from a certain pre-1989 period and a certain sociopolitical background proper to the Eastern Bloc. Perhaps this treatment of the interactivity of new media art actually deserves more and other than that, and it may well point towards the question of complexification we are trying to address. For Manovich saw in this an updated version of Althusser's Marxist socio-political concept of 'interpellation,' or the way in which ideology as embodied in major institutions and discourses always already constitutes subjects' identities by 'hailing' them in social interactions. Manovich made a series of observations remarkably similar to your question: engaging with interactive media art installations we are asked to follow pre-programmed, objectively existing associations – we are asked to mistake the structure of somebody else's mind for our own. According to him, this could be said to form a quite fitting kind of identity-formation for the information age. No longer so much that of early or late industrial society, being asked to identify with somebody else's body image (lifestyle, fashion, physical appearance). Rather that of a later epoch, one of cognitive labor: being asked to identify with somebody else's mind.

RS: The difference, though, would be that in an interactive art installation you are prompted to reflect on the interaction imposed on you (because the grammar of interaction presented is offered up for negotiation), while the application in an Internet of things-system does not aim at discussion but pragmatism and rather expects you to just follow the if-then-logic proposed.

UE: I am happy to agree that some interactive art installations offer such promptings, but this is not always the case, and besides, human interactants' behaviors often demonstrate quite some differences so that even explicit promptings may be ignored or turned into something else. Analogous remarks should be made with respect to interactive ubicomp systems and the Internet of Things: in some cases interactants are made very conscious of the implications of being in this context for

interactivity and may have the chance to opt out; in other cases the interaction design and the system remain altogether calm, embedded, and invisible to humans as a technocultural infrastructure that must be taken for granted. Of course, we also have a whole series of shades of gray here, ranging from almost prompting human awareness (obtrusive ambience) to almost not doing so (vague ambience).

My point here, though, is that already with the Internet, mid-90s new media, and the first set of notions of interactivity we had the uncanny sense of coming together with technics, software, and interaction designs demonstrating a certain complexity. We have externalized modes of psychological and social individuations in technics; we are reimplanting these individually and socially, often (not always) without noticing this consciously or discussing it with others, often (not always) without making a difference that makes a difference ourselves.

More specifically, then, smart ubicomp environments would be uncannily complex in ways not entirely unlike this. Perhaps they are getting a good deal closer to the uncanny – insofar as they reach solutions of complexity qua externalizations of traits and processes we tend to associate with the human. The technical developers of such environments are ideally aiming at self-adapting and proactive systems with a context-awareness capable of dealing more or less intelligently with a wide range of human behavior, interaction, motivation, and intention. Again, we are extraordinarily far from seeing anything like this realized. Even so, it should already today be relatively obvious to many of us that we have begun to engage with systems that profile our identities in incredible informational detail. We are interacting with systems that register our whereabouts, activities, and objects or property. They recognize our physical appearance and ways of moving, our ethnic and national belongings, our facial expression and gestures. They register movement, pressure, wind, humidity, temperature, light, sound, radio waves, and they may alter our environment and its ambience or mood. And they may begin to make themselves felt, make themselves heard, display themselves, and speak to us.

RS: The argument that we are far from seeing anything like this realized may not appease those old enough to have seen what seemed to be fiction turned into a profitable product. The fact that already today systems profile our identities and determine the patterns of our actions is not comforting either. On the contrary, wouldn't it be naïve to assume that in a profitable if-then-app-market the individual keeps a say against all the well thought through if-then-solutions? I guess the issue is again one of technical determinism and individual choice. Let me illustrate my concern by switching from Manovich to Morozov who, in his new book on *Technological Solutionisms* (2013), gives the example of a smart kitchen that scientists at Kyoto Sangyo University work on: "the Japanese researchers have mounted cameras and projectors on the kitchen's ceiling so that they can project instructions – in the form of arrows, geometric shapes, and speech bubbles guiding the cook through each step – right onto the ingredients. Thus, if you are about to cut a fish, the system will project a virtual knife and mark where exactly that it ought to cut into the fish's body." Of course we still can neglect what the smart kitchen utters about cutting fish and follow the advice we got from our grandma. However, how much talk will there be with grandmas and other relatives or friends about fish and similar important things in life if well paid professionals know it all better and do not hesitate to tell us?

