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Agency in the Internet of Things

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> ‘*These new technologies urge us to blur the boundaries between humans and technologies also at the level of our conceptual and moral frameworks’.*
>
> *Verbeek, 2009*

Which of the values we cherish today, will we want to cherish tomorrow?

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Preamble

In 2009, a European broad research programme called European Research Cluster on Internet of Things (IoT) ([1]), was launched to investigate the possibility of setting a policy framework in this field. The research delivered several studies and established a continuous dialogue amongst different stakeholders (see Santucci, 2011). Amongst those, the European Commission has established an Expert Group on IoT consisting of several sub-groups that during three years have facilitated a discussion on governance, architecture, standards, security and privacy and other ethical issues.

Santucci (2011) argued that '*the IoT does not concern objects only; it is about the relations between the everyday objects surrounding humans and humans themselves*' which requires that an urgent extended debate to all sectors of the society is started on the ethics of IoT. In their opinion on Ethics of Information and Communication Technologies ([2]), the European Group on Ethics in Science and New Technologies asserts that IoT will change '*radically the relationship between humans and the interconnected autonomous objects, giving to the last ones autonomy towards the interaction with human beings*'. The kinds of ethical issues that these types of technology raise are related to autonomy (of things and humans), security (dual use, freedom, liberty), equity/equality/justice/fairness (access. treatment, discrimination/discriminatory interfaces) and others. Commissioner Neelie Kroes has welcomed this opinion, in particular that investments should be made to undertake research on ethical, legal, social and environmental aspects of ICT, specifically mentioning the 'Internet of Things' ([3]).

Hence, the background of the present report is grounded on those quests to ascertain what ethical issues may emerge with the IoT vision. In the absence of 'experiment' in this field of technological development, the task of anticipating societal implications from the IoT vision deployment has necessarily to rely on analogies with recent developments in other areas, but above all on a much needed debate about 'what we are doing' (Arendt, 1958).

Contribution from the JRC

In response to DG CNECT request, the JRC studied this emergent technology following the methodologies pertaining to the Science and Technology Studies ([4]) field. Furthermore, we were asked by DG CNECT to contribute to a study of potential ethical aspects arising from the development and deployment of IoT. The JRC was also asked by the same DG to develop the ethics questions for the public consultation on IoT launched by the European Commission during the Spring of 2012.

The aim of this document is therefore to present and to explore, on the basis of present day conceptions of relevant values, rights and norms, some of the 'ethical issues' arising from the research, development and deployment of IoT, focusing on agency, autonomy and social justice. We start by exploring the types of imaginaries that seem to be entrenched and inspiring the developments of IoT and how they become portrayed in 'normal' communication from corporations and promoters to the ordinary citizen (**Chapter 2**). We

([1]) See http://www.Internet-of-things-research.eu/

([2]) See Opinion 26 of the 22/2/2012. Available at: http://ec.europa.eu/bepa/european-group-ethics/publications/opinions/index_en.htm

([3]) See Commissioner N. Kroes blog: http://blogs.ec.europa.eu/neelie-kroes/ict-ethics/

([4]) STS is a flourishing interdisciplinary field that examines the creation, development, and consequences of science and technology in their cultural, historical, and social contexts.

report the empirical work we have conducted, namely the JRC contribution to the limited public debate initiated by the European Commission via the Your Voice portal during the Spring of 2012 (**Chapter 3**) and an empirical exercise involving participants of two IoT conferences (**Chapter 4**). This latter exercise sought to illustrate how our notions of goodness, trust, relationships, agency and autonomy are negotiated through the appropriation of unnoticed ordinary objects; this contributes to the discussion about ethical issues at stake with the emerging IoT vision beyond the right to privacy, data protection and security. Furthermore, based on literature review the report reflects on two of the main ethical issues that arise with the IoT vision: agency (and autonomy) and social justice (**Chapter 5**), examining eventually governance alternatives of the challenged ethical issues (**Chapter 6**).

1. Introduction

> '*The new catchphrase of innovation is 'Internet of Things'. If we're always connected, then the Internet of Things is what we're always connected to. It's all those devices that are collecting huge amounts of data on you and the people around you and then sending it into the cloud. That includes many of those toys that are on your Christmas list this year, such as Fitbit, Jawbone, Google Glass and smart watches*.' Campbell, 2013.

By exploring the news media and others, one can see that there is some on-going debate amongst the public around the Internet of Things — also called Internet of Everything or the Evernet. Albeit contained, it often starts by *noticing* the 'things' that are or will be connected. In the media we looked at the debate which seems to be concentrated on data processing, on the vulnerabilities that can arise for society from concealed data transactions, the degrees of alienation that further mediation implies, the transformation and co-production of our constitution (i.e. way of life as described by Lessig (2006)) and humanness features. But what is IoT? And why do we need to trace emerging ethical issues?

1.1 What is IoT?

In 2000 the Auto-ID Center and its director Kevin Ashton and collaborators ([5]) envisioned '*a world in which all electronic devices are networked and every object, whether it is physical or electronic, is electronically tagged with information pertinent to that object. We envision the use of physical tags that allow remote, contactless interrogation of their contents; thus, enabling all physical objects to act as nodes in a networked physical world. The realisation of our vision will yield a wide range of benefits in diverse areas including supply chain management and inventory control, product tracking and location identification, and human-computer and human- object interfaces'.* However, it is not only at around 2007 that the concept really flies with devices and objects connected to the Internet outnumbered those connected to people (Evans 2011 ([6]).

Despite disparate definitions of the expression 'The Internet of Things', all the different definitions of it have in common that it is related to the integration of the physical world with the virtual world of the Internet ([7]). IoT can be broadly defined as a global network infrastructure, linking uniquely identified physical and virtual objects, things and devices through the exploitation of data capture (sensing), communication and actuation capabilities ([8]) ([9]) ([10]). The underlying infrastructure of virtually represented 'things' in an Internet-like structure includes existing and evolving Internet and network developments[3]. Emerging services and applications will be characterised by a high degree of autonomous data capture, event transfer, network connectivity and interoperability[3]. Potential uses of IoT include the home environment, smart city and health monitoring devices. The RFID technology is at the basis of these developments, but the IoT concept has been considerably

([5]) Sarma, S., Brock, D. L., Aston, K. 2000. *The Networked Physical World. Proposals for Engineering the Next Generation of Computing, Commerce & Automatic-Identification*. White Paper of the Auto-ID Center at the MIT, Cambridge, MA.

([6]) Evans, D. 2011. *The Internet of Things. How the Next Evolution of the Internet Is Changing Everything.* CISCO white paper. Available online at: http://www.cisco.com/web/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf

([7]) Haller, S. 2011. The Things in the Internet of Things. Poster paper presented at *Internet of Things Conference 2010*, Tokyo, Japan. http://www.iot2010.org/

([8]) CASAGRAS report…

([9]) Internet of Things. Wikipedia. Available at: http://en.wikipedia.org/wiki/Internet_of_things

([10]) Miorandi D., Sicari, S., De Pellegrini, F. and Chlamta, I. 2012*, Internet of things: Vision, applications and research challenges, Ad Hoc Netw*. (2012), http://dx.doi.org/10.1016/j.adhoc.2012.02.016

extended to a vision that envisages a plethora of heterogeneous objects interacting with the physical environment. '*In order to realise the vision of Ambient Intelligence in a future network and service environment, heterogeneous wireless sensor and actuator networks (WS&AN) have to be integrated into a common framework of global scale and made available to services and applications via universal service interfaces*' ([11]). Amongst the building blocks technologies that play an important role in IoT developments, the following are commonly listed: RFID, Near Field Communication, 2D bar codes, wireless sensors/actuators, Internet Protocol V. 6 and ultra-wide-band or 3/4G ([12]).

In the IoT scenario, 'everything' becomes *smart*: smart energy, smart health, smart buildings, smart transport, smart living, smart cities (Vermesan *et al.* 2011). But to what does 'smart' correspond in terms of societal challenges? What forms of governance are needed in a 'smart' environment? What ethics are embedded in the artefacts and those transactions? What ethics do we need to design and deploy those artefacts with? By what ethics will humans (things) relate to the rest of the (non-human) things?

1.2 Why does IoT need ethical analysis?

Defining features of IoT such as pervasiveness, strong mediation, agency in machine to machine interaction, embedded intelligence, seamless transfers, big data, many actors, etc. pose a myriad of unprecedented ethical issues that need to be interrogated. In here we list characteristics of the Internet of Things relevant to discussions concerning the ethical issues arising from its development and deployment:

'We will spy on you through your dishwasher'

The former Central Intelligence Agency (CIA) director, David Petraeus, (quoted in Ackerman, 2012 when he was still Director of the CIA) admitted that 'items of interest will be located, identified, monitored, and remotely controlled through technologies such as radio-frequency identification, sensor networks, tiny embedded servers, and energy harvesters' conceding that those ordinary devices 'change our notion of secrecy' and rethinking is needed about those changes. We argue that this *proposal* fiddles with a number of ethical issues: explicit dual use (*maleficence*), unconsented (or rather concealed) surveillance and data transactions (*loss of autonomy and lack of institutional trustworthiness, violation of the right to privacy and right to data protection*), (algorithmic or human) decisions taken on behalf of user or decisions based on unverifiable data collection (*impairment of human agency*), possibility for discriminatory treatment of those targeted (*social justice and violation of human dignity*), lack of proportionality between costs and benefits (*beneficence*).

The question then is, is this an honest revelation or an unfortunate one? Whatever we choose to believe, it is clear that a debate about the ethics in the design of these artefacts need to be interrogated and the ethics we wish to have by design need to be debated.

- *Ubiquity and pervasiveness:* in the IoT the user is immersed in a world of connected artefacts, becoming eventually a part of that; it is difficult to imagine clear ways of opting out from the IoT. Today many websites are not available to users that do not accept 'cookies'.
- *Miniaturisation and invisibility:* the disappearing computer becomes the 'spirit of the place' in IoT. But the invisibility is not only about the 'computer' or the 'processing software' but also about the invisibility of the objects in the IoT.

([11]) From SENSEI project (IoT-A report). Available at: http://www.iot-a.eu/public/public-documents/d1.1.
([12]) See COM(2009) 278. *Internet of Things – An action plan for Europe*.

- *Identification and Identity:* electronic unique identification of things and objects is carried out with tagging and networking of all sorts of objects, from the more mundane to the more extraordinary; indeed the concept of identifiers is very fundamental in the IoT vision, but equally important is the corresponding development of identity that interests another defining feature: agency. The governance of identities remains a non-trivial issue.
- *Connectivity at high speed*: High and unprecedented degree of high speed connectivity between objects and persons in networks. Speed is the condition *sine qua non* for the success of the IoT vision.
- *Big Data*: IoT is the locus of unprecedented data generation, storage and flow and processing.
- *Strong mediation*: in the IoT, human beings will increasingly interact and act upon their environment with artefacts, devices and systems, relationships with the environment becoming increasingly hybridised. The high degree of production and transfer of data will pose difficulties for the ordinary user to grasp what/who are the mediators.
- *Agency*: the IoT environment provides ways to extend human agency and eventually humans involuntarily delegate agency to the things of the IoT. IoT environments may present invisible interventions which are not directly caused by human agents or operators and which are unintended, unforeseen and unexpected.
- *New ontologies*: action of natural objects, artefacts and human beings will become hybridised given the blurring of entities; agency; through the tagging and 'amalgamation' networks of artefacts, we will have to deal both practically and conceptually with blurred ideas of identity and system boundaries. Additionally, the referential context changes as different spatial cues and temporalities arising from the creation of different entities, different relationships among humans and artefacts emerge.
- *Embedded intelligence*: smart and dynamic objects, with emergent behaviour and embedded intelligence and knowledge the objects of the IoT become [external] extensions to the human body and mind. The transformative potential of human cognition and action needs to be interrogated; this is about what Hannah Aredt calls human condition. A 'Wall.E' scenario is not far fetched.
- *Seamless transfer:* the IoT vision corresponds to a homogeneity of communication where objects become infused and augmented in smooth invisible ways; hence, information flows in the IoT context will be effortless, with potentially very low transaction and information costs.
- *Distributed control*: governance of IoT cannot be 'centralised' because of its distributed nature both in terms of infrastructure, of actors involved but also of generated data and emerging newer entities; this has implications for ascertaining accountability.
- *Unpredictability and uncertainty:* incremental development of IoT will lead to emerging behaviours without the user or the developer having full or even relevant knowledge of the IoT environment.

These defining features individually and collectively give rise a number of ethical issues; these features will be referred to throughout the remaining of this report namely, in the ethics considerations about IoT to describe on one hand how technology connects to worldviews and on the other hand the challenges that technology poses to values, norms, rights and the social fabric.

In the following chapter we first look at the world views that ground the IoT scenario and illustrate how these worldviews get into the design of the artefacts and transactions of the IoT.

2. The world views in the IoT vision ([13])

In the IoT scenario, both 'physical and virtual "things" have identities, physical attributes and virtual personalities, use intelligent interfaces and are seamlessly integrated into the information network' (Vermesan *et al.* 2011).

The ontology of the IoT is therefore essentially structured into three layers, inhabited by three kinds of 'things' in a''symbiotic interaction' with each other, through an overarching unified infrastructure: the physical, the digital and the virtual entities (Vermesan *et al* 2010). Physical 'things' have digital counterparts and virtual representations. In this threefold cosmology, *we* - meaning human beings - relate to our environment just like any other entity, through our multiple digital counterparts and virtual representations. The uniform set of characteristics attributed to all three kinds of entities, such as identity, personality and intelligence, converge into a single attribute: being *smart.* Moreover, 'smart things/objects' are also provided with agency as they are 'expected to actively participate in business, information and social processes' (Vermesan *et al.* 2011).

As we will explore along this whole work through this ontological symbiosis, a number of epistemic and normative equivalences between 'human-things' and other entities will take place.

We are reminded here of the term *Ding*, the Germanic root of the word 'thing', which, as Bruno Latour extensively articulates (and Heidegger and Whitehead before him), denotes both the *neutral objects* of investigations, the matter of facts — the kinds of entities populating the IoT universe — *and* the *reasons* for investigating them, the matters of concern — the modes and functions of existence of these entities — evoking the realm of values and subjectivity.

