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## < Preface >



*Figure 1: in dialogue with a networked object*

In earlier work performed at the Industrial Design department of the Technical University Eindhoven, the concept of networked objects and a possible Internet of things became known through a Bachelor Graduation project. In this project was done that focused on creating a 'derive' product; something that would trigger the user into unknown paths (figure 1). A short explanation of the concept: The object depicted above is placed in a (semi) public space and has simple geographic goals – it wants to go to places, to travel. In order to achieve this, people have to bring it along, take it with them. Thus performing a form of agency upon the “user” and its environment. Some aspects are, in retrospective, very much pointing out issues with an Internet of things and with objects that blog. The object created inherits qualities that refer to possible key issues in a networked- object - society. It knows where it is (traceability); others can see where it is (networked-ness) in real life and on the Web. Furthermore, it could act (agency) on “itself” (pre-programmed) or in command of others. In order to convince people to act/ react upon its action, it has to convince and/ or attract interaction somehow (anthropomorphism) and when achieved, this interaction has to make sense, or serve at least some form of dialogue (interaction design).

## < Article >

“Never mind Web 3.0: The next stage in technological evolution is a single worldwide computer. Collectively, we are already assembling this mega computer from our billions of Net-connected PCs, cell phones, PDAs, and the like. As an increasing number and variety of devices are lashed to one another via the Internet and other communication systems; they form the components of what we might call the One Machine. Its circuit board encompasses the million copper wires and radio connections linking all the chips contained in the gadgets in your pocket, office, and car. Instead of being powered by a mere billion tiny transistors, as your typical personal desktop is, it runs on a billion PC chips, each with its own billion transistors. Its memory is the collective hard disks and flash drives of the world. Its RAM is the sum of all memory chips online. Every second, a Library of Congress worth of data flows through it. The program it runs — its initial OS — is the World Wide Web. Just as the One Machine's hardware is assembled from our myriad devices, its software is written by our collective online behavior. Each time a person clicks on a search result or creates a link to a Web page, the Machine is being programmed. Each new link wires up a subroutine, creates a loop, and unleashes a cascade of impulses. As waves of links surge around the world, they resemble the thought patterns of a very large brain. Indeed, a hyperlink is much like a synapse in the brain. Both work by making associations between nodes. Each unit of thinking in the brain — an idea, for example — grows by gaining links to other thoughts. The greater the number of synapses connecting to an idea, the stronger it becomes. Similarly, the more heavily linked a Web node is, the greater its value to the Machine. Moreover, the number of hyperlinks in the World Wide Web is approaching that of synapses in the human brain. But the Machine contains a million times more transistors than you have neurons in your head. And, unlike your brain, it's growing at a rate that outpaces Moore's law. By 2040, the planetary computer will attain as much processing power as all 7 billion human brains on Earth. But the Machine also includes us. After all, our brains are programming and underpinning it. As much as we will come to depend on the One Machine (who needs memory when you've got Google?), it will depend on our minds for a sustaining river of input. We are headed toward a singular destiny: one vast computer composed of billions of chips and billions of brains, enveloping the planet in a single sphere of intelligence.” (Kelly, Kevin. “One Machine”. [http://www.wired.com/special\\_multimedia/2008/st\\_info-porn\\_1607](http://www.wired.com/special_multimedia/2008/st_info-porn_1607))

## < *Motivation* >

This article in Wired magazine in fall of 2008. This manifesto for the One Machine raises some discussion points. Can we really state that when things are connected, they become one machine? However convincing this may sound, the fact remains that all different types of artifacts connected to this Net have a different way of entering this sphere of knowledge. The second question mark can be put with the value of this knowledge that this sphere of intelligence is creating. If every click is enforcing a link, thus making this link more important for the One Machine, what will this machine become? Besides, is it defensible to explain human intelligence by mere processing power: by a set of transistors? The point Kelly is making here is that the number of devices hooked on to the Net, and that the different types of devices are expanding. This World Wide Web is not so much an OS (Operating System) as it is a first step towards a new way of looking at how to gather, process and create information. What will happen if the Internet moves beyond the screen – beyond that setup of screen-mouse-keyboard?

In the context of new media and research a couple of fields are emerging where the focus that of what can be called "new media beyond the screen". Here, fields of research not only look at what is happening on screen, but moreover look at how this information is shaped, where it comes from and how it can be manipulated, stored, reviewed. In short, disciplines that currently - or in the near future- are inevitably bound to deal with 'new media' or even becoming that 'new media' themselves. To name a few, think of robotics, tangible interaction, and architecture. A very relevant concept that binds the above-mentioned issues together is the concept of an Internet of things. Within this thesis, an attempt is made to look into how this notion came to be and what other ways and models of looking at this concept can be found. What is the current liveliness of this Internet of things - of networked objects- and within what theoretical frameworks have they evolved? Can foundations already be found and do we need to start looking at an Internet of things from another perspective in order to really see what is happening.

## < Introduction & Research question >

This thesis is an exploration into the status of objects. The objects we surround ourselves with are undergoing a certain change in their standing, compared to objects of old. With the coming of the electrical network, objects were equipped with new capabilities, and this also holds for information networks, where the things connected to them include mobile phones and computers. Recently the concept of an Internet of things has emerged. Objects begin communicating with each other over the same network as humans do. The consequences are that this can alter the relationship between human and object. It is important to examine how to our relationship to objects is being rethought, both in scholarly discourses as well as in what may be called speculative media theory. All together, what does an Internet of things imply for the status of objects? The following investigates what becomes of objects when networked.

The status of objects can be explained by the value that we ascribe to these objects. This value can be of a functional nature or of an emotional one. Do we favor certain artifact above others, and why? What happens in our interaction with these artifacts? How can one choose, and based on what reasons, between all the artifacts and their possible functions? Is the status of object dependent on how many times I touch it, or look at it? Or if it grabs my attention in other ways? Sterling summarizes three principles for interaction between human and thing:

“Is it beautiful? In such a way that I want to show it to other people? Or in a display case?  
Is it meaningful? Does it have an emotional value? Does it have meaning for a long time?  
Does the thing work? Is it useful? Is it a broken thing that I do not want to throw away?” <sup>1\*</sup>

By looking at these aspects, we grant an artifact a different status. We can now make a shift in the abundance of artifacts we surround ourselves with. Another reason for looking at the status of object is that we have to decide which objects we give attention. As Sterling points out:

“I think about my basic relationship with my material surrounding. They (things) are costing you time and space, stealing your life and stealing your space. If you look at your things from that perspective, you get into a new universe, and it is liberating...” <sup>2</sup>

With a growing number of devices becoming hybrid, being part of an informational (digital) network, does this influence the status of objects?

\* For notes, see < Notes > page

## *< Shaping Things and the introduction of the Internet of things >*

In the publication "Shaping Things" visionary Bruce Sterling writes about the history, present and future of things and the way we deal with things. Due to over-consumption and mass production, a resource war is bound to emerge. The current state of manufacturing and distribution of things cannot hold. In the near future, we will have to create a sustainable world. The mayor quest is how. In a world where we (in the West) are so familiar with all types of things, we must alter the way we make, use and dispose of our things. Sterling divides the evolution of things in five stages: artifacts, machines, products, gizmos and spimes. This taxonomy helps to make a point about the type of things we are engaged with (not to divide all things in sharp categories). Within every type of thing, a type of actor is linked: The hunter-farmer is linked to the artifact and it refers to tools 'made by hand, used by hand, and powered by muscle (Sterling, 9). The customer is linked to the machine, where machines are powered by an artificial power source and need specialized support and/or skills. The next step is that of products, which are widely distributed and commercial. The product is made uniformly and anonymous, where quantity becomes a more important factor than quality. The human actor is now a consumer. When products are being linked to a network they become gizmo's. A gizmo is an interface, in fact useless without a network. The human actor becomes an end-user that is actively involved in a dialogue with these things. Here, instead of action-reaction, interaction becomes the most important issue between gizmo and end-user. The next step is from gizmo to spime, where the spime is an 'object whose informational support is so overwhelmingly extensive and rich that they are regarded as material instantiations of an immaterial systems; they begin and end as data'" (Sterling, 11). The human actor now has become a Wrangler; a fully aware end-user-and builder, who is actively involved in tagging, naming, tracking and tracing and creating the objects that surround him/her. In explaining how a new phase of things gradually takes its place in society, Sterling states that all changes take place not within the human or the objects, but in the techno-social. Whenever a change is made, or a paradigm has set its foot in the technosocial, there are two measurements of its saturation. The first is the line of no return. This is where the technosocial cannot return to the previous condition, even if they would want to. The new transformation has had such an amount of impact on the technosocial that there is simply no way back. The second measurement is that of the line of empire: this is where the new standard has an imperial effect on the technosocial. Those who cannot keep up with this technosocial are forced into colonial or defensive mechanisms. In the

process of these changes, it is important to 'explicitly acknowledge the downsides of any technological transformation' (Sterling, 12). In creating the story of spimes, the underside as well as the upper side has to be taken into account from the very beginning. In explaining the taxonomy of things, Sterling takes the example of a wine bottle, that has transformed from an artifact in Aristotle's times, to machine-produced wines, to the point that you can buy wine everywhere, to the point where a bottle of wine has a website. This last stage makes the wine bottle a gizmo/spime thing, because it lures the end-user into the digital realm of the wine-bottle, with all the extra information about the local wine producer, its traces, reviews and so on. Instead of being the end product, the wine bottle is vessel for more involvement. Within this gizmo-culture of information, the end-user is asked of a lot more than before. Sterling explains this by two values you as an end-user deal with all the time: your cognitive load and your opportunity cost (Sterling, 20-21). Constantly, an end-user is weighing these two values against each other: how much effort and time does the gizmo ask of me and what do I receive for it in return. Within the technosocial of the spime, this comes down to designing and creating interactions that 'unite people and objects; designing for opportunity costs and cognitive load' (Sterling, 22). Translating all this to the now, the point is that we are already surrounded by gizmo's. When the metrics of these gizmo's become visible, thus laying bare the entire industrial process of that objects, from cradle to grave, these metrics are more valuable than the object the metrics are about; they become spimes.

He continues by mentioning the notion of metahistory, which is a technocultures' place in time; their context (according to their own knowledge and insights). "A culture's metahistory helps it determine whether new things are appropriate, whether they fit into the trajectory that is considered the right track' (Sterling, 37). It is of vital importance for a society to understand its metahistory in order to be able to make some sensible decisions on what's next. Even more, for a society to be able to survive, it must know about its metahistory as well as being sustainable. The point to make here is that when the computational power of an information society combined with the need for a sustainable society can be achieved via spimes. This because spimes are 'information melded with sustainability' says Sterling (p 43). Because a spime holds and archives information about itself, it is a meta-history generator. The value of that is possibility to trace the movements of people and things through time. When this happens, something like a synchronic society emerges. This society consists of a vast number of trajectories; of small histories between humans and objects; these trajectories are pieces of information that can be altered anywhere, in

real time. This mayor pool of a sort of Wikipedia for everything creates a new way of knowledge, where it is allowed to make any number of small mistakes in a short time: as long as every error is logged and accessible, the same mistake will never be made twice. In continuing this line of thought, objects, things, stop being static, but rather become shaping things; that collect and store all their moves and actions. These shaping things have names and a history; a track record. One way of realizing this is via arphids (RFID-tagged objects). The advantage here is that an RFID tag is unique, and that it is so small that it can be attached to almost everything, thus it becomes very easy to hook up all kinds of objects to a network; an Internet of things becomes visible. Sterling continues by explaining an Internet of things via arphids, where objects become searchable and archive-able on the web. Objects will generate their own data on their location, status, last update, and so on. They might even start connecting themselves to an available network in range.

Wranglers can sort out what they want from this Internet of things, the same way people now figure out what they want from the Web. Another aspect of an Internet of things is that in the near future, mass-production will alter into mass customization, where one designs, or copy-pastes the desired object from a database stored on the Web somewhere, This database makes a connection with a 3d-printer or Fablab-kind-of facility <sup>3</sup> in order to print the object. The thing will be made, probably out of recycled, re-usable or biodegradable material. 'It becomes an instantiation of identity; it is named and becomes traceable. That is a spime' (Sterling, 105). In the final chapter, Sterling tests the concept of a spime to (industrial) design-guidelines once put on paper by Wim Gilles. Gilles has advise on how to innovate within product design (so eventually, spime-design): 'Collate the positive and negative aspects of the products studied, and compare them in order to draw conclusions with which to formulate guidelines for the new product, which should possess as many of the positive characteristics possible and as few of the negative as possible' (qtd. in Sterling, 128) The difficulty however is how to do this; how to create a convincing, new product. Just by making a list of all the good and bad aspects of a design is not enough. Virtuosity and passion of the designer are needed here in order succeed, according to Sterling. Still, we need a better understanding and analysis of the interplay between humans and objects in order to revolutionize it. This is the only way for a technosociety to turn into something new.

