From Information to Perception

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From information to perception

The new design of the emerging computer technologies and its effects

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Abstract. The aim of the work is to introduce the elements we need to analyse the new emerging digital technologies, focussing on the novelties they introduce.
These new technologies are designed to merge computers into our world by being intertwined with our daily activities and by visualising digital objects in our surroundings.
Computers, while calculators at their inception, have been conceived of as information processing devices, their use as data processing. Today the same technology directly aims to develop a new way of being present in the world. If we continue to use our previous conception of them, too much oriented toward the captured and computed information, we are at risk of loosing the innovative aspects of these devices concerning the way they relate to the users' life.
History shows that the computers' design has evolved and so has the role of these devices in society.
In the second part we will use a phenomenological and post-phenomenological analysis to tackle the novelties these devices are introducing. Especially we will focus on the term "transparent" and we will show how we need to use two different notions of transparency in order to better understand what these devices produce.
Therefore, in conclusion, we will show how we need to think of the possible effects of these new technologies, not in term of the information computed by the device, but in terms of the device's actions in our world. Computers must be something which deeply changes our world by making it literally "digitally" embedded.
New computer technologies are making the "data" perceptual and so the notion of "information" has to be re-framed.

Keywords: Phenomenology, Post-phenomenology, Philosophy of Technology, Wearable Computers, Augmented Reality

1 Introduction

The aim of this work is to introduce the elements we need in order to be able to analyse the new emerging digital technologies, focussing on the novelties they introduce.

The present work finds its reason in the idea we might be so much obsessed with issue like the privacy of our information and our data, that we misplace the focus our research on how the new technologies relate to these aspects. Therefore, we are at risk to be blind to alternative analyses. This work is an attempt to open the door to a different kind of approach which can highlight more urgent aspects of these technologies and the effects they can have on our society.

The work will be structured in two main parts:

1. Section 2 will take into account the recent development of computer devices in order to make clear the new trend that computer scientists are following. In this part we will focus on the main elements which changed during the development of these technologies.
2. Section 3 will focus on phenomenology and post-phenomenology, in order to tackle the novel elements of these devices by following the new features they are proposing. Here we will focus the attention on the term "transparent" and on the meaning of being a transparent technology, in order to understand the path followed by the development of these devices and to identify where to focus for a better understanding of what they bring about.

2 Computers design through time

2.1 "Previous" computers' design

To better understand in which direction we are moving in the field of computer design, we need to identify the kind of development we had in the past in this field. A brief dip into history[1] may allow us to highlight the crucial elements for our analysis, and in fact to call for a phenomenological analysis.

The design of computers changed over time.[2] As late as in de middle of the 1960s Gordon Moore could set the agenda for increasing processing power and memory capacity for integrated circuits as the main target. And indeed he was in a position, viz. key manufacturer of ic's, to make such a prediction, that came to be dubbed a "law".[3]

Western society face incredible blooming times where computers acquired an ever increasing power. Not only did the devices become not more powerful, but even much cheaper. By the 1980 these became available to a wider public, and penetrated the homes.[4] Simultaneously data storage became smaller and cheaper, and the possibility grew of locally maintaining big archives and databases.[5] In parallel, the rapid development of digital communication links made

[1] A more detailed analysis would require much more space than a section of an article.
[2] Cf. [5] or [6].
[3] See [27] and [19].
[4] According to the U.S. Census the use of computers from 1984 to 2011 rise from 8.2% to 75.6% ([34]).
[5] "Technology pundits applaud this "substitution of bits for atoms" associated with digital technologies and suggested that the 'future,' will be fueled by some vague and ideal sense of digitality" ([8, p.94]).

possible the creation of a digital communication network system, connecting nodes geographically spread around the globe, allowing the rapid exchange of huge amounts of information worldwide. It was possible to have a digital net touching and connecting every single element of our everyday world.[6]

The computer was therefore at the same time an instrument to access this massive and ever increasing power and a door to enter a huge underlying digital world.

This main idea can be easily found in the cyberpunk movement as witnessed in novels written by William Gibson in the 1980s, where the characters would immerse themselves into a cyber digital world created inside the computers.[7] The protagonist were able to create this digital electronic *second world* ruled by bits of information. Therefore, even if virtual reality was technically not advance enough to make it perceptually evident – because, for example, the head mount display, at that time, was not so advanced as the cyberpunk movement would have loved –, it was an immersion in a second, different world.