UE: I think we will have no trouble agreeing that it matters how our lifeworld exists technologically, how it is programmed, and what interaction designs are made operational in its mixed realities. We do seem to differ with respect to the priority granted in the relation of technics and culture, machinic and human system. Here I insist on mutual implication and co-development prior to any clear and strict asymmetries in favor of either technological determinism or free human orchestration. Interestingly, in this example concerning the smart kitchen my angle of approach appears to permit of more of a role for human and cultural agency than yours, although that is only one of the stakes.

Let me reiterate that this broad tendential development is happening most often in piecemeal fashion. This allows me to point out that my worry is partially different from yours and concerns the reach towards an ideal of living intelligence. We have yet to see more integrated systems at play in any one such smart environment. But the fact that things are moving in that direction might alert us to that goal of smart organization and not least smart self-organization. To the best of my knowledge no existing systems are self-adaptive, proactive, or genuinely self- and other-generative. In fact they are almost all of them annoyingly stupid rather than intelligent and smart (depending on how you wish to define these two terms). They malfunction and crash. They miss the point more often than not. They have any number of unintended and not exactly felicitous side-effects. But this should nonetheless still be enough to suggest that the tendential pull in R&D is vaguely reminiscent of some of the things also addressed earlier in AI and AL initiatives. Here it concerns a specific pull towards externalization of a considerable bundle of 'human' traits and processes, then a pull towards a more genuine co-development of human culture and technics.

If you are facing an artifactual mixed-reality ubicomp environment with such complexity, we should perhaps be discussing issues that remain different (in degree) from those associated with the light switch (even though this has agency too, as science and technology studies and actor-network theory like to remind us). Socially you are now also interacting with systems qua a multitude of dynamic mixed-reality quasi-personalities and quasi-socialities. Technically: as both Weiser and most engineers of software and hardware knew only too well, complex embedded systems without good interfaces are notoriously hard to maintain and repair – since it is hard even for the engineers to figure out what is wrong, what is working correctly but has really undesirable side-effects, etc. Ethically, definitions of human values plus mindbody schemes for individual and social identity formations are at stake, most often invisibly and tacitly, and most often without any right to database access, control, or deletion of so-called personal information. Economically, such

an environment is truly excellent as regards supporting further development of experience and transformation economies. Technics may well help here with fine-grained registration over time of your profile -- on planes of affect, sensation, emotion, and perception – only then to engage you every so often prior to your conscious understanding and deliberation. Politically, individuals and social groupings most often remain powerless and uninformed about the 'humanoid' systems with which they interact. The concretization of the vision for billions and billions of computational units with mobility, context-awareness, and ad hoc networking connectivity on the micro- or molecular scale will have left modern notions of 'privacy' and the 'secret' far behind, just as it makes 'surveillance' a completely insufficient and misleading concept or term. It makes a kindergarten exercise of Huxley and Orwell's fictions, and even of the technical capacity of most existing intelligence services as we have known them.

If you have not sensed this already, I am extending the worst-case scenarios well into the incredible. We are very far indeed from seeing this happen, for any number of good reasons down along each one of these axes. And the complexity of the human, the animal, biological life forms include quite some good barriers and unknown membranes still for science and technics, computing included. I do have serious reservations, however, and these do run along lines somewhat similar to what I have just mentioned. At the same time, I will go on looking forward to further work on a human-oriented ubicomp environment. In all likelihood it has a lot to teach us about our relation to the environment, our sense of the world, and about our relation to ourselves and others. Every now and then I tend to try think of technics as our extended immune system. With ubicomp culture in mind I am again reminded how aggressively mastery-minded and appropriative this system is most of the time and in most of its processes. I am also reminded how often it displays processes that are obviously belonging to auto-immunity. I am almost always reminded how far our co-development with technics is from sustainability.