## < *How to think about things* >

One way of creating a better understanding of the interplay between humans and objects is to look into theories of understanding what objects are. How are the histories of objects described and how can we think about things? Besides being a contextual starting point for looking at an Internet of things, it is a way to discover how to think about connected things today.

### *Evocative objects*

A point-of-departure is the work of Sherry Turkle and the notion of an evocative object. Introduced in a publication in 1994, called “the things that think”, Turkle points out a history of a relation with things. Where during a lifetime, objects are disposed, re-used or saved; often the reason for this behavior is the notion that objects are giving clues. These clues can be about the history and user of that object. For Levi-Strauss, objects were good things to think with (qtd. in Turkle, 4). But rather than to focus, like Levi-Strauss, on the cool, cognitive, intellectual side of ‘thinking’ these objects were good at, Turkle stresses the emotional, or passionate side of thinking objects can evoke. In describing objects, we are used to point out its functional or aesthetical value. We are, however, ‘on less familiar grounds when we consider objects as companions to our emotional lives’ (Turkle, 5). The concept of an evocative object brings together the notion of both thought and feeling in relation the objects that surround us. Turkle puts it even stronger by stating that ‘we think with the objects we love and we love the objects we think with’ (Turkle, 5). By this it is meant that objects can be seen as a marker for a certain relationship- between people and their objects. Objects can be seen as relationship-carriers: triggering certain emotions or actions, bringing together ‘intellect and emotion’ (Turkle, 5). Where we are literally surrounded by objects (things), it becomes unavoidable that we become attached to these objects in one way or another, provoking emotions, ideas, or simply usage. Turkle claims it is time to give our objects the attention they deserve (Turkle, 6). In describing a short history of the attention objects used to receive, the point is that it was always in a lesser manner. Objects are maybe leads to theory and ‘knowing’ never are they seen as the end result, or as the physical representation of knowing. In a sense, this is what we also see in work of Latour, where he points out that things have always been in the centre of knowledge-creating, politics and reasoning. Not merely as a carrier of discussions or relation, rather being the discussion or relation. Turkle wants to go in the same direction, claiming here that earlier scholars in psychology and philosophy have tried to

move towards the object in order to explain certain phenomena. Levi-Strauss is mentioned in his claim that objects are 'prior to' thought (qtd. in Turkle, 7). For Turkle, this is still not putting objects on the same level, not making them equal; Turkle wants to move up the object in ranking (or scale). In an uprising of attempts in the study of the concrete within scholarly communities, Turkle is adding to this discourse the notion of an evocative object. This contribution contains a 'detailed examination of particular objects with rich connections to daily life as well as intellectual practice' (Turkle, 7). There is a scale in the level of evocativeness of an object. Here, a reference is made to Freud's notion of the uncanny, where he states that we experience things as uncanny that 'are known of old yet unfamiliar' (qtd. in Turkle, 8). In those things that seem close, but are at the same time strange, or unfamiliar in a way that scares us, This notion of uncanny-ness is also known in the area of robotics, where an uncanny valley-graph describes the evolution of robots in relation to man in such a way that at a certain point, they become too familiar and yet unfamiliar, too close to tell the difference between 'real' and 'fake'. After this period, we enter in a phase of acceptance and the uncanny valley-threshold moves up. Turkle links the level of evocativeness to the level of uncanny-ness, where there is also a link to the history of certain objects in our surrounding. The level of uncanny-ness here is linked to history because they lay bear a certain transitional time, a point of change. These objects thus are highly evocative and have therefore a high potential of creative possibility. Where the evocative object 'brings philosophy down to earth (Turkle, 8), the main point Turkle makes is that often these are descriptions of the relation between things and thinking; objects bring together thought and feeling. Moreover, 'objects of science are objects of passion' (Turkle, 9). This is a shift in looking at objects of science, posting them beyond the clinical mind of the scientist, into the passions and emotions of that same scientist. In shedding some light on how and why we have start looking at objects in this way, Turkle turns to Freud, who claims that when we lose a person or objects, we try to find it again in ourselves; "where an objects is lost, a subjects is found" (qtd. in Turkle, 10). Also it is mentioned that in narratives about how we make objects a part of ourselves we can find a language of interpreting the intensity of our connections to the world of things, and for 'discovering the similarities in how we relate to the animate and the inanimate" (Turkle, 10). We have to take a look at the things that matter.

When reviewing the term evocative object and its evolution, it can be said that along with its relevancy with the introduction of "relational artifacts", also its evocativeness has grown (for

Turkle). The first description of an evocative object in 1984 can be found in the book “the second self” and is literally: “An object that provokes self reflection and stimulates thought” (Turkle, 1984). In this case the object to refer to is a personal computer, but the founding elements can be found in ‘normal’ objects that surround us. They trigger thought as well as feeling. Due to digitalizing, the informational layers on top of these objects enlarge the scope to trigger, to evoke functional as well as emotional interaction. Via this digital layer we can ascribe more common attributes to these objects. By this I mean that thoughts usually only communicated via ideas in our minds or via language, now have a physical representation. Things to think with like laptops, PDA’s and mobile phones can evoke new values derived from objects in our surroundings. The point to make here is that rather than functional or task-driven values, emotional (or “soft”) values can point out a more intriguing role for objects. These hard-to-measure-values do have large consequences for the way we think, feel and experience, due to their power to establish and maintain our relation to networks, always leaving us the possibility to be “on”. Continuing, the notion of a relational artifact is given when looking into human –object relationships. “Relational artifacts” are computational artifacts specifically designed to engage the user in a relationship (qtd. in Turkle, 1). With the first example being that of the software program Eliza by Weizenbaum, the term encompasses both digital and physical “things” (or in this case “bots”) as means to describe that we do not only create functional, but moreover psychological relations with things. The point Turkle makes is that these relational artifacts have become evocative objects; objects, “that clarify our relationship to the world and ourselves” (Turkle, 2005). The difference between computational, or ‘smart’ objects and ‘normal’ objects is that of activity. While both types of object can be evocative in triggering emotions or creating though connections, the first type has the possibility to act rather than to be a tool of reflection. Turkle summarizes this as a shift from projection onto an object into engagement with a subject. The importance of this notion can be found in the development of, for instance, Artificial Intelligence, where ‘the computer enters into our thinking about mind through our everyday interactions with computational objects’. In recent years, people have embarked on a range of new inter-subjective relationships, some of which, albeit problematically, have taken machines as subjects. Understanding these forms of interaction -one on one with computers, on the Internet, in virtual realities, and with robotic creatures- calls for psychodynamic modes of understanding. New computational objects in the culture serve as "objects to think with" for a revitalized psychoanalytic discourse.” 4

## *Parliament of Things*

Bruno Latour presents another view on how to think about things in his work “From Realpolitik to Dingpolitik, or how to make things public”. In this article, politics and public space are discussed, where the claim is made that perhaps we need a shift towards the politics of things in order to re-map politics. This can be achieved via the introduction of Dingpolitik (as opposed to Realpolitik), combined with a set of experiments to research the following question: “what would object-oriented democracy look like?” (Latour, 4). He states that objects trigger the connections of public, or at least shared, issues. ‘Each object gathers around itself a different assembly of relevant parties’ (Latour, 2005), and triggers discussion. All these objects, with their issues, are binding us into a ‘public space’. Where this has up to now never been looked into as being political, objects are. Latour continues by strongly criticizing political philosophy due to its ‘strong object-avoidance tendency’. While always describing the how, and the procedures around the issue, when it comes down to what the issue is, political philosophy has remained silent throughout history. Within the *res publica*, the only focus until now has been on the procedures, not on the things that allow for politics; the ‘matters that matter’ (Latour, 6). Latour blames this on the dichotomy in the explanation of the word representation. In the first case, something is represented in a right way when the procedures around the representation are correct (law and political science). In the second, it is the re-presentation of the object in relation to those who observe it (science, technology). There is a need to investigate how and through what medium the matters of concern are discussed. How are all involved parties, people and things assembled? While one might claim that the actors in this setting are the human beings organizing this assembly, Latour claims that the influence of things have an even role in creating this assembly. To continue, this brings in another problem: ‘to assemble is one thing; to represent to the eyes and ears of those assembled what is at stake is another (Latour, 8). An object-oriented democracy should be concerned as much by the procedure to detect the relevant parties as to the methods to bring into the center of debate the proof of what it is to be debated’ (Latour, 8). In this proof finding some problems occur: when is something proven and when is there room for discussion? Is there something like a matter-of-fact? Here, he introduces a new approach by looking into matter of concern rather than matters of fact. Where objects used to be looked at as a literally matters-of fact, this is false, or at least too narrow of a view on the matter. But how can we transform objects to matter-of-concerns to things? Latour points out how the Ding has been around for centuries, referring to thingmen dating back from old northern peoples. It has always

been things that brought people together, because things divide. It is time to go back to things (Latour, 13). Now, the question rises how things should be shaped; what is the aesthetic of these things within current society? Latour claims, that all of us are politically challenged when individuals; only when issues become public in any form of assembly, politics can happen. While often in history, this advice has been taken too literally in the shape of spheres and domes; maybe it is time to look for other places of publicity, than the rather archaic town halls, churches and parliaments. These 'palaces of reason' (Latour, 20-21) are no longer sufficient places for our issues. Latour continues by pointing out that another mistake made in Western political history is that it focused on settling differences, instead of trying to co-evolve with a set of indifferences. Here he makes the argument for disagreement and cohabiting, especially with indifferences. How can this be achieved? Well, first of all by altering the view on the form and metaphor of state. Where the focus used to lie on body politics, imagining the state as something to be formed with one General Will (Latour, 28), we should be looking into politics of pragmatism ('pragmata' being Greek for things). In further debunking the political Western history, the next and important point to make is that of the shift from politics of time to politics of space. Where paradigm shifts of ways of thinking in politics, art, or science have always been labeled chronologically, one following the other, we now enter a time where time itself is condensed. Everything has become contemporary (Latour, 30). Although ordering things in time has been quite sorted out, we now have to move into a new territory: that of ordering in space. With a whole set of points made, the question of how dingpolitik can take shape now remains. How can we re-order the balance and become involved in Dingpolitik? Here Latour ends by providing a set of guidelines if you will, or parameters for success of dingpolitik, summed up in my own interpretation:

- 1) Politics go beyond humans, and have to involve everything they are linked to.
- 2) Matters-of-fact have to become more than that- they have to find a way to attract more attention and become matters-of-concern.
- 3) The traditional ways of assembling for politics, and matters-to-be discussed have to be altered into 'virtual parliaments', probably way more distributed than the current situation.
- 4) We have to accept flaws of human capacity and accept 'help' from all kinds of systems around us.
- 5) There are more and alternative ways of government-mechanisms over 'speech'.
- 6) Old bodies of politics must give way to a more fragile 'phantom' public to assemble.
- 7) Dingpolitik can exist only if we let go of a chronologic way of thinking and revert to a 'politics of space'.

The value of this “dingpolitik’ in the light of networked objects and an Internet of things becomes clear immediately. Where static objects were sometimes altered into ‘things’ or ‘matters-of-concern’, this still happened passively. The decision of assembling around the object was in the actor’s hand of humans. What if objects themselves can gather, spread and claim issues, turning each other into matters-of-concern? In his book “ We have never been modern” Latour investigates the history and evolution of the Modernist Constitution, in order to decipher- and debunk it. Where we have been settling for a dichotomy between nature (objects) and society (subjects), the western science has posted itself in the impasse between the two, the one never able to explain the other and never by the same arguments. In this nature-culture discussion there are a few ways to critique this seemingly everlasting dispute. The relevance of this attempt is to alter the way we look at our things, and their role, or status. Within this constitution, there are four anchor points:

- Transcendence of Nature: We can do nothing against Nature’s laws.
- Immanence of Nature: We have unlimited possibilities.
- Immanence of Society: We are totally free.
- Transcendence of Society: We can do nothing against Society’s laws (Latour, 36; ch.2).