Computer design had ny that time shifted from a single big computer (*mainframe*), with many distributed terminals, to a multitude of smaller devices. Computers became "personal". Everyone was able to have a computer in one's own apartment. The computing power became available to everybody. However, even if they became accessible from the private space of their own apartments, these devices were still related to the idea of a door to enter this digital new world. The "only" difference was that everyone had their own private entry point. Therefore, even if the availability of personal computers is a quite important element for their distribution among people and it changes its use, it merely change the idea of the computer as an access to another second digital world.

However personal the computer, storing and processing data remained the dominant activities of the new devices. The main innovation provided was the possibility of creating this digital framework and the capability of fast and efficient digitisation of most of the elements of our world. The attention of the designer (and of the users) was chiefly oriented towards the data involved in such a process and in the way of being rapidly processed by the devices.

Yet, this is just one aspect of these technologies an captured by Moore's prediction exponential growth of computing power.

2.2 The new computers' design

The present development of computer has ceased to follow this trend.

First of all, in the previous generations of computers progress and innovation was defined in therms of increasing the computing power. Today, the fit of Moore's law with the actual empirical data is problematic.

[6] "As for the convergence and globalisation of regional economies, this is only a macroscopic effect of the more fundamental phenomenon represented by the development of a world-wide system of digital communication, through which information can be exchanged anywhere, in real time, constantly, cheaply and reliably." ([9, p.3]).

[7] See [11]; [12]; [37]; [24].

The computers can no longer follow the massive development in the computing power anymore and the trend is rapidly slowing down[8] in spite of industry effort to compensate through the implementation of new nonstandard components.[9]

Secondly, and more importantly, even the very way these technologies were perceived has changed drastically. From being devices used as a door to the digital world and a mean to access the computing power, they began to be seen more as "ubiquitous" and intertwined with everyday life.

Since the 90's,[10] in the heydays of the personal computer, Mark Weiser at *Xerox PARC* at Palo Alto predicted the age of the personal computer was about to end[11] with the sudden change in the design of these devices and their perceived way of fitting in our everyday lives.

Even if the personal computer played an important role in the pervasiveness of these devices, it did not change the mentality of having a special place dedicated to its use. The computers still required attention and an explicit action to use them. With Weiser's idea, instead of being fixed[12] devices requiring a monopoly on the attention of the user,[13] the new devices should have been designed to be invisible,[14] and ubiquitous.[15]

According to this idea the most "intelligent" design for a computer is not the one which forces the subject to use it dragging him into a second digital world where he can perform some actions, but the one which is completely invisible to the subject and which acts in the background.[16] This computer has to allow the subject to focus its attention on the actual everyday life which is running in the surrounding world and not to force him to sit on a chair and to type strings of text on a keyboard or drive a mouse.

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[8] See [13] and [33] on the recent developments on Moore's law.

[9] "But this new phase of Moore's Law – what I call Moore's Law 3.0 and what others in the semiconductor industry call "more than Moore" – may not make economic sense. Integrating nonstandard components onto a chip offers many exciting opportunities for new products and capabilities." ([25, p.35]).

[10] It was present also at the end of the 80s, but the effect was received only in the following decade.

[11] "My colleagues and I at the Xerox Palo Alto Research Center think that the idea of a "personal" computer itself is misplaced and that the vision of laptop machines, dynabooks and "knowledge navigators" is only a transitional step towards achieving the real potential of information technology" ([38]).

[12] Of course as we saw above we have the same situation with mobile devices when they are used as the fixed ones and when they monopolise the attention of the users.

[13] "Unlike virtual reality, ubiquitous computing will integrate information displays into the everyday physical world" ([39]).

[14] "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it." [38].

[15] 'Ubiquitous computing is the method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user" ([40]).

[16] Technology should be in the background as a "part of the environment" ([38, p.1]). See also [21]; [41]; [42].

The device should not be the focal point of the subject, but it should be just silently working, unnoticed, in the back of the scene. For that reason Weiser coined the term "ubiquitous computing" in order to highlight the computer's non invasive way to be present in the surroundings, being part of it.

A classic example of such a device is the smartphone. This device, so important today that someone defined it the 7th mass media,[17] is not only constantly with us, but it allows many various functions to be always active in the background[18]. The smartphones are not therefore mere communication devices which allow you to be in touch with other people, being able to "move" with you. They have sensors which can record the subject's spatial position and track its movements or gather and store other information.[19] These "simple" additional functions are an indication of the power that these devices acquire by being always with us and making us always "connected" with other people, but also being always strictly intertwined with us and with our common activities.

