The Situated Technologies Pamphlets series explores the implications of ubiquitous computing for architecture and urbanism. How is our experience of the city and the choices we make in it affected by mobile communications, pervasive media, ambient informatics, and other "situated" technologies? How will the ability to design increasingly responsive environments alter the way architects conceive of space? What do architects need to know about urban computing, and what do technologists need to know about cities? Situated Technologies Pamphlets will be published in nine issues and will be edited by a rotating list of leading researchers and practitioners from architecture, art, philosophy of technology, comparative media study, performance studies, and engineering.

### **Series Editors**

Omar Khan, Trebor Scholz, Mark Shepard www.situatedtechnologies.net

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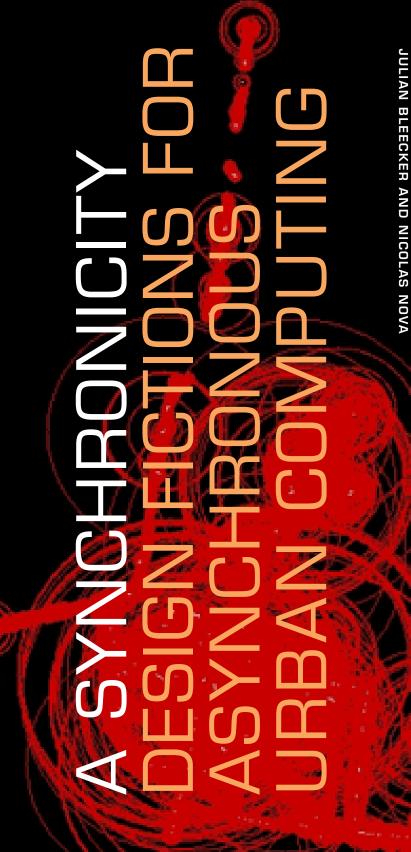
### Situated Technologies Pamphlets 5:

A synchronicity: Design Fictions for Asynchronous Urban Computing Julian Bleecker and Nicolas Nova

In the last five years, the urban computing field has featured an impressive emphasis on the so-called "real-time, database-enabled city" with its synchronized Internet of Things. Julian Bleecker and Nicholas Nova argue to invert this common perspective and speculate on the existence of an "asynchronous city." Through a discussion of objects that blog, they forecast situated technologies based on weak signals that show the importance of time on human practices. They imagine the emergence of truly social technologies that through thoughtful provocation can invert and disrupt common perspective.

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**Series Editors:** Omar Khan, Trebor Scholz, and Mark Shepard www.situatedtechnologies.net

**Advisory Committee:** Keller Easterling, Anne Galloway, Malcolm McCullough, Howard Rheingold

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**Pamphlets Coordinator:** Gregory Wessner Digital Programs and Exhibitions Director, The Architectural League of New York

Design: Jena Sher

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The Situated Technologies Pamphlet Series extends a discourse initiated in the summer of 2006 by a three-month-long discussion on the Institute for Distributed Creativity (iDC) mailing list that culminated in the Architecture and Situated Technologies symposium at the Urban Center and Eyebeam in New York, co-produced by the Center for Virtual Architecture (CVA), the Architectural League of New York and the iDC. The series explores the implications of ubiquitous computing for architecture and urbanism: how our experience of space and the choices we make within it are affected by a range of mobile, pervasive, embedded, or otherwise "situated" technologies. Published three times a year over three years, the series is structured as a succession of nine "conversations" between researchers, writers, and other practitioners from architecture, art, philosophy of technology, comparative media studies, performance studies, and engineering.

www.situatedtechnologies.net

FROM THE EDITORS

In this volume of the Situated Technologies Pamphlets Series, Near Future Laboratory directors Julian Bleecker and Nicholas Nova examine the role that sensing and information technologies can play in developing a distributed urban computing. Taking as their starting point the "blogject," or "objects that blog," they discuss the possibilities of location-based information systems through which people and technologies might interact in unscripted ways, making inhabitation of the metropolis more personal and meaningful.

Bleecker and Nova question the premise of the "real-time city": a synchronized Internet of Things seamlessly integrated into the background of everyday life as envisioned by Mark Weiser in his seminal essay *The Computer for the 21st Century*. While they acknowledge the relevance of a "realtime, database-enabled city," they see in its efficient framing and handling of information the same dangers that the Situationist International saw in modern urban planning. The top-down systemization of processes, whether informational or architectural, when designed to fade into the periphery of our awareness, do not encourage participation or foster creative reuse. It is in this vein that Bleecker and Nova see the potential for developing technologies through which people *asynchronously* appropriate urban space through their own personal and collective fictions.

Bleecker and Nova argue for the emergence of truly social technologies. This they see as the role of design: to shift discussion away from purely technological performance towards social engagement. The ability of digital technologies to register and quantify can easily decouple the relationship between information and the material processes that created it. This runs the risk of undermining embodied personal experience and simplifying our engagement with our environment. As an alternative, they propose the development of technologies designed to shift meaning and provide unexpected points of view of the contemporary city.

Omar Khan, Trebor Scholz and Mark Shepard

# THE AUTHORS

Julian Bleecker is a designer, technologist and researcher at the Design Strategic Projects studio at Nokia Design in Los Angeles and the Near Future Laboratory. He investigates emerging social practices and networked interaction rituals. His focus is on hands-on design, physical construction, prototyping, observation, prop-making and designed science fictions as a way to raise questions, tune in weak signals, reveal hidden insights and yield innovations that could make the world a more habitable, playful place. He has a BS in Electrical Engineering and an MS in computer-human interaction. He earned his PhD from the University of California, Santa Cruz where his doctoral dissertation focused on science, technology and culture. http://www.nearfuturelaboratory.com

**Nicolas Nova** is a researcher—with an interest in the implication of user experience and foresight for future technologies/practices—and the editorial director of the Lift conferences. He has a PhD in Human-Computer Interaction from the Swiss Institute of Technology (EPFL, Lausanne) where he also worked as a research scientist at the Media and Design Lab. His work is focused on observing people practices and their usage of technologies to inspire and inform the design of networked objects, video-games, mobile or ubiquitous applications. He blogs at Pasta and Vinegar and enjoy listening to dub music.

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The last five years of the urban computing field has featured an impressive emphasis towards a so-called "real-time, database-enabled city." Geospatial tracking, location-based services and visualizations of urban activity tend to focus on the present and the ephemeral. With real-time synchronized data, plus clever computational algorithms, the urban environment becomes more operationally and instrumentally efficient. Traffic is routed to avoid costly, polluting congestion and get vehicles to their destination quickly. Pedestrians are guided to the retailers with special deals for people like them. The friend with whom you are linked-in is notified that you are having a pint in the bar just a block over facilitating a meet-up. And so on.

