

Enhanced Causation for Design

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Abstract

This paper presents a philosophical overview for the field of design in general, and interaction design in particular. Based on the selected but important and influential philosophical theories, we argue for a hermeneutic position grounded in phenomenology. The popular view of Cartesianism is criticized due to its limitations, and the four causes of Aristotle are introduced to overcome those limitations regarding the academic demands of design. Phenomenology is presented as an alternative position. Thrown-ness into this world ('being in the world') is the basic assumption on, which any (interaction) design starts from a first person view to change our environment in a conscious and responsible manner.

Keywords

Aristotelian Causes; Cartesian Anxiety; Interaction Design; Phenomenology; Technology, Thrown-Ness

Introduction

For a very long period, Aristotle's *Physics* (Aristotle, 2008 (first 350 BC)) was the foundation to study natural sciences. Aristotle began with an analysis of change, which introduces us to the central concepts of matter and form. Next he moved on to an account of explanation in the sciences and a defense of teleological explanation. After this he turned to detailed and important notions of continuity, infinity, place, time, and void. He ended with a profound argument to show that the changes we experienced in the world demanded as their cause of a single unchanging cause of all change, namely God as a divine concept ('the cause without a cause').

The dominant paradigm in modern science is *logical positivism* (or also known as modern empiricism), and the implications of this philosophy for research methodology have been already intensively discussed (see (C. J. Thompson, Locander, & Pollio, 1989) (Bauer, 1987)). Logical positivism seeks to determine the *truth* of claims or statements. It has already noticed that a broader set of assumptions underlies the use of positivist methods. These meta-assumptions can be understood in the more global philosophical position as *Cartesianism* or *rationalism*. We do *not* refer or discuss the Chinese philosophical assumptions (Wang & Nakatsu, 2014). Some of the most fundamental ideas in Cartesianism mainly focused on the separation between *mind* and *body* (Crane & Patterson, 2012); it is also assumed that *reality* must be deduced and then described in mathematical terms (Rauterberg, 2008). The understanding of Cartesianism determines the way in which science is supposed to be executed today (Reiser, 1936) but also has to face its limitations (Sheldrake, 2012). Going back to Aristotle and passing by the long philosophical history, we can describe and hope to explain the main deficiencies of our modern view on science and the possible options to overcome these recognized limitations by incorporating design as a holistic approach towards nature. Although humans achieved in modern and highly industrialized countries the situation that we are surrounded by design artifacts, and nature as such hardly exist anymore (Van Mensvoort, 2011), it still makes sense to assume that nature as such exists. If it comes to design as an academic field, we have to 'explain' how design works and what kind of reasoning is adequate (Dorst, 2011). But as long as we try to answer those questions in the constrained framework of Cartesianism and rationalism, we will not be successful. Therefore we believe we have to enlarge our concept of causation by going back to what we already had a long time ago but forgot.

The Cartesian Anxiety

Kant (1855) required that we should frame the epistemological problem in an entirely different way. The crucial question is *not* how we can bring ourselves to understand the world, but how the world comes to be understood by us. This is a very interesting perspective, because Kant operated on the assumption that we as humans are capable of this; but how can we be assured of this? Kant described two concepts: (1) analytic *a priori* judgments include all merely logical truths and straightforward matters of definition; they are necessarily true; (2) synthetic *a priori*

judgments are the crucial cases, since only they could provide new information that is necessarily true. Analytical judgments can only be provided in a formal system and could be seen as a kind of tautologies (i.e. we cannot get more out of our axiom system than we put in from begin on; although we normally do not fully understand upfront what we put in; this holds also for most by humans designed artifacts in a broad sense). On the other hand, synthetic judgments create something out of nothing, and this is still difficult to understand (Copan & Craig, 2004).

The lack of an *undisputed foundation* of our being (i.e. science lost its ‘cause without cause’, and tried to recover by coming up with the ‘big bang’ as starting point for our universe (Linde, Linde, & Mezhlumian, 1994)) is called by Bernstein the *Cartesian Anxiety* (Bernstein, 1983). Even though this anxiety began long before Descartes’ “*cogito ergo sum*”, he argues that the ‘grand Either/Or’ is most clearly set forth:

“Either there is some support for our being, a fixed foundation for our knowledge, or we cannot escape the forces of darkness that envelop us with madness, with intellectual and moral chaos” ((Bernstein, 1983), p. 18).

Bernstein’s book substantiates how we must eliminate this Cartesian Anxiety without falling back into religious beliefs in divine concepts (like Aristotle). To face up to this dichotomy is to expose it and argue against its plausibility or appeal as a focus of our lives (Günther, 1954). This movement beyond must follow the path of post-empiricist philosophy of science, of philosophical hermeneutics, of praxis, and end with the injunction that we must seize the “dialogical character of our human existence” ((Bernstein, 1983), p. xv). To expose and overcome the anxiety is a practical task of conversation and communication or of the need to “cultivate dialogical communities” ((Bernstein, 1983) p. xv). This is a task to which Bernstein has made a major contribution. We should acknowledge and accept our *thrown-ness* into this world and try to understand, accept and live with (Winograd & Flores, 1986).

