Help From Strangers
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Media Arts In Ambient Intelligence Research

Marc BÖHLEN
Department of Media Study, University at Buffalo, Buffalo New York, USA
AILAB, Department of Informatics, University of Zürich, Zürich Switzerland

Abstract. Media Arts have acquired informal expertise in the design of spaces and events shared by sentient systems and people. Because of this, Media Arts should be of interest to investigators as they begin to seriously consider social interactions as an integral part of the Ambient Intelligence research agenda.

Keywords. media arts, critical technical practices, diversity in machine culture

Introduction

Ambient Intelligence (AmI) is likely the most ambitious and far-reaching version of Mark Weiser's [38] original vision of ubiquitous computing. AmI combines almost all of the subfields of the anywhere-anything-anytime computing paradigm: ubiquitous (including urban) computing, unobtrusive hardware, ad hoc networking, intelligent systems, robust and secure systems, context awareness, situated design, intelligent and intuitive interfaces [31] and, with renewed emphasis, social interactions. If AmI is not foremost about technology, but rather about people, then people studies need to be reconsidered for more effective AmI. This means reconsidering some of the fundamental concepts upon which AmI is contingent.

AmI is historically part of an ongoing discourse on our relationship with technology. Born from the Industrial Revolution's promise for a life of plenty and leisure, technology was become synonymous with progress and improving life. Information processing technologies, including AmI, are part of this larger narrative, firmly embedded in the history of Western culture. The German existentialist philosopher Martin Heidegger, seeking a fundamental understanding of technology as a civilizational phenomenon, understood the essence of technology as a 'Gestell' (standing reserve) [18]. By this he meant a potential, a prepared and efficient framework onto which a more complex process can be mapped and serve as a short-cut that replaces the original process. While this is useful for making life easier, (in not having to grind one's wheat every day but instead buying bread from the store), it prevents people from participating in the complete cycle of events (planting, growing, and harvesting, etc). So there is a price to pay for the removal of tedious labor. Reacting to this dilemma is not without precedent. Cybernetics, [27], and in particular the Second-order Cybernetics movement [29], generated one of the most notable attempts of integrating technology into daily life and putting technology in the service of people and society as a whole. Beer was an example of a Cyberneticist who was particularly enthusiastic about this. He devised an organizational design system called the 'Viable System Model' that attempted to model the flow of information in an entreprise based on the human nervous system. This included feedback loops leading to and from the board of directors [28]. Beer was even able to convince Salvador Allende to apply a similar system to the complete Chilean economy, linking all factories with a main control room in the central goverment. The experiment was abondoned in the wake of the Pinochet coup, however.

It is well known that Cybernetics failed from the perspective of the engineering sciences. Cybernetics failed because the simple feedback mechanisms would not scale to complex systems, and because it could not build an operational technical framework. The claimed territory was too vast and the means to hold it too simple. Cybernetics failed because it could not make good on its enormous promises. Cybernetics sister discipline Robotics did not suffer the same fate because it has been able to deliver tangible results and real world solutions. This, in turn, was made possible by casting the complex task domain of Cybernetics into a more tractible (and simple) 'sense-compute-act' model that Nakashima and others also find conceptually insufficient [25]. Still, the practical failure of Cybernetics and the rise of Robotics, AI, and in their wake Ubiquitous Computing and AmI, do not render Heidegger's fundamental critique nor Cybernetics' societal concerns obsolete. It is not surprising to find the agenda addressed repeatedly from science fiction writers to the Whole Earth Catalog [36] and Cyberpunk [3]. The need to reflect on the role of technology in society and its impact on our environment is as pressing today as it ever was.

1. Help from Strangers

Since the engineering sciences are generally not the domain where knowledge about people is a priority, realms from the social sciences are called upon for assistance. Indeed, Human Computer Interaction (HCI), Sociology, Ethnography all have their established place in this endeavor. However, I am interested in a different source of contribution, a strange and unlikely candidate; the arts, and in particular the field where artists fiddle with technology, commonly known as media arts. Specifically, I am interested in discussing qualitative aspects of mediation between people and ambient systems that are currently not part of the AmI framework.

2. Participants and People, not Users

Media arts are a new and evolving field that is far from unified. In general one could say that media arts comprise all art forms where technical media come into play. Media arts, as many traditional art forms, tend to be craft-based and thinking often occurs more through things than through abstractions of things. Because of the novelty and the lack of canon, media arts are a highly experimental field of inquiry. Artists are not accountable to disciplinary boundaries in the same way as other professionals are. This generates a substantial amount of awful work, but also, on occasion, some amazing surprises. Artists experiment on their own terms with technologies, often learning while doing, and apply technologies in unusual ways; sometimes in ways for which the technologies were not conceived (and are ill prepared to perform). Furthermore, media arts inherit from a lineage of 20th century art movements a sharp focus on subjective experience in lieu of universal truth. A common trait of many media art works is an elaborate concern with the effects technologies have on people in their daily lives. In this particular respect, there is a notable overlap between media arts practices and AmI.