We want to invert this common perspective on data-enabled experiences and speculate on the existence of something that is more like an "asynchronous" city. This is a place where technology for its own sake is not necessarily the canonical guiding principle of the urban computing dream. Inverting one of the principles of the urban computing story is done as a provocation, to stretch out the space of possibility and the space of possible imaginings. Our inversions are meant to create different stories and act as conversation pieces that allow for reconsideration and reflection, producing complimentary guiding principles that expand the visions.

"Blogjects" or "objects that blog" are a useful starting point to discuss what we might call "distributed urban computing." Blogjects are a peculiar convergence of sensors activated by physical "real-world" phenomena, very small computers and digital networks. Sensor readings can be of anything that can be detected—pollution, temperature and movement are canonical examples—and then given a quantity characteristic that is digitized and made computationally legible. So, we might consider how pollution levels, the net movement of people captured on a video apparatus, the London Tower Bridge opening or closing can be disseminated over a digital channel such as a Twitter or blog feed. What happens when you share this data? Can unexpected interpretations and re-interpretations of the meaning of the quantitative information result in new perspectives on the city?

We are interested in investigating many kinds of sensors beyond the typical hacker sort, as well as other arenas of physical-digital representation, especially through simple lenses, filters and distortion effects that take their design principles from our interest in creating new material stories. What new perspectives and insights derive when a new sort of magnetic compass follows its own course, interrupting the once indelible certainty of the traditional compass? When our mapping tools refer to events in time and things seen rather than coordinates and street addresses? These are material explorations and thought-andmade experiments manifested in constructed, near-future speculative instruments. We made these things so as to explore how the city can be experienced, how it can be read and written, re-interpreted and reinscribed. This conversation-essay in words and designed objects is an exploration of new and old interaction rituals in the urban setting. **Nicolas Nova:** A couple of years ago, we started discussing this notion of blogjects and network-connected things. Perhaps it can be relevant, as a preamble, to give a summary of what you meant by that.

Julian Bleecker: The idea of the blogject was a way to describe JB the inherent social character of objects in the context of a digitally networked world. So, the first principle here is that objects are not inert entities. They are social in the sense that they participate quite actively in shaping our perceptions, our ability to make sense of the world, and understand possibilities within the world. They are framing instruments that put outlines and contours on meaning. They have a kind of "optical" characteristic in the way they align the ways in which we see the world. They provide reference points, elevating or attenuating ways of understanding and making meaning about certain topics. Objects contribute in a deeply epistemological way to meaning and then to conversations about the matter of concern to which they are attuned. A map might be just one simple example of this principle of objects that activate and shape and incite conversations. They are always interpretative instruments and the thing they interpret is land and its exploration, use and abuse and so on. Maps are always kinds of alignment mechanisms and they have always been quite a topic of conversation and source of life as well as death. Or consider the practice of political redistricting, where the boundaries of municipalities are redrawn in a way that distributes demographics differently, changing the outcomes of representational political processes.

If objects have this property of being social things, rather than the fiction of inert, material lumps, we wondered what would happen, in the era of social networks, if they were able to participate in those networks quite actively, responding to and processing in this new networked age of data flows? If objects existed in the physical world, and were connected somehow to the digital world, would there be a more activated role for them?

Sensors that allowed communication between machines and humans, or between machines and other machines have been around for a while now. The idea of a blogject is different in at least one important respect, which is the social, cultural and political context in which the



**Figure 1:** Blog pigeon by Beatriz da Costa: by outfitting pigeons with a lightweight sensing platform to record environmental conditions, the animal is turned into a blogger who creates conversation about pollution (http://www.beatrizdacosta.net/pigeonblog.php).

idea came into being. The broader topic of objects that blog is not so much about machines communicating with other machines. There is this idea that some sort of object could connect to the network-this is the relatively simple, engineering aspect. But what happens next is that the data it was communicating has some larger meaning than just mostly operational data about open valves or reserve power levels, or things that are relevant in, for example, an industrial engineering context. The blogject data is semantically rich and has broad relevance to an audience beyond just machine operators in control rooms, or the traffic management authorities who use car flow sensors to adjust the timing of traffic signals to manage vehicular movement on public roads. The principle is to think about how one can combine meaningful data with a very large, open public network so that meaning is made in its circulation, in the ways the data is given rich semantics. And that seemed to be something entirely new and deserving of a new name than simply "man-machine communication."

The blogject is what you get when you have computational objects in the era of meaning-making social networks. The networks have effects on behavior, on perspectives and points-of-view. They are properly social environments in this sense. The blogject is entirely based on this particular technocultural moment and it corresponds to an intellectual investment in creating shared protocols and a spirit in some circles for "open technologies"—APIs, toolkits, discussions. Generally a sense that there is some value in embracing post-proprietary sensibilities.

**NN** To put it briefly, the whole point of this blogject meme was to signify that objects could participate in the so-called "Social Web." But there is certainly more to it; a blogject is not only digital content connected to material artifacts. That's interesting by itself and there are a lot of reasons to get excited about connecting things to the network. However, what is even more interesting is that objects change peoples' behaviors. They have the potential for creating and shaping semantically rich actions. This leads us to the recent explorations of the Near Future Laboratory.

Yes, thinking about this idea of activated objects, or "things" JD that were already full of potential to shape conversations and our recent commitments to the practices of design-you with your teaching at ENSCI in Paris and me with my participation with a fantastic little advanced design studio at Nokia-we started discussing the topic of objects that are conversation pieces. Like the peculiar things one might find in someone's house at a cocktail party that start discussions because they are provocative and unusual. At the same time these things help us, through those conversations and the forced consideration of sometimes peculiar, weird questions that arise and circulate around these things. I think we have come to appreciate the back and forth of reading that makes me want to make something that makes me want to write something that makes me want to read something again. This is what I have learned as my first lesson about the more formal aspects of design, as a practice. I think there are several more lessons.

**NN** Indeed, the craft side of the advanced thinking and scenario creation is quite important. Making to think and so forth. It's also rudimentary in a way, in that it feels honest to make things that are expressions of what you are thinking, to couple these two tendencies, and to recognize the expressive force of made things, either good or crappy—they "speak," which I think is a useful principle to understand.