By mixing up one with the other, by using Nature’s anchor point to explain Society and vice versa, for instance by changing human relations into durable objects, all could be explained, and Moderns were always right (even invincibly right!). The problem here lays in the fact that Modern thinking has given up on the delicate web of humans and things, something the ‘pre-moderns’ were involved in. The work of the Moderns – purification and mediation, leads to the separation of all into two camps; that of Nature and that of Society. Due to this steadfastly hold to an absolute dichotomy between the order of Nature and that of Society made it possible for hybrids to develop on a large scale (Latour, 40; ch. 2). Not by the separation of Human and Thing, which the Moderns so eagerly chased, but rather by the amplification of their contacts could hybrids grow so vast. Where it is now clear that the multiplication of hybrids has saturated the constitutional framework of the moderns (Latour, 51; ch. 3), we now move to the quasi-object. In wondering why this dualism is so strong, Latour asks: is not society literally built of gods, machines, sciences, arts and styles (54; ch. 3)? Why has it always been impossible for the social sciences to accept the object as part of that society, rather than turning to the ‘hard’ facts of natural sciences to provide for answers and vice versa? The things in between, the connectors that were always there but

never recognized as such, are called quasi –objects. These objects are not intermediaries, but mediators. They are simultaneously real, discursive and social. They belong to nature, the collective and to discourse (Latour, 64; ch 3). Latour claims that, in order to understand the modern world, we should embark on a mission to follow these quasi-objects or networks.

The statement that ‘the asymmetry between nature and culture then becomes an asymmetry between past and future; the past was the confusion of men and things: the future is what will no longer confuse them’ is what caused modern temporality, where we kept looking at the world in a superposition between past and future. Instead, it is wiser to accept a poly-temporality: we have reached a point where we are mixing up times. Latour’s argument is that the connections amongst beings alone make time. Instead of focusing on this constant fixation with ‘the next thing’, or ‘the new paradigm’, now we can give up analyses of the empty framework of temporality and return to the passing of time – that is, to beings and their relationships, to the networks that construct irreversibility and reversibility (Latour, 70-77; ch. 3).

The question that rises then, is how? And what does such a collective look like? How do we manage this shift from immanent/transcendent society towards collectives of humans and non-humans (Latour, 77; ch. 3)? Not by trying to create another revolution or debunk another paradigm. Rather by just re-thinking, re-evaluating the role of these quasi-objects, acknowledge them. Where things and human first needed to be explained ultimately by Nature Or Society, Latour points out that we do not need to attach our explanations to either Object or Subject/ Society. They are both part of the same central starting point: the collective that produces things and humans (Latour, 79; ch. 3). These quasi-objects can transform from intermediaries to mediators, because the message (however shaped) they transport, will undergo a transformation, is edited, altered, due to this transportation. The shift in thinking is about not to try and explain how the subjects constructs the object, but rather how the objects shapes the subject. To back up this point, a reference is made to the origin of the word ‘thing’, which is literally ‘cause’, a word from the realm of politics and criticism. In order to connect the four pillars (mentioned above) made by the Modern, Latour states that we have to move from digging into the essence of things into the event of things: the fact hat they ‘trace networks’ (Latour, 89; ch. 3). The quest of finding the truth becomes different when we chase not only the phenomena, but also gain access to things themselves. The real is not an abstract entity, but accessible in all the objects mobilized throughout the world (Latour, 90; ch. 3). Maybe there is more to things-in-themselves than we now

give them credit for. On the other hand, the collectives we move ourselves in, are maybe more interesting than the humans-amongst-themselves led us to expect. (Latour, 91; ch. 3) If we look at humans and objects together as a collective, maybe that does tell another tale. The dimensions of these collectives make sure that new hybrid keep popping up: an increasing number of objects need an increasing number of subjects. The nice aspects of science and technology are that they multiply the non-humans enrolled in the manufacturing of collectives and because they make the community that we form with this beings a more intimate one (Latour, 108; ch.4). So in order for these collectives to endure, a different role is given to the hybrid, the quasi-object and the human; one that is not so distinct, but much more networked than thought before (Latour, 117; ch. 4).

About networks, Latour continues that a typical technological network, like that of railroads or telephones, have a local aspect and a global dimension; they globally connect certain very local places; 'they are nets thrown over spaces and only retain a few scattered elements of those spaces' (Latour, 118; ch. 4). Where technical networks encounter these limits, ideas and knowledge networks seem to travel effortlessly across humans and objects. This because words like local and global do not really work in terms of networks and topology; in the past, we have been mixing up methods of spreading ideas. That's why they are so hard to trace; Maybe if we were to put those "high" or 'spiritual' concepts and ideas into technological networks, like for instance the computer makes possible, we can make a far more clear picture on how and where ideas roam, where they stick; to summarize, we can trace them. Latour thinks the time is there to make this transition, because our current societies' generations has been raised with science and technology; 'we no longer belief in the virtues nor the dangers of science and technology' (Latour, 127; ch. 4). Latour concludes with stating a Parliament of Things. We will have to make things public; show the value and the potential of hybrids. The mediators will have the new space all for themselves, not necessarily answering to works of Nature or Society. This new quasi-object that is created within the object-discourse-nature-society has new properties that will astound us all; its network extends from my refrigerator to the Antarctic via Law, chemistry, the state and satellites, for instance (Latour, 144; ch. 5). Re-shuffling the way we look at Things can create this Parliament, if we are ready to connect science with politics and nature with society.

## *Cognitive Science and the Cognisphere*

One binding factor of nature and society is that of action. Instead of making a separation, via an analysis of action, insights can be found in how nature and society are connected.

Lucy Suchman tries to capture what exactly happens when models of cognitive science are projected upon computer science. In 'Plans and situated actions' a theoretical evaluation is given on cognitive science and HCI, where the statement is made that all action is fundamentally concrete and embodied. In an analysis of action, it is claimed that every action is situated, and, whether planned or not, this action is ad hoc. In discussing interactive artifacts, questions concerning the distinction between artifacts and intelligent others, especially computer-based artifacts are investigated. Where artifacts used to only express their possible functionality, now these computer-based artifacts facilitate uniquely interpersonal activities, due their possibility to communicate. Interaction between people and machines implies mutual intelligibility or shared understanding, where a kind of almost-aliveness is ascribed to the computational artifact: the machine. One can question here if this understanding is actually mutual, and in what ways this artifact really 'understanding' its surroundings, including the (augmented) human actor as agent. In discussions on the mind and how intelligence can actually be described, it is stated that 'it is neither substantial nor insubstantial, but as an abstract-able structure with implement-able in any number of possible physical substrates' (Suchman, 1987). This would mean that intelligence is only accidentally embodied in the neurophysiology of the human brain. In decoupling reasoning and intelligence from being purely a human thing, it opens up space for intelligent artifacts'. The behaviorist reaction was that action should be understandable by describing the relation between organism and environment. The computer poses a new kind of environment. From this, artificial intelligence emerged, combined with new theories of information. From all these new influences, the cognitive view derived: 'to relocate the causes of action from the environment that impinges upon the actor to processes in the actor's head. Cognition is not just like computation; it is computation' (Suchman, 1987). This has widespread implications, for example that of the development of robotics. Problem remains that, despite the sense that we as humans keep seeing computers as intelligent, the state of the art intelligent machines are still not smarter than a young child. Whilst being a debatable statement, in the sense that the cognitive skills of a young child are far more complex than computers even now can imagine, the overall message is that in order to improve the dialogue between human and object, we have to look at other forms of intelligence besides the computational one.

In a publication in "Theory, Culture and Society" Hayles discusses the networked society, where she focuses on 'contemporary formations'. At the centre of these formations are networked and programmable media. These media have a large impact, from 'sensimotor functions and non-conscious cognitive processing to national political discourse and transnational economies' (Hayles, 160). Within this networked-ness, the individual human is no longer the best-suited research topic. Instead, Hayles urges for an investigation in 'relations', with the specific question: what relations should be foregrounded? In contemporary moment, these relations are intensified, as technologies are becoming more pervasive and interconnected. According to Hayles, the human, the animal and the technological are joined in shifting configuration of value (Hayles, 162). She performed research into the post-human, where this post-human is 'construed as an informational patterns that happens to be instantiated in a biological substrate'. An even more valuable insight in this research is the recognition that agency is always relational and distributed, where the (post) human cognition is extended beyond human flesh into the social and technological environment. A consequence of this movement of cognition is that human awareness (in highly developed societies) 'compromises the tip of a huge pyramid of data flows, most of which occur between machines' (Hayles, 163-164). Thomas Walen has named this new realm of cognition the cognisphere. This cognisphere does not only encompass the Internet, but moreover all networked and programmable systems, obtaining some form of data flow. The cognisphere names the 'globally embedded'. This cognisphere does not only address humans, but all actors within this sphere, including machines (and possibly enhanced animals?). Within this sphere, machines are 'more cognitive than ever before in human history' (Hayles, 161). She continues by showing negative as well as positive aspects concerning the agency of machines in the cognisphere, mentioning surveillance issues as well as increased communal knowledge building. What is more important is the change in subjectivity that the cognisphere is bringing about. As intelligent machines become more important and more present, human agency re-evaluations also contribute to the re-evaluation in human-animal relations. According to Hayles, the understanding that humans and animals have co-evolved together is consistent with the way humans and machines are now co-evolving. The common ground for this evolving can be found in the concept of computing (which is not bound by any medium), where the vision is adopted of seeing computation as the means to construct physical reality. Hayles claims that 'computation emerges as a crucial aspect of the entwined dynamical hierarchies that structure and energize relational dynamics, where we as inhabitants of globally interconnected networks, we are joined in

a dynamic co-evolutionary spiral with intelligent machines as well as with other biological species with whom we share the planet' (Hayles, 164-164). To sum is this rather large claim and to put it back in the context of the cognisphere, the main point to make is that in a cognisphere, we can no longer look at our world in binary terms, but must realize we are in a co-evolving and densely interconnected complex system. For Hayles, the Internet of things is an evocative object for thinking about this coming cognisphere, providing a method to explain the relevancy of thinking through this cognisphere. When taking the notion of a community of connected things, this can be seen for Hayles as the first 'proof' of an environment of networks.

## < *How to think about an Internet of things* >

In the previous chapter, three ways of thinking about things have been introduced and explained. These three ways are concerned with how to explain what objects are from a social-theory point of view. Instead of leaving objects unexplained and lifeless, the overall claim is that we are highly entangled with our object. It influences our ways of thinking, both rational as emotional. Objects empower us, and have always empowered us. Not only as tools to manipulate our direct environment, but also as means for communicating, for discussion.

The authors have contributed by rethinking our relation with objects and call for a re-evaluation of objects. Within an Internet of things, we are dealing with a growing set of objects that are part of an information network. What happens to objects and our relation with them in an Internet of things? In order to find out how what happens to the status of objects in an Internet of things, in this chapter the three notions of how to think about objects are projected on an Internet of things.

### *An Internet of Evocative objects*

It is already a difficult task to make some kind of sorting or index in the amount of attention we give to the objects that surround us. In thinking about an Internet of things-scenario, the notion of an evocative object can provide a way of dealing with the amount of attention we give our networked objects. In our behavior with objects during a lifetime, different things happen. The objects we use are disposed, re-used or saved. Often the reason for this behavior is the notion that objects are giving clues about the history and user of that object. This facilitates the decision on how to deal with the object (throw away, keep or re-use).

In an Internet of things focused on sustainability, this behavior can be influenced, due to the added information we have about the user and the history of this object. In the scenario Sterling sketches out, this archived information shifts our behavior towards object because we have access to different, and more, information than our own history with- and use of the object. In this Internet of evocative objects, the objects are themselves active in evoking. The notion of relational artifacts that brings forth a shift from projection onto an object into engagement with a subject is closely linked to Sterling's vision of spimes that serve a vessel for engagement. These vessels are to engage us in a way that is highly evocative; they would possess a high potential of creative possibility. If we think about how this would take place, these objects would constantly lure us into the digital side of the object, showing the networks and traces it has been in. In doing so, an

Internet of evocative objects is a perfect example of what Sterling means by ‘cognitive load versus opportunity costs’. When a large amount of objects in my surrounding will try to evoke thought and feeling (for instance by constantly reminding me of the (un) sustainability and history of use) how will I deal with this Internet? What does the evocation of an object cost me and what does it give me? The concepts are connected via the notion that a) I will have to deal with objects, always and that b) the more the object can do for me, the more likely I will interact with it/ deal with it. A following issue is that of how I will be evoked by this network of relational artifacts. If we see spimes as objects with a website, or a digital archive attached to it, how will I constantly access this information? As Turkle stresses the point of re-thinking relations, she turns to the fact that the physical presence of these relations can evoke. Within an Internet of things, where the interface to the added information that is to evoke, is moving into the background, the physical relation is lost. In other words, how can an invisible computer evoke, emotionally or rationally? In using the notion of an evocative object to envision an Internet of things, two issues become clear. The first is that objects gain the possibility to become evocative by revealing its history and use to the current user. The second is that if technology moves into the background, and becomes invisible, as envisioned in an Internet of things, it becomes unclear how the object can communicate its higher level of evocativeness. How does one know that an object has an extra layer of information when this information remains hidden?

