Cloud Architecture

Over the past 3 years, I've worked on the concept of Cloud Architecture with students in upper year architecture and urban design studios, as well as thesis projects. These studios proposed a series of methodological inversions and subversions of the relationship between matter, material, program, space, information and energy in architectural design.

The Cloud studios had 3 themes: Assembly, Disassembly and Reassembly.

CARLA LEITÃO
Rensselaer Polytechnic Institute

The first studio - CLOUD Archive/Institution/Transvercity - looked at the design of Cloud Structures with the capacity to create or inspire novel forms of institution within or across other environments: being both an ARCHIVE/LIBRARY and an education/promoter of protocols that would insure collection of memory/history, conservation, repetition, distribution, and platforms for the generation of new knowledge.

The second studio - CLOUD Disassembly - looked into Cloud Architectures that could disassemble other architectures as well as themselves. The framework for this search was a study of the architecture and urbanism of LARGE TEMPORARY EVENTS - World Cup, Olympics, and also World Expo, among others - and their promises and shortcomings economically and culturally for their host cities as well as in the larger context of global awareness of buildings' environmental impact.

The third studio - CLOUD Reassembly - proposed an enquiry into the possible new structures of order that can be found or (re)created in scenarios of CATASTROPHE or DISASTER in the preparation, duration or aftermath of radical cross-sectioning events of destructive force.

The studios' goal was to look into the possibility of architectural design conceptualized from its microstructure, seriously playing along the way with several approaches of design that included both what could be called top-down and bottom-up strategies without necessarily imparting known methodologies nor narratives of the fields of architecture and urban design usually associated with them - nor being bound to their specific objectives of research. Instead, students were encouraged and directed to experiment with different ways of defining hierarchies and hierarchical bodies for the ordering of space, material and information. Across the three Cloud Studios, we created a condition of transversality: a pervasiveness of repetition that would be like a 'fog-matter' capable of

light-terraforming existing landscapes and suggesting possibilities for new hybridized ones across existing environments and fabrics.

CLOUD ARCHITECTURE PRECEDENTS

The Cloud figure can be found in Architecture culture in more and less apparent ways, having lent its transversal trait to different political and speculative agendas. Ironically some of the precedents for Cloud Architecture could be said to resemble Megastructures or their concepts. Reyner Banham's discussion on megastructures (1976)[1] and the, albeit cross-cutting, totalizing regular spaces they may impose can be seen as both the natural mark of architecture's ambition for ordering space, but as well can be the face for some of the most common shortcomings of virtual networks. The project of Horizontal Skyscrapers by El Lissitzky (1925) was used as a stylistic device that - even when unanticipated - engaged the organizational and navigational political space of the city. Superstudio's different projects, including the "Continuous Monument" (1969) or their "Fundamental Acts" series, speculated on structures which have a vast and either generic or specific type of pervasiveness, a macro-scalar movement with high degrees of porosity with other landscapes, and used transversality as an operative connective tissue rendering certain cultural forms obsolete, while encouraging new vacancies to take shape. In Archigram's works - such as "Instant City" or "Walking City" (1964) - moving, changeable, deployable, pluggable, rhythmic structures that behaved programmatically like weather systems worked to advance the metaphor of the cloud as well. These provide interesting reflections on the intersection between an increasing pace of transformation of urban culture - and exchange of material, energy and information - and a material practice that embodied concepts of maintenance and property. Cedric Price's investigation into distributed systems such as the Potteries Thinkbelt (1964) - an educational program reusing an abandoned piece of infrastructure- was yet another early example of programmatic clouds at urban scale. And as a more totalizing example, nearer to a weather system: Buckminster Fuller's Energy Grids, Dymaxion and World Games projects can be imagined as systems that approached the transversality of what a cloud project could accomplish. Other contemporary references to 'cloud' morphologies or terminologies made by architects or design theorists include "Get Off My Cloud" (2006)[2], and its use of the word as illustration of an inclusive design process; or the famous Blur Building (2002) in Switzerland by Diller & Scofidio. Many of these 'cloud' precedents are easy metaphors, given their ambition of transversality to other systems, and their investigation into materials and programs. Notwithstanding that, the Cloud Studios tried to create new kinds of formations that would dangerously play with a distributed character, and its sensitivity to environmental conditions - formations that could become invisible, be torn apart by crowds, aggregate into rock or dissipate into thin air - while keeping its 'integrity'.