The Four Aristotelian Types of Causation

The Aristotle’s four causes are closer to being *be-causes* since they are usually thought of as the reasons or explanations for things (Hocutt, 1974). The presented example of the four causes is what is needed for the building of a house. A house is built *by* the craftsmen, *from* the raw materials, *into* the form shown on blueprints, *for* the homeowner to live in (see Figure 1). This example is concerned with the *making* of something. Final and formal causes have been abandoned since the beginning of the scientific revolution. Sir Francis Bacon claimed (Bacon, 2000 (first 1620)) that the only scientific reasons for things were the material and efficient causes. For materialism it was coined as *matter in motion*. Aristotle thought that matter could exist in *space*, and motion in *time*. But what shall we do with form or finality? We will discuss each Aristotelian ‘be’-cause separately which is as close as possible to its original meaning. At the end of each, we provide also our interpretation, which can be fed into the philosophical foundation for interaction design.

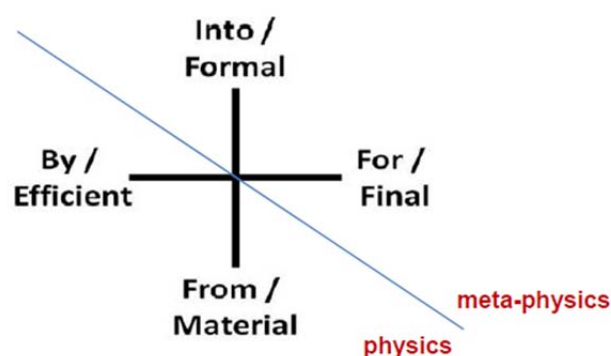


FIG. 1: THE FOUR ARISTOTELIAN CAUSES: EFFICIENT, MATERIAL, FINAL, AND FORMAL CAUSE (ADAPTED FROM (THE-KUBRICK-THEME, 2010)) AND THE FUNDAMENTAL SPLIT IN PHYSICS AND META-PHYSICS BY SIR FRANCIS BACON (2000 (FIRST 1620)).

The Efficient Cause

An *efficient cause* is the fundamental mechanism that causes changes and motion (i.e. to start or stop, accelerate or slow down, create or destroy, etc.) of objects (‘that *by* which something is made’). An efficient cause is the agent that initiates a change or brings a thing into being. Mostly, this is simply the force that brings something about (Wikipedia, 2014).

The efficient cause is the force, mechanism or agent immediately responsible for bringing this form and that matter together in the creation of a thing. Thus, the efficient cause of a product-service-system (PSS) would include the designer, engineer, and other workers who used specific materials to build the PSS in accordance with the blueprint for its construction. Clearly the PSS would not be what it is without the workers' contributions (Kemerling, 1997).

Our interpretation: The most appealing interpretation in this whole quartet of causes is the mainly accepted 'cause-effect' interpretation in its broad sense. A *cause* can be anything which influences the being of another thing; the last one is called *effect*. A *principiant* or *principle* is that from which a *being* originates or proceeds in any way. According to Coppens (Coppens, 1891b) it may proceed from it: A) *Logically*, as the conclusion does from the premises in reasoning. B) *Physically*, by deriving physical being from the principiant. It may happen as follows: (a) the principiant may produce it, e.g., a plant producing fruit; (b) the principiant may be one of its constituent elements, as a wheel is of a clock. A principiant is always prior to that which proceeds from it, in one of two ways: (a) in *time*, by existing sooner; (b) by *nature* only, when one being produces or constitutes another without existing before it.

The Material Cause

The *material cause* of an object is equivalent to the *nature* of the raw material out of which the thing or object is composed ('that *from* which something is made'). With other words, the material cause is the basic quality out of which the things are made. Aristotle applied the word *nature* to both (1) its potential in the raw material, and (2) its ultimate finished form. In a sense, this form already existed in the material (Wikipedia, 2014).

The material cause of a PSS, for example a house, would include the bricks, wood, metal, glass, and other materials used in its construction. All of these aspects belong in an explanation of the house because it could not exist unless they were present in its composition (Kemerling, 1997).

Our interpretation: Aristotle could not think of matter without a particular form attached. Due to the developments in chemistry, we can now understand matter without this constrain. The periodic table (Mendelejew, 1869) describes and classifies all elements of which matter is made, and even more, we can now create new kind of matter by combining elements. The material cause is therefore the matter out of which any being/thing is made. The quality of the chosen matter determines the being/thing next to all other causes. This interpretation of matter excludes any *immaterial* quality (e.g. knowledge, information, minds, etc.) of being a material cause. However, since the famous Einstein's formula $E=mc^2$, we have to include different types of energy in this category of material causes, i.e. mechanical, electricity, thermal, kinetic and potential energy, etc. (E. Wikipedia, 2015b). Ongoing research tries to explore fundamental concepts of matter and information in current physics, biology, philosophy and theology with respect to the question of ultimate reality (Davies & Gregersen, 2014).