### *An Internet of Political things*

Latour’s notion of Dingpolitik could be a think to think with about the Internet of things. How can we rethink community and a politics of objects? As objects are physical representations of relations, what meaning and politics can be found in what do these relations evoke? When projecting Dingpolitik on an Internet of things, added value can be found in creating awareness, or at least a tool for reflection on the impact, and potential power, of connecting things together. The way to do this is to make visible the things in between via quasi –objects. Also, Latour states that Dingpolitik can exist only if we let go of a chronologic way of thinking and revert to a ‘politics of space’. An Internet of things provides a way of making these quasi-objects recognizable through the concept of a spime. A spime-object as described by Sterling could make this transition of time to space: a spime is a meta-history generator. The value of that is possibility to trace the movements of people and things through time. When this happens, something like a synchronic society emerges. So, via the spime, a notion of objects through time becomes visible, together

with the networks this spime has been involved in. The value of “dingpolitik” in the light of networked objects and an Internet of things becomes clear when we think about this added layer of information. Where static objects are sometimes altered into ‘matters-of-concern’, this still happens passively. The decision of assembling, of gathering ‘around the object’ is in the actor’s hand of humans. In a spime- environment, objects themselves can gather, spread and claim issues, turning each other into matters-of-concern. In thinking through an Internet of political things, another important aspect is mentioned by Latour. While these objects might be involved in collecting data in order to form issues and to assemble, the way in which they can do this is of as much relevance. ‘An object-oriented democracy should be concerned as much by the procedure to detect the relevant parties as to the methods to bring into the center of debate the proof of what it is to be debated’ (Latour, 1993). Networked objects need to be more versatile than relational artifact we surround ourselves with currently in order for an Internet of political things can operate. This can be read as a call to relational artifacts to become more diverse, or to the concept of an Internet of things that it cannot contribute to a Parliament of things. Latour gives a warning here toward thinking about objects in that manner, stating that we have to move from digging into the essence of things into the event of things: the fact that they ‘trace networks’. This would mean that within an Internet of things, the lesson is that the focus must not be on the fact that objects are in a network, but rather how these objects are connected. How are they gathering data and how does this data relate to the network the object is in? Is it logical for a phone camera to send its picture directly to a public account online, for example, or is it more relevant to send it to all the phones of people that are accidentally in the picture at that place and time? Latour notes that a typical technological network contains a local aspect and a global dimension; they globally connect certain very local places. Moreover, where technical networks encounter these limits, ‘ideas and knowledge networks seem to travel effortlessly across humans and objects’ (Latour, 1993). If the connections of an Internet of things are of a diverse and contributing nature, the concept can be more than a technological framework. If histories, mistakes and improvements of objects were to be archived and traceable, this would mean a contribution to idea- and knowledge networks. A point of critique here is that it will become difficult to check the validity of the information in this Internet. Can I trust my things in this network to be a reliable source of information and action?

## *An Internet of cognitive relations*

In describing what a cognisphere is, the major point Katherine Hayles makes is that we should go beyond the notion of a cyberspace – some virtual, new dimension where we can dwell – and rethink the situation we are in now. When technologies are becoming more and more saturated in daily life situation, not only for us humans, but also for other forms of life around us, the relation we have with these others must be re-thought. What Hayles wants to point out resembles the work of van Mensvoort on the blog NextNature [5](#), where perspectives on nature and culture are questioned. We used to be scared of the powerful entity of nature, being something transcendent and bigger-than –ourselves. Now that we have cultivated nature, the magic is lost. Culture, however, is growing out of our control, where something like the Internet can be seen a form of NextNature; a cultural product that reaches beyond our understanding. Whether this mystifying and de-mystifying of Nature and Culture is a wise thing to do remains up for discussion. The point is that the relations we have with our surroundings are changing. Where the reference used to lie in the domain of nature, we are now shifting towards a ‘basis’ of cultural, or maybe next-natural knowledge. If kids start to question why the woods smell the same like the shampoo at home (van Mensvoort, 2005), it can be stated that relations are indeed altering. But how do these relations take shape now? Without exactly being able to answer that, the viewpoint is adopted that technological progress has brought an intensification of these relations. Where Hayles puts forward the urge of investigating these relations, it may be of interest to look at what relations are now intensified. Without discussing the consequences things like the phone or the Internet have on humans, rather I would like to point out the consequences for things themselves. One consequence for things is that connected things are more popular and yet more disposable than ‘dead’ things. Connected things are maybe touched more, they for sure are thought of more; they are more present in our cognition, playing a more important role in our lives. Being a mobile phone, for instance, means you are bound to travel more, be looked at lots of times a day, being connected to a network. It also means you end up in the trashcan after a year of intensive use. Within the hierarchy of things, this means you are a more import actor in the cognisphere than, for instance, a table. This is because you are a medium for relations. Moreover, you know things, like the time, and where you are right now on this planet (overtaking two objects that commonly used before; the watch and the compass). That makes you a more wanted, a more influential thing than others. If you are a state-of the-art laptop, your influence is beyond reckoning; you facilitate whole new ways for humans to deal with their surroundings, their way of information gathering and

learning; you are changing societies and you even mess with their view on reality. Your influence is of such a magnitude that you even start to become a scary tool that humans do not fully understand anymore when hooked onto a network.

When looking at the cognisphere from this perspective, it becomes clear that we are already entangled in deep relations with some of our things. These relations can be of a pure functional matter; they have proven to be capable of way more than that. One example here is research done by Friedman et al. Exploring emotional attachments with relational artifacts like the Aibo, a plastic-and-motor- dog that can raise as much affection as a real dog (Friedman, 2003). More examples can be found in high-end robotics, where topics like anthropomorphism and the “uncanny valley” (Mori, 1970) are important subjects here that reveal an already existing notion of a cognisphere. But, where this is a high-end, in-depth example, an Internet of things approach can possibly show a more broadened and in-reach view on a developing cognisphere. What will happen when the laptop and the phone mentioned above, which are both widely used and accepted ‘smart’ objects, express more competition? A scenario where not just one or two things are becoming more and more intelligent, but where a larger set of things becomes a little bit smarter. The point in this scenario is that, however influential they are, when only one or two objects possess this form of agency, we can still close-off, or opt-out of this agency; we can choose to close the laptop or shut off the phone. However, this becomes more and more difficult. When one does opt-out, his or her agency is weakened; the dependency of one’s agency, one’s momentum of action, is already for a large part the dependency of connectedness. Within the scenario of even more and more things connected, being able to carry this agency of ours, or that of things, this opting-out becomes increasingly more difficult. This means that we will be involved in a more densely connected surrounding, providing opportunity for learning, for comfort, for spreading a message. Such a network is empowering. On the other hand, such a network will compromise our role as individual, as the main actor in my surrounding. Moreover, this scenario will alter the hierarchy of things themselves, and the way we have a bond, a connection with these things. One straight-forward and visionary argument for the latter scenario to evolve is that when the development of even more processing power for computer starts to stagnate, thus the maniacal growth of new possibilities and applications in such a short time, existing technologies will try to find their way into new use and into new applications. They will spill out of the laptop into other things, forming new hybrid objects that co-operate with the computer and its network. Even if

it is a progression from your computer-setup to smart objects surrounding this setup that will start to communicate, trace and save data, this can be seen as a cognisphere coming to life.

## Optical Enhanced Pussycat Voyeur



*Figure 2: an actor in the cognisphere*

The figure above, which was made during a workshop about possible next natures, shows a future actor in this cognisphere. Hayles states that (as mentioned above) 'as intelligent machines become more important and more present, human agency re-evaluations also contribute to the re-evaluation in human-animal relations'. The above is an example of how we need to take another look at this 'optical enhanced pussycat'. By enhancing it, it maybe is connected to monitor the mouse population in the city, expanding knowledge about these types of networks. It may also be a new form of surveillance. This picture shows what can happen. Probably, such a scenario would alter our relations with this cat. Now we can see the problematic angle of a cognisphere; a sphere that knows. How do we know it knows? And feels, looks, interprets? How to make sense of the generated data, the new networks and the new players in these networks?

### *City of trust versus city of control: A combined scenario*

In an interview held by the french magazine *Chronic'Art*, Sterling points out insights concerning the Internet of things and the theoretical framework of *blogjects*, and *everyware*. About how to think about these concept, he notes:

“The new digital divide will take shape in division between those who can and cannot hide from visibility of the network. Concepts like an Internet of things and *everyware* mean the arrival of order and precision; an extra calculative layer on top of chaotic reality.”

(Sterling, 2008)

What will be the consequences of this paradox? According to Sterling, who thinks about Deleuze's 'postscripts on the societies of control', where discipline has become nomadic, something immanent in the world`;

'it is not so much domination of the machine, but rather a subordination of will and desire to a set of inappropriate logics Of course a poorly designed ubiquitous systems can have catastrophic consequences. But we can also learn from it; we can get smarter. Within a connected, *everyware* world, every human activity will leave a data trail, place in a certain time and space. Possibilities to search and re-use these traces are already present in our daily conversations. We already Wiki, Google, and YouTube during our daily conversations. In this line of questioning, what the real consequences are for our psyches and that of societies is something we cannot answer at this moment.' (Sterling, 2008).

Rob van Kranenburg can find a scenario that explores both the dangers of enclosure as well as the potential empowerment of an Internet of things in the recent publication [6](#). This booklet can be seen as an evocative object for thinking about an Internet of things. It combines theory and reflection as well as a strong emotional bond to the discussion what do with the coming of an RFID-infested world of things that are linked. In the notion of an Internet of things, van Kranenburg contributes to the discussion of a design approach as well as to the radicalizing of future scenarios by dividing options in a city of control versus that of a city of trust. The point made is that scenarios of Ambient Intelligence are decreasing our agency. Things should be physical representations of places of discussion: they should be places to fight for, with a bottom-up approach. If we were to keep our social power, we should be able to have control over our physical presence. We should take control not only over our objects, but also over our own protocols for community. Within (especially the European/western) acceptance of networks and information systems introduced by

top-down politics, we are losing grip on, literally, how to act. The approach here is that of looking at an Internet of things is from a human-agency, bottom-up point of view, where van Kranenburg can draw from both theoretical as well as practical and artistic experience with the subject. He also notes that each technology brings forth its own literacy; the booklet demonstrates this by touching different aspects (technological, political, artistic) with the main focus on how to act. In this case, the Internet of things becomes a tool to reflect on the current politics of technology as well as a scenario-based advice that we do have to think about an Internet of things.

## < *Key properties of networked things* >

In the previous chapter, different ways of thinking about an Internet of things were given to find out if object that operate in a network provide reasons to alter the way we think about things. In this chapter, the object itself is explored. If we can see a change in the way we think about things, how does this alter our things? What key properties of things will become more important, or need changing in order to fit a new way of thinking? In this chapter, these key properties of the relational artifact are looked into. This is done by first describing their importance and history of this importance to the relational artifact. Second, they are placed in an Internet of things in order to see how these key properties behave. The three properties discussed are the link, the interface, and agency.