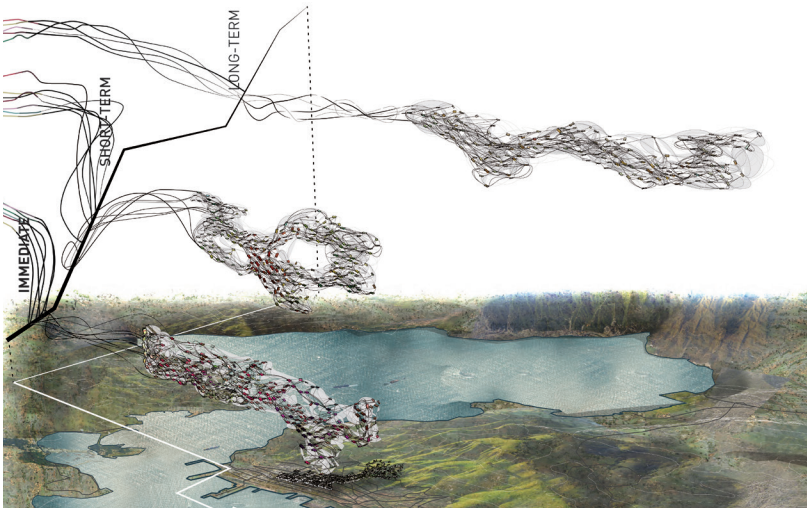
MEDIA CLOUDS

Currently, theories of cloud communication and storage for digital media across networks engage problems of information, intelligence and processing location, and subsequent problems of property privacy and access. While with similar vocabulary, these storage clouds often seem apart from problems of design, they seem to propose a future reduction on the need to house things in their proper places, and instead, create new systems of sharing and access that would render property and access, as we know it, obsolete. However, most of these systems of cloud storage (for data or software/operators) often use an imperfect

metaphor, aiming to install central systems which a number of nodes have access to. This brings them back to a model of megastructure, instead of one of redundancy. A more revealing possibility for thinking about transversality and clouds is proposed by science fiction writer Bruce Sterling, and his introduction of the concept of SPIME. In "Shaping Things" (2005)[3], Sterling talks of a near future where designed objects are aware of and broadcast their own history through embedded networking apparatus or 'live' pieces in their own constitution, cross-connecting to create future objects in continuous processes of assembly, disassembly and reassembly. In the Cloud Studios, our objective was to question what could emerge from pervasive SPIME behavior while continuing to look at the simple precedent present in real clouds: their highly concentrated humidity in different states and densities. A pervasiveness and redundancy of material, of distributed differentiated micro-autonomy, of packed performance, multiplicity and interconnectedness: how could this be used to create real networking potential in 'objects' or 'environments'? 'Live' objects [such as the ones Sterling talks about] bring new dimensions to thinking the discipline of architecture, and also challenge some of the culture's safer preconceptions: which scales can/will the discipline manage, and which processes can/will it influence?

MATTER(IAL) CLOUDS

The further conquest of lightness in both materials and assemblies, by revolutions in their constitution [as in porosity at different scales] - and also their lightness in terms of time [as in rapid-prototyping]- has influenced the evolution of different cultures of form and structure in architecture and engineering, and allowed for crystalized concepts of form to open up to a new levels of diversity. On the one hand, industries still cater to architecture mainly in connection with a particular type of lightness, which is based on presupposed typologies of production and assembly - windows, walls, doors. Much the same happens with scientific research concerning new materials, which is often split between pure scientific research or catering to small improvements on existing typological elements. Many developments in Nano-materials and Meta-materials seem to be bringing us back to a exploration of basic universal problems that have almost infinite applications - how to improve a lens, for instance - and simultaneously to revert altogether to inversions of natural phenomena or to hybrids and to the problematic of characteristic or trait… and from there back to the idea of design. The manipulations and effects within these new researches claim to indeed attempt to Program Matter, that is, to constitute new classes of materials which will be derived but also be able to derive other classes, and for these to become so ubiquitous and about ubiquity that they will resemble or start to integrate with that which we now call matter.[4] These will not be obscure, but potentially also not as tamable. They will probably be political and with increasing traits of "liveliness". There is an incredible opportunity here for design thought to expand and influence new constructions. The cultural agency in spatial design could start to take shape at very small scales of behavior. Yet another catalyzer for both speed and quality of development, in these often rather opaque and isolated areas, is the strong emergence of a DIY culture affecting access and ease in learning and experimentation, and as well cross-fertilization of knowledge. The impact of these in spatial design includes a greater degree of integration between high tech and low tech knowledge and strategies, and a broader range of participating expertise in real-time creative processes and building activities. While this alters the centralization of design as tool, it reinstates its necessity as a platform.