> 'Long before designating an object thrown out of the political sphere and standing there objectively and independently, the *Ding* or *Thing* has for many centuries meant the *issue* that bring people together precisely because it *divides* them'. (Latour 2005)

In this sense, the Internet of Things becomes the expression of a *forum* for 'human "things" and other entities' provided with autonomous identity, personality, intelligence and agency, all homogenously defined as *smart* and all sharing and functioning in a common information space (Van Kranenburg 2008).

What are then the actual' 'things' that the IoT is supposed to be made of, and, at the same time, what are the 'things' that the IoT is expected to address? What does it mean and imply to be *smart?* Reflecting on these questions will open the way to an epistemic and normative reflection about what kind of world (populated by whom, and with what modes of existence) is implied within the Internet of Things vision.

([13]) This section was drafted by Dr Alice Benessia and constitutes a deliverable of the appointment letter Nr 257235 issued to the expert in 2011.

2.1 Being smart: the narrative of techno-scientific innovation and the vision of the IoT

Maintaining the economic and the social stability of our life-supporting hyper-complex system, in a regime of resource scarcity and in a globally competitive market, is more and more challenging: more so, as our welfare is still essentially associated with indefinite consumption growth (Jakson 2009).

We then (continue to) face the paradox of *sustaining* a steady increase in our global resource consumption within a closed, finite system, with limited stocks and bio-geo-chemical resilience (Elser and Bennet 2011; Rockström *et al.* 2009, Townsend and Howarth, 2010). The post-normal scenario of uncertain facts, disputed values, high stakes and urgent decisions is, now more than ever, intrinsic in our way of proceeding through life, matter and energy manipulation (Funtowicz and Ravetz 1993, 1999). Nonetheless, the dominant discourse about a way out of our dilemma is still inherently embedded in the modern ideal of science as 'The Endless Frontier' (Bush 1945), despite the ever more evident contradictions and drawbacks of technologies designed to provide everything at the cost of nothing (Benessia *et al.* 2012).

Innovation can be considered as the decisive step along a path-dependent transition from normal, curiosity-oriented science creating common knowledge, to big, industrial, goal-oriented techno-science producing corporate know-how (Strand *et al.* 2011). In our context, this transition is vividly expressed in the fact that, as we will further explore, the same sets of narratives designed for corporate expansion, such as the IBM campaign for a 'smarter planet' (Palmisano 2008), can then be found within public institutions such as the EU 2020's strategy for a 'smart, sustainable and inclusive growth' (European Commission 2010).

The promises of innovation are articulated along a two-fold set of arguments. As the first line of reasoning reads, in our paradoxical situation, we need to take into account an essential hidden variable, which Malthus first proverbially overlooked: natural supplies might be limited, but human creativity is *unlimited*, and so is human power to decouple growth from scarcity, improving efficiency in the use of natural resources and ultimately substituting them altogether, with substantially equivalent technological optimised artefacts. Techno-scientific innovation allows then for a' 'sustainable growth', through the optimisation and the substitution of our means, and through the deployment of suitable silver-bullets, protecting us from the socio-ecological problems as they arise.

Secondly, techno-scientific innovation is taken as the mainstream solution in order to keep expanding our economies in spite of market saturation, by opening up new pathways of competitiveness and consumption, to be filled with new, constantly upgraded, products and services.

In this overall framework, the Information and Communication Technologies (ICT) in general, and the Internet of Things in particular, play a significant role, responding to both lines of arguments.

First, we can extensively improve our efficiency in the use of resources by allowing ICT — and more specifically the IoT — to manage *for* us, and also *through* us, the complexity of the socio-technical systems we rely on to live. The implicit assumption here is that this complexity can be decomposed and translated into structured binary information, by technologically enhancing our monitoring and our processing power. In this way, we can allegedly optimise not only our production system and our services, but also our decision-making processes. This vision of technological enhancement entails the convergence of the

physical, the digital and the virtual world, and the creation of hybrid forms of living and functioning, such as virtually connected cyborgs (Fleishmann 2009).

In addition, in this context, both the optimisation and the hybridisation processes are not only *possible*, but also *needed*, as silver bullets for the progressively graver challenge of keeping our collective life-supporting systems functional.

Second, implementing the IoT scenario entails the introduction of a plethora of new products, services and business models, thus ensuring new routes to revitalise consumption growth (The Economist 2010). In this context, the variety and the amount of benefits provided by this new wave of goods will make the transition to the world of IoT not only *possible* and *needed*, but also fundamentally *desirable*. This last step is taken to be essential, both within private and public institutions, in order to shift from the narratives of doom and sacrifice to the ones of hope and opportunity.

In short terms, within this narrative of innovation, *we* — meaning *us* and our *machines* — can, need and want to become *smart* enough to keep fulfilling the promises of progress and development in the face of the socio-ecological limits we are bounded to.

2.2 Wonder, power, control and urgency: the standard imaginaries of innovation

Every visual representation is relevant for what it shows, the factual content of 'things' portrayed, but also for how and why it shows them, namely for the 'things' it is made *for* and *about*; and of course for what it doesn't show. This complex interface between facts and values, between matter of facts and matters of concern, is particularly vague and ambiguous when the factual content is a *vision in itself*, and therefore a fast-moving target (Strand *et al.* 2011), like in our case.

In the science fiction classic movie Blade Runner, replicant memories are implanted and stabilised by using photographs: images mold our identity. The aim of this work is to discuss the role of visual language in implanting and stabilising the modern ideal of techno-scientific innovation through the vision of the IoT. As we have mentioned, this analysis will lead us to reflect about what kind of world is implicated by this very same vision, through a number of contradictions.

We will concentrate our analysis on the ways in which the IoT is portrayed and diffused in the Internet itself, focusing specifically on the visual language of videos and on the imaginaries that these videos evoke and communicate. Bruce Sterling recently defined these types of visual discourse as 'design fictions" ([14]). In his words:

> 'It's the deliberate use of diegetic prototypes to suspend disbelief about change. That's the best definition we've come up with. The important word there is *diegetic*. It means you're thinking very seriously about potential objects and services and trying to get people to concentrate on those rather than entire worlds or political trends or geopolitical strategies. It's not a kind of fiction. It's a kind of design. It tells worlds rather than stories'.

We will argue that, while indeed showing a population of objects and services through a number of characters, these design fictions are in fact representing and demonstrating political, economic, social and cultural trends, together with geopolitical strategies; and

([14]) http://www.slate.com/blogs/future_tense/2012/03/02/bruce_sterling_on_design_fictions_.html

most of all, they are more or less implicitly encouraging a radical change in the human condition. We will therefore be examining the fuzzy set defined by the threefold use of images as (supposedly) objective *representations* of phenomena, as creative techno-scientific *performances* and as *demonstrations* of institutional or corporate power.

Before looking at the actual imagery of the IoT, we will define and briefly articulate a four-dimensional space that can serve as a useful map to navigate into this post-normal complex scenario of knowledge production and values sharing interlinked processes. In order to be operational *as if* a value free knowledge production system in charge of securing the goods of development and progress, the market-embedded techno-scientific enterprise is, in most cases, *standardised* and defended along four dimensions, intrinsically connected and functional to each other. Four *standard* imaginaries of innovation, implemented as sophisticated epistemic marketing device: wonder, power, control and urgency.

These imaginaries can be seen as expressions of what we *want* (wonder), what we *can* (power and control) and what we *need* (urgency) to achieve through techno-scientific innovation, in this case through the Internet of Things.

Wonder is related to the modern ideal of scientists as explorers of the unknown, in charge of opening the doors of our perception and agency. As we will see, in the context of the IoT, *wonder* can be defined as the implicit assumption that a technologically mediated, namely a *virtual* experience is more valuable and rewarding than a direct one. More specifically, it is founded on the idea that technology allows for asymptotically effortless interaction with the external environment, being it social, cultural or natural. As we will explore, this shift entails a progressive alienation from phenomena, and a mediated, aesthetically standardised fruition of them.

Power is rooted in the ideal of extending indefinitely the limits of human being and agency through the creative manipulation of life, energy and matter. Either by reaching new territories on the macro, micro or nano scales, by intervening on organic and inorganic matter, or by fostering the convergence of nano, bio, information technologies and cognitive sciences, the power of human agency on its surroundings consists on a constant exercise of techno-scientific creative enhancement of the known and prompt treatment of the unknown. In our context, power is related to the possibility of enhancing our intelligence and our capacity to effectively act on our surroundings by hybridising and networking bio-physical, digital and virtual systems into common information spaces.

Power is nothing without *control*. Safely driving the 'wonderfully powerful' car of innovation means being able to govern *at will* the inherent complexity of the interaction between the human techno-scientifically enhanced species and its 'natural' surroundings. In the imaginary of *control*, radical uncertainty, indeterminacy and ignorance can be translated into quantifiable risks and managed as *data* through the tools of statistical analysis and numerical simulation, *as if* exhaustive matter-of-facts predictive technologies. In our context, the ideal of control is translated into the possibility of deciding a course of action, i.e. of dealing with complexity, by distinguishing data from noise within a global information space, and to transform information into knowledge for decision-making processes by augmenting our processing power. As we will see, the implicit modern assumption here is that the values and the stakes implied (the matters of concern) can be completely disentangled from the data (the matter of facts) and they can therefore be harmlessly obscured.

Urgency is based on the morally binding necessity to bypass any delaying post-normal knowledge production and decision-making process, in favour of a silver-bullet techno-scientific and technocratic approach, in order to effectively tackle and solve the pressing socio-environmental problems that afflict the planet local and global scales. In this future

oriented imaginary, lack of time and high stakes produce allegedly compelling mono-causal framings, in which techno-scientific expert knowledge emerge as a '*deus ex machina*' from the modern imaginaries of wonder, power and control. Ironically, in the IoT scenario, the *deus ex machina* is supposed to consists of a network of machines, a web of sensors and computing devices in charge of solving our problems.

Let's now begin our visual journey in this four dimensional space, starting from the imaginary of wonder.

Wonder: a smart day (we want)

In February 2011, Corning Incorporated, a global specialty glass and ceramics manufacturer based in Upstate New York, published a promotional video called 'A day made of glass' ([15]). The five minutes clip was seen by several millions of people in a few months (almost 19 millions as of today). It is a vision for the near future in which we follow a typical American family for a whole day, harmoniously driven from morning to night by smart glasses.

A year later, given the unexpected success of the clip, Corning posted a sequel called 'A day made of glass 2: Same day' ([16]) together with an extra called 'A day made of glass 2: Unpacked' ([17]). In this new series we meet the family again and deepen our exploration of their daily life, with the help of a an explanatory voice-over, appearing in the form of a pleasant young men, evoking for style and appearance Keanu Reeves playing Thomas Anderson (*alias* Neo) in the movie The Matrix. The narrator introduces a small set of characters, which we can easily relate to: Jennifer and Dan, the mother and father, Amy and Sarah, the two daughters in their primary school.

The 'things' depicted in this 'design fiction' are of course Corning near future's products: specialty glasses accurately defined by timely superimposed captions showing their main characteristics. But the 'things' that these products are *about*, the promises that they are meant to fulfill, consisting of implicitly *desirable* lifestyles, are embedded in the full cosmology of the IoT: the whole range of physical entities such as home appliances, cars and infrastructures, the main characters themselves, their digital counterparts and their virtual representations.

As the sun rises, we are presented with the affluent family waking up in its smart home. Information systems are everywhere, invisibly inserted into every possible glass surface, varying from a wall in the bedroom to the bathroom mirror, to the kitchen counter. From the first glimpse of consciousness the characters are therefore surrounded by information, standardising and reassuring their psychological and physical coordinates. While we could argue that, in essence, there is nothing radically different from our actual world of plasma TV screens, smart phones and tablets, yet, as for every future scenario, this more pervasive configuration of ICT allows for a reflection on our *present*.

The news, the stock market and the weather can be found from one room to the next, seamlessly complementing the early morning routine. The breakfast ingredients and the news share the same pristine space, both metaphorically and literally. The physical structure and the appearance of glass are conveying a whole variety of desirable properties: it is transparent, clean and protective, and it can be engineered to be light, durable and ubiquitous.

([15]) http://www.youtube.com/watch?v=6Cf7IL_eZ38
([16]) http://www.youtube.com/watch?v=jZkHpNnXLB0&feature=relmfu
([17]) http://www.youtube.com/watch?v=X-GXO_urMow&feature=relmfu

Adding to this uniform background of data is a second layer of *personalised* information, such as daily and weekly planning, social networks and applications. Our characters not only receive, but also share information as soon as they step out of sleep.

Jennifer: optimising time

While approaching the bathroom sink, Jennifer – the mother – automatically activates her personal interactive smart board on the main mirror. As a result, while washing her face she is presented with her daily schedule: information and water flow together. She is notified that her first meeting will be run an hour earlier by a text message and she instantly replies that she will make it.

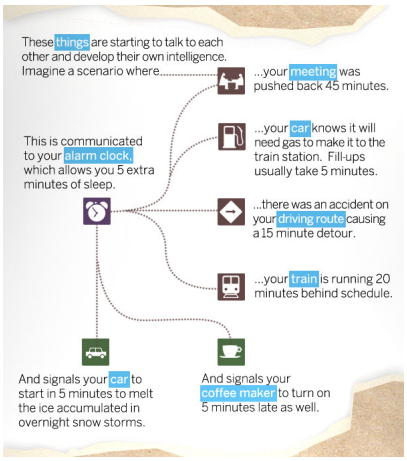

Figure 1. "Infographic" about IoT

Source: © CISCO.

A whole set of smart devices will drive her there on time. Her car will recognise her and her daily schedule: it will let her know of an accident ahead and devise a new route. The idea is that Jennifer can navigate through her day and adapt to sudden and unexpected changes because, through the ICT, she can access and manage information in *real time*. This means that there is practically no delay between an event happening in Jennifer *virtual* sphere of existence and her reaction to it in her *physical* space. In this scenario, and in Corning's vision, she is simply more efficient in a world of complex interactions and demands (and therefore implicitly *happier*). However, as we will further explore, a first level of contradiction seems to emerge: the very same complexity of interactions and demands, which she can manage and meet only through the ICT, is increased by the real time pervasiveness of the ICT themselves. She is asked to meet an hour earlier as she is supposed to be able to meet the demand.