**JB** Yes. Latour taught me that—the social object. And Donna Haraway helped me learn the richness of partial, situated knowledge and "companion species," which are not limited to house pets they can be other kinds of technological species. When you combine these ideas you get these chatty critters that may be closer to the object than a sniffing, helpful dog, but both help us see and make meaning of the world. It's important that we should not expect to always see "big pictures" but also the view from a little crack in the wall is as important and with great potential, this idea of a partial perspective, from the bird's eve rather than just the god's eve vantage point

**NN** Yes, the craft aspect to that is probably the only productive way to honestly create these ideas of social objects that blog. Like this thing that Jack Schulze from BERG said recently in an interview on the Kicker Studio blog: "No one cares about what you think, unless you do what you think. No one cares about what you do, unless you think about what you do." [http://www.kickerstudio.com/blog/2009/05/six-questions-from-kicker-jack-schulze/]

Yep, that is the core point put really incisively. Ideas last longer in action than they do if they are static knowledge, when the principles are practice, when they are things- enacted not just by someone who thinks, but as activities in a quotidian, everyday sense.

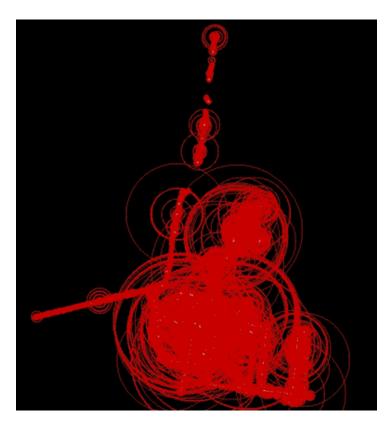


Figure 2: Map made at the first Locative Media workshop in Karosta (http://locative.x-i.net/) where people with mobile networking devices were located in real-time.

**NNN** Speaking of digital, networked objects that exist in the geographical world—in "reality" as opposed to the screen spaces, it's useful to recall the emergence a few years ago of the "Geospatial Web." The idea was that map data, computation, networks of data flows and the interaction of social beings within that network would combine with the geophysical world. Some in the commercial mapping world called it "location-based services." Others like Karlis Kalnins and Marc Tuters referred to it as "locative media." The idea was to think and make experiments that help ask–what would happen if the physical world were colonized by data networks? What would it be like to experience a world in which the system of canonical location semantics, like latitudes and longitudes, were attached to objects in the physical world? This would allow the latitude and longitude to acquire other semantics—the name of the street and address or the fact that there was a dry cleaner at that location, in the simplest possible cases. Or in the cases that make privacy advocates more nervous, you yourself where you are in the world—could have second-by-second reference datum assigned, so that your location could be tracked in real-time. Systems like these are already in place in outlier contexts, such as pet finders, children locators, truck trackers, work-release or house-arrest prisoner trackers, and monitors for the elderly. From a technical perspective this makes them already available for wider usage.

**JB** The GPS platform of satellites for example. Putting those up was no small feat–it never is with those sorts of things. But it has been there, ready for use for many years at this point. Then there's the question about what you do with it.

**NN** Yes, what do you do with it that goes beyond just the rather useful, but also rather plain, sometimes not particularly inspired—"I Am Here" sorts of synchronizations of bodies-in-the-world, always seen from this perfect, top-down, god's-eye-view.

**JB** This is where it starts—the natural first-move when experimenting with such a fantastic new bit of kit is the ability to find oneself relative to everywhere else. This is not the same as locating oneself with respect to that store across the street, or even that next mountain peak to the south. Seeing oneself from everywhere at once is what the technical magic performs. It's a point-of-view that can be quite deceptive because it represents the knowable world as being all figured out...that we can get above it all and perceive it in totality from heaven. I think this is why the "birds-eye-view" perspective—several to a hundred or so meters in the air, slightly awkward, tippy viewing platform, definitely barely stable, with a rakish downward view—has some more appeal to me right now. It's more embodied with a greater sense of participation. Vertigo is a distinct possibility, which is a reminder of something vital, something that comes from visceral feelings, things in your guts, with the potential to fall and be reminded that we are corporeal and that we can become corpses.

**NN** Yes—this is a perspective with a history. The point to be made here is to think about how geography, space, data and networks can come together and produce insights into the world, to help us in a way, provide useful services, hence this phrase "location-based services" which comes much more from the world where people pick at these things so as to pull off some fruits that taste like juicy, commercial, profit-making opportunities.

**JB** We already see wider adoption of "location-enabled services" in greater usage, especially those that are put into action in a mobile setting. For example, most iPhone owners by now know of location-awareness as a feature in the Apple iPhone. It's certainly not the first mobile phone to do this, but perhaps the idea that apps can be location conscious has become a bit more legible, simply by this "popup" that appears for privacy reasons when an app wants to use this data. This feature makes it relatively easy to integrate sensor readings of where you are in the world as a parameter that becomes part of what the application does. Embedding location-awareness in a mobile is not new. There is perhaps something about the culture of accumulation and accessorization-with-apps that is peculiar to the iPhone through the addictive App Store that has shifted this into a new, more powerful high gear that we didn't even know we had.

**NN** That's an interesting perspective—I hadn't thought of it this way, as accessorization-with-apps for mobile phones.

**JB** There are intriguing examples of how location becomes part of the application. There are also quite simple, well-done geotracking services, like Nokia SportsTracker (http://sportstracker.nokia.com) which simply allows you to use your Nokia with its built-in GPS to track your fitness routes and share, catalog, and track your performance numbers and so forth. This, and things like Bones In Motion (http://bonesinmotion.com), Geoladders (http://www.geoladders.com/) and others—we should not dismiss these quite straight-forward, comprehensible examples because they are very popular. They are the good, synchronous examples of knitting together location, time, experience and the network.

Of course, for our asynchronous city we also look at how these elements—geography, time, experience, context (information, other people, activities)—shift in various ways. What happens when geography is not taken as a "fixed" parameter, when the geography is entirely individual, made up of experience rather than, say, this taken-for-granted character of geography that says, "okay, we all have this intersection at 7th Avenue and 15th Street." Suppose some of us don't have such a thing simply because—well, not everyone has been there yet. Of course in most contexts you want to know everything that is to be known, but that is not the same as experiencing everything that you have never experienced. You need to meet that place and give it meaning. There are many geographies, asynchronous because we have individual experiences of the world. Fixed things become flows, and flows become the fixed point of reference. Just shifting things around a bit, changing the platform. Urban songlines and things like this. A shift in the way the world is seen. Perhaps we learn from this that computing in an urban setting should first of all not be about data and algorithms, but people and their activities. What happens when time everywhere is not synchronized, when it floats and lags a bit? **JB** There have been some experiments that I think, deliberately or not, were working through these questions, especially the ones about "location" as an active rather than passive, always-everywhere-for-everyone parameter for interaction scenarios. The work going on at Flickr that our friend Aaron Straup Cope (http://code.flickr.com/ blog/2008/10/30/the-shape-of-alpha/) is involved with, in which the densities of photographs and their tagged locations create new measures of neighborhoods and terrains—that's quite interesting. You find out what counts as a particular neighborhood in more of a "crowdsourced" way rather than what the county map says, or what the local realtors say.