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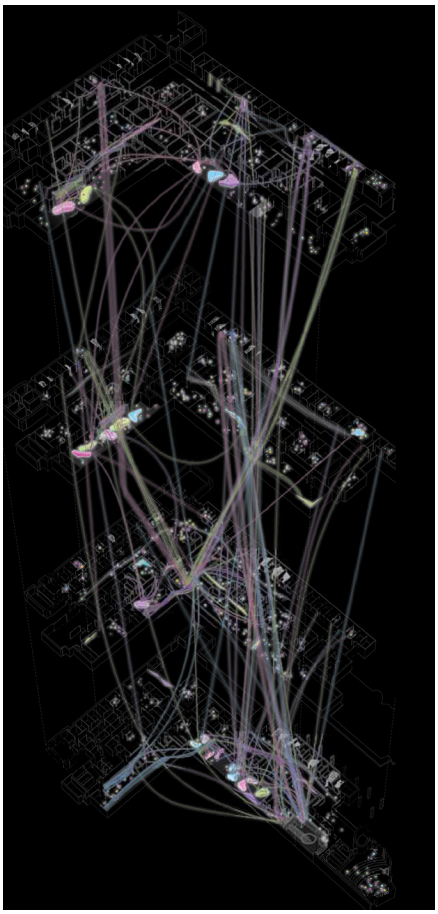

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With these scenarios in mind, the CLOUD Studios looked into all these possible futures through the design of spaces which take advantage of ultra-locality and remote connection brought by advanced material sensitivity and/or connectivity, and distributed form or protocol - possibilities in the constitution of new materials and media that architects, designers and users will increasingly use to create space and environments.

ASSEMBLY, DISASSEMBLY, REASSEMBLY: ARCHIVES, CIRCUS AND PALIMPSESTS

The Cloud Studios started by proposing a conceptualization of architecture from another scale perspective - one that creates pregnant reflections for design disciplines, in terms of the several new avenues by which terms like 'concept', 'program', 'development', or 'detail' are understood and able to be designed. The studios then asked: what kind of generative representations, documents, controls and application points will our design disciplines and practices use? The three sub-themes of the Cloud worked with ever-present [potentially future valued] tropes in the discipline, for the direct relationship they imply in a base concept of tectonics or building technique or drive. Not unlike Quatremère de Quincy's types - cave, tent and hut - [5] they are based on tectonics driven by social organization, but attempt to pair these with geological formations and logics of matter.

ASSEMBLY

In the Assembly Cloud Studio, students engaged the shifting relationships between buildings and institutions, and the role that buildings (spatial constructions) have played and can play in the production, storage and distribution of knowledge. The Cloud Assembly dealt with the cultural forms in the discipline that are interested in preservation of values, conservation of form of protocol, or recording and maintenance of history. These Clouds attend to the ever-present concerns of memory preservation and often engage concepts of the symbolic or representation. For example, in Vivian Bratone's project "Hydra Index", an active weather system connecting the information space of several agencies (including Governmental, NGO, research labs and hard activists), helps them collaborate to get an inside multi-sourced picture of the environmental make up of a region. The project then hovers over Perama, in Greece [7] to produce impressions of that information for the population. Much as the son of a fisherman learns to read the weather for the safety of the sea, the population of Perama would start to get a

Figure 1: Jennifer Plume, *Star Constellations* (Assembly)

Figure 2: Tyler Hopf, *Disasterology* (Reassembly)

Figure 3: Vivian Bratone, *Hydra Index* (Assembly)