On the other hand, media arts notoriously suffer from lack of technical sophistication. From an engineering perspective, many of the works are hobbyist hacks and at times discounted because of this. Also, as the sub discipline of media arts 'physical computing' continues to demonstrate, there is a particular interest in special effects, as it were, of computing. While there is a rich variety in customizing the output from computational systems, the computational processes themselves are often not part of the inquiry. Coding is usually performed in scripting languages, data acquisition and processing as well as motor control are reduced to minimum complexity, and the projects are often too fragile to be reliably reproduced. On the other hand, and this is of importance here, the media arts have a differentiated approach in defining gray scales in the relationship between people and technology, in the circumstances under which we experience technologies, and in the ways in which a given technology may receive new agency. There is a predisposition to contextualize the work outside of the art practice where it originates and outside of the particular technologies that enable it. This generates, for example, an appreciation for the mutual dependencies between technical challenges, aesthetic design and politics, as the recent interest in open source software shows. For media artists, technology is a not about task completion, and interaction does not limit itself to information processing. The concept of a 'user' does not exist in the media arts, rather a person engaging a work of art is understood as a particpant. Few artists are inclined to perform the formal 'user studies' HCI research requires. Artists are often more inclined to attempt to create uncategorizable ephemeral experiences or political rant and satire than solve problems. Contrary to reputation, media arts are not concerned exclusively with fun and entertainment. A few examples may shed some light on this.

2.1. Examples of Strangeness

2.1.1. Airborn Chairs

Arthur Gansen builds mechanical contraptions that perform beautiful and strange movements. His *Machine With Chair* [15] is an elaborate machine that does nothing more than rotate a wooden chair through 360 degrees in free space and place it back on the same spot from which it was taken. Gansen's work is part of a history in creating non-utilitarian devices and strange objects that can be used for absolutely nothing. Gansen's work is generally perceived as beautiful in the traditional sense of aesthetics. It is indeed strangely wonderful to watch a mundane object being moved elegantly through space for no apparent reason other than to see it nicely executed.

2.1.2. Tough Talking Barbie Dolls

Mike Bonanno of the activist artist-collective the YESMEN [9] and his collaborators purchased dozens of Barbie and G.I. Joe dolls, switched the voice boxes of Barbie and G.I. Joe dolls and returned them to store shelves. All of a sudden the G.I. Joes would say 'Let's go shopping today !', and the Barbies would bark 'Dead men tell no lies !' With this very simple technical and logistic prank, Bonanno was able to critique gender stereotypes projected onto children's toys and make his message known to a wide audience in ways that other consumer protests never achieved; and to do so with the effectiveness of a professionally managed public relations firm.

2.1.3. Robot Massage

Erwin Driessen and Maria Verstappen [13] interpret 'situated interaction' in a - literally - hands on fashion. The two artists developed a massaging robot; a robotic gizmo that crawls along your back and gives you a gentle tickle-like massage. The tickle robot also builds a 3D map of your back as it performs its massaging operations. The device delivers a pleasurable bodily experience that a engineering-centric approach to mapping the body could not capture. While the work is fully functional, it is preposterous and quixotic at once; machinic intimacy without empathy delivering canned affection on demand.

2.1.4. Gaia Studies with Floating Point Data

Christa McPhee borrowed a mobile carbon flux measurement system used for environmental monitoring in global climate change studies on the tallgrass prairie in Kansas [24]. Instead of analyzing the collected data as an environmental scientist might, she recorded the noises of the apparatus performing the measurements themselves. She also made the complete data set from the autonomous robotic system, unfiltered and raw, available to viewers such as not to 'remove' anything, imagining that something unknown might be lingering in the vast lines of floating-point data. McPhee resisted numerical methods of summarizing or mining the data in any way, not from lack of technical savvy. For her the data itself became a physical object of interest, not something that should be replaced by a convenient numerical summary.