Still, even if the smartphone can be already reasonably considered an "ubiquitous" device, as some of the installed applications work autonomously,[20] without requiring the attention of the subject, the majority of the applications are still calling for a complete subject's attention, or a good part of it. Many of them require a look, often more than a flash, to the screen and the use of the fingers to click on an icon, still a relic of the older keyboard. In too many cases the way we interact with them is still too conscious and definitely too explicit.[21]

A further step in this evolution are the wearable computers. These computers are designed to be so small as to become part of our own clothes or part of everyday objects we are used to use. If the smartphones had just some functions designed to be completely out of the focal point of attention of the subject, these wearable technologies are fully designed to be so.[22]

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[17] See [1]; [2]. Even if Tony Ahonen defined the mobile device as the 7th new mass medium and. not the smartphone, we can think of it as an extension of the mobile devices and so as an extension or an evolution of the mobile phone.

[18] For applications on smartphones working as ubiquitous computing See [3]; [29]; [26].

[19] See the *Apple* App *Health*. "Heart rate, calories burned, blood sugar, cholesterol – your health and fitness apps are great at collecting all that data." (See `http://www.apple.com/ios/health/` accessed December 23 2015).

[20] For example the application *Health* by *Apple* or any other applications working in the background and allowing the device to track the subject life.

[21] For example, it is quite indicative there are campaigns against the danger in using the smartphones while walking because it induces the distraction of the subject who does not pay attention of what happens in the street. See for example, the *au* campaign `https://youtu.be/wEXVZwcld74` (accessed November 24 2015) or the mobile app by *Docomo* which locks the screen of the smartphone if the subject is walking "危険です。歩きスマホ[It is dangerous. Stop using smartphone while walking]" or the famous side-walk in Washington D.C. dedicated to smartphones users which points out the risk in walking while using the device "CELLPHONES: WALK IN THIS LANE AT YOUR OWN RISK".

[22] See [21].

They are designed to be worn by the subject and to be intertwined completely with him by becoming invisible to the eyes and by working even if the subject has no idea of their activity.

There are many different devices which have been already released, or which are going to be put on the market soon:

- watches like the *Apple Watch*,[23]
- rings like the *RingU*,[24]
- and fashion bracialets like the *CUFF*.[25]

Perhaps the most famous one is the *Apple Watch*, which was recently lunched on the market in March 2015.

This device is designed to be active without the attention of the subject and to record peculiar information about their actions and about their bodily inner activities, as the recording of the user's heart beats.[26]

Therefore, the innovations offered by such devices are not related to the mere computing power density, which is at most responsible of their minimal physical dimension, but they are much more related to the way the users interact with the computer and to the way these devices are intertwined with the subject's everyday activities.

Moreover, there is another important innovation related to the interface. The classic personal computer is designed to induce an immersion into the digital world by making the subject completely lost in the activities displayed on the monitor. The concept of cyberspace actually just expands this immersion excluding every kind of spatial limit or physical border. The subject simply immerses themselves in a completely different environment.[27] This simply creates a mere digital duplicate of our world.[28]

This is completely opposite to the goal of having a computer intertwined within the everyday world.

Even in the case of the visualisation of digital 3D objects, the new technologies tend to make an intertwinement between the digital and the real by bring the digital objects into our everyday world. For example, Augmented Reality (AR) allows the subject to directly perceive the digital objects as part of their everyday surroundings.[29]

So, thanks to this technology, it is possible to have 3D objects which start to "dwell" our environment and which are capable of being seen and "touched" by subjects as if they were really part of the everyday world.

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[23] See `http://www.apple.com/watch/` (accessed December 23 2015).
[24] See `http://mixedrealitylab.org/projects/all-projects/ringu/` (accessed December 23 2015).
[25] See `https://cuff.io/` (accessed December 23 2015).
[26] See `https://support.apple.com/en-ap/HT204666` (accessed December 23 2015).
[27] See [7].
[28] See *Second Life*. `http://secondlife.com/` (accessed December 23 2015); [35]).
[29] See [4]; [10].

For example, the device *Spaceglasses* by *META*[30] has a depth camera mounted on the top of the frame which allows the capture the spatial position of the subject's hands. In this way it enables the interaction between the hand of the user and the digital objects when the physical spatial position of a hand gets close to the digital position of the object. Therefore, they manage to create a direct interaction between the subject's hand gestures and the digital objects visualized in front of them. The subject can therefore grab the object, literally stretch it and move it.