I'm still trying to figure this out, but there is a curious alternative to how location is typically used in these settings. Rather than it being a relative set of coordinates—for example, you are such-and-so miles from the restaurant, and here is the most efficient usage of streets to get there—location becomes an active site that comes into being in intriguing ways through the activity of being there, or going through that place, and not just a target or destination. It is a zone of sorts where you must go in order to engage some sort of digital activity. It's a weaksignal I think—where the physical place is more than just a physical place, it also contains something from the network. The earliest instance of this that I can think of is this mobile game in Japan from back in the days.

Mogi? That was an intriguing platform indeed.

Yes, that one. What was going on there?

JB

**NNN** Mogi was one of the first location-based games that made its way to the market. Simply put, it was a multi-player game in which individuals or teams hunted down treasures hidden in the city of Tokyo. Wandering around in the physical space, players had to use their GPS-enabled mobile phone to locate and collect these virtual items or trade them with other players. The game used the Global Positioning System to find out the players' whereabouts: when a player gets close to an item, it is then "collected" and the object's color on the map changed, so everyone knew it had been collected. So, back to what you just said, it's as if physical places were augmented by a new layer that could be explored and discovered.



Figure 3: Mogi (Newt Games)

What is also even more intriguing with Mogi was that the game itself has been subverted by some players. Christian Licoppe, a French sociologist, investigated this phenomena in a paper called "Supporting the emergence of specific forms of encounters through location awareness: the case of the Mogi players." He showed that the game was used more as a social networking tool rather than a game. The locationaware feature that indicated where players were located was employed as an opportunity to have face-to-face encounters. As much as players reused the soft infrastructure of Mogi for their own purposes, we can speculate on the advent of new digital platforms that would enable an original and creative use of cities.

Mogi is dead now but you have other attempts such as Plundr (http:// plundr.playareacode.com/) from the fine folks at Area/Code. It uses the location of wi-fi "hotspots" from a database to set up these areas that in the game appear as islands. This is an exciting example of how to turn raw and boring infrastructures into more creative objects. Playing with wi-fi antenna sounds dull, but it gets more inspiring if you can generate game elements on these devices. On the islands you are able to engage in spice and gemstone trade and warfare, like pirates—the more mythical, storybook ones, of course, not those we hear about today. This game has an intriguing asynchronous aspect to it in that you do things, and then come back later to see how they have evolved. You get this sense that things can change while you are away.

What made me so intrigued by these games, and really curi-JD ous about the play experience was the way an alternative landscape was placed on the ones right in front of us, and how that could shape your experience of the world. One of the more curious current examples that people can actually try themselves is in "JetSet," a game by Ian Bogost's studio Persuasive Games (http://www.persuasivegames. com/games/game.aspx?game=jetset). In the game, you are the security agent who has the anxious task of clearing little digital people through a security line at the airport. The rules constantly change so you have to decide what to "remove" from the people at every moment they come to the security gate. Of course, things go bananas and you are struggling to keep up with the ever-shifting rules and of course the people who are getting increasingly upset as the line grows and so on. So, that's the game mechanic. But what is most intriguing is that you, the 1st life you, plays at the airport. The game knows which airport you are in, and then that is the "airport" for your game. Nothing changes on the screen, but your score goes up on the digital leader board for that particular airport, which changes everything in a way. I was at the airport in Madrid and I could see on the leader board the small number of people who had been there and played the game, so of course I played in order to put my mark on that airport's leader board, which would appear whenever anyone else played there. This kind of game mechanic with location awareness is provocative stuff for people who live a little bit in the future. That is, people who are looking for new sorts of interaction rituals, including this idea that geography can be a kind of user interface-geography user interfaces.

One point about these games that is interesting to consider is location sharing. From my perspective it's a privacy issue, but I'm not opposed to it outright. I am interested in the evolving practice of sharing location in a digital context. Or, what I am more intrigued by is the future of this concern. How will location privacy and privacy about what I have done, or am doing change into either a "non-issue" or a normal, everyday, accepted practice. We see the signals of this sort of thing with the increasing amount of things that were once private but are now shared routinely in digital contexts.



That's indeed an important issue. I am not sure whether location sharing will become a non-issue. At least in its automated, technologically-supported sense. What I mean here is that mobile social software that tells your friend where you're located, or if you just showed up in the vicinity, are kind of weirdly adopted. In general, the one that detects your location in space and spreads it automatically to your buddies is less employed than the one where you could send it yourself via Twitter for instance. The latter is interesting because it allows you to lie or describe your spatial location in your own way. The former is all about automating the exchange of information about you, but it's generally hard because there are always exceptions. Some exceptions include the time of the day (it's okay to share your whereabouts with your colleagues during the day but less during the weekend) or the kind of relationships (friends versus family versus "contacts"). To some extent, lots of mobile social software does not manage to provide the right interfaces and features to share your location with whom you want or don't want.

The applications we're discussing here are good examples of the weak signals that indicate where geography, data and networks are goingthings that are more than just your location drawn as a little red dot on a map. If we extend the idea of objects that blog-that say something about themselves and share that data on digital networks-to a specific range of such geospatial tracking and visualization in urban settings, the city becomes a kind of blogiect itself. For instance, the work of the SENSEable City Lab at MIT aggregates data from cell phone activity. buses and taxi in Rome to visualize urban dynamics in real-time and reveal what they call "the pulse of the city" (http://senseable.mit.edu/realtimerome/). In the end, this project aims at helping individuals make more informed decisions about how to behave in their physical environment. There is now a whole bunch of projects in the same vein that rely on "urban tracking" techniques to visualize, render and depict the spatial and temporal behavior of city dwellers. The next step is then to provide people with services based on this aggregated data. Which is the point of a system such as Citysense (http://www.citysense.com), a mobile map application that takes data from cell phones and uses it to identify locations with high activity in real-time. As publicized on their website, it's a "real-time nightlife discovery and social navigation" tool that shows "the overall activity level of the city, top activity hotspots, and places with unexpectedly high activity."

**JB** What sorts of ways do you see this work shifting how urban space is occupied?

In the last five years we have seen a surge of projects like SENSEable City's *Real-Time Rome* and its sequels-Preemptive Media's AIR (http://www.pm-air.net/), Christian Nold's Biomapping (http://www.biomapping.net/), Tad Hirsch's Tripwire (http://web. media.mit.edu/~tad/htm/tripwire.html), Stamen's crimespotting (http:// oakland.crimespotting.org) or Intel's Sensing Atmosphere (http://www. eecs.berkeley.edu/~honicky/sensys07.pdf ), to name just a few. What these projects have in common is revealing or making explicit invisible phenomena such as pollution, noise, patterns of movements and people's emotional reactions to places. Their point is to develop a spatial representation of these invisible, temporal phenomena echoing geographers' goal to embrace the use of various technologies to augment their knowledge about the environment. From satellite images to urban tracking systems, the idea is the same: "to understand more our territories, we need to see more of it," as claimed by Stephen Graham in his Cybercities Reader book.

