SMART, AGENTIC, BUT OBJECTS NONETHELESS

A Vision of Human and Object Agency in the Future Internet of Things

by

Luca van der Heide

Student number: 5681561

Master thesis
Master of Applied Ethics
Utrecht University

Supervisor: Naomi van Steenbergen
Second reader: Joel Anderson

June 2016

Abstract

Systems of interconnected smart objects, a technology currently designated by the name "Internet of Things", are expected to gain an increasingly developed capability to act and react to their surroundings. This thesis investigates how such capability, which I refer to as "object agency", will affect our own agency, discussing both the possible risks and desirable prospects of man-thing interaction in future smart systems. My standpoint is that the Internet of Things is problematic, as it will be designed to take over many of our daily chores by means of a high degree of autonomous action. First of all, I argue that smart objects present the risk of harming human agency, as they could override the intentions of their users, acting in unexpected ways and without being noticed. Furthermore, the Internet of Things could induce to a state of passivity due to the substitution of the user in a wide range of activities and due to a progressive imposition on his choices. On the other hand, smart systems could allow users to exercise their agency more freely and stimulate them to exploit their capabilities in more proficient and fulfilling ways. When designed as tools aimed at serving the agency of their users, smart systems could then lead to a true augmentation of human capabilities and to greater opportunities for self-development.

Acknowledgments

Firstly, I would like to thank my thesis supervisor, Dr. Naomi van Steenbergen, for the accurate revision, the readiness in giving me feedback and the availability. Thanks to her patience in assisting me during the process, by identifying weak points in my arguments and helping me correct them, I was able to get useful insights and refine the quality of my work. I also thank her for supporting me in the choice of the topic I was most interested in.

I would then like to thank my internship supervisor at the Rathenau Instituut, Mrs. Linda Kool, and my other project fellows Mr. Jelte Timmers, Dr. ir. Rinie van Est and Dr. ir. ir. Lambèr Royakkers, who assisted me in the contribution to a project which I very much enjoyed being a part of. The experience at the Rathenau Instituut stimulated my interest in ethics of technology and provided me with the tools necessary to find and successfully follow through the subject of my thesis.

I am very grateful to Martin Raybould, for his meticulous language revision and for having provided such a useful and ready help in such a short notice.

My thanks also go to my friends and fellow students, who entertained me in long and enjoyable discussions and contributed to make this year inspiring, especially Jamie Draper, who had the patience to listen to my ramblings, and Aline Franzke, for the solidarity. Special thanks go to my friends in Italy, for the unshakable trust and the long-distance support.

Finally, a great deal of gratitude goes to my family, especially to my mother and father. Grazie di avermi dato questa opportunità e di continuare a credere in me in ogni caso e in ogni modo. Voglio che sappiate che la vostra fiducia ha avuto e ha tutt'ora un grande valore per me, e che vi sono intimamente grato per tutto quello che il vostro supporto ha reso possibile.

Table of contents

Setting the scene

"A mobile phone is something that can be switched off, or left at home. A computer is something that can be shut down, unplugged, walked away from. But the technology we're discussing here - ambient, ubiquitous, insinuative into all the apertures everyday life affords it - will be environment-forming in a way neither of those are."

– Adam Greenfield

As Greenfield's quote suggests, the scope of this thesis will be directed towards a particular kind of technology, a technology that is becoming more and more present in our society, and that we call *smart*. The use of this adjective has been abundantly used recently, with widespread debates on smart grids, smart cities, smart houses, smart farming, and others. What all of this smartness hints at is the development of a technological paradigm that increasingly dominates the scene, discussed under a vast array of names in a wide range of contexts, but that is generally and uniformly recognizable as the *Internet of Things*.

Before systems of smart objects were identified by what is now agreed as the dominant term – even though still not the only one –, they were called by different names. The first baptism was by Weiser, who coined the name *ubiquitous computing* (UbiComp) in 1988, to introduce a new type of computer, not on top of our desks anymore, but distributed around us in our environments.[1] Ten years later, as the debate on the subject was rapidly coming to life, Epstein and Birrel referred to *ambient intelligence* (AmI) to denote a technology forming interconnected environments which are context-aware and able to respond to each other by means of artificial intelligence.[2]

Almost simultaneously, the term "Internet of Things" emerged, immediately gaining widespread usage in the field. It was used for the first time by Kevin Ashton in a presentation at Procter & Gamble in 1999 to refer to a technology made to work without mediation, enabling data to be gathered thanks to sensors that connect it directly to the environment.[3] The vision behind the name is that the world is made of things, not of data, and for the *things* that we use as technological tools to really understand the world «in all its random glory»,[4] it is necessary to provide them with the means to do this by themselves. According to Ashton, as the data our computers process today are filtered by people with

---

1 Weiser defined the term during his work at the Computer Science Lab at Xerox PARC (1988).
2 The term Ambient Intelligence was defined in a series of presentations at Palo Alto Ventures (1998).
3 Kevin Ashton, "That 'Internet of Things' Thing", *RFID Journal* 4986 (2009), accessed 2 June.
4 *Ibidem.*

limited time, attention and accuracy, they are hindered in approaching the physical world for what it is.[5] Objects understanding and interacting with objects: this is the goal of the Internet of Things. And to achieve this, it has to be constituted not by computers anymore, but by *smart objects* functioning independently from the mediation of humans.[6]

Other less popular names were given by the technology before and after that conference, such as Greenfield's clever *everyware*[7] or Valéry's *thingternet*,[8] but none of them stuck as the term Internet of Things – sometimes shortened to IoT – did. In Van Kranenburg's opinion, the reason why this was the winning term is that, by using the metaphor of the internet, it is easily understandable by people.[9] In fact even though the name can be interpreted in a stricter sense to refer to smart objects being endowed with an internet connection and using IP protocol stacks, it is for the most part seen simply as a metaphor, meaning that «in the same way that people use the Web today, things will soon also communicate with each other, use services, provide data»[10]

But what is it that specifically distinguishes the Internet of Things from other technologies? First of all, smart objects, as the components of the Internet of Things, will be physical objects "digitally upgraded" with the capabilities of devices.[11] These objects will be *interconnected,* that is, able to communicate between themselves exchanging inputs and outputs, and to work simultaneously for the same purpose.[12] As this kind of smart technology is becoming increasingly miniaturized and implemented in the physical world, it will also be, to a certain degree, *invisible* or *silent*,[13] a notion that I will develop further in my argumentation. Moreover, being part of an environment in which they have to act, the objects should be *user-aware* and *context-aware*, in the sense of being able to detect the presence of people in their environment and to recognize the situational context with which they have to interact.[14] Finally and most importantly this technology provides smart objects and systems, as I will argue in the next chapter, with a certain capability to autonomous action that I refer to as *object agency.*

---

5   *Ibidem.*
6   Throughout the thesis, I will refer to *smart objects* as the components of the Internet of Things, and to *smart systems* as the systems of interconnected smart objects that constitute an Internet of Things environment.
7   Adam Greenfield*, Everyware: the dawning age of ubiquitous computing* (Berkeley: New Riders, 2006).
8   Nick Valéry, "Welcome to the Thingternet: Things, Rather than People, are About to Become the Biggest Users of the Internet", *The Economist* (2012), accessed 21 November.
9   Rob van Kranenburg *et al.*, "The Internet of Things" (paper presented at the 1st Berlin Symposium on Internet and Society, Berlin, Germany, October 26t-28, 2011), 15.
10 Friedemann Mattern and Christian Floerkemeier, "From the Internet of computers to the Intenet of Things", in *From active data management to event-based systems and more,* ed. Kai Sachs, Ilia Petrov, and Pablo Guerrero, (Heidelberg: Springer Verlag Berlin 2010), 243.
11 *Ibidem.*
12 Van Kranenburg, "The Internet of Things", 9.
13 Mark Weiser, "The Computer of the 21st Century", *Scientific American,* September 1991.
14 William H. Dutton, "The Internet of Things", *Social Science Electronic Publishing* (2013): 9, accessed 20 June.

On the basis of these attributes, that are expected to become more and more prominent in the next few years, the literature on the Internet of Things converges on the idea that this is a kind of technology the like of which we have never encountered before. The degree of change that this technology will lead to in our private and social living is such that some talk of a real ontological shift that will entail a reconceptualization of our position in the world, of our ways of life, of our capabilities, and even of our *selves*.[15] Thus our means to act and react to other people and the environment, what I will frame as *human agency,* will have to adapt to this radical shift, and our behavior will have to assume, in meeting new forms of interaction with the technology, new and ever-changing aspects.

Furthermore, because of the unique nature of the Internet of Things, this will be a change resting in the hands of many different stakeholders among designers, policy-makers and citizens, many of whom will largely be unaware of the actual impact of their interaction with the technology.[16] The Internet of Things is a technology made to be pervasive, that is, to be entangled in every context of our society, and interwoven in the texture itself of our daily living.

It is therefore clear that, as this process unfolds, what is needed is a transparent perspective on the direction it takes at each step. A huge debate has already ensued as to how this development should be ethically assessed, considering the consequences for our behavior, for our welfare and rights, for everything that makes us human. While some foresee catastrophes, critical losses or even an upcoming sort of techno-utopian fascism,[17] others predict a new age of prosperity, the solution to many of our current problems and even visions of a new garden of Eden.[18] Others, follow a policy of conscious and careful progress seeking a way to adequately integrate risks and advantages. The last of these seems to me to be the best path. At the same time, ethical frameworks for the evaluation of such progress should be constantly updated and adjusted to the parallel transformation of society and its technological means. Ethical considerations should then regulate innovation throughout the process, contributing to a responsible and safe socio-technological development.

The goal of my argumentation in this thesis will be to give an assessment of potential threats and advantages that the upcoming Internet of Things will bring about, focusing in particular on human agency, as our capability to act upon the world and determine ourselves through the result of our deeds.

---

15 Van Kranenburg, "The Internet of Things", 4.
16 *Ivi,* 5.
17 Justin McKeown, "On Being Humans and Human Beings: Ethics in the Internet of Things", 2012,
      http://www.theinternetofthings.eu/justin-mckeown-human-beings-and-being-human-ethics-and-internet-things.
18 Francis Heylighen, "Return to Eden? Promises and Perils on the Road to an Omnipotent Global Intelligence", in *The End of the Beginning: Life, Society and Economy on the Brink of the Singularity,* ed. Ben Goertzel and Ted Goertzel, (USA: Humanity+ press, 2015).