### *The link*

Within the first relational artifacts, a key issue was the possibility to link information (in text) dynamically, via a hyperlink. The first writing on hypertext dates back from 1945, when Vannevar Bush introduced the term in his article "As we may think". While the term was officially coined by Nelson in 1965, the conceptual outlines were sketched in 'As we may think'. Within a historical context, a new focus in science was emerging after WWII. Where most scholars were performing research for the army, now new areas and goals for study were emerging. Bush sought a solution for the growing amount of research. He wanted to develop a system that could help the scholar to organize and search his and other's work in a way more efficient way than the static paper and print can provide. Moreover, in this search he also saw possibilities for this system beyond the realm of the scholar. It could change the way people read, write and retrieve information, thus the way people think about information. In a time where the first computers were in the early stage of development, Bush first talks about the possibilities of computing in terms of adding, subtraction, multiplication and division. Bush continues by giving future scenarios on how such a machine could work (by a control card or microfilm). Further on he introduces his design for such a system, called the Memex; a microfilm-based 'device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility (Bush, 1945). The concept of the Memex consists of a desk with a copier, a voice recorder, microfilm and a punch card reader. Moreover all kinds of levers are integrated to manipulate data. Although never built, the Memex hold basic insights in terms of how to handle a

vast amount of documents and the way of navigating through information. Based on the premise of the associative brain, Bush states that this device allows the user to make associations between texts and documents and can directly jump towards these documents. The machine will remember and store the trail of thought and keeps the documents linked. Such a way of working would alter man's view on his own history and development, by finding new trails and links between pieces of information. Bush introduced terms like links, linkages, trails and web. The Memex as an (conceptual) object evoked future scenarios and a whole new paradigm for thinking about information, but also for thinking about empowering human agency. Theodore Nelson actually coined the term hypertext for this kind of system. Coming from a mathematical background, the prefix "hyper" for him means, 'extended and generalized' (Nelson, 1987). To Nelson, hypertext was a necessary tool for his work as an author where he claims that a tool like this should be simple and idiot-proof: 'A user interface should be so simple that a beginner in an emergency can understand it within ten seconds' (Nelson, 1987). A system that could prove concepts designed by Nelson was called the Xanadu project. This evocative media project had the main goal of 'allowing you to see connections between the contents of different windows, like rubber bands between the middles of the windows' (Nelson, 1987). For Nelson, hypertext was above all a literary tool that enables the author of a text to extend his or her text to the multiple and successive versions of it, in order to compare them. Links are not broken in successive versions; documents can be shown alongside each other. It is about transpointing windows and transclusions. It should be applicative instead of embedded. At the same time when Nelson was developing his Xanadu concept, Engelbart was working on a similar kind of project concerning the Augmentation of Human Intellect. Engelbart realized that 'we have this extremely flexible way in which computers can represent modules of symbols and can tie them together with any structuring relationship we can conceive of'. For Engelbart, hypertext is based on the premise that computers should be able to perform as a 'powerful auxiliary to human communication and collaboration if they were to manipulate the symbols that human beings manipulate'. For this to happen, humans and computers should co-evolve: the computer should learn to manipulate the human language and the human should learn to use the computer, where language act more as a social constructor than a symbolic representation. Where for Nelson hypertext is a tool to expand individual creativity, for Engelbart it is a way to improve communication. Now, a twofold in describing hypertext emerges: that of association versus connection. According to Bush, the human mind operates by association. In a web of trails, where a necessary criteria of connection is 'that it be intelligible by

others, and therefore the individuality of the subject cannot enter to the extent that it does in free association' (Bush, 1945). The importance of this dilemma takes shape in designing a hypertext-system. It is about the degree of freedom of the possible associations a user is permitted to make, ranging from free association to controlled connection within a system. In designing the interface to deal with this problem, the desktop metaphor was introduced, where Nelson stated in an interview in 1993 that we are now 'trapped in the success of the metaphor'. Historically, the desktop metaphor derived from the physical desktop of the information worker, with the anticipated situation that 'the user would be an individual owner of a personal, stand-alone computing system' (Bardini and Hovart, 1995). In retrospective, the individual user indeed has won over the model of a member of a user's community. Bardini claims that most of today's computer applications are more linked to 'association', than to 'connectivity' (Bardini, 1997). The relevance of this discussion lies in the fact that these were grounds for further development in theorizing the use of computers and the role of agency within this dialogue.

### *Hypertext and an Internet of things*

What happens when the areas and discussions of hypertext are projected on the concept of an Internet of things? Where hypertext theory is the foundation of human-computer interaction and moreover the Internet as we know it today, within an Internet of things this is bound to play an important role. There are different views on hypertext: that of association and that of connection. In looking at hypertext today, most present within the network of an Internet, what do we see? In taking the point of association, one cannot escape the feeling that this is looming somewhere in the potential of the Internet still, but is not dominantly the way we use it. Where the link, the tag and the search engine are becoming increasingly more intelligent, finding associated issues, topics, pointing me towards things I should like according to my click-behavior, there is still the notion that these are more technologies of a controlled connection, than of free association. When we break down what is actually happening, some points emerge that could be relevant when thinking about an Internet of things. First of all, all that happens in front of the mouse is anonymous. You can train a search engine by recording all my clicks, but who says they are "my" clicks? 7. You can create the most advanced and intelligent self-learning algorithms by recording all my search queries, but who says they are not generated randomly automatically? The larger point to make here is that, however much the existence of the Internet is dependant on bots and smart algorithms, the founding assumption is that users actually exist. The second assumption, which

follows out of the first, is that computers are personal. As shown before, this indeed was predicted and became reality. We do all have a personal computer, or at least personalized content, where the most promising future of Google is the personalized search: tailor made just for you. You no longer need free association as stated in hypertext theory by Bush, the search engine will do this for you; the only thing for you to do is click (as to confirm what we already knew). Secondly, when we assume that users indeed exist and computers are personal, the Internet as used currently, is no place for creation and sharing of creativity. My activities online are reading and clicking: a media consumer rather than maker. I might copy-paste or download content from the Web, I might occasionally post something on a blog, still the vast majority of tools that allow for real content creation and/or manipulation are those used offline. The generic mouse, trackpad, and keyboard subsequently control these tools. Maybe, within an environment of networked things it is time for an Engelbartian revolution, where computers learn from humans and vice versa.

Language should act more as a social constructor than a symbolic representation, according to Engelbart. But what kind of language can this be? One could argue that web 2.0 technologies are indeed new ways of creating social connections, thus answering to Engelbart's notion that computers should enhance communication and collaboration between people. The result of our connected society is twofold: yes we can connect, make a hundred new friends, or at least contacts, per day just by clicking 'invite' and 'confirm'; we can chat, blog, surf, and comment twenty-four seven. The downside of this revolution is that these activities are performed alone, behind a screen. Rather, by an Engelbartian revolution, a revolution is meant in the way we look at information and the way we, or others-than-we, organize and manipulate this information. Maybe this can be achieved by pursuing not only that language of text and links as we are so used to on the Web now, but to broaden the scope with a hyperpicture, a hyperhaptic, or even a hyper-object. This hyper-object will need an object language in order to make connections and associations.

### *The interface*

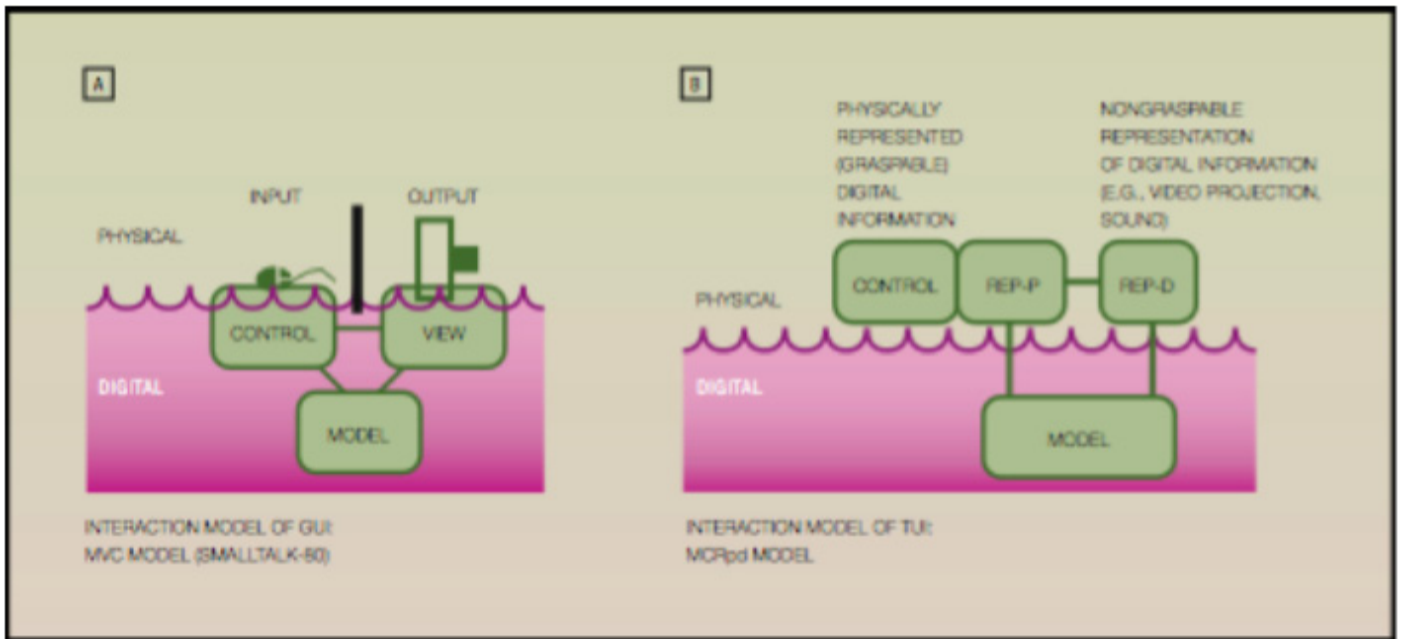
Within such a hyper-object how, do I know what links to what? How can I manipulate data and receive feedback of this action? This is a question of interface. The first sign of this question can be found in the first relational artifacts, where objects are becoming an interface to action and information. Since the introduction of the mouse as a manipulation device, several developments have taken place that deal with this issue. In a publication 'Direct manipulation' by Ben Shneiderman in 1983, a view is given on some of the issues concerning the implementation of

what Shneiderman calls interactive systems, as well as some statements concerning user involvement. During the time of publication, a shift was taking place in interacting with a computer, by the introduction of more graphical user interfaces (GUI's) rather than pure code. Via this new way of manipulating data, Shneiderman introduced the term direct manipulation. In a comparison between driving a car, which he states as something that has become a common skill in our culture, and the seemingly expert-task of handling a computer, this new, more visual way of interacting is promising, due to its direct representation of relations on the screen. Shneiderman claims here that graphical representation is giving us more sense of control and understanding of what a computer does and, more importantly, what we as users can do with it. As Shneiderman puts it: 'Direct manipulation can be applied to replace traditional question-and-answer computer-assisted instruction with more attractive alternatives'. However, this new shift does not immediately mean a better performance: a couple of problems are stated that are quite relevant for the dialogue discussion:

- The wrong information can lead to greater confusion.
- Users must learn the meaning of graphical representation, which is often more difficult (or at least ambiguous) than textual representation.
- This leads to a greater chance of misinterpretation of graphic representations. Think of cultural, and social differences in ascribing meaning to visual signs or icons, for instance.
- A fourth, practical problem Shneiderman foresees is the amount of space graphical representation takes up (over textual) on a screen. (Shneiderman, 1983).

Another large discussion point mentioned is that of metaphors. Where 'simple metaphors, analogies or models with a minimal set of concepts seems appropriate' according to Shneiderman, still, users do not automatically share the same idea of a metaphor as the designer. An important notice is the introduction of the syntactic/semantic model. Where first skills have to be learned on a syntactic level, understanding the action and representations, the next phase is experience in the meaning of those representations. This allows users to become more system-independent. 'Direct manipulation is an attempt to bring activity to the concrete operational stage or even to the preoperational stage, thus making some tasks easier' says Shneiderman. It provides a simple model for human cognitive activity, where the use of direct manipulation can attract users in interacting with a computer. The main contribution Shneiderman made is pointing out the necessity of cognitive science and psychology in the field of HCI (Human Computer Interaction),

and its importance in creating more attractive and comprehensible opportunities within HCI. A task he ascribes to designer of those systems in strong relation to the (potential) users of these systems. The improvement in connection between human and computer is essential in further developments of computational artifacts. Direct manipulation in this case is a thing to think with about this connection. In moving away from the purely computational side of these relational artifacts, Ullmer and Ishii are the first to introduce a framework that maps the dialogue of human-computational artifact interactivity in terms of tangible interaction.



**Figure 3: TUI framework by Ullmer and Ishii**

With the introduction of the model shown above, the existing model created to describe Graphical User Interfaces (GUI's in short) was altered into a model that maps the flow of Tangible User Interfaces (TUI's in short). In this new model, control-representation (physical and digital) is carried over, while the view element is divided into two subcomponents. 'The view notion is added with physical representations, for the artifacts constituting the physically embodied elements of tangible interfaces, and with digital representations for the computationally mediated components of tangible interfaces without embodied physical form' (Ullmer and Ishii, 1997). With also mapping tangibles, it is meant that physical objects used to hold- and manipulate digital data have a representational value, besides their control-value. This interaction model provides a tool for examining several important properties of tangible interfaces. Three relationships are mentioned concerning this physical representation:

- Physical representations (rep-p) are computationally coupled to underlying digital information (model).

- Physical representations embody mechanisms for interactive control.
- Physical representations are perceptually coupled to actively mediate digital representations. (Uller and Ishii, 1997).

Tangible interfaces rely on a balance between physical and digital representations. In defining representation, Ullmer and Ishii state that representation is a powerful term, taking on different meanings within different communities. They consider digital representations to be computationally mediated displays that may be perceptually observed in the world but are not embodied in physically manipulable form. This is a debatable point: why would digital information be represented only visually and only on-screen? An important notice is that tangibles also carry a physical state, with their physical configurations tightly coupled to the digital state of the systems they represent. Coupling artifacts with digital information, tangible interfaces afford a wide variety of associations between physical objects and digital information. Tangibles may be statically coupled or dynamically bound to computationally mediated associations including:

- Static digital media, such as images and three-dimensional (3-D) models
- Dynamic digital media, such as video and dynamic graphics
- Digital attributes, such as color or other material properties
- Computational operations, applications, and agents
- Remote people, places, and devices
- Simple data structures, such as lists of media objects
- Complex data structures, such as combinations of data, operations, and attributes.