3. Reflecting on Technical Practices

HCI and AmI communities have an established history of critically assessing the consequences of technologies on everyday life. Agre set the stage for this with 'Computation and Human Experience' [2] with the central tenet of a 'critical technical practice'. Sengers and others [32], [4], have refined Agre's vision into an acknowledged HCI practice. Many others have contributed as well, and sometimes the insights are unusual. The researcher Nijholt, for example, quotes Cohen who has spent time in a smart room in the *off* state (when the smart room was not receptive), and reports on the very odd feelings of being in a weird void vis a vis the unresponsive responsive system [26]. More often then not, sympathies for technical wizardry prevent a candid assessment of the actual benefit of lifestyle enhancing technologies. Automobile designers (and sales people) stubbornly deny the fact that cars spend a substantial amount of time idling in traffic. However smart smart rooms may be, when they go silent we experience a reality that was not designed to be experienced, a reality much less comfortable and far less interesting than the one the smart room replaced. New forms of alienation are formed when smart technologies go idle. This is, perhaps, the weak form of Paul Virilio's obseration on the co-occurance of technical innovation and accidents, of the train and the train accident [37].

Dourish [14] and others have argued that the historical context that equated mind exclusively with computational processes (and from which the Weiser vision of ubiquitous computing emerged) is insufficient as a lasting conceptual framework of ambient intelligence. For Dourish, information processing should be considered as a cultural category. Other HCI researchers have voiced similar opinions and have, for example, argued for the need and benefits of design strategies based on explicit social and ethical norms. The iHome project at the University at Aarhus is an important contribution to this HCI approach [20]. Its rasion d'être is to not make the home a carbon copy of the office as some large companies [1] have done, but to revitalize utopian ideals in the design of technology and implement them with systems that foster collective experience. The iHome in particular bases this on the the Scandinavian tradition of cooperative design. While the iHouse project does acknowledge the significance of the critical design tradition (Gaver, Dunne and Raby and others [30]) , it does not accept the radical decoupling of utility from technical invention particular to the media arts. And this brings me back to the media arts.

Selectively decoupling utility from technical invention can create opportunities for innovation. Media arts have built a qualitative but nonetheless operational craft of recontextualizing sentient systems with this. In the arts, people are not users, and fuzzy, irrational, sometimes opinionated and emotional aspects of being, all too easily removed in formal user models, are acknowledged. Despite their technical limitations, media arts have found ways to address messy components of being human in engagements with technology. With this they contribute to diversity in our machine culture. And that is what should make them attractive for AmI researchers.

4. Technically Engaged Media Arts

While some artists have been more inclined to express themselves in simple technologies and embrace an aesthetic of 'low tech', many are now interested in and capable of making use of state-of-the-art approaches in graphics, gaming and signal processing. Indeed, the list of artists working in close proximity to engineering practices has grown significantly in the last years. The works of David Rokeby, Steve Mann [21] and Ken Goldberg [17] , for example, find acknowledgement in both the engineering such as sciences as well as the media arts. For some artists/activists such as IAA [19] , the laision with engineering is strategic and political as it opens a conduit to audiences outside of the arts.

While it is not possible to describe this trend in detail here, the following paragraphs depict four select AmI related art works originating from the author's studio/lab that have found resonance in the art as well as the engineering science communities. Of the four chosen works, three deal with data and visual surveillance, one example of a growing and common concern amongst artists and engineers alike.

Figure 1. A Nature Interpretation Center with Second Thoughts. Left: The observation box with the video screens. Right: An example of the system watching motion of one of the plants generated by a gust of wind.

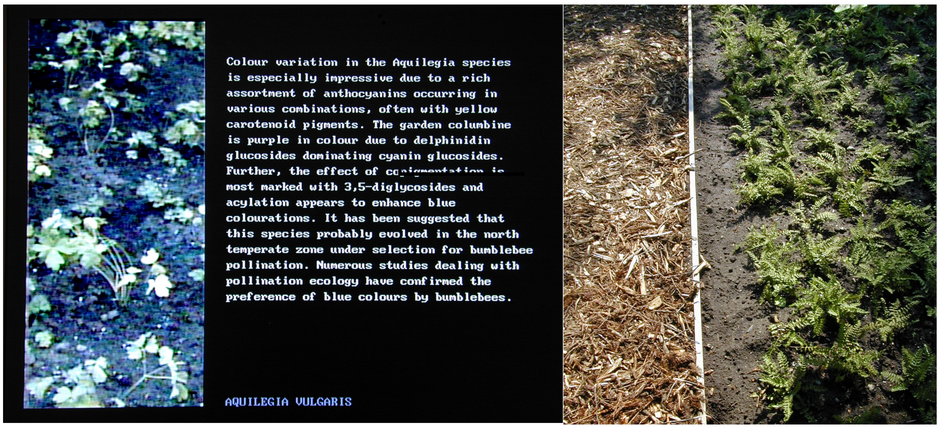

Figure 2. Left: A sample from the text generation system in action early in the summer of 2003. Right: Using garden design principles, such as pine board boundaries between planting and walking areas, to assist the machine vision system in determining areas of interest.