My viewpoint is that smart objects, by means of *their own* agency, will have a substantial impact on our ability to change our surroundings and competently pursue our lives, and that even though we should always be aware of the dangers of this impact we could also, with the right mindset, use it to enhance our capabilities in new and beneficial ways. Thus the question that I will answer is: what are the prospects for human agency in the future Internet of Things?

I will proceed in my argumentation according to the following structure. The first chapter will present the two kinds of agency that I discuss, and that inevitably meet in the context of interconnected environments. The part on human agency will explain how I define the concept, its scope and its significance for human beings. The part on object agency will follow more or less the same steps, focusing in particular on how the concept of agency should be applied to smart objects and systems. A chapter on the threats of smart systems for human agency will follow, mainly introducing the issues of unreliability of the system, lack of awareness of the user due to invisible action, delegation of decisions, dependency, and technology paternalism, all concerns that can be clustered under the issue of *passivity.* The third chapter will discuss how smart systems could enhance human agency and lead to positive consequences for our private and public lives. A new approach will be presented, based on the integration between Weiser's and Rogers' vision of the Internet of Things, and developed towards the prospects of an augmented human agency and of new opportunities for human flourishing. Finally, a list of recommendations will be crafted on the basis of my argumentation and, more widely, of my research, presenting some directive suggestions as my personal contribution to the topic.

I. Human and object agency

1. *Human agency*

The concept of "human agency", as it bears heavy implications on the definition of what makes us human, appears both enticing and quite difficult to frame. Intuitively, this concept is attractive as it relates to our power to influence elements of our surroundings. It implies that we are not just passive spectators of what happens around us, but that we are an active part of it, and as such we also have an active part in its shaping. However, where this power comes from, remains a mystery. What are its limits, and is it truly an intrinsic attribute of a free, self-determining, willing subject, as we are inclined to think? When we start to think about it more in depth, we discover that the attempt to give a definition to terms like "will", "free will", "intention", "choice" and "agency" itself risks making us lapse into strong metaphysical presuppositions, and that, to be able to explain them, we are tempted to engage in much-debated and still unsettled discussions.

Now, let us make a step back. What can we safely assert of the human capability of acting? This question has made philosophers struggle since the beginning of the history of thought. Nonetheless, as the ground for the concept of agency that will be employed for my argumentation, I will assume some basic statements to be true.

First of all, agency is about what someone does, and not about what happens to him.[19] Second, our actions have some kind of impact on the environment around us and on other beings. Third, what we perform involves, to some degree, factors internal to the subject. Fourth, acting as an instance of agency implies working towards a goal that we previously set in our minds and that we are driven to achieve.

An action is therefore guided by the agent, and it is to be distinguished from movements imposed by conditions independent from the agent. One way in which the movement of an agent is not an action is represented by the act of coercion. Frankfurt illustrates this instance with the example of a spider that, in one case, moves its legs spontaneously and, in another case, is moved by a child who has managed to tie some strings to its legs[20]. In the first case, the action is clearly the result of the agency of the spider, while in the second one it is not. Another way in which a movement is not agentic, on the other hand, is what Frankfurt identifies as a movement *of* the agent but that is not

---

19 Harry G. Frankfurt, "The problem of action", *American Philosophical Quarterly* 15 (1978): 157.
20 *Ivi*, 162.

guided by him, such as the beating of his heart or the dilation of his pupils[21].

It is clear at this point that acting involves an internal condition that is the trigger of a process aiming at the achievement of a goal: this condition is *intentionality.* As we are interested in particular in *human* intentionality, I will from here on conceive it as «a representation of a future course of action to be performed.»[22] This is to say that human agency involves, first of all, the design of a plan of action. In his *planning theory of intention*, Bratman gives a similar definition, stating that intentions are «elements of stable, partial plans of action concerning present and future conduct»[23]. Thus intention, coupled with the ability to envision possible outcomes of our actions, is what allows the agent to coherently follow through a conduct which he thinks will bring him to the outcome he has envisioned. It is the basis for structuring our behavior, as our behavior is always constructed upon more or less complete plans of action; and, furthermore, it is the force that pushes the agent to acquire the *means* that will enable him to enact the intended behavior, fostering his abilities to adapt and adequately react to the environment. To reach the status of action, intentionality also needs *motivation*, which I will briefly define as the force, guided by reasons, that "fuels" our intentions to progress towards the completion of a course of action.

However, human agency is not exhausted in the capability of planning and acting intentionally. In fact being a proficient agent does not only mean to be able to bring to completion intentional plans of action, but it also means being able to act on oneself in order to refine this ability. This is what in social cognitive theory is referred to as *self-efficacy.*[24] A fundamental part of functioning competently as an agent is to set for oneself new challenges and higher standards of performativity (or *proficiency*), in order to increase one's own ability to fulfill personal aims. This is possible thanks to the ability of the human agent to be «not only a planner and forethinker, but a motivator and selfregulator as well»[25]. Agents are able to influence themselves so as to attain the satisfaction and sense of personal worth that come from the achievement of preset goals. Not only that, but they are also capable of examining their own performances for the purpose of adapting to the situation and improving. Human agency is therefore based on what Bandura calls a "dual mechanism of control", formed by *proactive* and *reactive* control: the agent exercises control on his actions firstly by planning how to achieve his goal

---

21 *Ivi,* 159.
22 Albert Bandura, "Social cognitive theory: an agentic perspective", *Annual Review of Psychology*
    52 (2001): 6.
23 Michael E. Bratman, *Faces of intention: selected essays on intention and agency* (Cambridge: Cambridge University
    Press, 1999): 2.
24 Albert Bandura, "Human Agency in Social Cognitive Theory", *American Psychologist,* September 1989.
25 Bandura, "Social cognitive theory: an agentic perspective", 8.

and then adjusting his standards on the response he gets from the accomplishment or failure of his plans.[26]

Now that I have presented an overview of what human agency entails, I can attempt a definition: human agency is an ongoing process of self-determination constituted by intentional planning and constant adjustment of standards. At the basis of this process there are skills and beliefs about one's own ability to proficiently apply such skills.[27]

What this definition seeks to present is a view of human agency as the exercise of a range of capabilities that enable the agent to determine his own development, and that include therefore the capability to make choices for himself. Through self-influence the agent can decide both short-term and long-term plans, ultimately determining the course of his "plan of life". Human agency is therefore the power to achieve these plans through the actualization of our intentions and choices, and through the refinement of the capabilities that make it possible.

However, this definition should not mislead the reader into thinking that the agent is a self-sufficient being determined by nothing but himself. The agent *interacts* with the environment, so the environment influences the agent *and* the agent influences the environment.[28] Motives and intentions depend partly on what happens around the agent, and the agent, as previously stated, has to adapt to his surroundings to prevent his plans from failing. Saying that the agent and the environment reciprocally influence themselves is not to say, therefore, that the agent is fully in control of what happens to him, nor is it to say that he is predetermined by this. It is instead to simply observe that our actions are part of a larger spectrum of actions and events which happen around us at all times.

One thing is, then, affirming that the environment in which we move influences our way of acting, another thing is that external causes determine everything the agent intends and does; and still another thing is stating that an event or action can interfere in the self-determination of the subject. Indeed it is possible that some external causes, being themselves the outcome of natural events or of other agencies, prevent the agent from fulfilling his goals or even undermine his process of self-regulation. To do this would be to interrupt a process which allows us to reach objectives that we deem valuable and to which, as aforementioned, are associated feelings of satisfaction and self-worth. Thus, as we are interested in the positive outcome of our own actions and in the preservation of our power to achieve goals, and as being an agent means precisely to competently exercise this power, human

---

26 Bandura, "Human Agency in Social Cognitive Theory", 1180.
27 Albert Bandura, "Social foundation of thought and action: a social cognitive theory", in *The health psychology reader* ed. David F. Marks (Trowbridge: The Cromwell Press, 2002), 94.
28 Bandura, "Human Agency in Social Cognitive Theory", 1182.

agency has, for humans, a value. From this it follows that we have reasons for preserving human agency and that everything that consciously or unconsciously threatens it represents an issue.

I have now argued that an interference with human agency would represent an issue for human agents. This means, in my view, that also anything that affects the exercise of agency, in its different components, represents an issue. If something impairs our possibility to make choices, to follow through our intentions, to be proficient and set new standards of self-efficacy, or to preserve our process of self-determination and self-development, it also threatens our agency *in toto*. The degree of the threat depends then on how much a specific component is actually endangered and how much it would subtract from our agentic power – that is, how much it would lead us towards passivity. Likewise, the degree of an enhancement of agency depends on how much components of agency are improved and how much this would foster our capability to act and to be proficient agents. In discussing the risks and advantages for human agency in the Internet of Things, therefore, I discuss matters regarding smart systems that affect different aspects of our agency, and have consequently an impact on agency itself.

If my goal has been reached, what we have now is a concept of human agency that refrains from the risk I mentioned at the beginning of the chapter. Framing intention as reasonable planning and actions as part of a process of competent functioning and self-development, I aimed at a definition of human agency which is «modest and nonmysterious»[29], devoid of assumptions of absolute creative power or predetermined passivity.

2. *Object agency*

I will now introduce the concept of object agency as a different manifestation of a capability to act. Every human agent is part of an environment in which he is continuously confronted with events and other agencies that have an impact on his actions. In an IoT environment, in particular, the user is immersed in a crowd of artificial entities that "behave" in a certain way, depending on their utility and the task they have been created to perform. I will argue that such behavior can be said to be a form of agency as it involves some degree of efficiency in making plans and following courses of action, and as it enables an agent to respond to actions and events outside of it.

Thus the term "object agency" in my argumentation will be used only in relation to smart

---

29 Bratman, *Faces of intention,* 5.

objects as the components of an Internet of Things system.[30] This kind of capability of action is the result of certain technological developments and it is not something granted to every object nor to every device that participates in our environment; it is rather the range of activities that can be performed by smart objects implemented with digital memories and learning algorithms.[31] It is important to keep in mind that object agency as I intend it is therefore a feature of AI, and not of other devices like modern cars and appliances.

A lot of devices today are already equipped with a level of AI that allows them to make predictions, organize plans of action and take optimal decision, as well as to «react to communication scenarios within an environment and complete daily routines»[32]. Hence devices have pre-programmed drives to achieve certain goals, and thanks to the ability to upgrade and adapt to different situations through machine learning, they are able to act and react to an environment. As pre-programmed, these drives are limited by their algorithms and have thus circumscribed boundaries. When I will refer to the "intentions" of the objects, therefore, I will not mean drives directed by self-interested goals and connected to emotions and imagination, as in the case of human intentions, but I will use the term as an analogy with such intentionality, namely as triggers, based on predetermined algorithms, of a course of action. In the same way it is possible to say that the machine "decides" without including in the notion any concept of awareness, but in the sense that its algorithms enable it to initiate a course of action instead of another.