(Ullmer and Ishii, 1997).

The artifacts embodying these associations take on a range of physical forms, from generic to highly representational. Ullmer and Ishii also introduce the phycon, (physical icon) as an important category of tangibles. These phycons serve the goal of making interaction more logical, more understandable in the translation of graphical icons that we are now slowly becoming used to towards the emergence of physical icons, having a high level of representation. They state that these representations are defined as 'knowledge and structure in the environment, as physical symbols, objects or dimensions, and as external rules, constraints, or relations embedded in physical configurations.' With this framework a structured way was presented in

which lots of research could be identified and mapped, showing its strengths and weaknesses. However, one could argue that by clearly stating the digital as well as the physical representation of data in the physical world, options are excluded, like that of feed-forward (a digital action triggering a physical response) for instance. On the other hand, theorists like Kittler state that there is no software, because ultimately every digital action can be traced back to transistors and capacitors; to a physical change in voltage. Ullmer and Ishii state that we are shifting away from a traditional setup where one person is interacting with one computer, to one where the world becomes the interface. This is where a new paradigm introduces itself: where computational power moves away from the traditional setup and moves itself into 'the world', the question of representation of data and the way in which this data is manipulated asks for a new way of treating this representation.

Point of controversy within interaction design is: should one model the interaction on the human-side, or on the computer side? Moreover, should it be modeled on the interaction between humans (as an ideal, a utopia) or should we acknowledge that HCI is fundamentally different. An insight here stems from Dennet, who states that the fact that we cannot understand the computer fully makes interacting with it so interestingly, and makes us ascribe human values and expectation to this computer. "Communication is actually constructed in a better way by not knowing; by not being able to decipher its intended purpose" (Dennet, 1978). The designers of such artifacts must now think about possible behaviors and responses of a user. Must interaction be predictable, orchestrate-able, and to what extend? In relation to artifacts, and computational artifacts in specific, the main dichotomy that can be distilled out of the authors above seems to be if objects must be clear and self-explanatory in order for us to use them, or must they seduce and remains somewhat mysterious in order to draw our attention and possible use?

## *The interface in an Internet of things*

In an Internet of things scenario, how are things going to talk to each other? And how are the user and the context involved in this conversation? In this new paradigm the attention to the physical representation of data as a means to say something about data (or vice versa) re-enters the way we think about information. The physical attribute of information is as important as its digital aspect. An Internet of things paradigm can elevate the discussion Ullmer and Ishii have evoked on the dialogue between human and computational object to that of humans in a context of multiple computational artifacts.

One view on the interface within an Internet of things is that of everywhere, Technology and our experience of technology will alter drastically in the near future, according to Adam Greenfield. The ambient intelligence point is made that computing, or processing power will move away from a PC-desktop setting and will disappear into our walls, furniture, clothing and even our bodies. To be precise, the actual definition of everywhere is ‘information processing dissolving into behavior’ (Greenfield, 2006). This is a response to the phrase by Fukasawa, coming from product design: ‘design dissolving into behavior’. By this it is meant that the best product design ends up being unnoticed, due to the behavior and familiarity we grew to have with it; the design allows for such an interaction that it becomes natural and turns into a behavior. The same goal is ascribed to everywhere: to become a part of natural interaction patterns, thus behavior. Our environments will turn into dissolved, pervasive and invisible computation, where ‘complex data processing will fade from conscious use’ (Greenfield, 2006). This has positive and negative consequences, where (too easily) big brother- scenarios pop up of tracing and tracking all your moves, opposite (again ambient intelligence) scenarios, where you, sitting on your couch, can control your world in an amalgam of interactive, calm, responsive and aware systems. Both scenarios can be debunked due to their techno-push argument, where the question of ‘who’ and ‘why’ within these systems is forgotten (or dismissed). Greenfield explores the concept of everywhere (a combination of hard-and software everywhere), by asking himself five questions:

- What is everywhere? And how is it different from what we’re used to?
- What’s driving its emergence as a technology and design opportunity?
- What issues should we be aware of?
- Who is to determine what everywhere is, and how it behaves?
- When should we prepare for everywhere, and how can we avoid the sinister sides

(the big-brother scenarios).

(Greenfield, 2006).

A point Greenfield makes is that, within this everywhere environment, the human actor cannot really be called a 'user' of the system, as he or she is not the only actor in the interaction dialogue. Where classic HCI- academic research is focused on a user, with a set of goals and tasks to achieve, Greenfield argues that within an 'everywhere' environment, this simply cannot be the case, due to the multiplicity of possible actions; there is 'no linear call-and-response between user and system to predict, model and design'. Rather, it offers a context, a setup for all kinds of interactions. Here, a reference is made to Paul Dourish and his introduction on embodied interaction. His mayor point is that task-driven interaction never existed, and that it is always hindsight that makes the analysis of a 'relevant' interaction possible. This is why HCI research is always about, step-wise analyzable tasks, focused mainly on the parameter of saving time and efficiency. When engaging in more complex interactions, modeling and analysis of these interactions in terms of efficiency or measuring are soon becoming impossible. Greenfield emphasizes the need for integration of human values in this area of research. By combining visions of ambient intelligence and an Internet of things, Greenfield predicts a grown dependency of humans on their connected objects. Still it is hard to see what exactly this story does to the status of the object; where at one point, when more computational artifacts will surround us, they all will become more demanding, more important object than those non-connected things, at the other hand, when computation 'disappears' into the background, apparently, their physical presence is no longer wanted or needed. How then, will we interact with our things? In designing an Internet of things, we are moving to the hybrid field of digital and physical; there were the two cannot be perceived without each other. The two meet at the interface. As Erik Kluitenberg mentioned during a recent book release of "Internet Of Things" by Rob van Kranenburg:

"Within an Internet of things, you do not carry the device anymore; the functionality is in the environment. Obviously, we are not there yet. The interface challenge is a large one. The point to make is that we have to rethink that interface question. How do we intervene in current interfaces? Do we need a regulation for spaces? It is all about design and experiences of these things." 8

How about designing these things? There are different approaches and areas involved in this design practice. An important issue in this field is the quest for logical or natural interactions. We have failed to really address this issue since artifacts gained a digital layer. An example here is the keyboard that can be seen as a mismatch of old standards that meets new technology and cannot adjust. The mapping of interaction onto a new type of technology and moreover, a new type of user, seems to be a complex task.

### *Agency*

This complexity can be found in the fact that objects involved in a network are not only object I can do things with, they can also do things for me. The latter involves things that are able to act on behalf of the one using the object. This can be interpreted as a form of agency. Sterling notes that in an Internet of things we will see objects linked to agency-mediating networks, that will become demanding, warning, or just stating the obvious to us constantly, pointing out that we will have to deal with agency one way or another. Questions resulting out of this notion can be: Do I want to be in charge of everything? Do I want to be annoyed by my things? Or do I let them sort it out themselves? In order to provide a framework for dealing with these questions, Sterling talks about a cognitive load and an opportunity cost: this is the total result of interacting with an object worth-while, when looking at the results of that interaction. This can be read as: I want to do as less as possible, please just sort everything out for me, and I'll say or click "ok". The human agent in this case is in charge of the end –decision; this final binary choice, without having to know all the processes that lead to this choice. The question of agency becomes more complex now, since the human actor is does not have the complete insights in the consequences of his or her interaction anymore. Where interacting with static objects was still comprehensible, the relational artifact has become too complex to oversee. Sterling's notion of a cognitive load versus opportunity costs is therefore maybe not the best tactic to deal with agency, but it does point out certain realism. The objects around us that are equipped with sensors and actuators have the power to express their potential. Consequently, they have the power to grab attention, to become demanding. Apparently, something is not right yet in the relation between human and connected object. When looking at where things go wrong, the trouble is where to start: on the side of things, humans, or on their network? When elevating this problem to a more abstract level, we have seen that the question of agency can be seen as the problem of objects becoming subjects (Turkle). A solution therefore can be found in dealing with this object-subject dichotomy. In "WhatThingsDo", author Verbeek

deals with this problem by comparing two major lines of thought that deal with this problem of how to analyze. These two lines are post-phenomenology and actor-network theory. Phenomenology takes on the standpoint of human perception, thus excluding the possibility to ever understand ‘things’ (because we cannot escape our human intentionality). This has the dramatic consequence that the object-subject problem cannot be escaped. On the other hand, actor-network theory claims to forget about this distinction altogether, because it is a dead-end framework. Instead, we have to look at networks, where things and humans are both actors, bypassing the object-subject dichotomy. Verbeek turns to post-phenomenology to also critique Latour’s viewpoint. He states that it is wrong to claim that human beings are absolutely divorced from what things are in and for themselves’. Moreover, ‘humans are always with things, this is what intentionality means’ (Verbeek, 168; ch. 5). So we do have to look at networks and their actors, but we have to keep in mind that the subjects and the objects act together, and combined within this network. They are not separate actors as Latour claims, but when looking from inside to the relation between humans and world, they become co-actors. What this means is that the evocative object that we are constantly talking about is mediating our actions. This helps to sort out our view on object and subject, ‘how both the world (“objectivity”) and those who act in it (“subjectivity”) are present’ (Verbeek, 193; ch. 6). By looking at both theories in this way, Verbeek combines these two ways of thinking, where they used to be mutually exclusive. The value of this move is that it opens up space to leave the object-subject path of thinking while still including the human perspective in analysis. The need for this human perspective is clear; if we are, apparently, co-actors with our things within the world of networks, we better find out how to act. This teaming-up with our things becomes necessary for us to remain a relevant actor. On the other hand, due to this teaming up we are actively transposing agency (actor-ship) to our things; we are making ourselves more dependent. Why do we keep doing this? What is the motivation for keeping the process of creating new, smart –co-acting things going? In describing the irony of technological devices (our relational artifacts), Borgmann states that, ‘while technological breakthroughs of the past have liberated human beings from misery, most technological innovation nowadays only serves to diminish our engagement with our world’ (qtd. in Verbeek, 180; ch. 6). The excitement of a new thing is quickly replaced by boredom. The co-agency that started off so empowering and fun is becoming a boring and functional interaction. While this is a very techno-pessimistic view, there is a point in this insight when looking at the speedy process in which ‘gadgets’ appear. In order to keep a team of human and thing together is for the device to mediate engagement, and to evoke value.

## *Agency and an Internet of things*

A scenario on mediating engagement is provided by the work of Bleecker. In his 'manifesto for networked objects' an agency-based view on an Internet of things is described. The conceptual framework of an Internet of things is about understanding how physical objects, once networked and capable of information sharing, will behave and occupy space. Bleecker starts off with the claim that 'once things are connected to the Internet, they can only but become enrolled as active, worldly participants by knitting together, facilitating and contributing to networks of social exchange and discourse, and rearranging the rules of occupancy and patterns of mobility within the physical world.' (Bleecker, 2). Things in the pervasive Internet, will become first-class citizens with which we will interact and communicate. Things will have to be taken into account as they assume the role of socially relevant actors and strong-willed agents that create social capital and reconfigure the ways in which we live within and move about physical space: a blogject (Bleecker, 2). Blogjects, spimes, or other-than-computer-networked objects will exercise agency and will intervene in space and place. They will spread, save, download, upload, shift and delete data. Questions of agency, protocol and according to Bleecker, even citizenship has to be projected upon these 'things'. In comparison to the coined 'Spimes' by Sterling, the blogject is a first step towards this scenario. If things become networked, their reason for being networked will be sharing and communicating data; they will be blogging. In explaining what Bleecker means exactly by blogging, he states that 'blogging is reporting what you see, know and think about, always with a semantically weighty thing to talk about' (Bleecker 3-4). In the same sense blogjects will participate in the meaning-making apparatus; the social web. The most peculiar characteristic of Blogjects is that they participate in the exchange of ideas. 'Blogjects don't just publish; they circulate conversations (Bleecker, 4). Three peculiarities of Blogjects are mentioned:

- blogjects track and trace where they are and where they've been;
- blogjects have self-contained (embedded) histories of their encounters and experiences.
- blogjects always have some form of agency — they can foment action and participate; they have an assertive voice within the social web.