Interestingly, what is often revealed are negative aspects of our cities like crime, air and other forms of environmental pollution. I definitely don't want to blame anyone here. Rather I am just pointing out that there is a tendency in these early experiments towards revealing the problems of our lived spaces. Then there is also the existence of location-based applications that aim to describe the notable histories of urban places which tend towards nostalgia for the past when things were nicer and perhaps better than today. My point here is that it's as if most of what geo-information could deliver was frightening data about the present or comforting ideals from the past. Shouldn't there be other paths? Other things to show?

Perhaps I am a tad grumpy here because awareness seems to be a good first step towards discussing implications. As Preemptive Media puts it about their project, it can "serve as a platform to discuss energy politics and their impact on environment, health and social groups in specific regions." However, beyond basic awareness, the point is to allow people to act upon this information. Behavior can be modified based on this information: one can change one's daily route in response to crime or dangerous CO2 readings. An important question to consider here is who can be influenced by such systems: city dwellers are obviously targeted but also "urban stakeholders" such as city councils or transportation companies. And to a large extent, tourists and pets as well. In addition, there is also the concern with how data is collected, crossbred with other sources and visualized or "mashed-up" with spatial representations. While a large quantity of projects are based on blogject-like or automatic gathering of information through sensors, there are also interesting "volunteer-generated data" that engage humans in collecting information such as weird smells sniffed by volunteers in Lyon, or physiological behavior as in Christian Nold's Biomapping project. Eventually this uncovers the promises of a potential "participatory urbanism" as Eric Paulos from Intel Research Berkeley calls it: "the open authoring, sharing, and remixing of new or existing urban technologies marked by, requiring, or involving participation, especially affording the opportunity for individual citizen participation, sharing, and voice." I personally don't know if it's the case today with all these projects but that's the hope. What is at stake here is the difference between blogject-like automated collection of information and the participation of people in the process. It's machine agency versus human agency to some extent. As Anne Galloway recently addressed in a column at Vodafone's Receiver on-line magazine (http://www.receiver.vodafone. com/the-rise-of-the-sensor-citizen), this obviously raises concerns about the very nature of participation-Who participates and who doesn't and why? Is it about making measurements? And do people have the capacity to make sense of this information?



Figure 4: The City being measured through a technological device that counts the number of cars, motorcycles, trucks and bikes.

**JB** Can you elaborate a bit more on your reservations about these projects' ability to affect changes in people's behavior?

**NN** These projects are mostly experimental and data collected is still scarcely fed back to the inhabitants so we're left wondering how it can change people's behavior in the long run: will city dwellers travel along new routes? Will the information count in the decision to choose where to live?

One aspect of certain urban tracking projects that makes me wonder is the idea of acting upon all that data. Some reactions we've heard about urban tracking projects was that it would provide the possibility to make more "rational decisions" or experience the city in a more "efficient" way. It's as if these people were assuming that urban activities needed optimization. This is of course contradicted by studies about urban behavior, which is far from simple. For instance, scholars have described that mobility is not simply about going from A to B but can be driven by symbolic practices like pilgrimages, rituals and personal aesthetics. It's as if the model of desktop computer applications with their instrumental and efficacious purposes was directly transferred to a setting as complex as the city. In a way, the user expectations towards spreadsheets can be the same as exploring a city. Interestingly, this can be explained by the very fact that researchers from computer science who used to work on desktop applications might now re-apply their expectations, preconceptions and ideas to the nascent field of urban computing. There is a need to go beyond this hygienist model of efficiency to design qualitatively richer near future worlds based on the availability of these data. To put it shortly, I don't think that our relationship to the spatial environment should only be based on statistical analysis or mediated by computations.

Also, the outcomes on city behavior are often limited by the platform on which these visualizations are rendered: mobile phones or desktop computers screens (when they're available as mash-ups) or as a provocation in the form of an art exhibit. It's not yet a common tool. And what about the high-end devices it may require–fancy, expensive devices. Has the demographic for whom this would be useful been considered?

It may ultimately normalize out in the end, but this "quant" failure in the financial markets makes this idea of our reliance

on spreadsheets, quantification and computation more poignant. It's relevant in this context because the blogject belongs to the biome of quantification—it's a participant in this activity of quantifying things in the world. There's a history to our relationship with calculation, statistics, quantification and the way numbers became trustable. I mean—this all came from somewhere, right? And it was not etched into stone at the beginning of time, either. And now, you can barely get out of bed without quantifying and calculating and determining efficiencies based on these computations. When do I get up to make that 10am meeting? How many grams of fat in this bacon I am sizzling? One or two sugars in that delicious, gooey coffee that costs me three dollars? 26.7 miles on the bike this morning! More up-and-to-the-right graphs. Things like this.

And these numbers guys on Wall Street-the "quants"-were going berserk with their numbers. They were creating such byzantine computational number-crunching algorithms that no one knew how it all worked. The quants, with their theoretical mathematics PhDs, had so divorced themselves with their abstracting tier of calculation that it all was destined to collapse. Either that or it would end up as a kind of mystical religious orb of ever-increasing returns that, finally, gets ensconced in some marble sanctuary somewhere to just do what it does without anyone understanding it all. It was as much a failure of the formula as a failure of banking and markets and hubris. I find it all fascinating, the damage notwithstanding. I doubt it will happen, but if this episode turned into a real reboot of the way value is represented and assessed I would be excited. Value and values-not numbers of dollars, but something else, something other than trust in numbers and the processes that have evolved since Nicolas Oresme decided to council the Kings of France about the debasement of coin. If there were ways to make the case for everything that gets done that had another basis in reality besides how much money it will make? Wow, that would be fantastic. Right now, the accountants and engineers still run things. It's not too much to hope that things could be otherwise. And of course blogjects are not by themselves any sort of antidote to this because they are creating more data to be digested by the quants. I suppose this is where designers could participate if they sat at the same table as the engineers and accountants and brought additional sensibilities that can vector interpretations and semantics differently, away from the up-and-to-theright graphs of instrumental progression to bigger, faster and cheaper.

**NN** Hope is good. But, this makes me think about the strategy here for this different perspective on the city, the inverted, asynchronous one, doing unexpected things with the numbers, with the quantifiers of geography—streets, lots, timetables, latitudes and longitudes. Something that is not determined based on efficiency necessarily, or on a formula, or based on numbers and interlocking networks of flows. We can think of this inversion as something that is pre-modern or something. Or, part of these histories is something you read about and then want to explore in a materialized way so as to understand them further and think about how things may be other than they are for the purposes of creating more habitable worlds with different assumptions and different values. For example, a city that is created without overhead control or centralized planning or something like this. The one that is created from the patterns, activities and aspirations at a much more atomic, individual level.