Smart devices have a mechanical drive to self-efficacy as well, as they can upgrade themselves and improve their capability to achieve goals. In this way they set new standards and plan new actions with the means they have. The concept of object agency is used therefore as the definition of a behavior that it is triggered inside an AI in order to bring certain preset goals to completion. It is a movement imposed by an external source, being that the developers which implemented the algorithms in the machine, but it is also internal in the sense that once equipped with the right means, the machine is able to function autonomously – that is, without the direct intervention of an external cause.

Now, from what has been said up to this point, it seems that smart objects are not likely to be particularly dangerous for human agency, as they have pre-implemented goals and no internal drive to

---

30 European Commission. Joint Research Centre. Institute for the Protection and Security of the Citizen. *Agency in the Internet of Things* by Angela G. Pereira *et al.* (Publications Office of the European Union: Luxembourg, 2013); Hayian Jia *et al.*, "Balancing Human Agency and Object Agency: An End-User Interview Study of the Internet of Things" (paper presented at the 2012 ACM Conference on Ubiquitous Computing, Pittsburgh, Pennsylvania, September 05-08, 2012).
31 Jia, "Balancing Human Agency and Object Agency", 1185.
32 *Ibidem.*

change the course of their planning. In the Internet of Things, however, object agency becomes a more complicated process, as the user will not deal with an interface anymore, but, as Van Kranenburg put it, «the environment will become the interface.»[33] The agentic process of an object will intertwine with the other processes of the system, with a constant exchange and overlapping of inputs and outputs collaborating to serve the user in the best way possible. This cooperation is constituted by the presence in the same system of a wide range of different processes that need not override each other, and have therefore to function harmoniously together.

The collaboration of object agencies in a IoT environment will provide the network with a higher degree of self-efficacy and self-sufficiency, as the objects will create a constantly changing web of activities connected by the sharing of information and cross-calculations. In this passage, Strohbach presents the potentialities of what he calls *cooperative artefacts*:

> Cooperative artefacts [...] do no rely on external infrastructure, but are self-sufficient. This enables cooperative artefacts to function across a wide range of (augmented and nonaugmented) environments. Collections of co-located artefacts interact to cooperatively assess their situation in the world. Cooperative reasoning enables a system of cooperative artefacts to gain an understanding of the world far beyond the capabilities of each individual artefact.[34]

This expected capability will put the human agent in a network of single artificial intentions collaborating for a variety of shared purposes, in which his own intention will inevitably be involved. The system is therefore interconnected, responsive to the environment and to the actions of the user, formed by a range of objects with intentions, in the sense of implemented drives for the achievement of their tasks, capable of taking decisions based on such drives, and set to work in harmony with its components and with the user.

Envisioning this future manifestation of object agency and its relationship with human agency allows us to acknowledge this matter as somehow problematic. The pervasiveness of the Internet of Things, together with other factors that already characterize it and that are expected to become more and more prominent, create a new set of possible circumstances which in the literature on the subject are a cause of great enthusiasm and fear. As the agency of the Internet of Things is rapidly growing and already beginning to exist in various contexts of our lives, the time in which it will blend with our

---

33 Van Kranenburg, "The Internet of Things", 12.
34 Martin Strohbach *et al.*, "Cooperative Artefacts: Assessing Real World Situations with Embedded Technology", *Lecture Notes in Computer Science* 3205 (2004): 264.

everyday life is not as far away as we may think. This will mean the introduction of a complicated system of object agency in our houses, in our cities, in our private and public spaces, literally *everywhere.* Whether a co-living of this power with our agency will be harmful or will be the window to a new range of opportunities, is already a much-debated question.

What I aim to present in the following chapters is both sides of this expected development in an attempt to consider both the possible negative and positive consequences for our agency. I believe that in dealing with a phenomenon that it is still largely *potential* rather than *actual,* it is necessary to balance the fear with the enthusiasm in order to avoid being carried away by too idealistic or too catastrophic scenarios.

Bearing this in mind, I will now proceed to show how the Internet of Things could threaten our agentic power, presenting what the literature on the topic regards as the main concerns for this aspect of the technology, namely, what are the *dark sides* of future smart systems for human agency.

II. The threat of passivity: towards a disruption of human agency

The main reason why the advent of a fully pervasive Internet of Things could represent a step towards passivity is that in an ubiquitous environment the communication is not only man-to-thing anymore, but also thing-to-thing. This is implied in the *interconnectedness* of a system which acts by means of a cooperation between smart objects. Given that the objects in these environments will form complex networks of inputs and outputs, their interconnected communications could suggest an exclusion of the user from their processes. Whether the feared consequence is that we will be left out of the process or that we will lose sight of what the smart objects are actually doing, the root concern is the same: to progressively lose control over one's own objects and, consequently, over the interconnected environment as a whole.

There is therefore a widespread concern that IoT systems, due to some of their core features, could be unreliable, in the sense that they could act in unexpected and undesired ways, against the user's intentions. The problem of reliability, as it involves a relationship of trust between the device and its user, is always one of the first issues to face in the practice of regulating and limiting emerging technologies. However, it assumes a new shape in the case of a technology that could misbehave acting not only autonomously but also, as I will argue, invisibly.

The reason why a system's activities could be unexpected is that the objects will be programmed to take initiatives together without including the user. It could happen that the actions of the system, being unaware of the wishes of the user and of possible changes in the circumstances of the actions, will sometimes be «unwelcome or ill-timed».[35] Streitz uses the example of a fridge that is programmed to anticipate the user's wishes and order food spontaneously based on his consumption patterns. It could be a cause of resentment by the user, and of unreliability of the system, if the fridge were to order food that could not be consumed «because of circumstances beyond the refrigerator's knowledge such as an unanticipated absence or illness».[36]

Another cause of unexpected and undesired behavior could be the fact that the entire process makes it complicated for the user to acknowledge how the objects are acting. As the sources of artificial intentions come from different agents, it could be difficult to understand where an intention originated and how it was processed before resulting in an action. The user could then be hindered in tracing back

---

35 Norbert A. Streitz, "Designing smart artifacts for smart environments", *Computer IEEE Xplore* 38(2005): 41, doi 10.1109/MC.2005.92.
36 *Ibidem.*

the – potentially unwelcome – action. If the user does not know how the system is organized and programmed to take over his decisions, he cannot determine whether or not his intentions are respected. The source of this concern is therefore, primarily, the high complexity of a system of artificial intentions which can – and is made to – act «without any user interference».[37]

I thus maintain that these kind of interactive systems, as they will be created to take over many of our everyday decisions, will have a significant influence on our plans and actions. As object agency can include artificial intentions which are not in line with the intentions of the user, and as it is strictly connected to our process of setting goals and achieving them, it represent an issue for our agency. In fact interconnected systems will become so fundamental in our lives that our interaction with them could interfere not only with our immediate plans but also, in the long run, with our self-efficacy and self-determination.

This chapter therefore aims to show why this collective process could be unreliable, how it is problematic for human agency, and what makes it more problematic than other technologies. What are then the key features that make this kind of systems so dreaded?

1. *Invisibility*

A first reason why communication between objects could be unreliable is that it largely happens "in the shadows", that is, concealed from our attention. This represents one of the distinguishing characteristics of the Internet of Things: its invisibility.

The notion of invisibility in an interconnected environment is intended as involving both *physical disappearance,* a progressive miniaturization of the technology embedded in our objects, and *mental disappearance*, which refers to the smart objects being so interwoven in our daily lives that we may forget or even ignore their activities.[38] In particular this last concept relates to a phenomenological perspective of the sensible world as the background of our perception, so that the object is often said to "fade into the background". The notion of background, what Merleau-Ponty also called the *horizon*[39] and what Weiser and Brown called, in the context of ubiquitous computing, the *periphery*[40], refers to

---

37 Sarah Spiekermann and Frank Pallas, "Technology paternalism – wider implications of ubiquitous computing", *Poiesis Prax* 4 (2006): 7, doi 10.1007/s10202-005-0010-3.
38 Norbert A. Streitz, "Augmented reality an the disappearing computer", in *Cognitive engineering, intelligent agents and virtual reality,* ed. M. Smith *et al.*, (London: Lawrence Elbaum, 2001), 2.
39 Maurice Merleau-Ponty, *Phenomenology of perception,* trans: Colin Smith (London: Routledge & Kegan Paul, 1965).
40 Mark Weiser and John S. Brown, "The coming age of calm technology", in *Beyond calculation: the next fifty years of computing,* ed. Peter J. Denning and Robert M. Metcalfe, (New York: Copernicus New York, 1997), 78.

«what we are attuned to without attending to explicitly»[41], to something we are so used to that it remains inert to our perceptions, unless we intentionally focus our attention on it.

This aspect is particularly prominent because the Internet of Things is expected to reach a level of participation in most of our daily activities that has never been reached before. The more our objects become indistinguishable co-agents of *our* actions, the more we are likely to stop acknowledging *their* actions. And how can we control what they are doing, if we are not aware of it?

Thus taking the technology for granted entails a lack of awareness of the processes that happen around us and which we rely on to reach our goals. It appears now quite clear that the connection of invisibility with the issue of reliability is the fact that, remaining "in the shadows", if the objects were to act in a way that is discordant with the user's intentions, he would be likely to lack the awareness necessary to prevent it, making the activities of the objects more elusive to his attention and, consequently, to his control.

However where many see the possibility of an invisible unpredictable behavior that could interfere with our intentions and plans, others see no problem at all. Weiser and Brown explained that for a technology to be able to «lead to true calm and comfort»[42] it must act in the periphery of our attention, and that if it was always at the center of our attention it would not allow us to attend to different things. It would remain, in fact, an intrusive technology, such as the modern computer, which requires the user to be fully focused on it. What calm technology allows, on the other hand, is for the user to move the object from the periphery to the center of his attention. The user's agency is therefore not in danger, as he can take control again of the object *recentering* his attention on it.[43]

A way to respond to this is that, regardless the possibility of re-focusing attention on the object, we could still avoid doing so, due mainly to a confidence built up in light of the previous good functioning of the object. As I will show in the next paragraph, an attitude of excessive trust could represent an issue also in the case we spontaneously delegate activities to the system, as it could make the user blind to unexpected behaviors.