Optimising time (in order to be happier) is a common feature of the IoT vision. An interesting visual development of this idea can be found in an 'Infographic' about the Internet of Things (Figure 1), published online in July 2011 by the US company CISCO ([18]) — the company that introduces the idea of Internet of Everything — and in the EU video on the IoT 'Teaser No 1: Student', published online in January 2012 ([19]).

In these visions, there is no need for a human intervention or decision in front of a bathroom mirror: the' 'things', meaning in this case our home appliances and our car, are connected with our virtual sphere of existence — which never sleeps — and decide when we should wake up into our physical world. Again, on the one hand, the positive vision implied is a world in which we are never late, never lost and most of all, never *unprepared*. On the other hand, this same world is a place in which every minute of our *real* life needs to be controlled and be functionally oriented. In other words, we *can't* be late, lost of unprepared. Therefore, it is a world in which our relationship with the unknown is implicitly and ideally eliminated. This form of technological eradication of surprise entails abdicating to one of the fundamental sources of human creativity and learning: our capacity to adapt to complexity and to the unexpected (Benessia, Funtowicz *et al.* 2012). This in turn implies a second level of contradiction: what makes us safer and more efficient can be interpreted as the very same cause of our increased vulnerability to change.

([18]) http://blogs.cisco.com/news/the-Internet-of-things-infographic/
Cisco Systems, Inc. is an American multinational corporation headquartered in San Jose, California, United States, that designs, manufactures, and sells networking equipment.

([19]) http://www.youtube.com/watch?v=kq8wcjQYW90&feature=BFa&list=UUYBQQU7VCu8M6djxI4dvpIg

Amy: the things in the cloud

As we move from the adults to the children, a third layer of information becomes apparent: it is provided for managing a convergence of social life, learning and entertainment.

In the first clip, Amy and Sarah – the two daughters — can play with their own digital moving images on the fridge's door and they chat with their grandmother through an interactive video on the kitchen counter, while waiting for breakfast. All the virtual representations involved can freely move from one glass surface to the next, guided by a simple touch or even by a simple hand gesture, defying common perception and evoking J.K. Rowling's world of magic. This is made possible, as their digital counterparts are stored into remote servers, eloquently denominated as *clouds* ([20]).

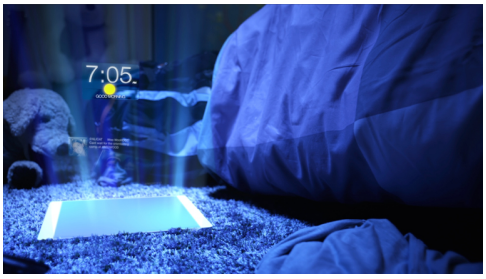

Figure 2. Scene from movie - tablet that "captures, organises and displays all favourite things"

Source: © CORNING.

In the second clip, this ''magical' imaginary is further developed: we enter Amy's room as she wakes up and the narrator introduces us in the quietness of the room to a 3D projection emerging from her personalised ''magic wand', a tablet that' 'captures, organises and displays all her favourite *things*' (Figure 2).

Here again, we are confronted with the symbiotic realms of physical, digital and virtual entities. In this vision, all the 'things' that Amy cares about and that mould her identity are translatable and translated into bits of information; not only her favourite images, music, books and her school materials, but also her friends and family, even her 'matters of concern' and her experiences. Furthermore, this catalogue of digital identity components is stored into a remote server, a cloud, and it is therefore virtually accessible and transferable to every interconnected device, always available and sharable with other peoples' virtual identities. Leaving aside the issue of privacy and security, which, as in a thought experiment, we here assume to be settled, let's explore what kind of world is implied by this set up.

As Amy wakes up into her real space — her bedroom — also her virtual sphere of existence wakes up, as her tablet activates all her digital counterparts into the glass surface of her closet.

Figure 3. Scene from the movie – aid to choose what to dress

Source: © CORNING.

Just like with her mother, she is presented with a layer of background information, the weather and the news (she might be too young for the stock market), her school schedule, but also her social network of friends. She then runs an application to choose her outfit, physically present behind the door. She browses through different categories of digital shoes, blouses and skirts in order to decide what to wear (Figure 3).

We could argue that, in this 'design fiction', Corning needs to demonstrate a variety of possible uses of its 'things-as–products', therefore depicting a quite implausible way of

([20]) Cloud computing is a key component of the IoT revolution: it is the possibility to outsource information and services to remote servers to be accessed and updated on demand through the Internet. The imaginary of dematerialisation and decentralisation of our physical and digital world to the virtual sphere of the empyrean can be interestingly contrasted with the reality of the physical 'web farms' at the other end of the virtual sky, with all the political, social and energetic challenges they pose (see for example www.marketplace.org/topics/tech/iceland-will-keep-your-servers-cool).

choosing one's own clothes. On the other hand, we could also reverse our argument and ask, once again, in what kind of world this scene can indeed be considered not only plausible, but also commonplace. It is a world in which the most desirable way to interact with our environment is to browse through a catalogue of virtual 'things' – ranging from our clothing all the way to our friends — in order to choose what component of our digital and virtual identity we want to activate. The implicit positive implication is that we can asymptotically reduce all effort in our interaction with our *real* environment *via* the creative, versatile, protective and efficient mediation of our *virtual* sphere of existence. At the end, of course, we wear real clothes and meet real people (at least some time) but we are helped to optimise their choice by suitable applications, designed to minimise our social stress.

On the other hand, in this kind of world our social experience and therefore our social skills are *standardised* within a system of catalogues and software designs, therefore intrinsically impoverished by the very same possibility of being operationalised.

Amy: tablets in the woods

Later in the day, we follow Amy in a school field trip to Redwood State Park ([21]). There, we are presented with a new level of interactive media: a large-scale, durable information wall made of glass, separating the students, the teacher and the guide on one side, from the woods on the other side. The class is presented with a time travel virtual experience to the era of the dinosaurs. As the guide presses a virtual red spot on the wall a 3D projection is activated, and the vision of a dinosaur appears behind the glass, as if *really* walking through the forest and threatening the audience. The narrator defines it as dynamic interactive signage, specifying all the advantages of the whole information wall:

> 'It creates a barrier where you need one, it's informative, it's interactive, it's aesthetically pleasing and it doesn't block the landscape. In fact in this case, it *enhances* it. And it's made of glass! When it's not displaying information it's transparent'.

The positive feature of this smart technology is therefore described as the possibility of protecting from a natural environment, a forest, while providing a layer of information about it. Moreover, as the actual landscape is not appealing enough, the technology allows the forest view to be enhanced by an aesthetically pleasing and emotionally entertaining spectacle, made of virtual entities interacting with physical ones.

In this case, the world that considers this set-up as desirable is a place in which the experience of actually being in a forest is considered as irrelevant for educational purposes and potentially dangerous. The process of education is translated into an entertaining information gathering and the whole experiential knowledge emerging form a walk the woods is substituted by a virtual spectacle on a screen.

Figure 4. Children exploring the park with glass tablets

Source: ©CORNING

The narrator then explains that, *alas*, this type of display cannot be implemented in the nearest future, as hiding all the electronics while retaining optical clarity on such a large-scale is still an unresolved challenge. He therefore introduces us to an alternative, intermediate possibility (Figure 4).

([21]) Analogous reflections could be made by analysing other episodes of the video, such as Amy's class or Dan's day at work in the hospital.

In this version, the children are allowed to explore the park with their glass tablets, along a predefined path disseminated with red spots. As they look through their transparent devices, working again as pristine barriers between them and the actual forest, the spots activate the dinosaurs' moving simulacra on their personal screens, together with a set of supposedly relevant set of information data. In other words, the children have access to an 'augmented reality' experience through a complex device 'all wrapped up in a thin, durable glass, perfect for education and perfect for a bit of fun too'. Even if the actual fruition of the smart glasses involved in the first and in the second version is relatively different, moving from a collective to an individual augmented experience, the *performative* function of the devices is the same: the children need to be informed, protected and entertained.

The advantage of this latter set up, as the narrator points out, is that once Amy is back home at night, her tablet can automatically connect to the main home edge-to-edge wall display, allowing her to 'share all the best bits of her field trip with her family, in next generation, high-definition 3D'.

In this whole section of the video about *smart* education, we learn that what defines both the making and the sharing of an experience, in a social as in a natural environment, can be and is transformed into the act of collecting and sharing bits of data on a screen. A new contradiction here emerges as we claim the need to 'augment' our reality, be it a forest or a family gathering at the end of the day, by actually preventing ourselves from physically, mentally (and spiritually) experiencing it in the first place.

Power and control: a smart decision for a smart planet (we can)

In the fall of 2008, in the middle the global financial crisis, the US multinational company IBM launched one of its most ambitious global campaigns ([22]), based on the idea of building a 'smarter planet'. On November 8, a few days after Barack Obama's election, IBM Chairman and CEO, Sam Palmisano, presented his narrative of smart innovation through a fifteen minutes speech at the US Council of Foreign Affair.

In his talk, the planet as a whole – considered both as a matter of facts and as a matter of concern – is described as a single highly complex and interconnected socio-technical system, running at a growing speed and demanding more energy and resources. Climate, energy, food and water need to be efficiently managed in order to meet the challenge of a growing population and a globally integrated economy. A number of sudden and unexpected wake-up calls such as the crisis of the financial markets need to be recognised as the signs of a discontinuity to be governed for our best. The leaders of both public and private institutions have to acknowledge this radical change and new decision-making tools are needed to constructively confront it.

Once the crisis scenario is presented, the IBM narrative of innovation moves to the resolution at hand: we have *already* the technological power and control to turn our predicament into an opportunity. If we are willing to embrace the change and technologically 'upgrade' our way of living, *we can* fix our problems ([23]). Moreover, not only this change is desirable, but it is also mandatory and *urgent*, if we want to prevent further sudden collapses in our systems on the one hand, and to preserve our competitiveness into the globalised market on the other.

([22]) IBM *'Let's build a smarter planet'* campaign by Ogilvy&Mather, won the 2010 Gold Effie Award.

([23]) One of the main underlying ideas implemented for IBM in Ogilvy&Mather's marketing strategy for a 'smarter planet' was the pragmatically optimistic message of Barack Obama's election campaign 'Yes, we can', which 'fuelled a massive shift in public mood and moved the conversation from the private sector issues to the public sector issues. The overall rationale of the campaign can be found at http://s3.amazonaws.com/effie_assets/2010/4625/2010_4625_pdf_1.pdf.

The implicit assumption is, of course, that the tools we need are techno-scientific and that IBM is in charges of delivering them for a new *smarter* leadership.

This can be done by

> 'infusing intelligence into the way the world literally works - the systems and processes that enable physical goods to be developed, manufactured, bought and sold…services to be delivered… every*thing* from people to money to oil, water and electrons to move…and billions of people to work and live' (Palmisano 2008).

As the boundaries of our finite, physical world become more and more evident in the transition to an era of resource scarcity, we are here provided with a solution coming from the ICT innovation: the apparently boundless universe of *digital information*, *virtual connectivity* and *computational power* allow us to become efficient enough to secure our consumption growth. These three fundamental axes of the new technological revolution are articulated *via* the terms 'instrumented', 'interconnected' and 'intelligent', which all together define the notion of 'smart'.

Instrumented reflects the indefinite proliferation and diffusion of the fundamental building blocks of the digital age, the transistors, up to one billion per human at the infinitesimal cost of one ten-millionth of a cents. As all these transistors become *interconnected*, anything can communicate with anything else. In this vision of the IoT, we can thus monitor and *control* our planet with unprecedented precision and capillarity by converging the realms of the physical, the digital and the virtual *things.* Finally, everything can become *intelligent*, as we are able to apply our ever-increasing computational *power* to sensors, end-users devices and actuators, in order transform the ocean of data that we collect into structured *knowledge*, and then into *action*.

In this whole scenario, the modern ideal of 'science speaking truth to power' (Wildavsky 1979) and the pristine separation between facts and values in our decision-making processes are ideally preserved by technologically enhancing our power to objectively, exhaustively and precisely collect, represent and analyse the 'facts' upon which a rational decision can be made.

Three framing epistemic and normative assumptions, emerging from the imaginaries of power and control, need to be set in place in order for this modern narrative to be functional. First, the inherent complexity of the interaction between socio-ecological and technological systems can be reduced to a measurable set of complicated and therefore simplifiable structured information. Second, the needed 'facts' can be defined in terms of supposedly relevant *data*, filtered through the appropriate information technologies. Third, the *quality* of our decision-making processes can be completely disentangled from the normative sphere of values and can be equated with the computational power to distinguish data from noise, and to assign them a meaning, in order to transform them into an operationalised notion of knowledge.

A new level of contradiction emerges here, as the very same technologies that we invoke to fix our problems are exponentially increasing the level of complexity they are supposed to manage for us. Moreover, in this view, human beings are dispensed from any kind of responsibility, as the arising systemic crisis is imputed to the ineluctable increase of socio-technological complexity. Our only commitment becomes allowing our machines (and the companies that produce them) to keep optimising our life ([24]).

([24]) Other relevant exemplifications of this kind of narrative are the HP project for '*The Central Nervous System for the Earth*' (http://www.youtube.com/watch?v=qMGyQGTpMFs) and the CISCO and NASA partnership into the global non-profit research and development organisation' 'Planetary Skin', http://www.planetaryskin.org/.

More radically, in this scenario, not only the 'things' about which decisions need to be taken, but also the 'we' who gather around those 'things' are fundamentally transformed ([25]). Indeed, the ultimate consequence of this set of assumptions is that the most effective decision-maker is *in itself* the merging of a physical, a virtual and a digital being: a cyborg or a robot. The IBM's supercomputer named Watson, a 'deep question answering' (DQA) machine, which outsmarted his predecessor Big Blue by winning the US TV game 'Jeopardy'!'' is a clear implementation (or an early incarnation) of this idea (Thompson 2010).