What does this look like? For example, what does our city look like, as a map for example, if we change the models for creating a relationship to the spatial environment from a largely quantification-based one, to one that is based on other ways of measuring, or experiencing the urban environment? Rather than the final output existing as numbers or deliberate, efficient routing computations, what does this look like and, as importantly, what does the experience become of occupying urban space? What are other ways to map paths or to see routes? It would be curious to experience these things for the purpose of understanding these ideas further. And then you come up with new possibilities that you didn't expect to see because you have been spending so much time trying to optimize things for efficient routes, neglecting exploration and curious experiences, like getting happily lost without panicking. Should the car GPS have a button that says, "lose me somewhere," or "take me the least traveled route." No, of course this won't happen because 99% of people would find this insane, like they were transported to a weird world. But, okav–let's just try it because it's not enough to just imagine or have a weird dream about it. We must also explore the idea in material form, as it might actually be to experience these things.

But, now the typical spatial tracking applications that I have looked at sit comfortably where they are, and there can definitely be more to it. The representation of what or who is tracked by all these projects is often limited. First, the dots, paths or lines we are offered are normative depictions of humans, as if they were averaged and then mixed up without any interest in their particularities. One characteristic of these sorts of mass city visualizations is that they operate at an abstract level and normalize the individual, averaging out all the atomic unitsthe people-of contemporary cities. Another dimension that is lost is the history and culture, which are not part of these representations. These outcomes often lose the richness of the reality and the near future worlds we can create out of it. Finally, the bird's eve view that is often proposed in these systems has its own limits. As Bruno Latour explained in his "Paris Ville Invisible," by "looking at the satellite image we extract ourselves from our particular point of view, yet without, bouncing up to the bird's eye view; we have no access to the divine view, the view from nowhere. We go from our bounded view to a sliding view that will carry us from a labyrinth of transformations to the general frame in which our daily action is set-and that will never be more than a few square centimeters big. The frame has the same dimension, in a sense, as the object it frames. The big is no bigger than the small."

And finally, the last problem I see is the overemphasis on the "real-time" promise of building services based on these urban tracking systems. The visualizations are only a step towards the design of services accessible on mobile device, web interface or other physical objects that would provide a "real-time information layer." Discussed scenarios are, for example, about promoting better navigation systems that would help you to take new paths based on how "clusters of people" move in the city.

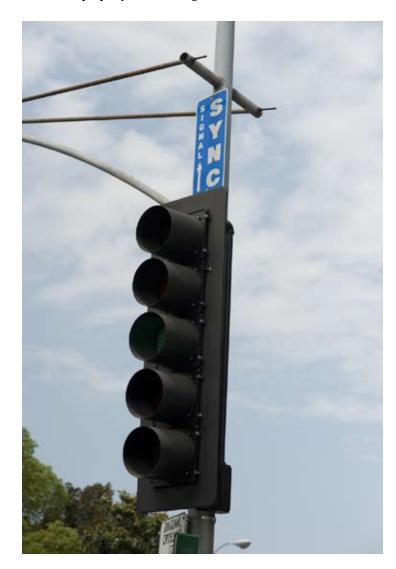
There is here a conspicuous arms race towards more instantaneity, more temporal proximity between events, people and places. Communication is promoted to be "just-in-time"; feedback to you activities should be in "real-time" as if you were playing a video-game character. Speed is essential, and this never-ending battle with time—to eliminate it—makes things happen instantaneously. This is perhaps the aspect that bugs me most. Although I do not dismiss the idea of having new "layers" enabled by these data, I am more interested in a different vector, a sort of "anti-reality" layer that would exist on top of the current one: something less instantaneous and certainly more speculative and poetic. Something we could call the "Asynchoni-city" to highlight the importance of asynchronous interactions.



Figure 5: A curious street trap encountered in Paris (France).

Bruce Sterling has some interesting perspectives on the re-ID JD lationship between space, time and material objects that's relevant to the Geospatial Web. I think he has imagined a world in which time has increasing relevance over space. Objects are not material goods with a fixed state, but rather shifting in their meaning, in their relative and absolute capabilities-his Spime concept. Consumer goods, for example, are hardly static. Even if they performed precisely as imagined, and exactly as they did when "factory new," they change in their meaning in relationship to evolving expectations and in relationship to the next "greatest thing." If we imagine a "space" of constantly re-shaped meanings and shifted relationships, and those relationships are processes of objects, we get close to what I think Sterling means by a "shaping-thing." They are processing entities, and process is about movements and changes in time, in the ways in which our network of relationships are created, or how they come into being.

And this I think is the substance of the Blogject. It is not the technical bits as "technical bits" themselves, without thinking of those technical bits as passage points through which relationships are created, reframed, and shifted in meanings. A good Blogject is one that makes meaning. We can marvel at some bit of clever technical kit, or an API that links this Twitter to Arduino or whatever, which is all good stuff—but, ultimately, it is the "so…what?" of that technical kit that is enthralling. The other "so…what?" I mean, the one you take seriously when you wonder what this thing is good for, what it is able to do and what imaginative new worlds and experiences it points towards. And, hopefully it's not only motivated by commercial impulses or to hoard some other bit of intellectual property or something like this.



**NN** So if we had to think about the instantiation of such asynchronicity, what would that evoke for you?

**JB** The idea of a ubiquitously computing urban setting where everything functions perfectly won't work. We don't even have to give the technical reasons why, we can rely on the history of failures as one often does, the things that are too often forgotten about but provide the richest set of materials for design and, despite this, are almost never considered.

In any case, as a design strategy to understand how this idea of a "city that is here for us to use," to paraphrase Adam Greenfield, and the "read-write city" to paraphrase Kevin Slavin, we are trying to think through what "urbanwares" might be—urban operating systems—if they were less about synchronization, top-down construction and connected channels of information and databases and so forth, and more about asynchronized, decentralized things. Software, data, time out of alignment, incongruities, tiles and imbrications of the geographic, spatial parameters into a kind of delicious, lively peasant's stew.



Figure 6: "Ware," a weird graffiti encountered in Geneva, Switzerland

### What would that world be like?

It's important to consider because in some way we will get this world, probably by accident. But, if it were designed, what would that mean, how would it be experienced and what would it be made from? Some of this is pre-historical, proto-modern kinds of things. Investigating through material strategies the histories of navigation, or city formations and thinking about how prior knowledge can shape possible futures. Mark Shepard's considerations of "propagative urbanism" is influential in this regard, particularly in the ways in which urban space can be fashioned from bottom-up algorithms based on the lives of people within the urban setting. These are explorations, really. Being very aware of the process and not establishing end-points for final conclusions.