Another reason why the issue of invisibility could be not particularly problematic is that it is the fate of every technology that becomes integrated in social life to become part of the background. Indeed «all technologies that have matured and become socially acceptable seem to withdraw into the unnoticed, invisible background, like clocks and telephone cables».[44] However this process assumes a

---

41 *Ivi,* 79.
42 Weiser and Brown, "The coming age of calm technology", 78.
43 *Ivi,* 79.
44 Anne Uteck, "Reconceptualizing spatial privacy for the Internet of Things" (PhD diss., University of Ottawa, 2013).

different connotation regarding the Internet of Things: the invisibility of a IoT system is not the same as that of previous technologies which merged with the environment, as its elements will have some kind of agency themselves. This kind of invisibility will conceal a network of autonomous activities made to take over our plans, and that have therefore a particularly strong influence on our agency.

I have now argued that the disappearance of the objects from our attention and their acting in an interconnected environment in which we are immersed is problematic as it could conceal an unpredictable and undesired behavior of the objects themselves. I also showed how this could mean an interference with the intentions and plans of the user, and therefore with his agency.

If the system misbehaves due to autonomous silent action, the intentions of the user may be overridden depending on how the objects were programmed to help him. But it could also happen, as I will now present, that the user will spontaneously delegate his decisions to the system, sharing his self-determination with the objects and, eventually, relying so much on it as to progressively lose self-efficacy.

2. *Delegation of decisions and dependency*

A different range of issues emerges where the user is not subjected to an environment that acts without notifying him, but rather he intentionally and consciously interacts with it. In this case, the user triggers a process of interaction with the objects which, I argue, potentially have negative consequences for his agency both in the short and long-term.

Thus another side of the man-thing interaction in the Internet of Things will be a *spontaneous* delegation to the technology of tasks that the user considers nuisances or of not significant importance, letting it take decisions for him on a regular basis. What this entails is a gradual shift of human agency to the objects, happening in many aspects of the user's daily life, and triggered by an initial decision of the user himself.[45]

Delegating decisions to a smart system can be problematic, first of all, because of the unreliability of the system. The user could be induced to place excessive trust in the system, relying on the objects as better agents in fulfilling tasks they were programmed to fulfill, and taking for granted that they will keep functioning in the way he intended them to.[46] This trust, however, could be

---

45 European Commission. Joint Research Centre. Institute for the Protection and Security of the Citizen. *Agency in the Internet of Things* by Angela G. Pereira *et al.* (Publications Office of the European Union: Luxembourg, 2013), 44.
46 Geir M. Køein, "Reflections on Trust in Devices: An Informal Survey of Human Trust in an Internet-of-Things Context", *Wireless Personal Communications* 61 (2011): 509, doi 10.1007/s11277-011-0386-4.

misplaced, as even though the user will hopefully be aware of the functions of the object, he will not know how these functions will be applied to the task that has to be performed.[47] In fact, knowing what the device is programmed to do does not mean knowing what the object will actually do when cooperating with a multiplicity of different agents.

On the other hand it could be argued that this kind of unreliability, even if present, is of negligible importance as it could be that the course of action taken by the system will not have particularly significant consequences. Thus even if something goes wrong and the intentions of the user are overridden, the impact is not considerable enough to actually represent a threat to our agency.

This is certainly a valid objection to the short-term consequences of delegation, to partially mitigate the influence of objects on our plans. What I argue, however, is that the major concern for human agency regarding the issue of delegation of decisions regards long-term consequences on the user's self-efficacy.

The habit of abstaining from personally intervening in many aspects of everyday life could in fact give rise to a growing *dependency* on the technology. Dependency represents an issue as, in delegating his decisions to an external agency, the user would impair his capability to deal with certain situations autonomously. This would have direct consequences on his self-efficacy, that is, on his power to perfect his performances and set new standards of performativity. This also means that the user will be so reliant on the help of the device that, in its absence, he would not be able to obtain the same results.

Social cognitive theory explains that «if people experience only easy successes, they come to expect quick results and their sense of efficacy is easily undermined by failure».[48] Setting challenges and making efforts to overcome them is a key component of being an efficient actor, as human agency is also and fundamentally a process of refinement of one's own abilities to act. It is likely that a tool as pervasive and powerful as the Internet of Things will tempt or induce the user to rely on it for an increasingly wide range of daily activities, causing him to depend more and more on artificial helpers. A foreseeable consequence is a progressive impairment of the user's capability to competently and fully interact with his environment when the adequate technological conditions are missing.

A willingness to trust the technology for the sake of comfort and avoiding the nuisances of daily life could therefore lie at the root of a process of what McLuhan calls autoamputation.[49] Smart objects

---

47 *Ivi,* p. 495.
48 Albert Bandura, "Human Agency in Social Cognitive Theory", *American Psychologist,* September 1989, 1180.
49 Marshall McLuhan and Lewis Lapham, *Understanding media: the extensions of man* (New York: MIT Press, 1994), 52.

will be considered so indispensable in many aspects of our daily life to become our "technological prostheses". Underlying this concept is a situation in which advanced technologies become extensions of the agent to the point that accepting such technology would entail him giving up a "limb", that is, a capability.[50] The technological prosthesis can substitute capabilities that are necessary for the subject to fully exercise his agency. At the same time, if the prosthesis were to be removed – remaining inside the metaphor –, the agent would not get his limb back. He would be deprived of the means he was used to relying on, and as a consequence he would be at least hindered, or even incapacitated, in fulfilling his plans.

The immediate reply to the problem of dependency is that other technological and non-technological tools are already so integrated in our daily lives to make us dependent, as without them we could not achieve the same results. This objection is certainly true, as the issue of dependency is not, in fact, peculiar to the Internet of Things. What I maintain however is that, regarding smart systems, this issue becomes particularly prominent, as smart objects will not only be so indispensable in our lives to be involved in most of the chores we have to attend to every day, but they will also be made to *substitute* the user in performing some of these chores. Apart from letting our choices fall into the hands of something outside of ourselves, with implications for our self-determination, this could also result in the user entirely losing some capabilities that are part of his common knowledge and overall proficiency.

There are, however, three strong arguments to dismiss these threats as unfounded. First, it could be argued that this kind of dependency impairs capabilities which are likely to be non-fundamental to our well-being and overall performativity. Second, it could be said that it is an acceptable price to pay for a high level of comfort that provides more time and resources to develop other more important capabilities. Finally, our self-determination could be not overridden as we intentionally delegate our decisions to the objects. Even an eventual autoamputation would be, in this case, still part of our plans, as we would be the conscious cause of it.

These objections make good points, but the issue of dependency remains, in my view, problematic. This is because dependency does not only mean losing some capabilities, but it also implies that the system is so efficient and that our lives are so much easier, that we do not need to be particularly efficient ourselves. The Internet of Things, due to its high comfort and efficiency, could be just as likely to motivate us to do more as to foster an attitude of passivity impairing our general

---

50 *Ivi,* p. 54.

motivation to act autonomously, resulting therefore in an overall reduction of our self-efficacy. Even though the decision would be conscious, therefore, it would actually be made within already established standards of comfort subtly imposed by the gradual integration of the Internet of Things in our lives.

It is possible to foresee at this point that object agency could arrive at the point of *constraining* the agency of the user. The issue of a complex and unreliable system of smart objects, whether as a result of conscious delegation of the user or silent autonomous action of the technology, could then reach the ultimate stage in the notion of *technology paternalism*.

3. *Technology paternalism and pervasiveness*

The concept of *technological* or *technology paternalism* is a concept coined by Spiekermann to present the scenario in which devices, taking autonomous action, impose their choices on the user, who will then be coerced into accepting them.[51] This scenario is opposed to the notion of a calm technology, able to serve the user unobtrusively and to respect his intentions, and is based on the concern that the choices of highly smart and efficient machines will not be overrulable anymore. In fact as these choices would be based on the absolute conviction of acting in the interest of the user, the user would not be given the choice to refuse them.

The Internet of Things could therefore lead to a «subtle type of technological paternalism», in the sense that «even with no ill intent, our own smart objects might not behave as we would wish, but rather as they "believe" is best for us».[52] It could happen that we will find ourselves in situations in which we are induced to abide by the intentions of the system that "knows best". Smart technologies could become so sophisticated as to be considered more reliable than human reason and capabilities, and given that they will be fully integrated in everyone's private and public life, the user could voluntarily let them take control of his daily activities, allowing them to plan his life, and becoming nothing more than a «passive service taker».[53] In this way he would give up his self-determination, renouncing the possibility to fully develop himself according to his choices and intentions, and thus progressively surrendering his own agency.

The plausibility of a user disempowerment is also and fundamentally linked to the particular

---

51 Spiekermann and Pallas, "Technology paternalism – wider implications of ubiquitous computing", 8.
52 Mattern, "From the Internet of computers to the Intenet of Things", 257.
53 Primavera De Filippi, "Ubiquitous Computing in the Cloud: User Empowerment vs. User Obsequity", in *User Behavior in Ubiquitous Online Environments,* ed. Jean-Eric Pelet, Panagiota Papadopoulou, (Paris: IGI Global, 2013), 3.

demands of contexts or situations in which the technology will be embedded. For instance we may be forced to rely on smart objects out of necessity,[54] because the achievement of our goal necessarily involves, in the context we are interacting with, the employment of a certain technology or simply because we do not have or we have lost the capability to act without the help of a specific object. It could also happen that in some environments – such as working or public environments – the requirement to use a certain technology leaves us no choice but to conform to it. Furthermore, we could be nudged into using certain technologies due to social pressure. In fact we could experience a strong push towards adopting some kinds of behavior linked to specific technologies, as abstaining from it would adversely affect our inclusion in society and our relationships with other people.

Finally, technology paternalism assumes an even more frightening aspect in the case of the Internet of Things due to one of its defining characteristics, the one of *pervasiveness*. The Internet of Things will be more and more present in every context of our lives, in our cities, in public spaces, in our buildings, in our rooms and even in – or on – our bodies.[55] It will therefore be impossible not to engage with it. Moreover, while on some objects we could exercise control, on others such control could be exercised by public authorities or be in the hands of society as a whole, that is, of a number of different agents. Thus what has been framed by many as an impossibility to *opt out* of the system will not just be a physical coercion, as every activity will be confronted with the medium of technology, but also a social coercion, as the user, in order to function competently in society, will be obliged to comply with an omnipresent technology. This also entails the institution of a compulsory relationship of trust between the user and the system, and a shift of power in the hands of who will control it.