Let's now explore the visual discourse associated with this whole narrative.

The smarter planets

A few weeks after Palmisano's speech, the nucleus of the campaign was translated into a single set of icons, which then informed all the successive imagery about the IoT. The 1972 'Blue Marble', the NASA famous photograph of our planet from outer space, which dramatically contributed to the formation of the awareness of our limits and to emergence of the US environmentalist movement (Jasanoff 2001), was transformed by IBM into an icon and associated with the conventional symbol of the Internet signal, furthermore evoking a solar crown, the essence of positive energy (Figure 5).

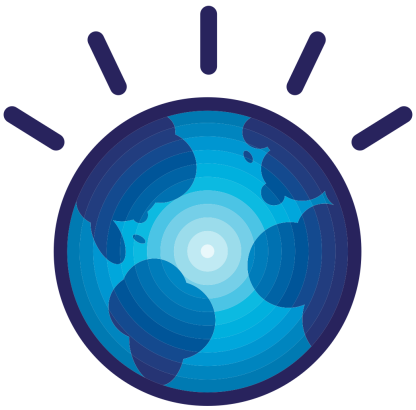

Figure 5. IBM icon - the digital Earth?

Source: © IBM.

The icon was then varied and multiplied for every aspect of our complex life: one entire new planet for every 'matter of concern', resulting in an overall image of an indefinitely growing creative abundance (Figure 6 and 7).

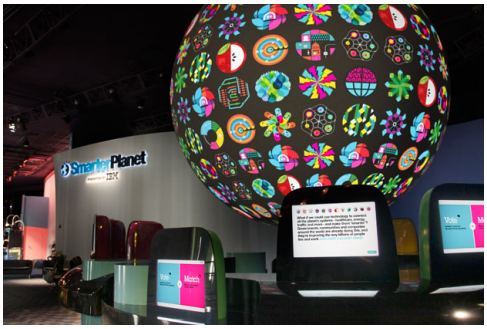

Figure 6 and 7. IBM planets for every matter of concern and IBM 'planet of planets'
Source: © IBM.

Finally, the same icon gave Watson a face, for the grand theatrical performance in the 'Jeopardy'!'' quiz show (Figures 8 and 9).

([25]) A broader reflection on the technoscientifically-driven transformation not only of our reality but of ourselves should include the radical changes involved by a number of emergent technologies such as synthetic biology, nanotechnology and robotics.

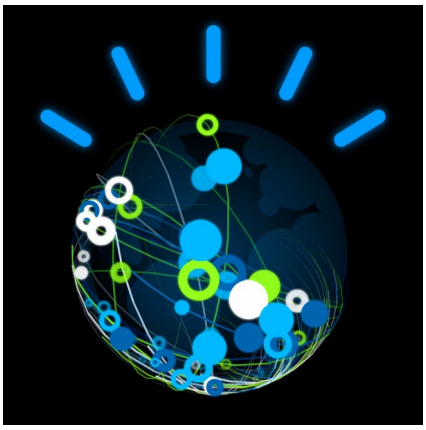

Figure 8. Watson's face
Source: © IBM.

Figure 9. Watson's face at "Jeopardy" Quiz show

Source: © IBM.

Welcome to the decade of smart

In the early 2009, IBM released a two minutes video clip titled 'The decade of smart' ([26]), as one of the key features of its campaign. From Corning's 'design fiction' intimate journey into a near future's daily life permeated by the IoT, we move here to a global, abstract vision of the 'anthropocene era' (Crutzen and Stoermer 2000) with all its challenges and opportunities. A voice-over guides us to through the essence of Palmisano's narrative of innovation, by focusing on its positive turn. The needed ICT are already at work for us: 'A smarter planet isn't a metaphor, or a vision, or a proposal, a smarter planet *is happening*'. From Corning's desirable, future oriented design fiction enabling us to be individually more efficient and more entertained, therefore 'happier', here we step into a present, actual representation of our collective power to optimise our life supporting systems.

A white text appearing on a black screen 'Hello, smart planet…' approaches the viewer as the inhabitant of an intelligent world, in which, once again, the realms of the physical, the digital and the virtual entities ubiquitously converge. This convergence is visually conveyed by repeatedly juxtaposing the virtual universe of interconnections between the nodes of a digital network, and the filmed representations of our physical world, described as a web of socio-technical systems.

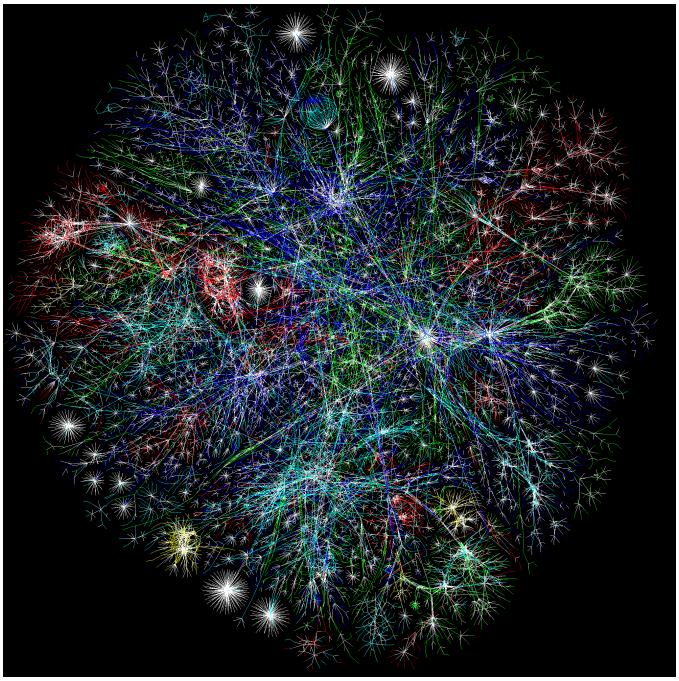

Figure 10. From the Opte project

Source: © Opte Project.

The digital and the virtual spaces are represented by a sophisticated animation, whose imagery clearly emerges from the pioneering Internet mapping iconic work of Barrett G. Lyon,

([26]) http://www.youtube.com/watch?v=uLvPsZVaIfk

known as The Opte Project ([27]) (Lyon 2005) and today part of the permanent collection of the New York Museum of Modern Art (MOMA).

Figure 11. From the film "Koyaanisqatsi", directed by Godfrey Reggio, with music by Philip Glass and cinematography by Ron Fricke

Source: © "Koyaanisqatsi".

A flowing galaxy of suspended data in an infinitely deep outer space (in a pure black background) is 'wonderfully' governed by analytical algorithms, which recognise and create a harmony of patterns. Orderly, dynamic structures are created from chaos as information, knowledge and wisdom emerge from data.

Concurrently, the cinematic depiction of the physical world can be ascribed to the 1982 film entitled *Koyaanisqatsi*, directed by Godfrey Reggio. The aerial shooting, the use the time-lapse and the modularity of the musical score are utilised by IBM to convey the high complexity of our socio-technical systems and to claim the equivalence between the physical and the virtual universes, and between us and our machines.

Figure 13. Scene from film Koyaaniskatsi

Source: © "Koyaanisqatsi".

Toward the end of the clip, when a new leadership is called for, the IBM physical 'smarter planet' is depicted through a series of live portraits, again closely evoking a very determinate Fricke's poetic choice. The alienation of *Koyaanisqatsi*'s tragic figures becomes, in the IBM clip, the power and will of human creativity to preserve its techno-scientific self-determination.

Ironically, the poetic use of images and sounds that made the success of Greggio's movie was conceived with the same overall function, but for an opposite aim.

Figure 12. Scene from the film Koyaaniskatsi

Source: © "Koyaanisqatsi".

'These films have never been about the effect *of* technology, *of* industry *on* people. It's been that everyone: politics, education, things of the financial structure, the nation state structure, language, the culture, religion, all of that exists within the host of technology. So it's not the effect *of*, it's that everything exists within [technology]. It's not that we *use* technology, we *live* technology. Technology has become as ubiquitous as the air we breathe so we are

([27]) http://opte.org/

no longer conscious of its presence' (Reggio, in Carson 2002).

In the IBM's visual narrative of innovation the equivalence between social and technological systems is what allows us to not only to survive in a time of change, but also to keep improving our welfare.

In *Koyaanisqatsi*, the hyper-complexity of our socio-technical systems and the merging of human beings in their technological infrastructures are taken to be the sign of a 'life out of balance' ([28]).

In the IBM narrative of innovation, we begin from acknowledging a period of transition, characterised by a state of disequilibrium, but the subject of this unbalance is not life *per se*, but growth. As we have seen, we could argue that the provided 'positive' answer in order to restore a dynamic equilibrium in our model of growth is to give up our agency: in short and provocative terms, to restore 'a balance out of life'.

Urgency: a smart solution (we need)

The techno-scientific narrative of innovation embedded in a marketing campaign, either for smart glasses or for smart services and infrastructures, is intrinsically biased by its very function of selling specific 'things', therefore it could considered as less representative of broader political, economic and cultural transitions. However, as previously mentioned, it is interesting to note that along the path-dependent trajectory from curiosity-oriented science to corporate goal-oriented industrialised techno-science, the same narrative of innovation can be found both within private companies plans for market shares expansion and within public institutions long terms engagements for the future, as they are *both* engaged in securing the overarching model of competitiveness and consumption growth. It is indeed the case of the 2020's strategy for a 'smart, sustainable and inclusive growth' proposed in 2010 by the European Union and incorporating the IoT innovation pathway within one of its key Flagship Initiatives, named *The Digital Agenda*.

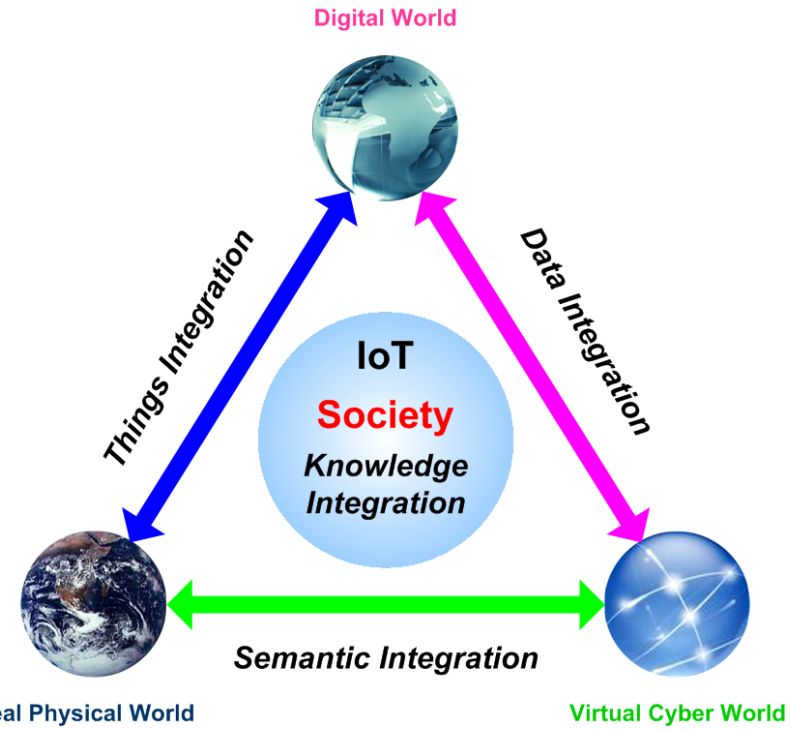

Figure 14. Vermesan *et al.*, 2010: p.45

Source: © Vermesan et al., 2010

The proliferation of planets and the convergence of the physical, the digital and the virtual worlds as a way out of our bio-physical limits is

([28]) The Hopi word Koyaanisqatsi (Hopi pronunciation: [kojɑːnisˈkɑtsi]) is defined as 'life of moral corruption and turmoil' or 'life out of balance'. The prefix koyaanis– means 'corrupted' or 'chaotic', and the word qatsi means 'life' or 'existence', literally translating koyaanisqatsi as 'chaotic life'. The film also defines the word as 'crazy life', 'life in turmoil', 'life disintegrating', and 'a state of life that calls for another way of living (from Wikipedia' 'Koyaanisqatsi').

proposed in the scientific-institutional style of a synoptic diagram (Figure 14) by the European Research Council on the Internet of Things ([29]) (Vermersan *et al.* 2010). The 'Blue Marble' is inserted in a triad of planets in a symbiotic interaction.

The main difference in this instantiation of the narrative is that in the EU context the IoT is still a vision and a work in progress. As we have seen, IBM fuels the optimistic will and need to technologically upgrade businesses and infrastructures by declaring that its 'smarter planet isn't a metaphor, a vision, or a proposal' but a reality. On the contrary, the EU proposes the IoT in a more ambivalent way: as a *vision* to be governed and implemented through an open, participatory process and as a *reality* that 'is being built today' ([30]), as one of the key drivers of the 'Innovation Union', 'gearing up for the next technological revolution' ([31]). The EU visual articulation of the IoT reflects this inherent ambiguity.

Imagine everything was linked…

In January 2012, a three minutes video titled 'Internet of Things Europe — The movie: Imagine everything was linked…' was posted on YouTube by the EU Information Society and Media Directorate General, within the Digital Agenda Flagship Initiative ([32]). The clip is conceived as a tool to support the Public Consultation on the IoT ([33]), which started in April 2012, ending in July 2012.

In the background information posted in conjunction with the video one could read:

> 'Europe is confronted with the challenge of remaining at the cutting-edge of this Internet of Things revolution while addressing the complex policy issues that it raises (privacy, security, ethics)'.

Whereas Corning needs essentially to present his portfolio of products as desirable lifestyles, and IBM needs to encourage a change in order to open up new market pathways and business models, the EU has to solve a more difficult task. On the one hand, the IoT has to be presented as a mere vision to be democratically discussed and governed, and on the other hand it needs to become (and it is becoming) a reality as soon as possible to ensure a competitive advantage.