Again, as in the previous case, the innovation is not related to the computing power of the devices, but to the user interface and to the way the device is designed in order to merge digital and real world.

For these new devices the way of being in relation with the subjects and the way the subjects live with them are much more important than the actual device's capability of dealing with information.

3 Phenomenology into play

In philosophy, in the case of phenomenology, we had the same kind of shift of attention as well. Phenomenology is not concerned with the "true" nature of an object, but with the way the object appears, the way the subject and the object relate. It does not study the object as the natural sciences, like Physics or Chemistry, do, but it analyses the object starting from the lived experiences of the subjects and how they live in the world.[31]

This shift of attention from "what" is the true nature of the object to "how" it is in relation to the subject describes exactly the actual turn we are facing in the design of the new computer technologies.

In their design the focal point is not the improvement of what is "inside" them such as their computing power, but the focus is on changing the way the subjects act and live with them and so on the way they are related to each others.

Post-phenomenology[32] makes the similarity even clearer because it directly tackles the relation between subject and object, mediated by a technology.[33] It studies the way the subject lives in a world using technologies which is the main interest of these technologies.[34]

[30] See `https://www.getameta.com` (accessed December 23 2015).

[31] See [28].

[32] I identify with this term the philosophy created by Don Ihde which is a phenomenological analysis on technology and how it acts in relation to the subject. See [15], [16]; [30]; [18]; [17].

[33] Phenomenology and post-phenomenology seem to be the the view required to understand this shift.

[34] We are interested in post-phenomenology for its attention on the relations between subject and technology at the perceptual level without focussing on the agency related to these technologies. Thus, even if post-phenomenology focusses on the ethical agency of the technological artefact, we will limit our study to the modification of the perceptual capabilities of the subjects.

Post-phenomenology states it is possible to have a technology which is in an embodiment relation with the subject. In such a case the technology seems to "disappear" and to act in a perfect "symbiosis" with the subject[35] and it produces an action which is the result of a perfect merge between subject and technology. The intentionality of the subject flows freely from the subject toward the object without being stopped by the technology.

Therefore, in this case, instead of having a "perceptual pole" composed of the simple subject, we have a twofold pole composed of subject plus the technology.

$$\overbrace{Subject}^{Percpetual\ Pole} \rightarrow Object$$

$$\Downarrow$$

$$\underbrace{(Subject - Technology)}_{Percpetual\ Pole} \rightarrow Object$$

A pair of glasses is a classic example of a technology which is in an embodiment relation with the subject. The user does not pay attention to the device at all. His goals lay completely outside the technology and he acts and perceives through it without looking at it directly. The focus of the attention is the world around the subject and not the pair of glasses posed on his nose. The glasses, thanks to these elements, are "transparent".

The ability to make the device transparent for the user in order to have a subject who freely lives in the everyday world without caring too much to the technologies acting in it is exactly what researchers are trying to design.

Therefore, it is not a surprise that the design of these new technologies tends to reproduce something very close to a pair of glasses.[36] What the researchers want is what they can already see existing in a pair of classic glasses. Therefore, they are trying to bring these elements to their devices by mimicking the glasses-like design because the "transparency" of this technology is what they look for.

However, we need to go more deeply into the analysis in order to fully appreciate the term "transparency", which seems to be the key element for the embodiment relations in post-phenomenology and for these new technologies.

3.1 On "Transparency"

The "transparency" is achieved thanks to two different aspects, or more precisely thanks to two different kinds of "transparency",[37] and both of them are strictly related to the idea of intentionality we find in Husserl.[38]

[35] See [15].

[36] See *GoogleGlass* (`https://www.google.co.jp/glass/start/`) or *Hololens* by *Microsoft* (`http://www.microsoft.com/microsoft-hololens/en-us`) (accessed December 23 2015).

[37] See [23].

[38] See [14]; [31]; [32].

The first one is related to the way the subject is *directly* intentional toward the object. The technology does not create any kind of duplicate of the "original" object, but it allows the subject to perceive it as if the technology were not there.

For example, we have this kind of transparency when we look through a pair of glasses because our intentionality is not stopped by the lenses. Therefore, even if our perception changes thanks to the modification provided by the tool used, we still perceive the object in front of us directly.[39]

Differently, when we use the smartphone we do not have such a transparency. As we highlighted before, our attention is completely monopolised by the device. If we are looking for information about something around us, we are not directed toward the objects in our world, but we look at the monitor of the smartphone loosing any link with the surroundings.