However, pervasiveness is not necessarily a negative term. It is only so when connected with negative implications, such as an imposition of object agency on our lives. But there is no need, once we take the necessary measures against the possible maleficence of smart objects, to frame this interaction as an *invasion* of the human world by technology. Being it an interaction, we could rather say that it involves a *mutual pervasion*[56] of humans and things.

The issue of "pervasiveness" assumes the negative aspect that I have identified as the "impossibility to opt out" only if we represent the ubiquity of inputs and outputs of the system as a restriction of our actions, in the sense that we are not left with the choice of avoiding it. However in the moment in which the system becomes an integral part of our environment, our interaction with it

---

54 Køein, "Reflections on Trust in Devices An Informal Survey of Human Trust in an Internet-of-Things Context", 496.
55 Greenfield, *Everyware*, 36-47.
56 Mark Coeckelbergh, "Pervasion of what? Techno–human ecologies and their ubiquitous spirits", *AI & Society* 28(2013): 58, doi 10.1007/s00146-012-0418-y.

simply becomes part of our process of agency, as human agency involves influencing and being influenced by the environment. As long as we are immersed in an environment, we can never "opt out", from technology, society, or relationships with other people. Thus pervasiveness, taken as a neutral concept, does not represent an issue, as the "being everywhere" of the system could be understood as much an invasion of the human world as the presence of humans an invasion of the system; it should then be properly interpreted as a mutual pervasion – meaning *relation* and *influence* – of humans and objects as interacting elements of the same environment.[57]

It should be clear at this point that what makes pervasiveness frightening and problematic is that it is associated with the idea of inevitability. Consequently, if a form of technology paternalism were to manifest itself through an ubiquitous technology, the process of "disenhancement" of men and deterioration of human agency would be, as omnipresent, unavoidable.

Permeating the debate on the Internet of Things is, as I have tried to show, a series of concerns which ranges from the likely interference of our smart objects with everyday-life activities to more pessimistic scenarios of omnipresent technology paternalism. Acting invisibly and autonomously, smart systems could behave according to their agency, making choices incompatible with our intention but doing so on our behalf, and keeping us, at the same time, in the dark. On the other hand, delegating decisions to the technology could impair some of our capabilities and induce us in a state of excessive comfort that would hinder our development as proficient agents. Moreover, the increasing sophistication of the technology could induce the establishment of a logic of efficiency according to which human performativity would coincide with the obedience to a system much more efficient than single individuals. We would therefore be compelled to bend to the demands of the system whether or not they were in accordance with our intentions. This would lead to an amputation of capabilities not only self-inflicted, but also commissioned by the system itself, and to an ultimate delegation of decisions that would finally prevent human agents determining the course of their own lives.

All these *slippery slopes,* however, even though they contain some legitimate concerns, are not to be taken as predictions of an inevitable dystopian future. While problematic, the Internet of Things also opens to a spectrum of opportunities that have never existed before. There are therefore reasons to believe that if we take the adequate precautions and if developed in the

---

57 *Ibidem.*

right way, smart objects could actually produce a radical *and* ethical improvement of humanity's conditions of life. The Internet of Things would then become part of a transformation of habits and practices that could even lead to the creation of a new type of agency, an agency not solely based on an affirmation of the subject, but rather on a perfected collaboration between humans and things.

III. Prospects for an augmented agency: flourishing through the Internet of Things

The perspective on the future Internet of Things that has been presented so far has provided us with the picture of a technology that is likely to be invested with a great deal of power, due to its attributes of interconnectedness, autonomy and invisibility. Further, systems of smart cooperative artifacts will assume such an important and influential place in our lives that it will make this power especially frightening. Our smart objects will be our mediums and our indispensable tools in a wide range of social and private situations, and our agency will inevitably have to coexist with their agency.

For this reason it is ever more important to make sure that this co-living will be a contented one. To work towards this goal I believe that, even though smart and even though regarded as agents, our objects will have to stay what they are: *tools*. It is our job to maintain the priority spot in the hierarchy, so to ensure that our own agency will at all times be in control, interacting with the objects only as a means of conscious and self-directed action.

In this line of reasoning Streitz distinguishes between two types of smart artifacts: one that he calls *system-oriented, importunate smartness* and the other one *people-oriented, empowering smartness*.[58] The first type entails an almost absolute autonomy of the system in relation to the user, as single objects or the environment as a whole are set to take action spontaneously, without the user initiating the process, but based solely on previously collected information.[59] This paradigm would then aim at producing highly «active and even proactive»[60] environments that make decisions and execute them leaving the user out of the process.

The second type, on the other hand, is aimed at providing a people-friendly environment that acts in an intuitive, easily comprehensible and thus transparent way. This system also acts in the background, but it is set at the same time to make itself visible when needed, so that «users remain in the loop and can always decide what to do next».[61] As «it might be more efficient if the system does not ask for a user's feedback and confirmation at every step in an action chain»[62], an environment of this kind would have to be designed in a way that maintains its unobtrusiveness while at the same time keeping the user in control with adequate notifications and interaction.

System-oriented objects, which is the type of artifacts I have discussed so far, present, as I have

---

58 Streitz, "Designing smart artifacts for smart environments", 41.
59 *Ibidem.*
60 *Ibidem.*
61 *Ivi,* 42.
62 *Ibidem.*

argued, the risk of acting in unexpected ways. In fact leaving the user outside the process opens up the possibility that objects, acting on the basis of certain patterns established through their algorithms and machine learning, will not acknowledge the actual situation and intentions of the user. To prevent this outcome, I will argue, the user should always remain protagonist of the interaction.

This chapter will thus explore the potentialities of a people-oriented approach, towards a design integrating the agency of humans with the one of their smart tools. I will start by presenting a silent, subtle, *calm* type of Internet of Things, in line with the idea of Streitz and based on Weiser's first and famous vision of ubiquitous technology. I will then proceed further, towards the vision of a future pervasive technology which is able to actively engage and empower its user. If the goal of my argumentation is reached, the chapter will conclude with the presentation of a new perspective on man-thing interaction and its desirable development in the Internet of Things.

1. *Calmness*

For the purpose of creating a people-friendly environment, the "computer as we know it"[63] must disappear. In this way Streitz links back to Weiser and his representation of future ubiquitous computing as a technology substituting often hostile interfaces with unobtrusive devices that are designed to silently and calmly interact with the user. According to Weiser, modern technology forces us to interact with machines that require both the comprehension of a particular jargon and a specific know-how, remaining therefore in a world of their own.[64] For technology to become fully integrated in our daily lives, it should become part of the environment that we already know and which we are already used to acting in. Only in this way would it be possible, Weiser explains, to reach the goal of *calmness*, namely, of a technology that does not oppose the user but that is able to inform him and calm him at the same time.[65]

Enabling this would be the invisibility of the system, which, as I have shown in the previous chapter, will entail a disappearance of its components from our attention. While the interface demands for our attention to be fully focused on it, smart objects, as part of our environment, allow the human agent to «use them without thinking and so to focus beyond them on new goals.»[66] This attribute of ubiquitous technology is explained with a famous example of Heidegger. The fact that we can turn our

---

63 *Ivi,* 44.
64 Weiser, "The Computer of the 21th Century", 94.
65 Weiser and Brown, "The coming age of calm technology", 3.
66 Weiser, "The Computer of the 21th Century", 94.

attention from one object to the other means that there is a foreground, on which is our focus, and a background. Once we get used to something, we do not need to put our attention on it anymore, but we integrate it as part of our background; just like the hammer "disappears" in the hands of the carpenter, allowing him to focus his attention on the object of his work.[67] In a similar way, Weiser's vision aims at transforming the interaction with technology from the paradigm of the interface to a paradigm that reflects our spontaneous interaction with the environment.

Following this paradigm it can now be asserted that calm technology, assuming the role of the perfectly unobtrusive aid and liberating its user from the attention-demanding intrusiveness of the interface, opens to the opportunity of a wider and freer exercise of human agency. The unawareness of the user can indeed represent a concern if the system acts unexpectedly and its actions pass unobserved; but it is also necessary to achieve calmness. Calm technology represents a promising paradigm as the comprehensible and intuitive aspect that it is supposed to be designed with would foster the capability of a user to make plans and bring them to completion, providing invisible support without affecting his focus. This means that a balance between explicit and invisible action is pivotal for the functioning of the paradigm, allowing the system to act in the background without completely disappearing as well as helping the user without requiring his full attention.

Furthermore, providing a sense of warmth and comfort could enhance one's motivation to interact with the technology.[68] A calming environment stimulates the agent to feel more intimately related to the objects that are part of and, to a certain degree, *are* themselves the environment. While this could affect a detached perspective of the user on the good functioning of the system and condition him to rely too much on it, it also has the potential to enforce his interaction with the objects and to fully integrate them in his plans and actions.

Calm technology could also support human agency thanks to what social cognitive theory identifies as *proxy agency*.[69] This is a kind of agency exercised through the reliance on other agents with particular competences and resources. Given that «maintaining proficiency under the ever-changing conditions of life demands continued investment of time, effort, and resources in self-renewal», and that, moreover, «the exercise of personal control often carries heavy responsibilities, stressors, and risks»[70], calm technology could partially relieve this stress by taking over a consistent

---

67 Martin Heidegger, *Being and Time,* trans. John Macquarrie and Edward Robinson (London: Blackwell Publishing, 2000), 98.
68 Jia *et al.*, "Balancing Human Agency and Object Agency: An End-User Interview Study of the Internet of Things", 1186.
69 Bandura, "Social cognitive theory: an agentic perspective", 13.
70 *Ibidem.*

part of what causes it. This does not entail, of course, that the user should delegate his own responsibilities to the system, but rather to safely delegate as much as is needed for him to dedicate his energies and efforts to those tasks that specifically require his attention. At the same time, lightening up the workload would also allow him to focus on more fulfilling activities. The performance of certain capabilities would in this case be left to the system in exchange for the possibility of exercising capabilities which are both more satisfying and more fundamental for our overall performativity and self-determination.

I have now presented a perspective of the Internet of Things based on the goal of making it calm- and comfort-enhancing, providing at the same time the user with the possibility to assess its functioning and direct its activities whenever needed or desired. However this model of interconnected systems promotes a level of comfort that could lead either to a stronger motivation to achieve goals or to a lack of motivation due to the utility and – possibly excessive – assistance of the system itself. The temptation of falling into a state of passivity regarding certain capabilities and behaviors is, therefore, particularly present in a system that is made to silently assist and soothe the user.