As we have seen, Corning's appeal to desirability entails recurring to a near and attractive future, through an imaginary of wonder. IBM's call for positive change implies entrusting the present with an already available technological power and control. The answer to the EU dilemma comes from accelerating public acceptability, and this can be visually (and politically) achieved with the interplay between the present and the future, connected one another through the imaginary of urgency.

The first half of the video is situated in our present time, described through the daily life of four European citizens, in their urban environments. In the second half, we are seamlessly conducted in their very near future, in which the IoT depicted as a *reality*, while the narrating voices evoke it as a *desirable vision*.

In the first part, we follow the characters along their day and we hear their eloquent flow of thoughts, expressing frustration and psychological stress. They are preoccupied and overwhelmed by the complexity and inefficiency of the systems and infrastructures they

([29]) http://www.internet-of-things-research.eu/about_iot.htm. Last accessed 09/09/2013.

([30]) 'The Internet of Things is a vision. It is being build today. […] The purpose of Council is to forecast what will happen when smart objects surround us in smart homes, offices, streets, and cities. Forecast... and build' in: http://www.theinternetofthings.eu/. Last accessed 09/09/2013.

([31]) This video is no longer available through the EU consultation on IoT through the Your Voice portal is closed. But it is available at: http://www.youtube.com/watch?v=nDBup8KLEtk. Last accessed 09.09.2013.

([32]) http://www.youtube.com/watch?v=nDBup8KLEtk. Last accessed 09.09.2013.

([33]) Partial results are available at: http://ec.europa.eu/digital-agenda/en/news/conclusions-Internet-things-public-consultation. Last access on 09/09/2013.

depend upon. Energy consumption is constantly increasing, transportation, medical structures and shopping malls are congested and people can only passively endure the growing challenges. European economic stagnation is evoked by the recurring frustration of 'standing still' expressed by all the characters.

The crisis scenario of resource scarcity and socio-technical systems saturation is thus presented through an imaginary of urgency in which an immediate shift from the 'vision' to the 'reality' of the IoT is needed, as a technological silver-bullet to be implemented first, and only later politically and ethically adjusted.

In the second part of the clip, the needed change becomes an opportunity, as in the IBM campaign, and a desirable evolution of our way of life, as in Corning's day made of glass. The plurality of voices presented in the clip collectively appeals to a new technological revolution, a *dues ex machina* emerging from the imaginaries of wonder, power and control, with 'infinite applications'. If objects are interconnected and smart, every*thing* from our energy to our cars, our goods, our medical systems can efficiently flow again and a new 'endless frontier' is open.

> 'If we want to be smart about energy, we should let energy be smart about itself'. ('Imagine everything was linked', female character n.1)

Once again, this kind of narrative entails the reduction of eminently political issues, i.e. the 'things' as matters of concern such as energy needs and distribution patterns, to technical issues, i.e. the 'things' as matter of facts, such as energy use optimisation.

2.3 Concluding remarks

In this work, we have contextualised the narrative and the imaginaries associated with the announced Internet of Things revolution in the broader context of techno-scientific innovation as the main driver for competitiveness and growth. As we have articulated, if we take for granted that the model of growth needs to be secured from the systemic crises of our socio-ecological systems (including ourselves), then we are forced to appeal to the techno-scientific hybridisation and substitution of our means, and ultimately of ourselves. This overall normative framing assumption necessarily entails the reduction of the political and ethical discourse about innovation to a set of *a posteriori* technical fixes (Tallacchini 2009; Funtowicz and Strand 2011) which are designed to address a set of identifiable risks and are not supposed to challenge the framing assumption in itself.

By closely observing the visual discourse associated to the IoT revolution, within private and public institutions, we are proposing a shift from reflecting and debating about the possible dangers and by-products of techno-scientific innovation (the 'bads'), to contemplating the inherent implications of the positive solutions they are supposed to provide (the 'goods'). As we have seen, within this path of reflection, we encounter a number of contradictions that can be interpreted as the manifestations of the limits of the innovation framing assumption (Ravetz 2006; Dovers and Handmer 1993).

The first contradiction that we have outlined arises from the fact that as we become more connected in terms of our possibility to share digitised information in our virtual sphere of existence, we become more isolated in terms of the possibility to share experiences in our physical, daily life. More specifically and more radically, even before sharing any*thing*, our own capacity to make an experience — meaning to be *present* and related to our own physical, biological and psychological space — is compromised by our technological enhancement. And this latter is, in turn, specifically designed to inform, entertain and protect us from the complexity and the unknown, both inside and outside of us.

If we then take experience as the foundation of knowledge, then we step into a second contradiction, as what is supposed to augment our capacity to understand ourselves and the world around us ([34]) indeed compromises our ability to elaborate mindful knowledge.

Finally, technologically enhancing our efficiency entails drastically reducing the space and time of our inner dialogue, undermining our ability to' 'think', as defined by Hanna Arendt (1971), and therefore to feel responsible (Kjølberg and Strand, 2011).

Taken all together, these contradictions seem to indicate that we either redefine what human integrity and agency are, or we acknowledge that the techno-scientific enhancement we invoke in order to secure our model of growth dramatically challenges our human condition (Arendt 1958).

If we take the second option, then we are induced to open up an ethical and political discussion about the overall framing assumptions that define the meaning and the aim of innovation. To recognise and to reduce the existing suffering and structural violence, perpetrated on humans and other beings, which seems to be inherent in our way of living, doesn't necessarily require new technologies, but new framings and forums for an extension of rights (Van den Hove 2012, STEPS 2010, Jackson 2009).

([34]) See for example, Gary Wolf *"The quantified self"*, TED conference: http://www.ted.com/talks/gary_wolf_the_quantified_self.html, or, as mentioned earlier, http://www.planetaryskin.org

3.Public Consultation: ethics perspective

What ethical issues are of concern?

In this section we present the questions developed for the public consultation organised by DG CNECT in the Spring of 2012 under the activities of the IoT task force chaired by the same DG. Not all these questions made it to the final online questionnaire available to the participants via the' 'Your Voice' portal of the European Commission (http://ec.europa.eu/yourvoice/). The questions embedded many of the ethical issues that the JRC team deemed relevant to investigate, namely agency, dignity (autonomy and identity), social justice and trust.

3.1 Ethics questions

Rationale of these questions

This group of questions focuses on key human values with ethical implications, i.e. values likely to be challenged, ending in 'value conflicts' and tensions. In addition, a group of questions that focus on the procedural, regulatory aspects for 'ensuring' or at least taking care of ethical aspects in the design and deployment of IoT are also proposed.
NB: We have (rightly) assumed that privacy (and its states) was taken care of by other members of the IoT expert group.

Group 1 – ethical issues

Identity	I AGREE	I DON'T AGREE	MAYBE
IoT applications pose threats to the protections of an individual's identity.			
IoT applications could change our sense and definition of personal identity.			

(If you answer MAYBE, please leave a comment)

Autonomy	I AGREE	I DON'T AGREE	MAYBE
I will have the ability to decide whether or not I will use IoT applications.			
IoT applications should operate under 'explicit consent' by its users as with other ICT applications.			
IoT applications could interfere with individuals' autonomy.			

(If you answer MAYBE, please leave a comment)

Fairness and social justice	YES	NO	MAYBE
Will IoT applications promote equality and solidarity?			
Do you expect current developments of IoT applications to take into account the different capacities, constraints, needs and expectations of individuals?			

Will IoT applications enhance existing or emerging social disparities and divides?			

(Please leave a comment, whichever answer you choose)

Human welfare – and security	I AGREE	I DON'T AGREE	MAYBE
Increasing dependency on IoT applications will intensify threats to human welfare.			
People's physical, material and psychological well-being constitute the fundamental value that is guiding current developments of IoT.			

(Please leave a comment, whichever answer you choose)

Trust	YES	NO	MAYBE
I see IoT applications as brokers between myself and the environment with which I could directly interrelate.			
I am concerned about the governance of the quantity of data that will be resulting from the interaction of objects			
I see 'traditional' human relationships changing both amongst humans and with objects themselves with IoT.			

(Please leave a comment, whichever answer you choose)

Open question – Responsible innovation

What other ethical questions would you like to be asked in relation to IoT?
(Please comment)

Group 2 – procedural issues

Governance of Ethical considerations in IoT	I AGREE	I DON'T AGREE
It is necessary to establish an 'IoT ethical charter' to be followed by any entity involved in the design, development and deployment of IoT technologies and applications. *(lease comment if you do not agree)*		
(a) I identify the following as key ethical principles which should be part of such charter: *(Please state here)*		
(b) Who should be involved in the definition of a' 'IoT ethical charter'? *(Please state here)*		
	I AGREE	I DON'T AGREE
The public sector should supervise compliance of IoT applications design, development and deployment with an 'IoT ethical charter'? *(Please comment if you do not agree)*		

3.2 Summary of Observations

The results of the public consultation responses were done through a report and presentation by DG CNECT at the last meeting of the IoT task force in November 2012; the report is available at: http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetailDoc&id=7602&no=3 [Last access 12/12/2013].

According to what is reported in the aforementioned report, more than 600 answers to the online questionnaire were received. Around 50 % of the respondents responded as representatives of some type of institution (e.g. RFID industry, Telecommunications, NGO, Academic, Governmental organisation, etc.), whereas the other 50 % has responded as *interested citizen*.

Again according to that report, the major ethical concerns listed in relation to the questions posed are the following:

Ethical concerns	**Agree**	**Do not agree**
IoT threats the protection of identity	>60 % agreed or strongly agreed	<20 % disagreed or strongly disagreed
IoT changes our definition of identity	>60 % agreed or strongly agreed	<20 % disagreed or strongly disagreed
IoT should operate under explicit consent – 'autonomy'	≈80 % agreed or strongly agreed	≈10 % disagreed or strongly disagreed
Safeguard of autonomy should be sought if consent does not work	≈50 % agreed or strongly agreed	<20 % disagreed or strongly disagreed
IoT can interfere with individuals autonomy	>60 % agreed or strongly agreed	<20 % disagreed or strongly disagreed
IoT development shall not create social injustice	>80 % agreed or strongly agreed	≈5 % disagreed or strongly disagreed
Concern about IoT collected data	>80 % agreed or strongly agreed	<20 % disagreed or strongly disagreed

Hence, the great majority of respondents are concerned by the ethical issues raised through the questionnaire. Moreover, according to the report many respondents think that a charter or other forms of self-regulation would be insufficient to ensure that the ethical issues they are concerned with are appropriately dealt with by the industry. In particular, the report mentions that a consumer organisation stated the following: 'a strong regulatory framework that is properly enforced is needed to ensure that consumers' rights and autonomy are respected'.

The report also mentions that a 'bottom up multi-stakeholder approach to define the ethical framework relevant to IoT was proposed'. This suggestion amounts to a need for further engagement of the public to ascertain what values and what norm and ethics need to be empowered.

4. Noticing objects' agency

'Of all the various cutting-edge gadgets and toys waiting for me on my first day at WIRED's Gadget Lab, my favourite was a decidedly low-tech flip book. That's because it's the dead tree version of Charles and Ray Eames' legendary 1977 short film *Powers of Ten: A Film Dealing with the Relative Size of Things in the Universe and the Effect of Adding Another Zero*, or just *Powers of Ten* for short'.
Wired Magazine17/09/2013.

Do we *notice* the objects we engage with everyday? Do we realise how much we *delegate* on those objects? What humane features are impaired by our contract with objects?

In the section 2 we have introduced the idea that the objects that we are creating, using, relating to, sharing, etc. correspond to specific imaginaries of innovation that are thriving unquestioned. When we say unquestioned, what we mean is that they are either explicitly or subtly embedded in Action, i.e. in mundane activities but also in arts, research funding schemes, corporate rhetoric, etc. More specifically we have explored the narrative and the imaginaries associated with the Internet of Things vision in the broader context of techno-scientific innovation as the main driver for competitiveness and growth. As we have argued earlier, if we take for granted that the model of growth needs to be secured from the systemic crises of our socio-ecological systems, then we are forced to appeal to the techno-scientific hybridisation and substitution of our means, and ultimately of ourselves.

As described earlier these types of technologies embed worldviews (with their ethics), being intentionally transformative of human action and interaction; in fact many STS scholars have studied how technology and society are co-constructed ([35]); but are we noticing the 'things' (physical and virtual objects) with which we seem to have created inevitable relationships? How much do we realise in practice how 'things' became interfaces or mediators to nature, human beings, etc.? How much do we notice that inexorably many ordinary objects are becoming substitutes for skills, experience, and ways of knowing with consequent human disconnection? Do we notice the objects that break with the boundaries between nature and human culture? What different ontologies are emerging? And as technology development and usage embed worldviews, how inevitable is the IoT proposal? The values that are privileging some worldviews in detriment of others may be visible or invisible, explicit or implicit, addressed as such or ignored in the development and deployment of technology such as IoT. Where is the debate taking place about this pervasive experiment of the digitalisation of the society? What are meanings users make of the 'things' in IoT?

At the IoT Week in 2012 and IoT International Forum that took place in Venice, an open session on Ethics in IoT ([36]) was organised by Rob Van Kranenburg ([37]) where the JRC contributed with one oral presentation of the work presented in section 2 of this report and an interactive session with the audience. During this creative workshop the audience was expected to perform on relationships with mundane objects, focusing on ICT and electronics.

([35]) The idea of co-production is thoroughly addressed in the work of science and technology studies scholars such as Bruno Latour, Donna Haraway and Sheila Jasanoff. In here we cannot extend the review of their work, but the reader of the report should refer to those authors for deeper consideration.

([36]) Available at: http://www.iot-week.eu/iot-week-2012/programme-1/monday-1/ethics. Last access 09/09/2013

([37]) Mr Van Kranenburg was an active member of the Internet of Things Expert group chaired by DG CONNECT between 2010-2012; he has been teaching at various schools in the Netherlands (UvA, EMMA Interaction Design, Industrial Design) and has worked at several Dutch cultural institutions; de Balie, Doors of Perception and Virtual Platform. Currently he works as the Head of the Public Domain Program at Waag Society.