4.1. A Nature Interpretation Center with Second Thoughts (UNSEEN)

This work is an attempt to create, with real-time machine vision and text generation, a new form of engaging the outdoors. *Unseen* is a nature interpretation center with second thoughts; an autonomous outdoor knowledge-mixing system that dynamically proposed expertise on plants and shared this with its visitors [6].

Nature interpretation centers are a romantic expression of the desire to understand and experience nature without giving up the comforts of civilization. Interpretation centers attempt to shore up this deficit through visual effects. Following trends in news and entertainment TV, they offer seductive media shows depicting portraits of wildlife busily eating, hunting, copulating, cleaning, and so forth - in contrast to the reality where usually nothing much happens.

A public garden offers a particular conditioning of the natural environment for those interested in querying this cultural malaise. Midway between untouched, pristine land and controlled construction, public gardens are established forms of colonialized wildlife. Following the Linnaean tradition, marked trees and labeled plants promise clear classifications with no secrets. Paved paths and directional cues prevent accidental disorientation and exposure to unstructured spaces. There is no room and no need for questions. *Unseen* proposes a different approach to the experience of being in the outdoors. Set in the Reford Gardens of Grand-Métis on the Gaspé Peninsula of eastern Québec during the summer of 2003, this multi-camera real time machine vision system observed select plants indigenous to the region and shared its results with visitors.

Working with unstructured spaces creates encounters with several levels of engineering and design challenges. Since our system was placed in a large garden in the middle of a forest one-half a mile from the nearest power outlet, we had to address a variety of adverse conditions: line voltage fluctuations, temperature variations, and high levels of humidity. Since our system was designed for public access, we had to anticipate peak traffic during weekends and allay anxieties about surveillance technologies. The presence of high-bandwidth data collection machinery in public spaces of leisure can make people feel uncomfortable. While most people have grown accustomed to the presence of surveillance technologies in urban areas, they expect the outdoors to be unspoiled by surveillance technologies. The challenge consisted in finding ways to counter such anxieties and still be able to collect rich data over the course of the summer. The solution was simple but effective. We placed the weather-proofed cameras all below (human) eye level and cast the view downwards toward the ground. This posture of downcast stance signaled to visitors that the vision system was watching not them, but the garden.

The Dogwood, the Wild Sarsaparilla, the Harebell, the Foamflower, the Wild Columbine, the Garden Columbine, the Alpine Woodsia, the Lowbush Blueberry and the Canadian Burnet were under continued observation during the entire summer. Borrowing from data analysis and classification techniques, the system searched for, found and tallied instances of these plants. The system had a variety of display scenarios, amongst others one in which the change over time was visible. Such an image slowly intensified as the movements under the camera accumulated [Fig. 1]. This mode of seeing is unique to machine vision systems. Using image differencing, one can reduce the numeric representation of change to minimal information. The method was quite sensitive and could register the flight path of a large bee, for example. Short texts, constructed from a large database of acknowledged expert sources, depicted factual data on the plants and on computer screens in the small hut adjacent to the garden [Fig. 2]. Over the course of the summer, however, the flavour of the texts changed. As the initially sparse garden grew luscious, the system followed the changes and altered its opinion, as it were, on the plants. The texts it created shifted from descriptive to hypothetical, and, having 'second thoughts', confronted the visitor with imagined future understandings of plant life, suggesting that a walk in the woods really is more than just an act of information processing. *Unseen* was an expert system driven by the very objects it observed. It was an open invitation to look again, with fresh eyes, human and synthetic, at a simple garden.

4.2. The Make Language Project: Living with Synthetic Speech

Amy and Klara are an experiment in probing the limits of the mimetic approach in robot design, in particular with regards to the use of synthetic speech [8] [Fig. 3]. The logical