It seems at this point that the goal of interconnected systems should go beyond comfort, so as to allow a true influence on the user's capabilities, rather than on his mood and motivation. The direction of the Internet of Things could therefore be aimed, for the benefit of human agency, towards a technology that does not only have the purpose of calming the agent, but also of *engaging* him.

2. *Engagement and augmented agency*

As an alternative to the paradigm of a calm technology aimed at the goals of comfort and easy living, Rogers presented the following idea:

> I propose […] a significant shift from proactive computing to proactive people; where UbiComp technologies are designed not to do things for people but to engage them more actively in what they currently do. Rather than calm living it promotes engaged living, where technology is designed to enable people to do what they want, need or never even considered before by acting in and upon the environment. […] people rather than computers should take the initiative to be constructive, creative and, ultimately, in control of their interactions with the world – in novel and extensive ways.[71]

---

71 Yvonne Rogers, "Moving on from Weiser's Vision of Calm Computing: Engaging UbiComp Experiences", *Ubicomp*

This is an approach that focuses on how the human agent can improve his experience through the interaction with a technology that is still merged with the environment but that is designed, instead of taking over his actions, to promote a stimulation of his capabilities. The purpose of this paradigm is therefore to support the relationship of the user with a technology that engages with his actions directly, rather than through the creation of a comfortable environment.

In this vision, smart objects and systems would present themselves as mediums of new forms of private and public activities, as well as users would be able to consciously "link themselves" to different systems in ways that foster the creative and self-fulfilling exercise of their capabilities.[72] Designing objects within this paradigm creates the possibility of extending the user's capabilities and the reach of his capabilities, allowing him to achieve new modes of communication, more efficient ways to behave in specific contexts and to be generally more efficient in what he does.

To give an idea of the direction this paradigm should take, Rogers gives some examples. The first is that smart systems could enhance creativity through "toolkits" implementable in different spaces, such as houses, classes, parks, *etc.* These would be programmed to react to certain situations in order to make them more playful, provoking, exciting, and to enhance learning, enjoyment and reflection.[73] Another way to enhance positive engagement could be through persuasive practices: smart objects could foster the realization of the user's spontaneous intention to change his habits and lifestyle for the better, encouraging him – *i.e.* in the form of wearables – to adopt certain behaviors instead of others.[74] In this way the user could achieve positive change through a process that he initiated and that he has the power to stop at any time.

With regard to the objective of my argumentation, Roger's claim presents an important addition. However, I do not think that the goal of calmness should be abandoned. In fact, one of the major advantages of the Internet of Things for human agency is that, by taking on annoying and unimportant tasks, it allows the agent to make a better use of his time. It seems therefore that an optimal approach would be one that could integrate calmness and engagement, so that the Internet of Things would be programmed both to assist the user silently, making his life easier, and to foster new forms of interaction, allowing the user to spontaneously engage with systems made to respond to his intentions and improve his performances. Smart systems would then have different purposes, both reacting to our intentions under our control and supervision, such as in the examples given above, and liberating the

---

4206(2006): 406.

72 Rogers, "Moving on from Weiser's Vision of Calm Computing: Engaging UbiComp Experiences", 412.

73 *Ivi,* 413.

74 *Ivi,* 416.

user from the nuisances of everyday chores.

Furthermore, as it promotes self-improving interaction, this approach represents an improvement for self-efficacy, giving the user the means to set higher standards for himself. This happens thanks to a two-folded mechanism: first, by providing an enhancement of the agent's capabilities, the object raises *de facto* his standard of proficiency, and second, in allowing him to reach new levels of accomplishment, it acts on his motivation and self-influence. So while a technology designed only to be calm has the potential to enhance human agency by influencing the user's motivation and relieving him from stressful activities, an object agency also designed to engage the user would augment the overall proficiency of the agent contributing *directly* to his capabilities.

However it is clear that to enable such an intimate relation between users and objects it would be necessary to establish, at the same time, quite a solid relationship of trust. In fact only if the object is adequately trusted is it possible for the user to engage with it routinely to the point of incorporating it in his activities. Thus while an excessive trust could mean a blindness regarding possible deviations of the system from its expected and desired course of action, an *appropriate* amount of trust, depending on the task and the context, is needed to enable the proficient and spontaneous interaction of the user with the artifacts in his surroundings.

The first requirement of smart systems is therefore to ensure that they comply with accepted standards of operation, in order to act continually within the boundaries of what is expected from them.[75] While for humans trustworthiness has an ethical dimension and is connected in particular to responsibility, regarding inanimate objects it can be identified with simple reliability, as closely related to risks assessment and predictability. An object can be accountable for an action, in the sense that a chain of action can be followed back to it, but it cannot be responsible in the sense of being worthy of blame and punishment, as the intention of the device is not a self-aware, human-like intention. It is therefore possible to make an object trustworthy if it can be designed in a way that makes it predictable and safe.

Hence, while we can predict that every system will be endowed with some kind of safety measures, it is unreasonable not have any trust in it. On the other hand, the trust of the user cannot be a static one, but must be established and re-established in the interaction with the system, in an ongoing process of dynamic adjustment.[76] The human agent should then be given the possibility to easily ascertain the reliability of a specific system, case-by-case, and to set himself, when needed, the

---

75 Køein, "Reflections on Trust in Devices An Informal Survey of Human Trust in an Internet-of-Things Context", 496.
76 *Ivi,* 502.

conditions for his interaction with it. Confidence is therefore «constantly redefined, renegotiated, renovated, quantified when appropriate», and «human agents are enabled and empowered "by-design" to make their own choices and changes "in-design"».[77] In this way the system would be adaptable to the intentions of the user and able to respond appropriately.

We now have a vision of the Internet of Things that is designed to be a reliable tool in the hands of any user that interacts with it, and that is not only aimed at motivating the user and giving him more possibilities to exercise his agency, but also at engaging him more profoundly in his activities and making him more proficient in obtaining ever more ambitious goals. Thus what I propose is that the interaction with smart systems does not limit itself to a collaboration of artificial and human agents, but additionally enables the exercise of a *human agency-plus,* an augmented agency, as the agency of smart objects can also become a direct extension of the agency of users.

I should now point out that my approach represents a deviation from Ashton's original vision of the Internet of Things. On one side, in my view the function of smart objects of working independently from human mediation is partly preserved, as smart objects should be able both to act autonomously and to serve as mediums for enhanced action. On the other side, I believe that the main goal of the Internet of Things should not be to enable objects to gather data from the world without human intervention, but rather to enhance the interaction of the user with the world, maintaining him always in the loop and in control of the system's functioning. What my approach sustains is that the capability of smart systems of acting autonomously should not prevent us to engage with them and therefore to be mediators of the technology whenever we want. Adopting a system-oriented Internet of Things focused only on autonomous functioning precludes the possibility of a kind of interaction that could be, as I will argue in the next paragraph, most beneficial for the individual lives of users and for the overall improvement of society as well.

I also believe that the people-oriented approach I have introduced is particularly advantageous as it provides adequate counterweights to the threats of unexpected behavior and of an impairment of self-efficacy due to dependency that I described in the previous chapter. First of all, as the technology still acts, in certain circumstances, on our behalf, one could question whether or not the issue of unexpected behavior is resolved with this approach. I would reply that, for the user to maintain control over the technology at all times, he should always be aware of its processes. Thus even though smart objects work in the background, the user should be able to check them periodically to ensure they are

77 Ioannis Kournelis *et al.*, "Building Trust in the Human-Internet of Things Relationship", *IEEE Technology and Society Magazine* 33(2014): 75, doi: 10.1109/MTS.2014.2364020 .

functioning correctly. Moreover, even when smart systems override the user's intentions, this would be limited to superficial tasks, and therefore not particularly problematic and likely to be fixable.

Regarding the issue of dependency, within the introduced perspective the technology would not create an excessive level of comfort, nor is the success that we experience likely to undermine our self-efficacy, as smart systems and objects would also be designed to stimulate the user to keep engaging in more and more challenging activities. Thus we will delegate only nuisances to the systems, and the system will keep us motivated and engaged: eliminated the threat of passivity from the issue of delegation, it does not represent an issue anymore, but rather an opportunity for calmness and for a freer exercise of the user's agency.

Other issues could emerge with this vision, linked to the power that an augmented agency allows users to achieve. Primarily, these are that this kind of power could be difficult to contain and that, in the process of enhancing the possibilities of many people in many different contexts, it could have a great deal of influence both on the user and on others.

My proposal, as presented in more detail in the next chapter, is that adequate precautions should be taken to avoid an abuse of smart systems. Firstly, this means that the power accessible through a particular object or system should be limited, in order to prevent excessive user empowerment. Secondly, that the amount of power conceded should be aimed only at positive outcomes, so as to prevent the user from harming himself or others. To make this possible I suggest that provisions should be taken both regarding the design of the technology, which should be made harmless, and regarding adequate legal regulations crafted specifically to limit, prevent and punish any kind of abuse.

Having said this, it is still likely, regardless of these safety measures, that it will not be possible to make the Internet of Things completely harmless and that some potential abuse could be overlooked either in its design or in legislation. The power of interconnected systems remains somewhat scary; but it is unlikely that the right solution is to condemn the Internet of Things as a whole, since this would be to risk abandoning a progress that could also bring major advantages. This is particularly important, I will argue, given that such advantages provide opportunities for self-improvement and, eventually, enable us to flourish as human beings.

3. *Human flourishing and pervasive improvement*

From the notion of augmented agency I have presented, one could be inclined to refrain due to some

legitimate concerns regarding an excessive drive to efficiency as well as a possible impoverishment of human experience. Contrary to the technology paternalism described in the previous chapter, that would make users powerless, what could also be foreseen is that the pressure from society to abide by standards of technical efficiency could be coupled with an excessive empowerment of the users, thus directing such power towards dangerous dynamics of limitless growth and productivity. Furthermore, I sustain that if the achievement of more time and resources focus on the ambition to seamlessly increase progress and rationalize society, human experience would not be improved but impoverished. The underlying fear is that those aspects of life that make us human, and that are already considered more and more irrelevant for economical and social development, will be progressively discarded in favor of a one-sided optimization of the means to achieve such development.[78] Thus we have to keep in mind that mathematical rationalization and quantification of practices and social relationships are dangerous enemies of what indispensably contributes to self-fulfillment and flourishing, what McKeown sums up as «the aesthetic and its expression through art, romance and play.»[79]

I here intend human flourishing as creatively determining and re-inventing oneself through the pursuit of a fulfilling plan of life. As agency is based on self-determination and self-efficacy, which are the key features in the personal development of an individual, an *augmented* human agency cannot but multiply the possibilities of self-development and, consequently, of flourishing. Satisfaction and the prospect of higher standards of self-efficacy are the basis to motivate such development, and its prospering largely depends on the disposition of the social environment to foster the free and fulfilling exercise of the agent's capabilities.