Participants were asked to describe an object that the JRC organisers provided, describing the thoughts it triggered, including individual stories or events that related the participant to the object. Through this description it was expected that the participants got awareness of the object's place in their quotidian, including the dependencies and symbolic meanings it carries. The participants were also asked to reflect on the inevitability and dependency the object creates.

The aims of the section were to explore paradoxical elements present in subject-objects and nature-culture relationships ([38]). In addition, the issue of human autonomy in the context of greater (mundane) technology dependency was questioned. Lastly, we explored the idea that 'things' have agency, as well as the notion of humans as a network of technological induced habits.

This interactive workshop was repurposed some months after in Bled at the 3rd edition of the IoT forum organised within the 'Living Bits and Things 2012' conference ([39]). At both events the great majority of the participants had a technical background.

So, a number of mundane objects ([40]) were distributed to the participants; those objects were objects that today we take for granted and do not question for their original meaning or the imaginaries they represent. In the two events a total of 60 people participated in this interactive exercise. The audience was asked to *notice* the object given to them and had around 7-8 minutes to write in cards distributed by the organisers a reflection taking into account the aforementioned issues.
In the words of Rob Van Kranenburg 'this exercise proved immensely successful for three reasons:

- it broke the normal pattern of talks and q&a's to such an extent that it allowed participants to mix personal memories with their professional expertise;
- it *performed* not discussed the main point of JRC's presentation at the beginning of the session; that there is a granularity to our relationship with objects that cannot be reduced to "pure functionality";
- it showed – in the words of Gérald Santucci – the "ephemeral" of technological realities put in front of us as experience'.

We have looked into the cards where participants have annotated their thoughts about the objects distributed to them ([41]).
In order to facilitate our analysis of these stories, we have categorised the stories of the participants by the object's main functionality: Memory, Connectedness, Power, Interoperability, Identification. Through the analysis of the cards the following issues emerged recurrently with regards to the technology the participants were looking at:

1) Transience
2) Obsolescence (programmed?)
3) Sustainability
4) Indispensability
5) Inevitability
6) 'Fragility'/vulnerability
7) Identifiability

([38]) In her article, '*Cyborg Manifesto'*, Donna Haraway (1991) contends these binarisms in what she calls the cyborg age. A cyborg is a 'cybernetic organism, hybrid of machine and organism, a creature of social reality as well as a creature of fiction'. As stated in section 2, we would argue that IoT is a metaphor of such hybridisation.
([39]) Available at: http://www.livingbitsandthings.com/events/2012/program. Last access 09/09/2013.
([40]) Including the following: Plugs, CDs, Mouse, Internet cable, Pen drive, Bar code, RFID tag, Mobile phone, smart phone, Web cam, Diskette, USB adapter, electrical adapter, portable computer, tapes
([41]) The idea that participants could not choose an object was intentional since the objects proposed are commonly used in our everyday or professional lives and we did not want descriptions of the ones about which the audience had an a priori tie or relationship.

8) Privacy
9) Agency

On Table 1 we list some quotes that illustrate these issues.

Table 1: Issues emerging from the exercise' 'noticing objects"

About a…	**Quotes**	**Functionality**	**Issues**
Floppy disk	'the past... but a recent past ->> how fast does technology change'?'' ' 'capacity: 1.4 MB'! ' 'because of the increasing storage + network (technical) capabilities we become very inefficient about how we use them.'	Memory	Transience Fragility Obsolescence Indispensability Sustainability
Ps2 connector	'Adaptors needed for connecting old and new technology; cycles are too short'	Connectedness	Obsolescence
Mouse adapter	'It allows my old PC using new types of mouse devices'	Interoperability	Obsolescence
Cable connector	'cable adapters are painful; their existence reminds me of bad design' 'I liked Nokia's slogan– get connected — and always imagined how will we get a cable directly into our heads and brains; then I saw the matrix…'	Interoperability Connectedness	Agency
Mouse	'mouse are older than CD; why do we still have computer mice?' ' 'I see the "thing" as a prolongation of my arm/finger bridging the gap from physical to virtual world; very intuitive, simple efficient – sorry, I'm a computer scientist!'	Mediation Human extensions	Indispensability Agency
Mobile phone	'gives me loneliness; then it makes me know that communication is essential; I imagined that people are eager to communicate with each others. But when the original function is lost, then we found the intrinsic importance of the object ' 'this thing knows everything about my friends; like life logs' 'I remember the world before mobile phones. My first one was yellow and I bought it because… my boyfriend was a telecom commercial. My friends thought I was mad. 3 months later all of them had one, and meeting people, organising days out and communicating was never the same. This was September 1998, Spain. It took me little to realise that I could easily lie – at a distance – and misguide those around me – if I wanted to – to believe I was somewhere else, with someone else, doing something else. And those were the sweet old times before multimedia MMS. So private, so small. I miss the communication vacuum, the turning up late for a date and find myself alone, the plan B and the backup strategies. The telephone box, the old meeting points, the freedom. I enjoy the always on, the 24/7 connection and the other type of freedom that it brings: control of my location and of my time'	Connectedness Memory	Inevitability Indispensability Agency Mediation Privacy
RFID tag	'contact less world → easier methods for accessing different applications, electronic tickets, payments' "big brother"	Interoperability	Mediation Privacy Agency
Headphones	'constant communication' 'need for mobile privacy '	Connectedness	Inevitability Privacy

	'they can deliver secrets and destroy ears; they will deviate the users mind from the public scene'		Alienation
Webcam	'part of my laptop' 'big brother'	Connectedness	Mediation Identifiability Privacy
Microphone	'dramatically changed the world as it allowed to record (CAPTURE) speech, sound, music, interviews, radio broadcasting, phones, music studios, Skype, amplifying a voice transporting it to others – change the world of sound'	Connectedness	Mediation Indispensability
Memory card	'a storage and exchanging device, but now because it is old it became a piece of waste' 'scary stuff; it contains Gbytes of my personal photos… I have lost one but found it; it was scary to think that I had lost part of the family history'	Memory	Transience Sustainability Obsolescence Vulnerability Mediation
USB stick	'easy data storage, small affordable. What info could be lost if I forget it somewhere? How can I locate it?'	Memory	Vulnerability Indispensability
Tape	'I remember rewinding it with a similar pen to the one I am writing with. I no longer use a Dictaphone because I have it fully functional on my smart phone. I like the design though' 'personally used for 35 years; overcomes my inability to type and forced me to think before I 'write'. It was the employment for my secretary who is now my wife! Digital alternatives exist but I never tested. This records instant response from my work' 'cannot function alone; it needs a cassette player'	Memory	Obsolescence Transience Vulnerability Mediation Indispensability
Voice recorder	'Self-contained as long as there is power and available record space; expandable if there are more tapes; easy control that do not distract'.	Memory	Mediation Obsolescence
Power plug adapter	'If you don't have it, it's a problem' 'Converts electric socket to other types, being easy to carry around [made easy!)'' 'wouldn't it be nice if do not need this and have this wirelessly as the other devices' 'looks insignificantly, but if you forget it you feel like an idiot' 'Where are the solar cells to use it even if you don't have access to a plug' 'useful: just put it in your bag and you can forget it; when you need it you will remember it'	Power Interoperability	Indispensability Interoperability Ubiquity Sustainability
Smart meter	'another plug to put in-between' 'easy to use for a' 'normal' consumer?' ' 'Who else can read the measured data (privacy)?' 'What can be done with it? Reduce electricity bill?' 'Costs vs benefits?'	Power	Mediation Autonomy Privacy Sustainability Divides
Power	'device forces me to think about feeding it with energy,	Power	Dependency

	frustration, pressure, demand' 'still different power systems in Europe (lack of standardisation) and even more in the world' 'how much energy will all these new applications of the IoT consume from the environment? ' 'separation; old and conservative; each country has its own, why?' (interoperability; why do we have different "plastic" material interfaces to access the same 'resource') 'connection' 'can break' 'when I need it, it is not there, when I've got it, I don't need it'.	Interoperability Connectedness	Lack of harmonisation Sustainability Fragility
Mobile battery	'most mandatory part of a mobile phone that eventually will fail whenever it is mostly expected to operate' 'good candidate for recycling' 'this is quite heavy, must be quite old' 'not made in China' 'most likely coming with intelligence features as it has more than 2 connectors' 'with S/N therefore full traceability'	Power	Obsolescence Transience Identifiability Privacy Indispensability Agency of objects Sustainability
Battery charger	'no standard plugs' 'limitations for mobile phones – sooner or later I will need it'	Power Interoperability	Indispensability Vulnerability Ubiquity
Ethernet adaptor	'nice to have it but so fragile' 'unprecedented ace to a connected world' 'connect to friends and information and knowledge' 'it is a cable, an adapter, *it does not seem to have any intelligence*; for a non-technician person this thing is totally useless'	Connectedness	Agency Fragility
CD-rom	'revolution for music distribution' 'killed the warmth of analogue but provided sustainable media' 'can be used as a frisbee' ' 'major step of digitalisation of everything' 'fragile' 'making it impossible to retrieve photos, music, old archives (programmed obsolescence?) ' 'it has a hole, I can see through it; It flies. It has a smooth surface. Part of it is transparent, I could breath it; why 74 minutes? 650 MB(3 movies, 60 songs) – granularity data'	Memory	Fragile Obsolescence Transience
Telephone cable	'looks like a simple wire with two plugs but it is a vital link in communicating ideas, news and humour' 'it's a nice piece of art stapled as it is in two places and might have a place in a museum someday. I wonder what words and data were transmitted using this wire' ' 'huge impact in civilisation', 'telephone communication changed the world because every people in their houses	Connectedness Power	Mediation Transience Obsolescence

	had a telephone.' 'piece of history in terms of voice' 'mess of wires spread all over our rooms'		

The objects proposed during the exercise implied different degrees of mediation — human to machine and machine to machine. The observations made by the participants were for a great extent centred on the obsolescence of the objects and together with this realisation, the awareness of transience and un-sustainability and the quest for interoperability. In some cases the IoT vision is invoked as the means to overcome transience and other temporal dimensions – the need for adaptors between old and new – or spatial (geographical or contextual) dimensions – the need for adaptors to overcome physical constraints. Another strong focus of the observations was the awareness that many very humane functions are now strongly mediated including relationships and memory, knowledge production, etc.
The objects described by participants were subjects of some of the participants' stories. They were not MacGuffins ([42]) of their lives plots. To objects they often attribute personality and identities.
In an IoT expert meeting it becomes quite expected that reflections about objects become influenced by the IoT scenario's 'futuristic' lens of ubiquity and pervasiveness, etc. One can see that inspiration (or bias) through the suggestions of further dematerialisation and ubiquity but also through the reflections on agency, autonomy and privacy made by the participants of this exercise. There is hardly any observation that challenges the' 'inevitability' of a IoT future given the history of the others; the path to connectivity of everything is deemed a given.
The intentional or unintended transformative potential of technologies is reflected upon through the analysis of objects taken for granted for such a long time as something good and indispensable by the majority, such as a microphone, a tape or a telephone cable for the functions they came to support. The reflection on these objects provided also means to understand that we are progressively negotiating objects agency; in the words of Latour (1994), through *delegation* (technical action) *'*that allows us to mobilise in an interaction movements which have been executed earlier (…) by other *actants*, as though they are still present and available to us now' (Latour, *op. cit.: 792*). Progressive and further *delegation* on objects, a feature emphasised in the IoT scenario requires teasing out of emerging contracts between human and non-human artefacts.
This collaborative exercise aimed to tap into the justifications we use to embrace and appropriate ICT and it clearly illustrated that if the positive stories of IoT do not get more trustful, more rooted in everyday life and practice, then future adoption of IoT by a broad community of people might become very difficult (Van Kranenburg, 2012). The exercise showed further that we take for granted the existence of so many objects (and technology) that we do not interrogate really how our interactions have been co-producing our notions of human relationships, human-nature relationships, human action, norms and rule of law. By what mechanisms do we wish to maintain 'veillance' about these transformations? Can we opt out at all from this scenario? In a world of connected 'quantified selves" ([43]), through what kinds of experiments can we enhance our watchfulness about the ethical implications of a technological scenario that is extending (replacing) our senses with sensors, our genes with digits and our action with algorithms? One could ask him/herself, why do we need further mediation that puts in jeopardy our received notions of autonomy and agency?

([42]) Hitchcock has popularised this notion, which originates from cinematic contexts. It is 'a plot device in the form of some goal, desired object, or other motivator that the protagonist pursues, often with little or no narrative explanation as to why it is considered so important.' See http://en.wikipedia.org/wiki/MacGuffin.
([43]) See http://quantifiedself.com an international collaboration of users and makers of self-tracking tools.

In our hybrid world there clearly is a momentum for ethics as an umbrella to collectively discuss *what we are doing*, as the philosopher Hanna Arendt asked in her book 'Human Condition' (1958).

5. IoT Ethics: Agency and Divides

The section hereunder represents the contribution of the Joint Research Centre ([44]) to the study of ethics implications of a scenario increasingly pervasive where new ontologies develop, where *everything* becomes mediated by things, where our senses are complemented or replaced by sensors, where our autonomy may need further protection, as most of the promised mediations are carried out by corporations with strong vested business interests, ultimately interested in ourselves as data packages.

5.1 Social justice & (Digital) Divides

There is not a single definition of social justice, yet based on the vast available literature one can say that equality and solidarity are the main pillars that support this concept. Both equality and solidarity are considered as universal values, which are in turn enshrined in many rights, freedoms and principles worldwide. In this section we look at how IoT defining features may impact values such as equality and solidarity arising from divides that may develop by the deployment of IoT.

Relation to defining IoT features

1. Connectivity
2. Pervasiveness and ubiquity
3. Distributed control
4. Seamless transfers
5. Embedded intelligence

The main defining features (see section 1) that interest this ethical issue include the new connectivity arising from devices networking, 'machine to machine' communication, wireless sensors and the convergence of these with the Internet. The 'digital intelligence' embedded in the emerging connectivity of IoT is its developers' and industry's; hence, it does not necessarily include the ordinary user's point of view or representing her chosen lifestyles.

Ubiquity, pervasiveness and invisibility of data transactions performed by the objects of IoT will hamper many from realising how much their lives are tangled by what may become ordinary networked life. Unless investment on transparency and openness of IoT takes place, only an educated elite will grasp, interrogate or even protect the types of operations that will go on with IoT.