Bleecker continues by showing examples of objects in current society that already blog; most of them can be found in mobility. Luggage that leaves traces and aircraft that log their travels digitally. A conclusion of this logging is that 'in the Internet of Things, it is not human agency alone that shapes the way we occupy and move through space (Bleecker, 7). As objects are blogging,

they gather a history, and a trace through time. This gives blogjects the consequential character of telling a story about their making, about their past. For Bleecker, this is not enough; blogjects should have the property, like their ephemeral, software kin, to be self-describing, they need to let us know what they are, what their API touch points are, how to construct them and how to destruct them. The Blogject capacity for producing effects is powerful because 'it has always been pervasively, ubiquitously, everywhere tethered to the far reaching, speedy, robust network of social exchange and discourse that humanity has every constructed (Bleecker, 9). In the Internet of Things, that kind of agency happens within the ecology of networked publics — streams, feeds, track-backs, permalinks, Wiki inscriptions and blog posts. Bleecker is projecting everyday-web-based functionalities on the physical blogging object. Here he differs from Sterling in a sense that Sterling takes a starting point in the physical, while Bleecker takes natively digital technology. Continuing on the importance of agency, the point Bleecker makes is that agency in this case is concerning with facilitating narratives; 'Things could not care any less about their Turing Test report card. Blogject intellect is their ability to effect change (Bleecker, 9). But how is this change taking shape? In the difficulty of creating meaningful scenarios, due the many variables and issues dealing with this Internet of things, Bleecker asks some important questions: 'When it is not only "us" but also our "Things" that can upload, download, disseminate and stream meaningful and meaning-making stuff, how does the way in which we occupy the physical world become different (Bleecker, 10)? What sorts of implications and effects on existing social practices can we anticipate? How does our imaginary skew when we think about how we might move about and occupy future worlds alongside of objects that blog and other Spimey creatures?' In this cognisphere-line of thinking, the evocative notion of Bleecker's work lies in the speculative scenario of co-existence, rather than domination of our objects.

'Occasionally objects, things, non-humans, non-subjects step out of their thing-ness to become more than lifeless props. Things can learn to walk upright, too, so as to distinguish themselves as valued companion species, with something to say, something to effect our disposition and attitude about our (we humans) role in managing and maintaining, or mismanaging and terrorizing the world in which we live' (Bleecker, 14).

According to Bleecker, the social and political import of the Internet of Things is that things can now participate in the conversations that were previously off-limits to Things. How these conversations will shape remains unclear, except that the method is described as follows:

'It means, in simple terms, that Things, once plugged into the Internet, will become agents that circulate food for thought, that "speak on" matters from an altogether different point of view, that lend a Thing-y perspective on micro and macro social, cultural, political and personal matters' (Bleecker, 16).

Moreover, it is questioned how to make the Internet of Things into a platform for World 2.0. How can the Internet of Things become a framework for creating more habitable worlds, rather than a technical framework for a television talking to a reading lamp? Bleecker places things in the perspective of the social, political, and cultural. His contribution can be found on two levels; in the first place it is a rather large claim that objects must be seen as citizens, actively involved decision-making. In a way, this can be read as an example, or continuation of the Latourian Parliament-of-things. Bleecker also contributes by giving practical examples of where and how this is already taking place by looking at the Internet as it is used today. He simply puts the logics of the Web on physical things in order to see what this Internet of thing can possibly have to offer. Indeed, this must go beyond a technical framework for connected things, into a new perspective on our relation to objects.

## < Cases >

In the previous chapter an exploration was made concerning key properties of objects that roam in networks. Via three cases an attempt is made to reason if these key properties can be recognized in current objects, and how they influence our behavior with these objects. How dependent are these objects on their link, their interface and their agency, and do these properties elevate them into more valuable objects to us?

### *A gps-enhanced table*

The objects created by Dunne and Raby can be seen in the light of “design for debate”. They have created a set of objects linked to a type of network that is normally hidden from human perception. These objects work as engagers not only because they show these networks, but also because they do this in an engaging way. The goal of these objects becomes clear via the way information is presented to the user. The designers of these objects thought about how to team-up; how to make information logical and the interaction logical to both objects and user. In the example below, the following discourse takes place: While the table is inside for a while, it starts to look for connection to its network (in this case, satellites). When it cannot find its network due to the fact that it is inside, it displays “lost”. The ‘user’ of this table can comply with this call for help and move the table (and him/herself) outside, allowing the table to reconnect; he/she can also choose to have a lost table in the house. What happens here is that the choice to help this object or not is in fact a forced decision upon the user; a call to discuss (internally in this case) what has to be done. This object is exercising democracy, by triggering a choice, and reasoning behind this choice. Moreover, the user comes to think about the satellite networks and the fact that he/she is hidden from this network while inside, but exposed while going out: the object also raises an issue, making something a matter of concern. This case shows a clear example of politics of space, where changing its physical location activates the link. The interface is clear and tangible; move the table, as to move the behavior of the object. Also, the object expressed agency by actively evoking a choice. The status of this object is elevated not due to its networkedness, rather due to its evocative interface. Although this object does meet the requirements of a networked object it does not take part in an Internet of things because it does not have a digital representation or archive. How then, can an Internet of things contribute to the elevation of the object?



*Figure 4: location table by Dunne and Raby; gps-enhanced table that displays “lost” while being outside satellite range (e.g. being inside).*

## *A wikipedia bot*

Another way of looking into the dependencies in an Internet of things is by taking a look at the reliance on networked digital objects. Networked digital objects exist alongside humans for some time already, performing a form of agency. Within the research group called Digital Methods Initiative 9, one recent research is that of networked content. This involves investigation on how content, whatever the kind, is affected, altered and/or manipulated due to its networkedness. One object of study is Wikipedia editing behavior. One of the methods used is to do an edit history recording 10. When performing this, one can have insights in who or what is altering a Wikipedia article. The results tell a story about dependency. While started as a site for sharing knowledge via human entries it turns out that bots 11 perform a large part of the structure of Wikipedia. Mostly, these bots perform editing and re-shaping activities, that make sure all articles can be viewed in a similar lay-out . Where this used to be the work of human editors, pieces of software have taken over this work. In fact so much that if they were not there, Wikipedia would probably collapse 12. Without going that far, the point to make is that large chunks of what we daily receive as user-generated content, and connecting people via knowledge-spreading, is actually checked, maintained and edited by software. These Wikipedia bots are improving human entries already, correcting them mainly on form; thereby altering the way content is received. Unlike the future scenarios of agency-performing, possibly political things that surround us, this case provides an example of our entanglement with things that is taking place already. This elevates the status of objects by granting them a amount of responsibility of taking care of, in this case, human knowledge collection.

## Wikipedia editing by bots and users: Overall percentage of Bot activity of all edit activity



Figure 5: Percentage of Wikipedia bot activity of all activity.

## *A blogging plant*

The first example showed a physical object that via its interface elevated itself above other objects. The second example showed a strong dependency on digital objects in a network, in this case the Wikipedia website. Where the first object cannot be a part of an internet of things due to the lack of a digital counterpart, the second example showed an agent, designed digitally, performing its task, sometimes manifesting its physical form via the Wikipedia page on a computer screen. Is this already the spime that Sterling talks about? Probably not because it is a natively digital object, only representing itself via a screen. We cannot replace all our objects with screens. The figure below shows something close to a spime, or more likely, to a blogject. It is a blogging plant. In this setup plants tell their story, going from twittering to even full blogposts. What is this story about, and what is value of this information? Is it for the purpose of plants, complaining about their amount of sunlight, via a human network? Can they teach us to go outside more, that the office air we are breathing cannot be healthy for humans, as it is not for our plants?

‘To activate a web-controlled fluorescent lamp positioned next to the plant inside the cafe, click the “Give Light to Midori-san” button at the bottom of the widget, enter your name (or a nickname), and click OK. Once the lamp activated, the widget shows a real-time view of Midori-san under the light. Judging from the blog content and the numerous “thank yous” below the fold of each post, Midori-san seems to really appreciate every chance it gets to photosynthesize.’ <sup>13</sup>

A normal plant is granted more status because it has a link to an information network. It turns something we normally do not take notice into something that can share information that we can understand. In doing so, it is performing agency. We can also archive and follow its entire history and user-list. It is even recyclable. Is this then a perfect example of an Internet of things? It becomes problematic at the interface. This example appeals more the old notion of an Internet of things, that consists of all kinds of things just hooked up to the Internet. For the user, who receives a screenshot of the plant, there is no feedback to the ‘reality’ of the object. The feedback is via a computer screen, thus making it very debatable if the screenshot is actually made real-time of the exact plant you fed. In a network of connected things, the scenario would be far more convincing if the plant would communicate with other plants via a computer-mediated network. The point is that in the example of the GPS table, the interface expressed a politics of space, due to the fact that the object needed to be moved in real space. In this example, the feedback is limited to a screen, missing the exact point of connecting-other-than-computers to an Internet.



Figure 6: twittering plants.

## < *Conclusions* >

In the chapter above, three examples were shown of objects in current society that are granted a higher status than other objects. In different levels, this is due to their link with a network, their interface and the agency they can express. These three factors are also present in the concept of an Internet of things. However, all three cases described do not necessarily fit in this concept. How then, must objects alter in order to benefit from a network?

Since the first computational artifacts have been introduced, theories of human-computer interaction are concerned with granting these objects the status of 'normal' or 'everyday'. This is seen as an elevation of the object; from an abnormal, marginal lab-status, the computational artifacts' greatest achievement is that of becoming an everyday object. The reasoning behind this is that when these objects blend into the every day use, they work. When they are no longer seen as difficult, hard-to-grasp and connected hybrid things, but are used alongside well-established, normal objects, they become possible targets for extra meaning. This line of reasoning has been strongly represented in the development of thinking about these computational artifacts; first they have to work properly, interaction should be 'natural' and it should fulfill its task. Only then humans can develop other-than functional relations with these objects. This luxury-position is a starting point to think about objects on a much broader, social scale. For Turkle and Latour it is clear that we always had other-than functional relations with our objects, computational and non-computational. Since humans have deployed objects in their surroundings in order to manipulate these surroundings (since the first tools), humans have had a very strong connection to these objects. For Turkle, objects trigger connections and hold relations to memories, to stories and to places. For Latour, objects are the mediators of social behavior; they are the reason for politics. Things to think with, but also things that make us think in the first place. For Turkle and Latour, the computational artifact, the self-thinking thing, can be a tool to prove these relations and to actively explore theory about the politics of things. The concept of an Internet of things could visualize these ever-existing networks of humans and things. By taking a starting point in what relations are already made visible, Bleecker turns to the Internet as a reference to how these relations are built, maintained, and what their influence is. By translating these insights onto things, the contours of a networked-object scenario become visible. Within this scenario, all are contributing to that one Web (why pigeons, plants and people will blog is not addressed here by Bleecker; it is a given).

Hereby, it is noticed that certain aspects become problematic in this scenario, such as the question of agency. Sterling, Bleecker and Hayles (and to a lesser extend, Greenfield) altered the status of the object by creating hybrid theories. On the one hand, they built upon the transition to computational objects in society in order to 'reason' a future line of thinking that these computational objects might induce. Also, they point out an alternative view on how to place this development in historical context, current way of thinking about networks and future scenarios on how this might alter our societies. On the other hand, they dismiss the work of Turkle and Latour by dismissing the physical representation of these networks. By stating that all is computing and metahistories and archives are more important than the product they dismiss the exact point made that it is because of these physical representations that networks become visible. In the line of Dingpolitik and evocative objects, is it the object that triggers the relation, not the relation that triggers the object.

### *Object and interface*

From readings as early as Krueger and his concept of responsive environments, (published in 1976), we want computational artifacts to disappear, to dissolve into everyday environments. Now that it has become a standard piece of furniture as well as an object constantly in our pockets, we want it to disappear again. Into walls, floors, clothing. This idea is called ubiquitous computing. A notion of local information sharing on a global scale has made its entry via these computational artifacts, where more and more of these artifacts will be part of our information culture. Besides, and probably before, visionaries, computer scientists and suitable business models, we will need people who think about the why and the how of our interaction with these things. If connected things will take part in increasingly more layers of society and decision-making, this interaction part is crucial. Where it is already very complex to model and act out a shared living space between humans, we will now have to deal with artifacts, too. We have always dealt with artifacts, being present in our surroundings, empowering via a typical action. Now we have an extra, often active but at least informational, layer on top of these artifacts. This will make "things more complicated", for all of us. Besides digital things that are already mediating, interfering and reshuffling our content on the Web, what will happen when physical objects will start acting in the same way?