Thus the vision of an augmented human agency should be the basis for an *augmented humanity*, regarding all the aspects that make life worth living. Society should embed the upcoming technological possibilities in a dynamic of all-round improvement, in which the protection of human agency from an impoverishment of human experience will necessarily be included. Augmenting agency in this manner would entail respecting the right of people to have a good life, and would therefore represent a positive development in the morals of the interested society. The social environment would then be improved both culturally and ethically, as it will allow higher standards of life and well-being, enable the free pursuit of life-projects and, as a consequence, stimulate the advancement of culturally valuable ideas and actions.[80]

---

78 McKeown, "On Being Humans and Human Beings".
79 *Ivi.*
80 European Commission. Joint Research Centre. Institute for the Protection and Security of the Citizen. *The constitution of the hybrid world: How ICT's are transforming our received notions of humanness* by Paula Curvelo *et al.*

Promoting an ongoing process of cultural and human development over ambitions of efficiency and productivity becomes especially important in relation to smart systems, because of their pervasiveness. I have presented in the previous chapter how pervasiveness is not necessarily a negative concept, but is rather a neutral concept connected with relatedness, and referring in particular to a relation which is omnipresent and thus inevitable. Its prominence as a feature of the Internet of Things, I have argued, is precisely its potential to make an issue more critical, as impossible to avoid.

It is now quite clear that, following this line of reasoning, the same can be said regarding possible advantages: pervasiveness, as connected to ubiquitous interaction and change, can also give rise, when associated with positive implications, to *good* ubiquitous interaction and change. Pervasiveness would then entail that, developing the right conceptual framework and the right approach to the Internet of Things, that is, towards the good of the individual and his contribution to the cultural life of his society, would have a strong influence on the realization of such purposes. Being integrated in every context of society, smart systems could provide the possibility of being more proficient agents in many different situations and, ideally, to everyone involved. For this reason interconnected systems should also be designed so to avoid the clash of too many different intentions in the same environment, and so to give as many opportunities as possible to everyone and in equal measure.

I conclude by remarking that, having taken adequate precautions, and always remaining in the boundaries of what we can control and prevent without the risk of substantial losses – such as the loss of some of our capabilities – the Internet of Things could be the instrument of a serious cultural and collective growth, as a major promoter of the positive and self-enhancing actions of individuals. Even though it is, admittedly, quite ambitious, to develop a fully democratic version of the Internet of Things with the aim of prioritizing the good of the people and avoiding excessive drives of efficiency, it surely represents, in the regulation of this technology, one of the most exciting and promising challenges.

I have now sketched two main prospects of the Internet of Things as a positively enhancing technology, opting in the end for a middle-ground solution which incorporates the most advantageous side of the one and the other. One approach involves a system mainly based on the initiatives of smart objects as smart assistants designed to work for the user leaving him unaware of their functioning. Even though the user is given the possibility to control the technology at any time, and the unobtrusiveness of the

---

(Publications Office of the European Union: Luxembourg, 2014), 25.

system also allows him to a more self-fulfilling employment of his time and resources, this paradigm is still vulnerable to the risks of dependency and of technology paternalism, as it could foster an attitude of passivity linked to excessive comfort.

I then presented an alternative paradigm based on improving the experience of the user through his direct engagement. This kind of smart technology would not serve the user "from the shadows", but it would be designed to react to his intentions and choices, stimulating him to creatively improve his performances and to be more proficient in the fulfillment of his purposes.

I finally suggested an integration of these two paradigms: the Internet of Things should be designed to be calming and to remove the nuisance of daily life, so as to allow the user to dedicate himself to activities that are more important for his self-determination; but it should also be designed to create new forms of interaction with the user, responding to his initiatives with a positive contribution to his ends and remaining at all time under his control and in accordance with his intentions. I further argued that this new approach would be the basis for a true augmentation of human agency, and that, when employed in a society driven to preserve cultural flourishing and the good of the individual over the goals of efficiency and productivity, it could substantially and positively change the current dynamics of society.

To foster the affirmation of such augmented agency, however, the first step is to create safety measures that will allow us to avoid the threats that I mentioned in the previous chapter. The last part of my argumentation will therefore be devoted to some final recommendations that, I believe, support a positive development of the Internet of Things, grounded in the recognition of the priority of human agency over the agency of objects.

IV. Recommendations

The following is a list of suggestions to develop the Internet of Things in a way that aims at avoiding the threats that I presented and that comes as close as possible to the vision of an augmented human agency. These proposals represent what I believe are the main conditions for my vision to be successfully constituted, and I have selected them based on their pertinence to my discussion as well as on their plausibility. It is important to keep in mind, however, that this list is by no means exhaustive, and that the crafting of new and constantly updated guidelines should be a gradual process working hand-in-hand with the development of the technology.

1. *Smart objects and systems should be aimed both at comfort and engagement.*

The vision of augmented human agency that I have presented is based on the proposal that the Internet of Things should not only be aimed at creating comfortable environments in which smart objects are programmed to work *for* the user, but also at designing objects able to work *with* the user, that is, a technology that will both serve the user and extend his capabilities. This means that in an interconnected environment a system would generally act in the background of our attention, while allowing us to interact with it when desired. Thus, first of all, smart systems should be programmed to lift the user from the stress of daily life assisting him in routinely activities. Second, to be able to engage the user more profoundly in his activities as well as to enable him to undertake new activities, it will also be necessary to find ways to make the technology adaptable to the intentions of the interacting users and able to stimulate their creativity.

2. *Smart objects and systems should be controllable.*

The Internet of Things should be a tool of the user, and should never be permitted to take autonomous action that is not under his supervision and in accordance with his intentions. This proposal is pivotal for my approach to avoid the same threats of a system-oriented perspective, of a system that would keep acting unnoticed in our own surroundings, and regarding activities that involve our daily living. Objects and systems should be kept within our control, so that the user is aware of how they are working and can, if desired, intervene.

3. *Smart systems should take over only superficial tasks.*

Smart systems should only be programmed to substitute the user with regard to superficial activities, that do not represent significant contributions to his self-development. In this way potentially unexpected and unwelcome behaviors of the technology would not have significant consequences on the plans of the user. The goal of the calming function of the Internet of Things is therefore simply to protect the user from excessive stress and liberate him from daily chores that take up much of his time and energies, allowing him to deploy his resources in activities of greater importance for his self-determination and well-being.

4. *Smart objects should be user-friendly.*

Within the aforementioned approach, the objects should be designed in a way that makes them easy to use and comprehend. This is linked to the goal, as Oriwoh accurately highlights, of the objects being controllable by the user.[81] It is therefore necessary that the objects are programmed following an intuitive design that can allow the user to interact with it without requiring any particular knowledge or training. In this way the system will avoid frustrations linked to incomprehension, and the user will be able to use it being aware of the consequences his actions will have. User-friendliness is therefore needed for the user to competently and consciously interact with the system.

5. *Smart objects and systems should be transparent.*

In the perspective I have presented smart objects, for the purpose of improving the proficiency of the user, have to conform to his intentions. For this to be possible, they have to be user-friendly and unobtrusive, so to be easily employed for the desired purpose. This also calls for a complete transparency of the systems. The user should be aware of how the system is acting in the background and of what it is set to do. Apart from being properly informed about how a determinate object or system functions, he should also be aware of the range of possibilities that it opens up, so to be at all times cognizant of how his capabilities could be augmented in different contexts. For the user to be able to adequately enhance his agency, the impact and consequences of the interaction with the

---

81 Edewede Oriwoh, Paul Sant, and Gregory Epiphaniou, "Guidelines for Internet of Things deployment approaches – The Thing Commandments", *Procedia Computer Science* 21 (2013): 129.

technology should always be clear. Making the Internet of Things transparent also involves a push from society to spread awareness about its safe use and to actively inform users. As Rogers already suggests, users should then be progressively taught to build their own systems or to participate within publicly shared systems, so as to be fully aware of how to satisfy their wishes and creatively exploit the technology for their ends.[82]

6. *Smart systems should conform to new standards of trustworthiness and predictability.*

For IoT systems to be reliable they should, first of all, act in a predictable way. Predictability is not only a condition for trust, but also for control. Thus to make the technology trustworthy it is necessary to craft standards of predictability to which every smart object and system of smart objects should abide. First, a certain amount of trust has to be offered by the system to the user as a way to ensure its reliability. Then the user should be able to ascertain the reliability of a system in every context he is interacting with, and this should be repeatedly reinforced to allow a constantly redefined relationship of trust. Aspects that contribute to these standards of trustworthiness are a safe design and the obedience to strict regulations on smart objects usage.

7. *Smart objects should be designed to be limited and harmless.*

For a user to be able to safely interact with the system, it is firstly necessary to find ways to prevent their abuse by users. The best way to do this, I suggest, is to design the objects with limited power and so to make them harmless, or at least, no more threatening than other everyday objects. Smart objects should be incapable of engaging in harmful activities, as they should be focused on positive stimulation, with the primary goals being enjoyment, reflection, learning and creativity. The user should not be able to gain any form of power unless it is uniquely directed towards a positive self-development of his capabilities, allowing in this way other users to do the same.

8. *Misbehavior by smart objects should always be preventable.*

In addition to impeding misbehaviors of the user, it should also be possible to prevent at all times

---

82 Rogers, "Moving on from Weiser's Vision of Calm Computing: Engaging UbiComp Experiences"*,* 413.

undesired behaviors of the technology. As I previously stated, the object should be designed only to undertake tasks in which the outcome has no significant impact on the user's plans and, furthermore, it should always act in a predictable way. In any event, however, the user should be reassured that, in case of misbehavior, there is always a way to stop it immediately. Thus some safety measures should be implemented in the object that, for example, force it to deactivate, or that notify the user, when it does not behave as it should. Further, it should also be possible for the user to manually interrupt the interaction whenever he wants. To prevent the object from assuming undesirable behaviors it could also be instituted, as Spiekermann proposes, a «legal obligation for manufacturers to design technology in an overrulable way»,[83] so to allow users to maintain control on the technology under every circumstance.