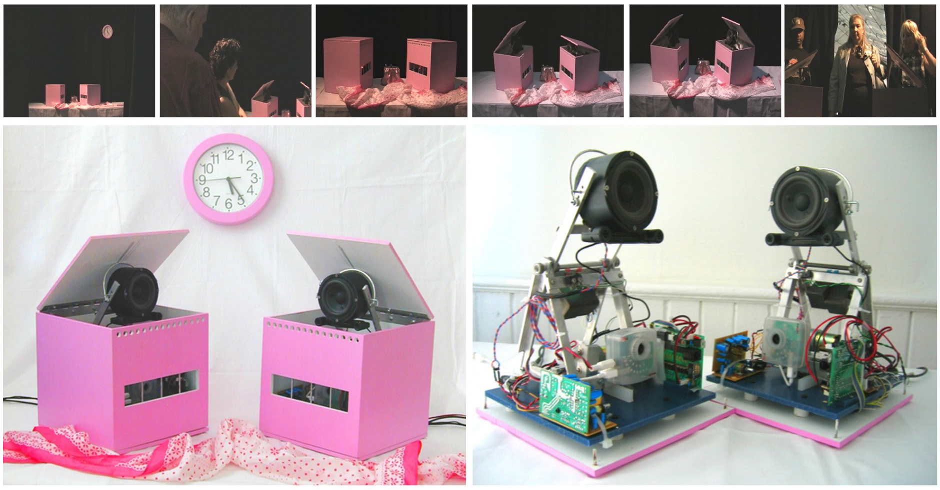

Figure 3. Amy and Klara. Left: The robots inside of their pink boxes. Right: Mechanical structure inside the boxes. Top: Images from an Amy and Klara performance. Amy and Klara's computers are synchronized (hence the large pink clock). This allows them to pop out of their respective boxes simultaneously. Each box is 10 x 10 by 10 inches. Each robot is equipped with a microphone, a speaker and a camera.

consequence of the desire to mimic humans in synthetic systems is to mimic human idiosyncracies. The perfection of imperfection might become a useful heuristic, a negative feedback component in the ongoing pursuit of synthetic beings. A case in point is foul language. When humans learn a new language they usually acquire a odd mix of bare essentials and examples of foul language. This is interesting as foul language circumvents the unknown new language and connects the speaker directly back to known territories. While culturally specific in the boundary conditions that control its use, foul language links us more directly to our bodies than other forms of speech.

In order to experiment with foul language in synthetic systems, I built a set of robotic agents housed in cute pink boxes named *Amy and Klara*. Their ontologies are formed by and limited to reading and analyzing on-line trivia of life style magazines such as Salon dot com. There is no claim to universality or completeness in this borrowed simplistic epistemology. What is listed in this continuously updated website of fashion, politics and celebrity trash is considered significant by the two robots. That which is mentioned repeatedly receives more computational weight than topics only listed once. Items that reach a critical threshold of numerically constructed significance become material for discussion. *Amy and Klara* share their statically weighted text summaries with each other via Text to Speech and Automated Speech Recognition. The results from the speech recognizer as well as the physical transmission of utterances from speaker to microphone are error prone; miscommunication is unavoidable but becomes operational - ambivalence by design. If the robots choose different topics and 'disagree' in their statistical evaluation, they begin to call each other names.

Both robots are equipped with video cameras and able to see each other. An adaptive histogram based hue detection algorithm allows them to detect the other box's pink even under varying lighting conditions [10]. With a parametric disposition to be agitated by pink (and not knowing that they are themselves pink), they are primed for trouble when set next to each other. The fact that Klara has a thick German accent only increases the potential for misunderstanding. This game invariably ends in a rather ugly exchange of expletives that often leaves people watching the two robots wondering about machine intelligence.

Amy and Klara and their provocative synthetic hissy fits are antipodes to the army of kind and gentle agents that greet us on telephones, in airports and at banks. They belong to the underbelly of language; to embodied language particular to being human that is purposely removed from the realm of antiseptisized synthetic speech. If nothing else, *Amy and Klara* warn us not to expect too much from intelligent machines and to consider the potential advantages of less human forms of intelligence in artificially intelligent machines.

5. Privacy in the Age of Easy Data

Collecting data is easy today. Sometimes it is too easy. There is growing concern about the side effects of easy data and ubiquitous computing with regards to privacy and civil liberties. Powerful surveillance systems are deployed to control the flow of people and data. But these systems often do more than they should. Because media arts have, as elaborated above, a different view of people visavis technology, it is not surprising to find within media arts a particular sensitivity to this issue and strong calls for new approaches to intrusive surveillance. Indeed, various artists have proposed, and some implemented, counter-surveillance systems, playful but serious surveillance camera games [34], and public sessions of scanning drivers licences to show just how much data is easily available in the name of law, order and internal security [11]. Here I will concentrate on data surveillance critique that accepts the need for surveillance but modifies the data collection procedures to curtail the side effects of uncontrolled data collection.