The levels of promised interconnectivity not only preclude a high number of interacting objects but also a high number of actors and institutions involved. Such situation may not be grasped by all – see for example the issue of Agency, where Orwell's 'big brother' idea is replaced by an abstract 'some brother' one; problems arising from unwanted data transfers and processing may result into user distress and even legal appeals as far as accountability is concerned.

We argue here that these IoT defining features will instil divides that go beyond what is normally described as 'digital divide' – have's and have not's. This will subsist not only due to accessibility differences among different sectors of the population, but also due to geographical and cultural differences, social structure, institutionalised inequalities, as well as generational gaps in technology appropriation and user agency. However, even if the

([44]) NB: In Van den Hoven *et al.* (2012) other ethical issues were explored by the Expert Group that the JRC was a part of. For example, trust, autonomy and informed consent are duly explored.

more sophisticated IoT promises may be oddly distributed within the income geography, the dividing issue is likely to arise from other types of access; we argue that only an educated knowledgeable elite will be actually empowered to make sense, to take informed decisions, to control the (Smart) data transactions that will take place among the myriad of objects of IoT or even to be able to protect those devices. And this is a knowledge divide, the inequalities that will be created being of a different order.

Ethical analysis

In the analysis that follows, it is assumed that access to the Internet of Things is beneficial for people and that preventing or lessening access to it causes disadvantages and unfairness as far as knowledge, empowerment, economic prospects and other vital resources for people's well-being, such as education and healthcare are concerned. For the sake of simplicity, we will examine here two types of divides that may arise from IoT deployment. They represent the two sides of the same coin; on one hand as with other ICT, the possibility of a digital divide, usually referring to differences in group (ethnicity, age, income, education, gender, and other demographic factors) access or usage of ICT within single nations or across nations; and a more paradoxical divide which we will call a 'knowledge divide', arising from the progressive disempowerment and deskilling provoked by the ubiquitous and invisible (smart) automation of data transactions, management of such transactions among objects and associated activities that IoT promises.

'Digital Divide'

The Digital Divide ([45]) concept emerged during the 1990's with the realisation that many did not have access to the Internet and therefore were left out from a burgeoning place of data and information transactions, knowledge creation, etc. Many have problematised the Digital Divide as an ethical issue; for instance, in Floridi's words ([46]), this divide 'disempowers, discriminates, and generates dependency'.

The Internet and data networking has increased interdependencies of actors and dependency on means to govern such interdependencies ([47]); so, as with the Internet, will IoT raise social integrity? Or will it contribute to social disparities and increase potential conflicts and raise the digital divide, instead?

The 'digital divide' is seen as one of the challenges for the development of IoT at policy level. Although, a great deal of this technology will be imposed onto people (a good example of this fact, being the 'smart' *movement*, such as small and large scale applications like Smart Cities and Smart Grids, Intelligent Transport, eHealth, Intelligent Manufacturing), the diffusion of and access to IoT technologies will be different according to global geography and is likely to permeate and transform work and leisure patterns, engagement in civic and political activities and people's quotidian, at different paces, even in Europe. It must be noted that this is not likely to be about the 'objects' *per se* but about equal access to health, education, and other vital resources. The stuff in one's hands is probably the least relevant.

'Knowledge Divide'

IoT could easily end up reinforcing the divide between capable users and those intimidated or outpaced by new technology. In here we will go beyond the commonly described 'digital

([45]) The commonplace definition of 'digital divide' comes from the US National Telecommunication and Information Administration's (NTIA) '*Falling Through the Net'* policy report series issued during the Clinton administration.

([46]) Floridi, L. 2001. *Information Ethics*: *An Environmental Approach to the Digital Divide. Paper presented at the 1st meeting of the Unesco's* World Commission On The Ethics Of Scientific Knowledge And Technology (COMEST) Sub-Commission On Ethics Of The Information Society. 18-19 June 2001.

([47]) ref.

divide', describing other diffuse divides that the unauthorised and unquestioned automations, seamless transfers and unnoticed ubiquity featured by IoT may create due to overwhelming consent demands. The divides in this case are not exclusively related to lack of skill, but also to what we could call 'consent fatigue'. If ever asked, the ordinary user may not have the time to keep pace with all consent activities he/she needs to respond to. This is even more serious for the individuals that have reduced autonomy such as 'special needs people', children and the elderly. With IoT, where the kinds of promised interconnectivity involve billions of 'objects' and transactions for which mechanisms of authentication and consent need to be put in practice, much attention has to be put on this issue. (Who reads today more than one page of software License Agreements?) So, those who are knowledgeable and skilled enough and empowered to control the working of the technology will master it, will be able to protect themselves against abuse, and to choose amidst the technological offer or opt-out if they deem it necessary. Hence, the rising divides in these cases have, paradoxically, implications for knowledge production, skills development and empowerment. Those who cannot keep the pace with the pervasiveness will progressively become deskilled, disempowered and unknowledgeable. This latter situation, however dramatic it may sound, already happens today with objects as mundane as home appliances, cars, etc. where sophisticated electronics have progressively prevented ordinary users from resolving even small malfunction. Some have described this trend of substitution as the *incompetence trap ([48])*: when technologies do what people could do themselves, de-skilling people and make people more dependent on experts and tools. This situation amounts to what the philosopher Hannah Arendt would describe as a new human condition. It appears as though that after a flourishing democratisation of knowledge production momentum especially with social media, IoT could become the epitome of control and disempowerment: the space for knowledge co-production and creativity could be more controlled and confined with IoT. Therefore, there is an urgent need for a wide debate that involves all stakeholders to understand by what values present and future generations will like to live and what kinds of knowledge production need to be protected. Additionally, the IoT developments should ensure openness to avoid these types of divide.

Moreover, the diffused control that IoT raises issues of responsibility and also of accountability – the latter dealt with in this Fact Sheet. Those with resources may be able to trace what data and where their data is being processed and in which transaction is participating and act accordingly. Again, this divide arises as a 'knowledge divide'.'

'The "divides" and social justice ([49])'

Equality — as for Internet and computer access today, it is still small a fraction of the population that has a knowledgeable and regular access to it or to put it in other words benefiting from the whole set of opportunities that Internet access offers. Although, the character of the IoT is heralded as ubiquitous, not all people will have access to all promised functionality, given the divides described above. And if that is so, the inevitable question is, what is that people are missing when they do not benefit from access to the networking of things? What kinds of alternatives are put in place in order to guarantee that those that voluntarily (or not) are not engaged in the web of device communications and sensing do not get hampered with their lifestyles, hindered with personal endeavours or even excluded from their communities?

([48]) In Crabb, P. B, 2010. *Technology traps: who is responsible?* Technoethics. 1(2).

([49]) In here we ground our analysis on the ideas of Moor (2004) for whom knowledge, ability and freedom are core goods, and of Moss (2002) who argues that persons lacking access to cybertechnology are deprived from vital resources that ensure their well-being. Therefore an impaired access to IoT arising by the divides described earlier is an ethical issue.

Solidarity – In IoT objects are at the same time communication channels and digital memory; the nature of the objects and the terms of the transactions among them simultaneously represent and redefine the types of human relationships and human values that a society wants to cherish. Different types of solidarity such as on caring and on sharing, may emerge and they need to be harnessed.

'Rights'

Other ethical issues may arise from violation of specific rights. IoT can potentially set the grounds for violations of Article 21 of the European Charter of Human Rights on 'non-discrimination', since as we have seen with other ICT developments, phenomena like *profiling* and *target advertisement* are at the basis of seemingly discriminations already. Article 8 'protection of personal data' where '… data must be processed fairly for specified purposes and on the basis of the consent of the person concerned…' could be vulnerable to the issues discussed above on 'knowledge divide'.

It should also be important to see how core IoT features such as seamless transfers and distributed control deal with the recently proposed provisions for rectification and erasure in the proposal for a new legal framework for the protection of personal data in the EU (COM(2012) 11 final), which includes the 'famous' right to be forgotten and to erasure (Article 17).

5.2 Agency: what social contract between people and objects?

Figure 11: Image from the animation film Wall-e directed by A. Stanton.

Source: © Disney Pixar

AUTO: *[Auto has just shown the Captain Directive A-113, which is a message not to return to Earth due to rising toxicity levels making life unsustainable] Now, the plant.*
Captain: No wait a minute, Computer when was the message sent out to the Axiom?
Ship's Computer: Message received in the year 2110.
Captain: That's... That's nearly 700 years ago! Auto, things have changed. We've gotta go back.
AUTO: *Sir, orders are do not return to Earth.*
Captain: But life is sustainable now. Look at this plant. Green and growing. It's living proof he was wrong.
AUTO: *Irrelevant, Captain.*
Captain: What? It's completely relevant.
[Moves toward the window]
*Captain: Out there is our home. *HOME*, Auto. And it's in trouble. I can't just sit here and-and-do nothing.*
[Moves back toward Auto]
Captain: That's all I've ever done! That's all anyone on this blasted ship has ever done. Nothing!
AUTO: *On the Axiom, you will survive.*
Captain: I don't want to survive. I want to live.
AUTO: *Must follow my directive.*
*Captain: [Groans in frustration, then turns around and notices that Auto is looming closer in the portraits of his predecessors. AUTO looms close behind him making him tighten his cap] I'm the captain of the Axiom. We are going home *today*.*
[Auto advances toward him threateningly, causing the Captain to flinch] ([50])

If we were to illustrate threats to human agency arising from the development and deployment of an Internet of Everything, we would choose the 2008 film Wall-E directed by Andrew Stanton. This particular interaction dramatises the importance of protecting human agency but also unveils other dilemmas: with which ethics do we negotiate and contract with the objects in the IoT?

In here we will look at two interrelated aspects of human agency in an environment where objects act and decide in invisible but intentional ways, on behalf of human users. Agency becomes an ethical issue when the intentionality of delegated actions is not fully

([50]) These quotes from Wall-e are available at: http://www.imdb.com/title/tt0910970/quotes.

controllable by the user, does not identify with the user's identity and compromises his/her integrity, autonomy and eventually his/her freedom.

Relation to defining IoT features

1. Connectivity
2. Pervasiveness and ubiquity
3. Strong mediation
4. Embedded intelligence
5. Seamless transfers
6. Unpredictability

The main defining features (see section 1) that interest this ethical issue include the high degree of connectivity, which implies that a myriad of entities are interconnected and interacting; this is not only about objects but also about actors and institutions involved. Such situation (which may not be grasped by all – see digital divide issue) amounts to a replacement of Orwell's 'big brother' idea by an abstract 'some brother' ([51]) concept. The pervasiveness and ubiquity, invisibility, seamless transfers and strong mediation features of IoT imply delegation of actions and decisions by users. It moreover leads the user to stop noticing presence, transactions, and eventually actions are taken on her behalf. This situation sets the grounds for loss of control, disempowerment and potential unauthorised actions. Who the agent (user or object?) is, becomes object of controversy. After all, objects become agents of their developers' worldviews and morals. *Unpredictability*, described as unpredictable emergent behaviours due to potentially accessible IoT infrastructure from anywhere at anytime ([52]); as there will always be incremental developments and deployments, leading into emerging relationships and behaviours without the user having full realisation, unpredictability remains a key feature as far as the discussion on agency is concerned.

Ethical analysis'

> '*The Panopticon is a machine for dissociating the see/being seen dyad: in the peripheral ring, one is totally seen, without ever seeing; in the central tower, one sees everything without ever being seen.' In M. Foucault ([53])*

In this analysis we are assuming that values, moral and human rights that sustain ideas of autonomous choice and action, which inherently characterise human beings are still cherished by all citisenry. Therefore, we will look at how some defining features of IoT may interfere with the ethical issues, autonomy and agency of both humans and the 'things' of the IoT. Human autonomy and agency are constitutional human values being explicitly enshrined in the European Charter of Human Rights and European purposeful regulation about digital life.

'Strong Mediation'

IoT defining features include strong mediation, through both embodiment and hermeneutic relations between humans and artefacts ([54]). In the former the 'artefacts' are incorporated by users, becoming extensions of the human body or mind enhancing the interface between

([51]) Mannermaa, M. 2007. *Living in the European Ubiquitous Society*. Journal of Future Studies 11(4):105-120.
([52]) In Wrigth et al. (EDS). 2008. *Safeguards in a World of Ambient Intelligence.*
([53]) Foucault, M. 1995. *Discipline & Punish: The Birth of the Prison* (NY: Vintage Books 1995) pp. 195-228
([54]) In Verbeek, 2006, quoting D. Ihde. Verbeek, P-P. 2006. *Materialising Morality. Design Ethics and Technological Mediation, Science, Technology & Human Values*. 31(3). Pp. 361-380.

humans and the environment (a most common example are glasses); in this type of relations the artefacts are not perceived. Hermeneutic relations on the other hand refer to relations where the artefacts provide a representation of reality requiring interpretation, decisions being taken based on such interpretation (e.g. a thermometer). With IoT both types of relationships are emphasised and hybridised; users are likely to stop 'noticing' the artefacts (sensors, RFID, etc.) that communicate among themselves in *autonomous* ways, and at the same time many of these artefacts encapsulate representations of reality through the algorithms and models driving their activity. This latter condition, amounts to a deeper form of not 'noticing' technology; it is not only about the artefact but also, more importantly, about the invisibility of the interaction itself (data transfers, decision and action). Voluntarily or not, the user will need to rely on models and technology to achieve the chores that technology is meant to help her/him with ([55]).

Hence, the strong mediation inherent to IoT developments, will lead eventually to shifting or delegation of human autonomy and agency to the objects of the IoT. If noticed, artefacts will act on the user's behalf; if not noticed artefacts will act on their developers' worldviews, intentionality and interests. This strong mediation poses challenges to human agency.'

'Profiling yet again' – Our dignity and integrity in jeopardy.