9. *Man-thing interaction should be regulated by law.*

Apart from their being implemented with safety measures, the use of smart objects should be subjected to severe regulations, concerning national and international law as well as specific protocols for different kinds of objects and systems. Such regulations should be focused on preserving a proper interaction with the technology that would give the opportunity to everyone to attain an augmented form of human agency. This should be done mainly by preventing and, eventually, punishing potential misuses of the technology.

10. *The enhancement of human agency should be directed to human flourishing.*

Finally, it is important to make sure that the development of the Internet of Things does not move towards an impoverishment of human experience, but that it contributes, rather, to the fulfillment of the user's aspirations. This means avoiding the establishment of a framework that would promote the use of smart systems solely for the purposes of efficiency and productivity, leaving behind the nurturing of other activities which are fundamental for the development of humans. Art and culture should be supported by technological progress, as they foster creativity and self-fulfillment. The rethinking and constant adaptation of standards regarding the Internet of Things should therefore comprise and promote human flourishing as the main goal of an enhancement of human agency.

---

83 Spiekermann and Pallas, "Technology paternalism – wider implications of ubiquitous computing", 16.

Concluding remarks

In my argumentation I have showed how the Internet of Things, through a capability to interact with the environment and its users that is more similar to the one of humans than that of any other previous technology, represents an increasingly significant factor in our lives, both in the private and the public sector. First I considered the possibility that smart objects and systems could be unreliable, as they could misbehave due to their being programmed to assist the user without properly acknowledging his situation and his wishes, and as they are designed to remain in the background of our attention, preventing us from halting its misbehavior. I argued that this unreliability could also depend on the fact that IoT systems are made to take over our activities, and that intentionally delegating our decisions to this kind of system could in the long run impair our self-efficacy, thereby inducing us to lose some capabilities. In the worst of scenarios, this could lead to our objectification as the system takes decisions for us that will not be overrulable anymore.

I then argued that another range of scenarios should be balanced against the one presented, as smart systems could, if designed to be people-oriented, empower rather than impair us. I firstly considered Weiser's vision of calm technology; I then presented Rogers' alternative paradigm of engaging technology, and finally opted for a third solution that would provide the user with the comfort necessary for a wider exercise of his agency and would be able at the same time to improve his experience and proficiency through direct engagement in his activities. I concluded by arguing that if nurtured in the right framework, directed towards cultural and human flourishing rather than to technical efficiency and productivity, this type of smart technology would promote the achievement of the user's project of life and self-fulfillment.

This thesis presents different perspectives on the development of the Internet of Things and on the impact that it will have on human agency, including some suggestions derived from my view on how this development should be directed. Its scope is the ethical implications of the interaction between smart interconnected systems and their users, and in particular the consequences that this interaction will have on our human agency in the short and in the long term. For this reason my argumentation does not provide the technological knowledge to properly guide said development. Also, considerations regarding the economical and political aspects of the debate were left out, and the social and legal aspects were touched upon without being analyzed in depth.

I propose that to foster and enrich this debate, the goal of augmented human agency should be

supported by the crafting of adequate frameworks for its realization in an interdisciplinary way, involving perspectives from economics, politics, law, sociology, anthropology, philosophy and others. This should be done as part of an ongoing process, side by side with the progress of smart systems. Furthermore, the ethical evaluation of the means to achieve this goal should be aimed at giving a realistic prospect of new developments as well as furnishing guidance on how to react to them from a public perspective. Research on the topic should also adapt its concept of object agency and the notions connected to it as smart technologies evolve, to ensure that the terms we use to describe and prescribe are not based on misleading or obsolete theoretical viewpoints.

Remaining always in our line of sight, in the course of this assessment, should be our duty as humans to preserve what is for us most valuable and all the means that make it possible. In the respect of this common purpose, the Internet of Things should remain focused on the priority of humans on their objects, remembering that even though agentic and even though smart, our tools should remain our tools. Only in this way is possible to avoid losing control over our technological artifacts and to direct their development not only to the creation of more proficient human agents, but of better human beings as well.

Bibliography

Ashton, Kevin. "That 'Internet of Things' Thing". *RFID Journal* 4986 (2009), accessed 2 June.

Bandura, Albert. "Human Agency in Social Cognitive Theory". *American Psychologist,* September 1989.

Bandura, Albert. "Social cognitive theory: an agentic perspective". *Annual Review of Psychology* 52 (2001): 1-26.

Bandura, Albert. "Social foundation of thought and action: a social cognitive theory". In *The health psychology reader,* edited by David F. Marks. Trowbridge: The Cromwell Press, 2002.

Bratman, Michael E. *Faces of intention: selected essays on intention and agency.* Cambridge: Cambridge University Press, 1999.

Coeckelbergh, Mark. "Pervasion of what? Techno–human ecologies and their ubiquitous spirits". *AI & Society* 28(2013): 55-63. doi 10.1007/s00146-012-0418-y.

De Filippi, Primavera. "Ubiquitous Computing in the Cloud: User Empowerment vs. User Obsequity", in *User Behavior in Ubiquitous Online Environments,* edited by Jean-Eric Pelet, Panagiota Papadopoulou. Paris: IGI Global, 2013.

Dutton, William H. "The Internet of Things". *Social Science Electronic Publishing* (2013), accessed 20 June.

European Commission. Joint Research Centre. Institute for the Protection and Security of the Citizen. *Agency in the Internet of Things* by Angela G. Pereira, Paula Curvelo, and Alice Benessia. Publications Office of the European Union. Luxembourg, 2013.

European Commission. Joint Research Centre. Institute for the Protection and Security of the Citizen. *The constitution of the hybrid world: How ICT's are transforming our received notions of humanness* by Paula Curvelo Paula, Angela G. Pereira, Philip Boucher, Melina Breitegger, Alessia Ghezzi, Caroline Rizza, Mariachiara Tallacchini, and Lucia Vesnic-Alujevic. Publications Office of the European Union: Luxembourg, 2014.

Frankfurt, Harry G. "The problem of action". *American Philosophical Quarterly* 15 (1978): 157-162.

Greenfield, Adam. *Everyware: the dawning age of ubiquitous computing.* Berkeley: New Riders, 2006.

Heidegger, Martin. *Being and Time.* Translated by John Macquarrie and Edward Robinson. London: Blackwell Publishing, 2000.

Heylighen, Francis, "Return to Eden? Promises and Perils on the Road to an Omnipotent Global Intelligence", in *The End of the Beginning: Life, Society and Economy on the Brink of the Singularity,* edited by Ben Goertzel and Ted Goertzel. USA: Humanity+ press, 2015.

Jia, Hayian, Wu, Mu, Jung, Eunhwa, Shapiro, Alice, and Sundar, Shyam S. "Balancing Human Agency and Object Agency: An End-User Interview Study of the Internet of Things". Paper presented at the 2012 ACM Conference on Ubiquitous Computing, Pittsburgh, Pennsylvania, September 05-08, 2012.

Køein, Geir M. "Reflections on Trust in Devices: An Informal Survey of Human Trust in an Internet-of-Things Context", *Wireless Personal Communications* 61 (2011): 495–510. doi 10.1007/s11277-011-0386-4.

Kournelis, Ioannis, Baldini, Gianmarco, Neisse, Ricardo, Steri, Gary, Tallacchini, Mariachiara, Pereira, Angela G. "Building Trust in the Human-Internet of Things Relationship". *IEEE Technology and Society Magazine* 33(2014): 73-80. doi: 10.1109/MTS.2014.2364020 .

Kranenburg, Rob van, Anzelmo, Erin, Bassi, Alessandro, Caprio, Dan, Dodson, Sean, and Ratto, Matt. "The Internet of Things". Paper presented at the 1st Berlin Symposium on Internet and Society, Berlin, Germany, October 26t-28, 2011.

Mattern, Friedemann and Floerkemeier, Christian. "From the Internet of computers to the Intenet of Things", in *From active data management to event-based systems and more,* edited by Kai Sachs, Ilia Petrov, and Pablo Guerrero, 242-259. Heidelberg: Springer Verlag Berlin 2010.

Merleau-Ponty,Maurice. *Phenomenology of perception.* Translated by Colin Smith. London: Routledge & Kegan Paul, 1965.

McLuhan, Marshall and Lapham, Lewis. *Understanding media: the extensions of man.* New York: MIT Press, 1994.

McKeown, Justin. "On Being Humans and Human Beings: Ethics in the Internet of Things", 2012. http://www.theinternetofthings.eu/justin-mckeown-human-beings-and-being-human-ethics-and-internet-things.

Oriwoh, Edewede , Sant, Paul, and Epiphaniou, Gregory. "Guidelines for Internet of Things deployment approaches – The Thing Commandments". *Procedia Computer Science* 21 (2013): 122-131.

Rogers, Yvonne. "Moving on from Weiser's Vision of Calm Computing: Engaging UbiComp Experiences". *Ubicomp* 4206(2006): 404-421.

Spiekermann, Sarah and Pallas, Frank. "Technology paternalism – wider implications of ubiquitous computing", *Poiesis Prax* 4 (2006): 6–18, doi 10.1007/s10202-005-0010-3.

Streitz, Norbert A. "Augmented reality an the disappearing computer", in *Cognitive engineering, intelligent agents and virtual reality,* edited by Michael Smith, Gavriel Salvendy, Don Harris, and Richard Koubek, 738-742. London: Lawrence Elbaum, 2001.

Streitz, Norbert A. "Designing smart artifacts for smart environments". *Computer IEEE Xplore* 38(2005): 41-49. doi 10.1109/MC.2005.92.

Strohbach, Martin, Gellersen, Hans-Werner, Kortuem, Gerd, and Kray, Christian. "Cooperative Artefacts: Assessing Real World Situations with Embedded Technology". *Lecture Notes in Computer Science* 3205 (2004): 250-267.

Uteck, Anne, "Reconceptualizing spatial privacy for the Internet of Things". PhD diss., University of Ottawa, 2013.

Valéry, Nick. "Welcome to the Thingternet: Things, Rather than People, are About to Become the Biggest Users of the Internet". *The Economist* (2012), accessed 21 November.

Weiser, Mark, *The computer for the 21ˢᵗ century.* Scientific American, September 1991.

Weiser, Mark and Brown, John S. "The coming age of calm technology", in *Beyond calculation: the next fifty years of computing,* edited by Peter J. Denning and Robert M. Metcalfe, 75-85. New York: Copernicus New York, 1997.