For the asynchronicity we are asking the question—why, besides "operational efficiency," would we want a ubiquitously computed environment? What are the measures of "better" that we want to count as meaningful? I don't think we're trying to be difficult by questioning some underlying assumptions, but it is because the underlying assumptions are so often not questioned that we feel the need to explore them by showing, in playful ways, that there are wide ranges of possible computational worlds. That is it. A strategy for exploring these is the strategy of thoughtful inversion. Take an assumption and, ask—what is the opposite? Let's pretend the opposite is the principle to activate and take this seriously so as to learn more about what we are doing. What are other possible, habitable worlds? I mean—why wouldn't you do this is what I often wonder? Why wouldn't one invert and probe and explore with new sorts of parameters of "goodness?"

**NN** Exploring other directions is important indeed, especially if we want to find things serendipitously. Besides, the point is to excavate new meanings for things like GPS mapping, cellphone tracking techniques or latitude/longitude registered digital photography. What are the alternative opportunities for navigating and moving through mapped terrains? What are the ways these new techniques can be points of entry for unusual and playful means of exploration? Rather than optimizing the route to drive from one point to another, are there other ways of re-routing, where the goals optimize exploration and play? In other words, what are the opportunities for re-imagining the databased city that have not been directly designed-into these systems?

Both out of synchronization with conservative time-based flows, and in synchrony with unexpected or unusual events. This has its legacies in the Situationists, but in a digital mode. Now that space is so fully "instrumented" and databased, how do we find ways to do what the Situationists did in reviving and finding new rules of tenancy with these new "overlays" of data? Or simply go beyond their legacies?

**JB** So, in that spirit you just described, our Bureau of Urban Scouting created some objects that were designed to shift perspectives, create partial perspectives and slide ever-always knowledge a bit to the side as regards conventional, technical ways of navigating through the world. These are derived quite directly from the data producing object-the blogject. They don't "blog" in the quaint oldfashioned way of posting things to the web, or even producing streams of data. The sensibility of the blogject has moved well beyond this quotidian notion of disseminating knowledge. We're in the realm of epistemological monkey-wrenching broadly conceived. Creating objects that shift meanings and provide new, unexpected points of view. Or, they may just show you the obvious, but do so in a new, more legible way. This to me is the most poignant thing that the whole blogging thing has done in its short history-it allows for the circulation of many perspectives. And now, I wonder how this notion could be expressed in other material forms besides screens-even besides things that have batteries in them.

Seeing as we have been interested in producing data about urban contexts, we created some objects that might be simple cool tools for latter day adventuring and exploring in urban settings, creating the sense that the city is an entirely foreign, unexplored territory—that it is something and someplace new.

There is the compass with the curious behavior of listening to other things rather than just the magnetic forces of the planet Earth. A second project is this enormously tall viewing platform that produces a bird's eye view video of what lies beneath it. Then we have the Drift Deck, which is basically a set of instructions for navigating the city in the form of cards for playful exploration, each with instructions of actions to be performed. These three are instruments to help displace and replace, disconnecting the fixed references we typically use for navigating geographies and then repositioning the Urban Scout onto another plane of reference.



Figure 7: compass with curious behavior

The first is a compass with curious behaviors. Actually, there are a couple of variations on the device, with different physical forms and experiments with a variety of internal electronics. The movement-the way the dial swings-is more important than I had originally thought, as is the compass pointer. The way it "works" is this: rather than fixing itself to point at the North Pole, the compass makes subtle adjustments to this canonical reference point. It's a noisy, jumpy compass. Its pointer turns on its own, without concern for the magnetic lines of the earth, so that the compass's and explorer's reference to "North" is constantly shifting. This means that the normal way of wayfinding does not work very well. If you take a bearing and follow it, with some time that bearing loosens up so that it is at first along, say, 230 degrees from North and then, without you really knowing it, it becomes 114 degrees from North. Of course, you will know quite certainly that this will happen because the compass moves quite dramatically at times, according to an algorithm for producing noise that Ken Perlin, a computer scientist, created. The movement of the compass is not meant to "fool" anyone. It's not a joke in that way, or meant to pull one over on anyone or a gag, like a fountain pen that squirts ink.

This compass is an object that confronts our expectations and deliberately alienates us from our geographical assumptions. It upsets this usual convention not so as to make us upset and angry that we cannot seem to get from the beginning of a journey to an expected end point. The convention is turned on its head so that we can ask questions about it, study where it has come from and interrogate it for the sake of learning and exploring. We want to know about the history of navigation, about the grids and continuous bearing lines that geography and maps are built upon—where do these come from? We want to learn about the world as it must have been when navigation was something you did not take for granted the way we do today with top-down digital maps, to discover the possibility of exploring in the face of variable, contingent, unexpected disruptions.



Figure 8: Drift Deck

Another project that we created together with Dawn Lozzi, a wonderful graphic and interaction designer, is called Drift Deck. It's a deck of cards meant to provide strategies for movement and interaction within the normal, human world. We call it "an algorithmic puzzle game used to navigate city streets." The Drift Deck is mostly inspired from the strategies that the Situationists described for their urban "drifts" through the city. These were strategies for navigating in unconventional, unexpected ways with the purpose being to find new places in the city, and new perspectives and vantage points for seeing the city that you would not obtain if you were sticking to your usual routes. I had read about these, of course-and there were discussions about the concept and the deck. But, I had never really seen such a thing and thought that I would like a set of these cards so the only way was to make one. Each card contains at a minimum an object or a situation and then an action to perform. For example, "You see a collision" would be a situation, and then "inquisitively confirm this with any passerby to your right"-this would be the action to perform. Some actions are to record the moment with a photograph or take notes. There may be

actions describing what to do or where to go next. And so on. A friend, Andrew Gartrell, designed a card box that would also contain a Nokia phone to gather location data behind the scenes and then feed this into these personal visualizations. So, at the end of a good day's tramp in Urban Scout mode, you could get your own "triptik" that was this rich abstraction of the geography you had just experienced. Of course, you might not be able to retrace your steps with this sort of map, but this is part of the point of the asynchronicity. It may not be repeatable, like software code. (http://www.nearfuturelaboratory.com/projects/drift-deck)

Recently a colleague in the studio named Jan Chipchase came by my desk with a book, called "The Social Life of Small Urban Places" by William H. Whyte. I became utterly fascinated with the topic that this urban sociologist was exploring in the 1980s, which is exactly what the book title suggests—social lives, interaction rituals, behaviors in small corners of the urban context, such as public spaces, street corners, and so on. We immediately started wondering about the material in the book and how this would look from different perspectives—how it would be done again, today. What are the ways that these observations would be captured and what sorts of meanings might we extract from them today?