Profiling became the nightmare of social and legal scholars with many recent ICT developments. Profiling puts in jeopardy people's autonomy and agency, amongst others. High level of connectivity, seamless transfers and embedded intelligence of objects and machines cannot but make one think of scenarios where human autonomy about even mundane decisions and activity is put in jeopardy. Profiling is an algorithmic procedure over data; it follows the logic of identification, categorisation and clustering of those who developed the algorithms used for such purpose. But such algorithms are blind to specificities of individuals. They act with indifference with respect to context in which the data they use are collected. In Kafka's 'The Trial', Joseph K. gets arrested by unspecified agents and gets entrapped in judiciary machinery without reason or due process for an unspecified crime. The loss of autonomy that IoT features could lead to a scenario where the human indifference in Joseph K.'s story is overridden by the indifference of the 'things' collecting and storing our data, forming a multiplicity of 'dossiers' on our whereabouts that may be used in unexpected contexts ([56])[57]. Profiling is about 'being identified', but such identification is established upon the individual corresponding to lack of an individual's autonomy to establish her/his public self-image (personality, identity); with the IoT promised levels of data transactions and embedded intelligence, profiling will lead yet to another level of disempowerment: the crucial issue is not abuse, but the fact that users will have no effective means to know whether and when profiles are used or abused ([58]). So, caring, medicating, reminding, buying, selling, messaging, etc. may all stem from autonomous procedures of the IoT 'things' lead by categories of identity with which potentially the user may not identify herself and which the user will most certainly not be aware of; as with Joseph K. users could be tangled on processes with which (s)he has nothing to do and what could be worse, no one to get support from, not even from a smart object. Hence, profiling as in other developments of ICT, poses several threats to autonomy and therefore challenges human agency. In IoT we need at least the same kind of attention for the issue of data profiling as in other current and emerging ICT.

([55]) Stahl, Bernd Carsten. 2011. *IT for a Better future: how to integrate ethics, politics and innovation*. Journal of Information, Communication & Ethics in Society 9(3). Pp. 140-156.

([56]) De Hert, P. *A right to identity to face the Internet of Things*, p. 5 at http://portal.unesco.org/ci/fr/files/25857/12021328273de_Hert-Paul.pdf/de %2BHert-Paul.pdf

([57]) M. Hildebrandt and S. Gutwirth (EDS), 2007. *Profiling the European Citizen. Cross-disciplinary perspectives.*

([58]) Hildebrandt and Gutwirth, *op. cit.*

'*Some brother*: visible and unverifiable(?) power' – who can we trust?

In the ubiquitous world of IoT there won't be the Orwell's 'big brother' to blame or to refer to; a myriad of human and artificial agents are implied in the interconnected smart artefacts and machines promised in the IoT world view. Such developments will lead to a '*Some brother controls, knows and never forgets society*" ([59]). 'Some brother' is not a single agent, but a heterogeneous 'mass' consisting of innumerable social actors, e.g. public sector authorities, citizens' movements and NGOs, economic players, big corporations, SMEs and citizens.

The diffuse nature of the interactions, which inevitably results in changes of a user's agency with regards to artefact-to-artefact or machine-to-machine interactions, will imply opacity when it comes to decide on agents' responsibility, accountability and eventually agents' liability. Many scholars have used Brentham's *Panopticon* to describe how users will be constantly visible and 'solicited' by invisible (and unverifiable) requests of 'some brother' in the IoT world. Paradoxically, however invisibility is a defining feature of IoT; but if a *Panopticon* scenario for IoT is plausible, how will IoT developers deal with the intolerable idea of non-verifiability and invisibility in the 'things' interaction? How can we guarantee identification of all agents involved in the data transactions, veiled decisions and actions in order to ensure that attempts to violate human rights, EU legislation or other principles of our present human condition are stopped from the outset?'

'Intentionality: others' smartness and ethics' – Human agency at stake.

In here we would like to look at objects agency and so, we look at the intentionality implied in objects' activity and what we can call a 'contract' between objects and people. The IoT defining features that interest this issue are embedded intelligence, seamless transfers and unpredictability ([60]). The roots of the ethical challenges with relevance to agency that we describe in this section are similar to those described in the earlier section 'profiling yet again'.

To which extent is there in the interconnected world of IoT conceptual equality between people and objects with respect to intentionality? Are people and objects just connected physically and causally, or also intentionally or symbolically? Can we attribute dignity or responsibility to objects?

Numerous current examples of ICT developments include devices that take autonomous decisions (for example, in healthcare or search and rescue situations ([61]), the moral qualities of which are pre-established in algorithmic ways. Many automated technologies make it unnecessary and often undesirable for human users to exercise control over their own behaviour; this is what has been termed the *self-miscontrol* trap ([62]), i.e. a failure of people self-control when their behaviour is controlled by technological devices rather than by social and moral norms. People are often compelled to use technology as something inevitable otherwise risk being isolated; up until recently we could argue that it is the users' appropriation of technology that dictates major categories of intentionality, responsibility and accountability. With the promised automation in IoT, this attribution can be at least questioned; in a IoT world vision, intentionality is at most shared among creators, designers and users of technology; all human agents need to be identified for their intentionality, the morals they sustain, otherwise the risk is that no responsibility can be attributed once the objects mediate and operate within a IoT.

([59]) Mannesmma, *op. cit.*

([60]) Objects and services potentially accessible from anywhere at any time, may result in unpredictable emergent behaviours – see for instance, Wright *et al., op. cit.* in their discussion of ambient intelligence's key characteristics.

([61]) In Stahl, Bernd Carsten. 2011. *Op. cit.*

([62]) In Crabb, P. B, 2010. *Technology traps: who is responsible?* Technoethics. 1(2).

'Rights'

Other ethical issues may arise from violation of specific rights related to agency and autonomy. IoT can potentially set the grounds for violations of Article 21 of the European Charter of Human Rights on 'non-discrimination', since as we have seen with other ICT developments, phenomena like *profiling* and *target advertisement* are at the basis of seemingly discriminations already. Article 8 'protection of personal data' where '… data must be processed fairly for specified purposes and on the basis of the consent of the person concerned…' could be vulnerable to the issues discussed above on 'intentionality' and the 'some brother' concept.

The right to integrity of the person (Article 3 of the European Charter of Human Rights), relies very much on the autonomy of the person. Challenging people's ability to take decisions and exert their agency may compromise their integrity.

6. Pursuing IoT ethics: what's next

In this section we summarise main issues arising from our analysis, suggesting also a way forward.

1. Ethical issues – beyond privacy, data protection and security considerations

Based on the analysis done in the earlier sections, and specifically, taking due consideration of concerns showed by the EU citizens' responses to the public consultation on IoT, as well as the issues emerging from the empirical work organised around objects' agency and complexity of relationships humans establish with non-humans, we argue here that the right to 'privacy' and right to 'data protection', as well as the right to security are not the sole appropriate containers for the types of ethical issues that the Internet of Things (or rather Everything) vision is proposing. They are certainly relevant and should be considered but we argue that the following issues in the context of IoT need an appropriate space to be widely debated and attention from a normative point of view:

1) Issues on **Agency**: that artefacts have politics, and embody specific forms of power and authority (Mumford, 1964; Winner, 1980) and that politics are implemented through artefacts, is hard to contradict; moreover, in addition to the complexity of relationships and hybridisation of human and machine interactions (Haraway, 1991; Latour, 1993), we have with IoT *machine 2 machine* complex interactions of exchange of information of various nature and (consented or concealed) action, for which intentionality is not necessarily explicit, transparent, agreed or let aside discussed. As with other 'things' (see e.g. Friedman and Kahn, 1992), the things in the IoT scenario are normative and moral agents. Therefore, we argue that Agency and its renegotiation between humans and non-humans is one of the pivotal ethical issues that deserve, not only attention from a normative perspective, but also watchfulness mechanisms in order to guarantee that fundamental rights such as dignity, integrity, liberty, freedom of thought amongst others, are not violated with the deployment of these technologies.
2) Issues on human **Autonomy**: e.g. informed consent, a protective strategy that arises from other fields of ethics, is unlikely to work in such a world of connectivity and complex hybridised relationships and new ontologies.
3) Issues on human **Dignity** and **Justice**: the divides that IoT may rise are not only due to accessibility to the technology as such, but to the actual understanding of what and in what legal or ethical basis transactions of one's data are carried out. Divides arise from progressive de-skilling of those that by choice or by ignorance do not access the complexity of the transactions made on their behalf in an IoT scenario.
4) Issues on **Integrity** and **Identity**: we have outlined the issue of profiling and in a time where we discuss provisions for a right to be forgotten, one may wonder how such a right could ever be implemented in a scenario of billions of things exchanging and transacting one's data.
5) Issues on **Beneficence:** the benefits of this technology need to be tamed, including vis. à vis. sustainability, dignity and integrity of the persons. Benefits should be identified in every context as it is understandable that 'smartness' can be useful in many fields of human operation. However, human grand challenges

for which these types of technologies bring benefits and respond to need to be assessed.

6) Issues on **Non-Maleficence**: in a Iot scenario dual use ([63]) is a given; recent events at the world level, where at least the US National Security Agency was found to mass survey all data transactions of EU citizens, it seems rather plausible that our data travelling among billions objects' sensors could add to current intelligence services operations. In the name of security, discriminatory action could result from this type of activity, violating fundamental rights including privacy and dignity.
7) **Trust**: not only about what 'some brother' could be doing with our data or to what action could we unnoticeably led to do by the things with their agency, but also about the unpredictability with regard to plausible and implausible systems' failures, plausible and implausible human appropriations of technology, etc.

2. Public Engagement – a collective debate is needed'

> 'Where not existence but "quality" of life is in question there is room for honest dissent on goals, time for theory to ponder them, and freedom from the tyranny of the lifeboat situation' (Jonas, 1979).

We conclude, however, that because of the pervasive nature of IoT the process of establishing by what values, norms and morals we want our lives to be permeated with these technologies, there should be a continuous process of invited enquiry through purposeful organised public engagement. In the domain of ethics of ICT in general and of IoT in particular, we do not have the luxury of the lab experiment to enquire about the deep transformations that these technologies may bring to individuals, societies and the planet in general. As in other areas of operation, with ICT those transformations are not necessarily material, but rather of a constitutional matter (Latour, 1993; Jonas, *Op. cit.*; Jasanoff, 2003; Lessig, 2000; 2006) profound or nuanced. Also, as with so many other technologies, we are not able to anticipate impacts of technology at all levels in order to govern them, but still we need to have a grasp of those impacts – the Collingridge dilemma inherent to technology assessment discussions (Collingridge, 1980). As with many other areas of techno-science development and deployment such anticipation cannot be done by illuminated individuals; rather discussions of values, norms, and technology appropriation should be part of collective deliberation as often more than impacts what governance action needs to know is why are we doing what we are doing and how society may respond to that, including uninvited developments from an ever growing DIY community of developers.

Hence, we suggest, also in order to respond to the quest for responsible and research innovation, a lemma of the current EU research framework programme ([64]), that the debate about IoT is launched with first awareness raising about the promised and known functions it tries to respond to, but also with the known challenges and uncertainties with regards to their deployment. A genuine extension of the debate about IoT not only counteracts the pervasive and persisting corporate views of what our *future* should be, but also opens the space to explore how human rights can be extended, reframed or empowered in a scenario that is from the onset challenging the existing ones. By extending, it is meant that existing rights may need to cover current unprotected situations, where appropriate, by learning from the experiences of involved citisens. Reframing refers to rethinking rights when their main assumptions have been radically changed by techno-scientific developments. Finally, empowering suggests that citisens have to be increasingly involved in the protection of their

([63]) Dual use goods are products and technologies normally used for civilian purposes but which may have military applications. See: http://ec.europa.eu/trade/import-and-export-rules/export-from-eu/dual-use-controls/index_en.htm

([64]) See http://ec.europa.eu/programmes/horison2020/. Last access: 17/12/2013

rights – and at the same time entitled to do so – as a top-down, taken for granted protection from institutions can be unrealistic when dealing with emerging, unexpected conditions (the increasing use of instruments of soft law being a clear symptom of this).

In a nutshell what we are creating, what we are appropriating, what we are saying needs to be properly engaged in policy in this area.

3. Guidance is needed

Guidance for developments in this area should fully encompass the ethical considerations discussed throughout this report. Hence, an ethical framework that scrutinises research and industry proposals in the form of both guidelines for development, but also guidelines to appropriately investigate by what values, by what norms and by what ethics we wish our technology to perform, by what ethics do we relate to our technologies (for example resisting the temptation of dual use). For example, who is going to define values? Whose ethics?: public, State-based ethics or citisens' choices? What kind of normativity: soft or hard? How will we govern and empower the chosen normativity?

In practical terms, the issues raised earlier (point 1) must constitute a starting point to assess developments made in IoT, those being at research, business and policy levels. However, as we illustrated in point 2, with a world in transformation in which our own received notions of humanness are being challenged, ethics review are subject to an URGENT open debate. Our changing constitution may imply rethinking of our values, reframing of social norms and reframing of rights.

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Abstract
This report summarises and extends the work done for the task force on IoT terminated in 2012.
In response to DG CNECT request, the JRC studied this emergent technology following the methodologies pertaining to the Science and Technology Studies field. The aim of this document is therefore to present and to explore, on the basis of present day conceptions of relevant values, rights and norms, some of the "ethical issues" arising from the research, development and deployment of IoT, focusing on agency, autonomy and social justice. We start by exploring the types of imaginaries that seem to be entrenched and inspiring the developments of IoT and how they become portrayed in "normal" communication from corporations and promoters to the ordinary citizen (chapter 2). We report the empirical work we have conducted, namely the JRC contribution to the limited public debate initiated by the European Commission via the Your Voice portal during the Spring of 2012 (chapter 3) and an empirical exercise involving participants of two IoT conferences (chapter 4). This latter exercise sought to illustrate how our notions of goodness, trust, relationships, agency and autonomy are negotiated through the appropriation of unnoticed ordinary objects; this contributes to the discussion about ethical issues at stake with the emerging IoT vision beyond the right to privacy, data protection and security. Furthermore, based on literature review the report reflects on two of the main ethical issues that arise with the IoT vision: agency (and autonomy) and social justice (chapter 5), examining eventually governance alternatives of the challenged ethical issues (chapter 6).

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