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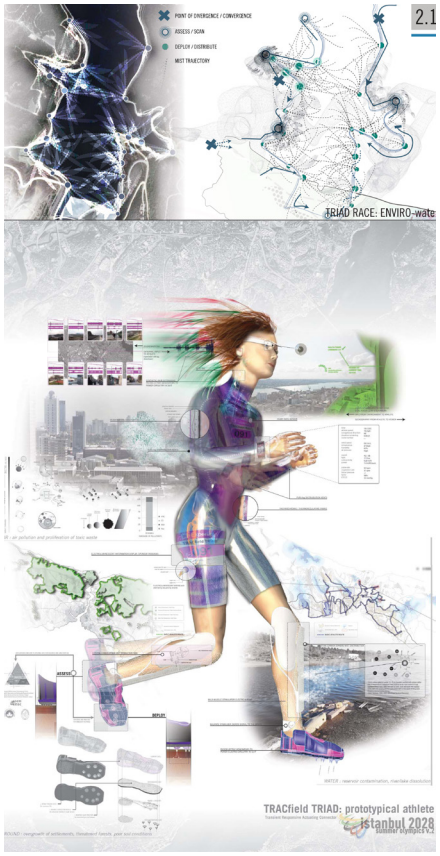

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synthetic intuition of which areas to avoid on which days and which practices to change permanently for the preservation of the well-being of its population and environment. Perhaps a new form of the 'gentle but firm' policing done by environmental activists? Another example of an Assembly Cloud, Jennifer Plume's project - STAR constellations - shows the way in which a web of networked 3D pixels become a map of materialized work relationships in a biotech lab facility - connecting researchers with their information and with each other, reflecting trends of 'up and coming' and 'phased out' research.

DISASSEMBLY

The Disassembly Cloud engaged tectonics of the temporary, of light construction, and also models of the aggregate, of erosion, and of the ruin. In the work of Jillian Crandall - The Sentient Event - Olympic athletes are technologically augmented to become agents that map sites and deploy strategies in them. Deformed to their sports, athletes can be activists for collectives - be it populations, or other agencies - deploying physical systems in situ, for political and environmental change, under the umbrella of nation cultural exchange, political protocol and propaganda. In the case of Philip Vernon's project - Irradiant City - the creation of a peer to peer network in areas of Cameroon without electricity, through RFIDs[6] deployed in different forms - as stickers, sprays or concrete aggregate, act as information relays across vast landscapes, and link to an in depth analysis of existing patterns of communication, organization and exchange.

REASSEMBLY

The Reassembly Cloud engaged properties of resilience in both human constructions [through concepts of contingency and adaptation] as well as natural formations. This studio very directly reflected on the predicted challenges of the Anthropocene era, where layering, recovery and transformation will increasingly dominate the tectonics of architecture and design. The ever-present palimpsest is a vehicle by which memory - past and future, in the form of imagined orders of form and organization - can again be engaged by architectural thought. John Baker's project - Cloud Power - establishes a system of relays for the upcoming witricity - wireless electricity - which creates a new economy of storage through use, pairing users that otherwise would not intersect in activities across a common urban fabric. In Tyler Hopf's project - Disasterology - we see a poignant provocation: if architects become disasterologists, could they perhaps more

Figure 4: Philip Vernon, *Irradiant City* (Disassembly)

Figure 5: Jillian Crandall, *The Sentient Event (Disassembly)*

swiftly arrive to their objectives of getting architecture and urban projects built, with dialogue and also irreverent innovation? Tyler imagined scenarios where a city's agencies and diverse bodies of counseling for urban development would be played against each other, to [indirectly] produce architecture: by poking, waiting on context specificity; through user feedback and opinion and carefully crafted micro-site analysis and material deployment. In his Final Project - a Disasterology Institute - Tyler redesigns architectural education itself, formulating a comprehensive new curriculum through which levels of interdisciplinarity are curated and directly experienced within the education of the designer. The project functioned self-referentially, as a substantial part of his work was the pedagogical model for that curriculum.

TROPES: THE BODY

Nonetheless - and after all this speculation - there are some emergent characters that remind us of architecture history and some of its so-called traditional culture forming processes. The body is still (or again?) a central figure - it is not only a measure but now also a carrier, a construction material, a distribution corridor - the body is now both a site and the architecture through which site is measured and revealed. Not unlike what could be imagined with the 'self' that drives configurations of social media, media in general - the user-focused platforms that re-centralize spatial experience by framing the 'real' through the 'perceived' - where the body is the vehicle we can augment, sever, change, appropriate, dress up and down, install software on, and drive. It is as well the cartographer that measures sites providing a diversity of maps and underlining its possible scenarios. This is clear in the work of Jillian Crandall - a Disassembly Cloud - where the bodies of the athletes are the place of projection for all the games that urban fabrics and their inhabitants want to play. It becomes the central place for technological and technical innovation, insofar as it is the vehicle through which users - the spectators - can navigate and transform space - real space, but real primarily through perception.