5.1. The Open Biometrics Project

Unfortunately, there is much less research on mitigating public concerns of potentially intrusive biometric identification systems than on algorithms to detect and extract biometric features. Toldano [35] and co-authors offer an interesting overview of usability issues in biometric systems. Unfortunately, the survey does not expand beyond the question of usability. There are no references to methodology of gathering and managing biometric data that prevent, as far as possible, the misinterpretation and misuse of biometric data.

The Open Biometrics Project sets out to do just this. The project has two parts. Part II is referenced here [7], but I will discuss only part I, a finger print extraction and analysis system [5] that displays intermittent results of a finger print data analysis process and offers this data as a probability map [Fig. 4]. The system calculates and prints the same data that law enforcement agencies use to check one's presumed identity. Instead of matching the data to a database of criminals, this machine calculates an unfiltered set of characteristic points as a probabilistic IDcard [22].

5.1.1. Challenging Biometric Decision Landscapes

There have been many attempts to find technical solutions to classifying human beings based on body metrics. At least since Lavater, body metrics is a contested field of char-

Figure 4. The Open Biometrics reader/printer. Left: The machine in use with printout. Right: A map of the constituent minutiae points together with ridge type (bifurication vs.ending) and their respective probabilities.

acter validation. Indeed, critique of biometrics, can occur on a number of levels. While there is much circumstantial evidence, for example, that every human being has a distinct set of fingerprints this has never been statistically proven over all populations and peoples. The computerized automation of biometric validation is not without its own set of issues. It is one thing to solve an isolated problem in biometric data interpretation, and a very different thing to devise and enforce a largescale system on all members of a diverse population. With advances in signal processing and computation, it is becoming very convenient to automate any numerically tractable problem, however questionable the underlying assumptions may be. Numerous government and private agencies are working towards largescale biometric identification systems. In the near future, no official government document will be issued without a fingerprint or an eye-scan. Because finger print based analysis and validation is the most established from of identity control in law enforcement through out the world, the *Open Biometrics Project* focuses on this type of biometric data.

5.1.2. Identity through Probability

A fingerprint contains a series of ridges and furrows on the surface of the finger. The uniqueness of a fingerprint can be determined by the pattern of ridges and furrows as well as the singular or minutiae points, local ridge characteristics that occur at either a ridge bifurcation or a ridge ending. The extraction of the minutiae points from a scan delivers the structural basis of identification. Fingerprint matching [16] techniques that use minutiae based methods first find minutiae point positions and angles and then compare their relative placements to a reference fingerprint. The constellation and number of minutiae points build the basis for matching a one fingerprint to another. Formerly a domain reserved for human forensics experts, minutiae extraction can now be translated into executable computer code. In the machine, both minutiae map and minutiae matching are found within degrees of error and translated into probabilities. However, the results of these mathematical operations generate information that is valid within certain limits and under certain assumptions. The rules of probability theory ensure that the assumptions are computationally tractable.

Numerically, one usually defines a threshold value as an arbitrator. Values above a set threshold belong to one class while those below belong to a different one. While the human in the loop might ponder the uncertainties of a classification task, and consider additional aspects in particular circumstances, the machine is programmed to minimize ambiguities for efficiency. The imperative of erring on the side of caution (or control, as the case may be) only enforces the tendency to streamline complex operations once the technical infrastructure to do so is in place.

All of the underlying signal analysis and image processing processes (noise removal, image enhancement, feature extraction) are strongly dependent on the premises of probability theory. The Open Biometrics machine opens a window onto the reality of signal processing constraints. As opposed to claiming binary clarity, the result set of a finger scan from this machine is an open list of probable results. It allows the user insight into the internals of an otherwise hidden process and makes the biometric decision landscape known [12]. The machine prints this information as a map with all characteristic points of a finger scan together with class (ridge ending or bifurcation) and likelihood. It offers a map to those interested in seeing the basis of finger print identification and serves as a reference for those afraid of false identification. *The Open Biometrics* Project is nothing more than a suggestion as how to redirect the flow of data analysis for the benefit of anxious people in the age of easy data.

5.2. Shoeveillance

Shoeveillance as *The Open Biometrics Project*, is a contribution to the critical use of surveillance systems in public settings. *Shoeveillance* is an observation system that tallyies the number of people entering and leaving a room in real time [Fig. 5]. A digital video camera is set a few inches above the entrance of the room, and the only moving objects the vision system is exposed to are doors, feet and wheels. The vision system uses a combination of optical flow together with form recognition to find instances of feet-like objects as they move across the camera's field of vision. The optical flow component is responsible for delivering the direction of motion. With this, *Shoeveillance* is able to tally the number of pairs of feet (people) entering and leaving a shoeveillance enabled room. Since the system can scale to multiple rooms over multiple floors, it could be used to monitor the number of people in a large public building, a new need for first responders in many cities today.