## *What is missing?*

With van Kranenburg and like Norman's affordance as a design principle of non-networked objects, we return to the idea of interface as a vital point of continuous elevation of objects to a network. Rather than contributing via object-theory, there is a gap in interface-theory when it comes to networked objects. The value of the interface in understanding what an object is, is clearly explained by Ullmer and Ishii via tangible interaction as well as by Donald Norman via affordance. Via the design of everyday things, Norman explains that everyday objects have something called affordance. With this affordance it is meant that things communicate behavior via the way they look, feel and are placed. Via their physical shape, they allow for certain action while they exclude other. With the notion of affordance a new way of analyzing interaction between human and object was introduced. Already we are sorting and behaving according to these interactions. From a simple door handle to the complexity of driving a car, the physical manifestations of these products tell us without saying what we can do with them. Moreover, they force us, knowingly or unknowingly, into a typical behavior. These objects are designed and made by humans, taking into account the possibilities of this human; its measurements, its scale; its ergonomics. One could then argue that the agency that the objects projects onto the world is actually the agency of the objects' creator. But this cannot be true, because while interacting with the object, I cannot argue with the creator/ designer about what is happening, and how I should or should not use it. I have to deal with the object at hand to sort out what we are going to do in a particular situation. With the arrival of things with digital layers and things geared with an informational layer, Ullmer and Ishii were the first to really put the topic of tangibles on the design-agenda. They noticed that the access and manipulation of data was a more complex and stretching task than visual representation on a screen.

Norman contributed by re-thinking our relation with objects via affordance. Ullmer and Ishii continued on this notion by making a link with the representation of objects on a computer and vice-versa. The next step for interaction-research is to think about the network of these objects as a part of the interaction between human and artifact.

## < *Argument Summary* >

This thesis investigates what becomes of objects when networked. Objects we surround ourselves with are undergoing a certain change in their standing, compared to objects of old. With the coming of the electrical network, objects were equipped with new capabilities, and this also holds for information networks. Recently the concept of an Internet of things has emerged. Objects begin communicating with each other over the same network as humans do. The consequences are that this can alter the relationship between human and object. It is important to examine how to our relationship to objects is being rethought, both in scholarly discourses as well as in what may be called speculative media theory. All together, what does an Internet of things imply for the status of objects?

Media critic and science-fiction writer Sterling has provided a taxonomy of things, granting each type of thing a different status. This is achieved by dividing objects into artifacts, machines, gizmos and spimes. Sterling introduces the technosocial, in order to define the realm in which these transitions of things take place. The new status is reached when a technosocial has become dependant of the new type of object; the new object has reached a line of no return. When objects have reaches the status of a Spime, it means that they are highly networked. Together, these Spimes form an Internet of things.

First, a definition is given on what the status of an object is, or how we can look at this status of objects. The next step is to look into how one can think about objects in general.

The work of Turkle introduces two concepts that are relevant for thinking about objects. The first is the evocative object. Turkle describes how we have always had relations with our artifacts, due to the simple reason that we are surrounded by them 24/7. Some objects are emotionally closer to us than other, because they trigger memories, thoughts and reflections. The second is the relational artifact. Where evocative objects passively remind us or trigger us into different modes of thinking, a relational artifact does this in an active manner, due to the fact that it is part of a network.

Latour talks about Dingpolitik and a Parliament of things. This viewpoint advocates that objects have always taken part in human social and political processes. Due to our object-subject dichotomy, we have divided the world into abstraction and matters-of-fact. Latour points out that it is about matters-of-concerns, where humans and objects are in the same network. Politics go beyond humans and have to involve everything they are linked to. We have to change matters-of-fact into matters-of-concern. Things around us can assemble and put matter on the agenda; we humans have to start accepting this help. In order to be able to do this, we have to learn that there are more and alternative ways of government-mechanisms over 'speech'. Also, Dingpolitik can exist only if we let go of a chronologic way of thinking and revert to a 'politics of space'. We have to look at humans and objects together as a collective. The dimensions of these collectives make sure that new hybrids keep popping up: an increasing number of objects need an increasing number of subjects. The nice aspects of science and technology are that they multiply the non-humans enrolled in the manufacturing of collectives. They make the community that we form with this beings a more intimate one.

A third alternative stems from Hayles with her introduction of the cognisphere. This cognisphere is a way to re-shuffle the hierarchy between human, animal and thing. She discusses the networked society, where the focus is on 'contemporary formations'. At the centre of these formations are networked and programmable media. These media have a large impact, from 'sensimotor functions and non-conscious cognitive processing to national political discourse and transnational economies. Hayles urges for an investigation in 'relations', with the specific question: what relations should be foregrounded? In contemporary moment, these relations are intensified, as technologies of things are becoming more pervasive and interconnected. Thomas Walen has named this new realm of cognition the cognisphere. This cognisphere does not only encompass the Internet, but moreover all networked and programmable systems, obtaining some form of data flow. The cognisphere names the 'globally embedded'. This cognisphere does not only address humans, but all actors within this sphere, including machines. Within this sphere, machines are more cognitive than ever before in human history. Summarizing, certain objects can actively evoke (Turkle), can reveal networks (Latour) and are more cognitive than ever (Hayles). By projecting these ways of thinking about things on the concept of an Internet of things, three ways of thinking about this concept are introduced. This results in the following scenarios:

### *An Internet of evocative objects.*

In this Internet the objects are themselves active in evoking. The notion of relational artifacts brings forth a shift from projection onto an object into engagement with a subject is closely linked to Sterling's vision of spimes that serve a vessel for engagement. These vessels are to engage us in a way that is highly evocative; they would possess a high potential of creative possibility. If we think about how this would take place, these objects would constantly lure us into the digital side of the object, showing the networks and traces it has been in. Within an Internet of things, where the interface to the added information that is to evoke, is moving into the background, the physical relation is lost. In other words, how can an invisible computer evoke, emotionally or rationally? In using the notion of an evocative object to envision an Internet of things two issues become clear. The first is that objects gain the possibility to become evocative by revealing their history and use to the current user. The second is that if technology moves into the background as envisioned in an Internet of things, it becomes unclear how the object can communicate its higher level of evocativeness.

### *An Internet of political things.*

Latour shows that Dingpolitik can exist only if we let go of a chronologic way of thinking. We have to revert to a 'politics of space'. In this light, an Internet of things provides a way of making these quasi-objects recognizable through the concept of a spime. A spime-object as described by Sterling could make this transition of time to space since a spime is a meta-history generator. This creates the possibility to trace movements of people and things through time. But, networked objects need to be more versatile than current relational artifacts in order for an Internet of political things to operate. Within an Internet of things, the lesson is that the focus must not be on the fact that objects are in a network, but rather how these objects are connected. If the connections of an Internet of things are of a diverse and contributing nature, the concept can be more than a technological framework. If histories, mistakes and improvements of objects (and the use of objects) will be archived and traceable, this could prove a contribution to idea- and knowledge networks. A point of critique here is that it will become difficult to check the validity of the information in this Internet. Can I trust my things in this network to be a reliable source of information and action?

## *An Internet of cognitive relations*

One consequence of looking at networked objects as cognitive relations is that connected things are more popular and yet more disposable than 'dead' things. Connected things are maybe touched more, thought of more. They are more present in our cognition by playing a more important role in our lives. Within an Internet of things this means that we will be able to be involved in a more densely connected surrounding, providing opportunity for learning, for comfort, for spreading a message, for empowerment. On the other hand, this will compromise our role of individuals as main actors in our surroundings. This scenario will alter the hierarchy of things themselves and the way we connect with things. Are my connected things revealing data relations, or hiding them?

An example of how to think about an Internet of things is provided by the work of van Kranenburg. He introduces the concept of the City of trust versus the City of control. The first is an idea of empowerment due to possible bottom-up freeing of technology and protocols. The second is an Internet of things as an enclosing idea due to possible top-down surveillance and misuse of connected things.

From these projections key properties of current networked things are mentioned. What are the things about things that make the above reflections possible? The key properties identified are the link, the interface and agency. What happens to these properties when placed in an Internet of things? First, the link is examined. When looking at the notion and history of hypertext, what it does for objects is rather practical; it links them. The consequences of this linkage, this connection, can be explained via a human- and an object perspective. For humans, it changed the way we look at and think about information. For objects, it has meant a serious leap in showing their importance and proving their evocativeness. When placing hypertext in an Internet of things we see that Engelbart's notion (that computers should enhance communication and collaboration between people) can provide a basis for networked things. If computing is associative, then information should be linked to objects again. The idea of a hyper-object is posted.

In finding a language for connected objects, we turn to the interface. Since the mouse as dominant interface tool for relational artifacts, some developments have taken place. First there was the idea of direct manipulation as a new way of looking at information on screen. This is the

introduction of the GUI (Graphical User Interface). Following, the notion of tangible interaction is introduced as a new way of looking at data representation by looking at feedback systems beyond the screen (Tangible User Interface). When we look at the interface in an Internet of things, one way of looking at it is via Everyware. This concept thrives on an Ambient –Intelligence view of connected things, where the World becomes the interface, hiding technology, thus separating function from interaction. A critique by Kranenburg on Everyware shows where this becomes problematic: Where are the buttons in this interface? How do I know the interface in an environment of connected things?

Concerning agency, the point is that objects involved in a network are not only objects I can do things with, they can also do things for me. The latter involves things that are able to act on behalf of the one using the object. Sterling notes that in an Internet of things we will see objects linked to agency-mediating networks, that will become demanding, warning, or just stating the obvious to us constantly, pointing out that we will have to deal with agency one way or another. When elevating this problem to a more abstract level, the question of agency can be seen as the problem of objects becoming subjects (Turkle). We have to look at networks, where things and humans are both actors, bypassing the object-subject dichotomy, Verbeek answers. He turns to post-phenomenology to also critique Latours' viewpoint. 'It is wrong to claim that human beings are absolutely divorced from what things are in and for themselves'. Moreover, 'humans are always with things, this is what intentionality means'. Bleecker gives an example of this agency in an Internet of things. He looks at this agency of connected objects by looking at the current Internet. Blogjects are introduced; they track and trace where they are and where they have been; they have self-contained (embedded) histories of their encounters and experiences; blogjects always have some form of agency - they can foment action and participate; they have an assertive voice within the social web.

Via three cases these key properties can be recognized in current objects. How do they influence our behavior with these objects? How dependent are these objects on their link, their interface and their agency, and do these properties elevate them into more valuable objects to us? Via the case of a gps-enhanced table, we see that an object does not need networked-ness in order to express agency. Via the case of Wikipedia bots we see that we do need to make visual this agency. Objects that are connected must be able to say something about this connection; they

need an interface. Via the case of a blogging plant we see that hooking things up to the Internet does not necessarily make an Internet of things, due to the lack of a logical output, a logical feedback.

With van Kranenburg and like Norman's affordance as a design principle of non-networked objects, we return to the idea of interface as a vital point of continuous elevation of objects to a network. People have been concentrating on networking objects instead of networked interfaces to objects. In answering what an Internet of things can do for objects, it is argued here that it can elevate them via the interface. In this thesis a contribution is made by discussing ideas of status of objects; next is research into interfaces of networked objects.

Norman contributed to the interaction discussion by re-thinking our relation with objects via affordance. Ullmer and Ishii continued on this notion by making a link with the representation of objects on a computer and in the world. The next step for interaction-research is to think about the network of these objects as a part of the interaction between human and artifact. Rather than contributing via object-theory, there is a gap in interface- theory when it comes to networked objects.

## < Notes >

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2. Sterling, Bruce. "Lecture on Spimes at the Tu/e", October 2008
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4. PsycINFO Database Record, taken from Turkle, Sherry. "Things to think with"
5. See <http://www.nextnature.net>
6. Kranenburg, Rob van. "Internet of things – a critique of ambient technology and the all-seeing network of RFID". Published via INC.
7. One of many examples is the TrackMeNot plugin for Firefox that "fools" query recorders by sending random queries. See <http://www.mrl.nyu.edu/~dhowe/trackmenot/>
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9. DMI website, Faculty of Humanities, UvA, Amsterdam
10. <http://wiki.issuecrawler.net/twiki/bin/view/Dmi/TheNetworkedContent>.
11. Term derived from robotics. In this case periodically running pieces of software on the Web.
12. For detailed results see <http://wiki.issuecrawler.net/twiki/bin/view/Dmi/TheNetworkedContent>
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- 1) Screenshot of movie explaining B. Sc. Graduation Project Tjerk Timan at the TU/e. 2006.
- 2) TUI framework by Ullmer and Ishii. Taken from *Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms* by Hiroshi Ishii and Brygg Ullmer. MIT Media Laboratory, 1997.
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- 5) Wikipedia editing by bots and users. Overall percentage of Bot activity of all activity. [wiki.issuecrawler.net/twiki/bin/view/Dmi/TheNetworkedContent](http://wiki.issuecrawler.net/twiki/bin/view/Dmi/TheNetworkedContent).
- 6) Twittering plants? Taken from <http://www.thefutureisawesome.com/2008/10/07/first-plants-twitter-now-they-blog/>. 2008.