TROPES: ARCHITECTURE AS NETWORK

Architecture is used to re-link the scattered pieces of landscape that are part of a common abstract body - cultural or otherwise. Abhorring distance, cloud architectures materialize or create virtual networks, linking remote communities together in one space to better analyze, generate, distribute or characterize space and information of a particular locale. In the case of Philip Vernon's project - a Disassembly Cloud - it is through a new low-tech invisible relay network made of cheap RFID particles that tag architecture and landscape elements - that we cross landscapes via existing vehicles of distribution. In the case of Vivian Bratone, the cloud formation that patrols environmental pollution at Perama port, crosses local samples analysis with that of sensors belonging to different research institutes, NGOs, and other agencies with common interests, while offering different opinions and solutions for sites and their problems. Or still in Jennifer Plume's project, the biotech lab reconnected with STAR constellations is now inverted and the real tectonic happens because of information exchange in real time pertaining to the spaces where it is created, transformed and accumulated - here, architecture works as a linkage of space and time, between physical and virtual entities, their contents and potential performance.

TROPES: THE MAP IS THE MESSAGE

Architecture - cloud architecture - the info-aesthetic of a site - reading its present and possible futures. Scenarios are drawn to build excess maps of sites - sites at the edges of their potentials. Those maps become multiple cross-sections of performance as layers that are never all co-present nor work synchronously. The mapping of consistencies in a site becomes a way by which apparently unmatchable narratives find some common deployment points - living up these intersections as nodes/gateways locales where networks do not intensely overlap. The range of methods to achieve this in the projects was diverse. In Jillian Crandall's project, the augmented olympic athlete, reveals a new map of the political, social, cultural and environmental landscape that is Istanbul by effecting real time analysis of sites with its networked sensors ; and as well in Philip Vernon's RFID components deployment, the network of layered RFIDs used by locals as a local and global network that belongs to all but is owned by none quickly becomes a map of the geocultural conditions of the terrain - demonstrating borders, corridors and densities that are not visible in any other existing map. Because they are visible through apparatus that read them but also because of their specific design to the human eye, they become a system of feedback loops by which the design of the nodes insists on an aesthetic of navigation - this creates new figures of mirage, second natures in the landscape and spatial enclosure concepts through layering of the tech of RFID over the tech of the architecture built fabric. In John Baker's witricity relay project, the furnitures that deploy the witricity relay, evidence through their positioning and movement the maps of adjacency and intensity of social exchange, appropriation and participation in the system. Jennifer Plume's STAR constellations in the Biotech lab remaps and acknowledges the real programs of spaces in biotech lab interiors - revealing for instance the ways in which machine rooms are social and how some office spaces are unused 90% of the time - and the ways in which collaboration between projects emerges in a work environment. Vivian Bratone's Cloud over Perama shows the way weather systems - even synthetic ones - are reflections of the sites they inhabit or revolve around. And in Tyler Hopf's project, Disasterology - a Reassembly Cloud - the resulting architectures become maps of the anguished fights between conservation and development, neighboorhood feel and anonymity, typology and perceived space.

TECHNOLOGY AND DELAY: CLOUD VS SMART DUST/UTILITY FOG

An important part of the Cloud Architecture Studios was the process of setting up the scenarios themselves - of understanding the relationship between existing realities and potential realities for the exercise of design itself. We constrained projects to scenarios that have contemporary characterizations of populations, materials and information, and their designs operated within environmental frameworks defined by different predominances or hybrids between access to HIGH-TECH apparatus or potential of resorting to LOW-TECH apparatus. Even though the studios created scenarios of radical extrapolation and speculation, nevertheless in the student work, scenarios that departed from initial conceptual problem-solving outside of architectural problematics never continued into design proposals. Similarly, in spite of the Cloud Studios' interest in material research and invention, some scenarios were avoided. Those where transmutation of matter is possible or where radical pervasive intelligence and communication have been attained - scenarios where Smart Dust or Utility Fog[8] exist, for instance - these were avoided as they would imply very different questions of design than the ones that pertain a contemporary or near future condition. Such

extremes may indeed surpass the need for design, and its very value/concept as practice. Excessive scenarios of suspension of disbelief and problem-solving-centering usually avoid the productive aspects of a delay between problem and solution that innovative design and thought can achieve - the delay present in the lingering imperfect connections within reality's informational and energetic databases.