While *Shoeveillance* acknowledges the potential need for collecting pedestrian traffic data, it suggests gathering the data where people are less sensitive in providing it. Most people are not shy about having their shoes watched by a person or a machine. Some even enjoy the idea of being able to show off their fancy shoeware. *Shoeveillance* is not unique as a tally system. There are several other systems that offer the same information [23], and this work can not claim as accurate a counting rate as other systems can [33]. However, *Shoeveillance* is unique in that it builds the discomfort of being watched into its design philosophy. With this, it offers a more robust approach to surveillance in public settings. *Shoeveillance* is socially robust. It puts the machine in its place, on the ground, where we can see it while it can not see more of us than we like. *Shoeveillance* counters surveillance creep, the insidious side effect of surveillance systems that are designed to gather data of one kind, but also collect other data, some of it sensitive, in the same process.

Figure 5. *Shoeveillance* system. Left: A diagram showing limited camera view. Right: The wake of a shoe captured by the system.

6. Conclusion

Based on several media art works I have illustrated interaction strategies with flavors different from those in interaction design common to HCI and engineering. I have argued that critical, non-utilitarian, and sometimes irrational approaches address fundamental needs unmet by traditional interaction design. Finally I have described several works that couple such alternate design strategies with solid engineering methodologies and claimed that similar approaches can assist AmI in devising systems that are technically as well as socially robust. In order to realistically engage social interactions in all their forms and flavors and to understand people not just as users of smart technologies but as participants with their very own hopes and fears, AmI is called upon to expand its concept of interaction and intelligently counter the predominance of utility as an exclusive design principle. Strange as they may be, media arts have qualitative expertise in this and might be very helpful for AmI research.

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References

[1] E. Aarts, B. de Ruyter, "Ambient intelligence: visualizing the future". In Proceedings of the Working Conference on Advanced Visual interfaces. AVI '04. ACM Press, New York, NY, 203-208.

[2] P. Agre, Computation and Human Experience. Cambridge: Cambridge UP, 1997.

[3] B. Bethke, Cyberpunk, in: AMAZING Science Fiction Stories, Volume 57, Number 4, November 1983. http://project.cyberpunk.ru/lib/cyberpunk/

[4] K. Boehner, J. Kaye, P. Sengers, "Critical Technical Practice as a Methodology for Values in Design". CHI 2005 Workshop: Quality, Value(s) and Choice: Exploring Wider Implications of HCI Practice, April 2-7 2005, Portland, Oregan.

[5] M. Böhlen, S. Diamond, S. Mann, "Decontamination, Surveillance and Ready Made Martial Law in the Anthrax Age". 11th International Symposium on Electronic Art, ISEA2002, October 27-31 2002, Nagoya, Japan.

[6] M. Böhlen, N. Tan, "Garden Variety Pervasive Computing", Pervasive Computing, IEEE, Volume 3, Issue 1, Jan.-March 2004, 29-34.

[7] M. Böhlen, *The Open Biometrics Initiative and World Card*, WhatTheHack2005, July 28-31 2005, Liempde, The Netherlands. http://www.realtechsupport.org/pdf/WorldCard2005.pdf

[8] M. Böhlen, "Robots with Bad Accents - Living with Synthetic Speech". LEONARDO, MIT Press (forthcoming, 2008). http://www.realtechsupport.org/new_works/ml.html

[9] M. Bonnano, The Barbie Liberation Organization, Text by Brigitte Greenberg, Associated Press. www.etext.org/Zines/UnitCircle/nonfiction/blo.html

[10] G. Bradski, "Computer vision face tracking for use in a perceptual user interface". Intel Technol. J. 2(2), 1999, 1-15.

[11] B. Da Costa, B. Singer and J. Schulte, *Swipe*, http://www.we-swipe.us/plain.html

[12] J. Daugman, Biometric decision landscapes, Technical Report, Number 482, Computer Laboratory, University of Cambridge, ISSN 1476-2986.

[13] E. Driessen, M. Verstappen, *The Tickle Robot and Tickle Salon*, 1999. http://www.xs4all.nl/~notnot/tickle/TICKLEcat.html

[14] P. Dourish, J. Brewer, and G. Bell, "Information as a cultural category". In: Interactions 12, 4 (Jul. 2005), 31-33.

[15] A. Gansen, *Machine with Chair*. http://www.arthurganson.com/pages/Sculptures.html

[16] M. Garris and R. McCabe, NIST Special Database 27, Fingerprint Minutiae from Latent and Matching Tenprint Images, National Institute of Standards and Technology, Gaithersburg, June 2000.