The second transparency involved is related to the type of "content" the subject perceives. The object perceived through a transparent technology is a perceptual object which does not require any reading capability.[40] This element is quite important, especially with computer technologies because it helps to show how these technologies are not limited to the use of written codes to visualise the output. Even if they use a binary code to compute, they can generate perceptual objects like 2D images or 3D objects which do not require any reading capability by the subjects.

For example, classic glasses are transparent because they do not turn the object into a string of text, but they just change the details the subject perceives of the object. A device which provides textual information, for example, on a monitor is not transparent.

These new technologies are actually following these two transparencies, or at least they tend to do so.[41]

Wearable computers aim to be "active" without being noticed by the subject and without forcing them to expressively direct their attention toward them. They allow you to act in your everyday world without being immersed in any digital world.

Augmented Reality follows this trend as well because it does not try to give the subject strings of text, but it allows the visualization of entire 3D objects as part of the everyday world.[42]

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[39] This transparency is strictly connected to the one described by Ihde. See [15].

[40] This second transparency is closely related to the the one described by Verbeek. See [36].

[41] There are many technologies which are not following any of these transparencies, but they are not the ideal technology and so they are seen by the developers as something transitional, which will be surpassed. Therefore, even if there are devices which do not follow the transparencies, we can still go on in our analysis because they are just prototypes which need to be improved according to these transparencies. See, for example, the case of the ARs and the devices providing textual information instead of 3D objects.

[42] On augmented reality and the idea of transparency and how it works to merge digital and real world See [20]; [22].

The products of the major companies today on the market are moving in such a direction. *Apple* bought *Metaio*,[43] which was one of the leader for Augmented Reality, Microsoft is developing *Hololens*, *Google* developped the *GoogleGlass* and *CardBoard*[44] and now is working on the *GoogleGlass v2*. Moreover, many other companies are moving in this direction.[45]

However, this analysis is not just oriented toward showing how these devices will look like in the near future, but it allows to study these devices starting from their peculiar novelties. It clearly shows that two main points should be taken into consideration when analysing these technologies.

The first kind of transparency shows how the device acts in *this* world and it does not open a door to another world. Therefore, we should not consider them as something which allows us to be connected to data or information because this is the element these devices are trying to avoid. It is not the digitalisation of this world or the capability of having a perfect digital representation of it their most important novelty, but their capability to perform actions in this world.

So we should think of them as acting in this world without any reference to what lays in the digital world of the computer.

The second transparency shows how the effects of these technology has to be taken into consideration starting from their capability of literally producing digital objects in our world. The digital objects they create are not only *here* in this world thanks to the first transparency, but they are visualised as common objects which do not need to be read and comprehended by the subject. Even if there is a large amount of processed data, these data are not to be conceived as string of text, but as perceptual objects. Therefore, we should think of these technologies not as tools which merely manipulate or capture data, but instead as being capable of adding digital objects to this world.

4 Conclusions

The first part of the work shows how the development of computer technologies is actually moving toward the intertwinement of digital and everyday world, by making the devices more transparent.

The second part shows in what this transparency consists and how we should analyse these technologies, following the novelties they are introducing.

Therefore, if the analysis on the information and data were quite efficient in the past because it tackled the most important novelty of such devices which were the enormous and never-ending increasing computing power, now we should turn our attention towards a more phenomenological point of view because it allows us to understand the novelty of these technologies in a better way, by focusing on the way they interact with the subjects.

[43] See `https://www.metaio.com/` (accessed December 23 2015).

[44] See `https://www.google.com/get/cardboard/` (accessed December 23 2015).

[45] See, for example, *Intel* with the project *Real Sense* (`http://www.intel.com/content/www/us/en/architecture-and-technology/realsense-overview.html`) (accessed December 23 2015).

Of course data and information are still quite important, especially with devices which are so pervasive that can track every moment of our life. However, they are not the main element of the development and so they should not be taken as the main element of our analysis as well.

We can ask ourselves if it is so important the fact that we are always connected to a network, which constantly acquires and stores data, and if the question about the of our data is the sole important element to be studied with these devices.

Maybe they are doing something more than "merely" capture our personal information like ubiquitous lurking entities.

Our world becomes digital not because computers create a digital entities underlying it, but because it directly becomes part of it by being intertwined with our common activities and by producing perceptual digital objects around us.

The world is literally becoming digital.

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