DISTRIBUTED: THE CENTER IN THE PERIPHERY

A contemporary broader discussion on the generation of knowledge centers on the distinction between the humanities and the sciences and their influences on social development. There is a tendency to distinguish these two branches by methodology: with a contemporary preference for scientific methodology, or that which delivers knowledge through deductively born facts. There is much to be done in revealing the creative aspects of the generation of knowledge within scientific methodology. Namely, the role of 'abduction' in the scientific method [a parallel process to 'induction' and 'deduction'] depends on the practice of a highly cultivated intuition, through the synthesis of learned law and experiment as well as a broad experience of reality's processes.[9] Similarly, in architecture theory, there is a tendency to distinguish between architectural space conceived as background for program, or as program itself. This often creates a binary between aesthetics and performance. Like all other binaries, this creates a misconception of reality - which tends to be made of gradients, and denies the aesthetic of performative value or its inverse. Rather than conceptualizing buildings/edifications as backgrounds where other virtual things happen - such as program, social exchange, content delivery - the Cloud Studios have offered an inclusive and pervasive model for construction of space, such that it becomes impossible to distinguish between space from what happens in/through it. In this way, one could consider that Cloud Studios attempt the meta-performative: the resulting form uses design tools to reorganize elements co-designed with other disciplines. On the other hand, they could also be considered meta-formal or nearer to the True Formalisms described by Sanford Kwinter , where the process of formation is indexed in the form and tectonics - with perhaps dynamic consequences. Designers must become more diligent in making clearer the performative aspect of aesthetics. The Cloud Architecture programs and projects helped reevaluate the trigger of tectonic in spatial design - the information set that is generative. This supported a rhetoric of 'distributed architecture', and tested it within the culture of the discipline and against its potential confusion with ideas of political ideology and organization.

UNCERTAINTY OF FUTURE/PERSISTENCE OF THE CONCEPT OF INHABITABILITY

If architecture is made of inert materials its capabilities are different than if it is made of media, linked, 'active' materials. This brings to the forefront of the discipline and practice new types of invisibilities to virtualities already addressed in the discipline's history. Cloud Architecture proposes a method and pedagogy that puts at the center a model for architectural design which embraces the potential in working with these linked, active materials, understanding their capacity to influence cultural, social, economic and political systems through a range of new materials and formal logics.

ENDNOTES

1. "Megastructures: Urban Futures of the Recent Past" was published by Icon Editions in 1976. Author Reyner Banham.
2. "Wolf Prix&Coop Himmelb(l)au: Get Off My Cloud: Texts 1969-2005" was published by Hatje Cantz Publishers in 2006. Author Wolf Prix.
3. "Shaping Things" was published by Mediaworks Pamphlets in 2005. Author Bruce Sterling uses this book to coin a few terms defining technological objects and their relationships with people and with modes of production - these objects have different networking capabilities with each other and with environments and are placed in eras. Our current era is that of Spimes - objects with integrated history.
4. Philip Ball's "Made to Measure" published in 1997 by Princeton University Press is a visionary early take on the emergence of new materials and properties and represents an interesting setup for the current developments in that area. Significant developments are occurring at multiple universities. Examples are research on metamaterials at Duke University and the consortium for Programmable Matter between MIT, Harvard University and Cornell University.
5. For a contemporary reading on Quatremère de Quincy's work on types, see "Quatremère de Quincy and the Invention of a Modern Language of Architecture" by Sylvia Lavin, published by The MIT Press in 1992.
6. For RFID info: http://electronics.howstuffworks.com/gadgets/high-tech-gadgets/rfid.htm
7. Perama, is a port city in Greece that has had several pollution problems related with industrial and port activities.
8. Smart Fog is a concept, *"is a system of many tiny microelectro-mechanical systems (MEMS) such as sensors, robots, or other devices, that can detect, for example, light, temperature, vibration, magnetism, or chemicals."* (Wikipedia) Utility fog is a concept, *"a hypothetical collection of tiny robots that can replicate a physical structure."*(Wikipedia). For Smart Dust and Utility Fog definitions: http://en.wikipedia.org/wiki/Smartdust, and, http://en.wikipedia.org/wiki/Utility_fog
9. For an interesting essay on the concept of Abduction, see "The Sign of Three: Dupin, Holmes, Peirce" by Umberto Eco and Thomas A. Sebeok