[17] Goldberg, K. et al. "Respectful Cameras: Detecting Visual Markers in Real-Time to Address Privacy Concerns". International Conference on Intelligent Robots and Systems (IROS), San Diego, CA, Oct 2007

[18] M. Heidegger, Die Frage nach der Technik in: Martin Heidegger Gesamtausgabe, Bd7, Vortraege und Aufsaetze, Frankfurt a. M., Klostermann, 2000.

[19] IAA, "Engaging Ambivalence". In: G. Cox, J. Krysa (ed), Engineering Culture, Autonomedia 2005, 95-105.

[20] O. Iversen, A. Kanstrup, and M. Petersen," A visit to the 'new Utopia': revitalizing democracy, emancipation and quality in co-operative design". In: Proceedings of the Third Nordic Conference on Human-Computer interaction. NordiCHI '04, vol. 82. ACM Press 2004, New York, NY, 171-179.

[21] S. Mann, "Sousveillance: inverse surveillance in multimedia imaging". In: Proceedings of the 12th Annual ACM international Conference on Multimedia (New York, NY, USA, October 10 - 16, 2004). MULTIMEDIA '04. ACM Press, New York, NY, 620-627.

[22] T. Mansfield, M. Rejman-Greene, "Feasibility Study on the Use of Biometrics in an Entitlement Scheme". For UKPS, DVLA, and the Home Office, Version 3, February 2003.

[23] O. Masoud, N. Papanikolopoulos, "A novel method for tracking and counting pedestrians in real-time using a single camera". Vehicular Technology, IEEE Transactions on Volume 50, Issue 5, Sept. 2001, 1267-1278.

[24] C. McPhee, "Slipstreamkonza Semiotics: Towards a Telemimetic Sublime in the Data Landscape".In: Proceedings of the 4th International Converence on Computational Semiotics in Games and New Media, University of Split, Croatia, 2004.

[25] H. Nakashima, "Cyber Assist Project for Ambient Intelligence", Section 3.5.1 of this volume, IOS Press, 2007.

[26] A. Nijholt, T. Rist, K. Tuijnenbreijer, "Lost in ambient intelligence?" In CHI '04 Extended Abstracts on Human Factors in Computing Systems. CHI '04. ACM Press 2004, New York, NY, 1725-1726.

[27] C. Pias, ed.,Cybernetics - Kybernetik. The Macy-Conferences 1946-1953, Band 1: Transactions/ Protokolle, Band 2: Documents / Dokumente, Diaphanes Verlag Zürich, 2004

[28] A. Pickering, Cybernetics and the mangle: Ashby, Beer and Pask, Social studies of science, 2002, vol. 32, no3, 413-437.

[29] A. Pickering, "The Science of the Unknowable: Stafford Beer's Cybernetic Informatics". Kybernetes, Vol. 33 No. 3/4, 2004, The Emerald Group Publishing Limited, 299 - 521.

[30] F. Raby and A. Dunne. Design Noir: The Secret Life of Electronic Objects. August/Birkhäuser (2001).

[31] N. Shadbolt, "Ambient Intelligence". IEEE Intelligent Systems archive, Volume 18, Issue 4 (July/August 2003), 1541-1672.

[32] P. Sengers, Practices for Machine Culture: A Case Study of Integrating Artificial Intelligence and Cultural Theory. Surfaces. Volume VIII, 1999.

[33] O. Sidla, Y. Lypetskyy, N. Brandle, S. Seer, "Pedestrian Detection and Tracking for Counting Applications in Crowded Situations". IEEE International Conference on Video and Signal Based Surveillance (AVSS'06), 2006.

[34] Surveillance Camera Players. A ten year report. http://www.notbored.org/10-year-report.html

[35] D. Toledano, R. Fernández Pozo, Á. Hernández Trapote, and L. Hernández Gómez, "Usability evaluation of multi-modal biometric verification systems". Interact. Comput. 18, 5 (Sep. 2006), 1101-1122.

[36] F. Turner, From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism, University Of Chicago Press, 2006.

[37] P. Virilio, Ce Qui Arrive / Museum of Accidents, Fondation Cartier pour I'Art Contemporain Paris, 29/112002 - 30/32003. Reprinted in: P. Virilio and S. Redhead, The Paul Virilio Reader, Columbia University Press 2004, 257-263.

[38] M. Weiser, "The computer for the twenty-first century". Scientific American 265(3), 1991, 94 -104.