Figure 9: Apparatus for Capturing Other Points of View (http://www.nearfuturelaboratory. com/2009/08/0/an-apparatus-for-capturing-other-points-of-view/)

I started thinking very simply about how some bit of kit could become part of the Urban Scout gear. Something that would assist in capturing the adventures from other points-of-view and with other semantic filters. Just having some resources or tools to help reframe what it is you observe is very useful and a practical technique to master. Not looking at the usual things, but observing these interaction rituals and behaviors and tendencies that take place in the interstices of urban places. How can you turn these observations around a bit and provide a different perspective of these interactions? There's definitely an aesthetic component to drawing the observer into small behaviors and interactions in small urban places. You see how strangers relate to one another, how people move chairs in public places and where they move them to—the sun, or just a couple of feet to the side so as to, what? Perhaps so as to make the person nearby not feel as though they were invading their "space," which is maybe a 4 foot invisible square?

What seemed interesting to capture and observe were the metadata of movement through urban spaces, which seemed quite in keeping with the urban computing idiom. If we could capture a broad swath of movement from above with digital video and then post-process it in some way to create an abstraction of flows-vectors of movement, highlighting things that do or do not move and so on-I wondered what insights might be obtained. Intuitively there was some expectations here just based in "on the ground" experiences. You get all kinds of curious movements and flows-over here you might have a broad phalanx of people on a tour, the "fast mover" who is a local who just wants to get to where they are going and have the urban flow radar on high intensity, anticipating where they can make their next break-out to get ahead of the crowd; you have the urban perambulator who is in no hurry and allows others to move around them as they stop to take in a storefront window, and so on. We know these things, but I wondered what they look like from a slightly elevated platform. Of course, it is not just me-people come up to you when you are doing this and you get these wonderful conversations from the bizarre ("do you work for Google?") to longer, thoughtful discussions about urban life, to objections such as the one while deploying this apparatus at the new High Line Park in New York City which evidently does not allow long poles in the park. Then there was of course the computational aspects of this-how do you reflect and represent these things as data? What meanings come from seeing this in the visible as well as the computational

spectrum? Does something appear that was previously invisible, beyond our eyeball's abilities to see through the all of the other expected, legible stuff? I have been working closely with Chris Woebken on many aspects of this—he happens to know quite a bit about Whyte and has helped conceptually, digitally and physically with the project.

If the Urban Scout thought about observing these interaction rituals I thought we would need a means to observe from above, like Whyte had done with his camera platforms that viewed city flows from above, so I got a long pole used by painters and brought it into the studio, fiddling



Figure 10a: Image taken from the Apparatus for Capturing Other Points of View



Figure 10b: Image taken from the Apparatus for Capturing Other Points of View

with it a bit in the model shop to see how it might stabilize a good camera. While walking around the studio with this thing that was like a gigantic sheep herder's staff, another colleague Rhys Newman produced a quick sketch that swerved the apparatus into view. It was a kind of mobile observation platform, which made it more conversational than something one attempted to disguise and hide from view. It was no longer about hiding the camera to secretly capture video—it was a tool to capture views and provoke conversations. So, along with these other bits of technical equipment that would be used to re-navigate and reframe exploration and observations based on some computational frameworks, we brought into play this kind of preposterous Apparatus for Capturing Other Points of View. It could be something to see over or around, or to reframe a perspective, but also something that could do some urban computing.

Each of these exploratory devices are contemplative objects, or conversations pieces that function in two ways, at least. First, they do a little bit of creative and constructive alienation. They swerve us away from our usual perspectives and expectations about what the thing is meant to do based on its visual similarities to things we already know or take for granted. This function turns the objects into expressive things that can be talked about or that raise certain concerns or force a series of questions about, for example, categories and kinds of pedestrians in urban settings.

The second way they function is: they function. They are operative instruments, despite that they don't do what we expect. Working as kinds of conceptual props that help move conversations and stories about, they are meant to help us contemplate questions bigger than the objects themselves, and to help us imagine things that are reasonably unimaginable, given the everyday limits of our knowledge as well as the limits we put on our imagination in the normal course of things. The challenge with these kinds of designed fictions is to find the point of entry, the little transit action that moves us from the everyday and normal into a world tilted a bit strangely. This is what I mean by epistemological monkey wrenching.

**NN** What these probes simply show is that we can try out curious new visions, out of sync with current tropes such as "real-time" services or "serendipity platforms." What we want to achieve here is simply to show new paths for the near future. Of course they might sound awkward at first glance but they definitely show alternatives to the existing holy grails that we encounter in tech/business circles. While some folks keep reinventing location-based coupons and buddy-finders for mobile phones, these projects adopt an orthogonal perspective.

**JB** They are also fun things, playful objects. It's not interesting to do these kinds of design probes if they are tedious. Avoid tedium—and PowerPoint—at all costs. They are not ways to make the world a more habitable, adventurous and playful place.

### ALSO AVAILABLE Situated Technologies Pamphlets 1:

Urban Computing and Its Discontents Adam Greenfield and Mark Shepard The first volume in the Situated Technologies Pamphlets Series, "Urban

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Matthew Fuller and Usman Haque

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### UPCOMING

### Situated Technologies Pamphlets 6: Micro Public Places Marc Böhlen / Hans Frei December 2009

Micro Public Places (MPPs) are a response to two strong global vectors: the rise of pervasive information processing technologies and the privatization of public matters. MPPs combine insights from ambient intelligence, human computing, architecture, social engineering and urbanism to propose ways to re-animate public life in contemporary societies.

MPPs are distributed in the urban body like acupuncture needles with the aim of activating public life. In contrast to the traditional big public institutions-which are called 'public' only because they offer access to all–MPPs offer access to things that are or should be available to all: air, water, medicine, books etc. In that sense the MPPs are like extraterritorial territories representing the public in a territory colonized by private interests. They combine machine procedures with subjective human intuition to develop joint forms of observing and knowing that neither system is capable of on its own. Established procedures of direct participation are compounded with information aggregation technologies that do not disappear into the background (Weiser 1991). MPPs are more than public gathering spots that tolerate picnics and concerts. They maintain the spirit of place that efficient technologies tend to ignore. They are hubs of a networked backbone for critical infotopia (Sunstein 2008) allowing-through combined architectural and information design-transparent and distributed participation (Beynon 2006) in matters that concern us all.

The Architectural League of New York is an independent forum for creative and intellectual work in architecture, urbanism and related disciplines. Through its lectures, exhibitions, publications, and digital programming, the League fosters discussion and debate of the most stimulating work and important issues in contemporary architecture and design.

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### The Architectural League of New York

594 Broadway, Suite 607 New York, NY 10012 212 753 1722 www.archleague.org info@archleague.org

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