The Final Cause

Final cause, or *telos*, is understood as the inherent final purpose (i.e. end, aim, or goal) of the phenomena under investigation ('that *for* which something is made'). This Aristotelian cause is also one of the most controversial types of cause in modern science, because *telos'* causal effects work from the future back into the presence. One could argue that Aristotle's conception of *nature* is teleological in the sense that he believed, and that nature as a whole, has *telos* apart from those humans have. This is possible, because Aristotle thought "that a *telos* can be present without any form of deliberation, consciousness or intelligence" (Wikipedia, 2014).

A lot of scholars thought and still think that one of Darwin's main accomplishments was to provide biology with a *non-teleological* explanation of adaptation. However, quite a lot of Darwin's closest biologists, and even Darwin himself, would probably not agree on that. Darwin saw selection explanations of adaptations as *teleological* explanations. The confusion in the last centuries about Darwin's attitude to teleology is argued by Lennox "to be a result of Darwin's teleological explanations not conforming to either of the dominant philosophical justifications of teleology at that time" (Lennox, 1993). This is one view to argue that Darwin brought back the concept of teleological causes on the scientific agenda!

Our interpretation: The *final cause* is the purpose or the end *inherent* in a particular action; e. g., when a person exerts himself to acquire fame, the acquisition of fame is a true cause of his exertion. The goal itself aimed at, i. e., fame, is the final cause *effectively* considered; the acquisition of this fame is the final cause *formally* considered

(Coppens, 1891a). We could go even further, when “retroactive effects of a subject's present mental effort on a previous random event” can be observed and seen as a form of ‘non-causal’ lawfulness (Schmidt, 1993).

The Formal Cause

Formal cause [eidos] is a term describing the form or pattern that makes *matter* into a particular type of thing, which we recognize as *being* of that particular type (‘that *into* which something is made’). This particular cause is Aristotle’s continuation of Platon’s world of ideas because Aristotle had to distinguish this form from the form given in the material cause (Wikipedia, 2014). The formal cause is the pattern or essence in conformity with which these materials are assembled. Thus, the formal cause of our exemplary product would be the sort of thing that is represented on a blueprint of its design. This is also part of the explanation of the PSS, since its materials would be only a pile of plastic, etc. if they were not put together in this particular way (Kemerling, 1997).

Our interpretation: After we separated matter and form, we can now say that the form *is* the formal cause, which specifies the matter to become a particular being/thing. A form exists in two ways: (1) *Substantial* if the form makes the very nature of the being and cannot be removed without changing the nature of this being; (2) *Accidental*, if the form can be removed or changed without affecting the nature of the being (Coppens, 1891a). If we design a table, there are substantial form aspects and accidental form aspects; if we take the substantial aspects (often called ‘function’) away, the table will not be a table anymore. If we take the accidental aspects away (often called ‘style’) the table still functions as a table but with changed appearance. The substantial form of a PSS is also called the essence.

Discussion and Conclusion

As we have argued, the four different concepts of causation have their adequate places in the foundation for design of interactive products and systems. Although the original interpretations from Aristotle are not directly applicable any more, the clear distinction of those concepts is still valid and useful. Buchanan introduced as an external view the four elements of a product: (1) manner, (2) materials, (3) function, and (4) form (Buchanan, 2001). He motivates these four elements because “the new perspective on products deepens our concern for, and understanding of, the nature of form” by arguing that ‘form’ should not be understood from an external view but from an internal view: “form as a synthesis of what is useful, usable, and desirable.” Now, form becomes dynamic and contextualized (Rauterberg, Salem, & Mortel van de, 2005). Hence, interaction design is a dynamic form giving in a particular context of use! Designing the dynamic form is not only in three spatial dimensions but also has to include the fourth dimension ‘time’. “Time is clearly one of the most important features of the new understanding of products” (Buchanan, 2001). Some of the remaining questions are: how can we capture and describe those dynamic forms; how can we ‘sketch’ our ideas if they are dynamic and fluid; and finally how can we design for these complex, volatile and transitory new dynamic forms? (Feijs, 2006).

To introduce and discuss causation which makes only sense if there is something to be caused! From the very beginning, any kind of philosophy tried to address this ontological question and several answers were provided. Ontology is the branch of metaphysics that studies the nature of existence or being as such. But how do we know what exists? This first person perspective to reality is of utmost importance not only for philosophers and physicists but also for designers and their designs. Several decades ago, this particular aspect – the inherently intertwined-ness of ‘observer and observed’, ‘designer and artifact’, ‘human and technology’ – was already discussed by Everett for the ‘observer’ in quantum mechanics (Everett, 1957) (see in particular the ‘Copenhagen Interpretation’ of quantum mechanics (Bohr, 1928)), and by Bateson and Mead about the foundations of Norbert Wiener’s cybernetics (Brand, Bateson, & Mead, 1976): Design from outside or from inside the ‘box’? Bateson and Mead stated that every engineer and designer should design from *inside the box*! Now we are bounced back to our actual situated-ness with all accompanying responsibilities and *no* escape at all from this. What does this grounded-ness mean to us?

Recent works in philosophy, linguistics, and cognitive psychology have argued that cognitive processes are ‘embodied’, i.e., grounded in our bodily experience with the environment (Wilson, 2002). In this view, the sensory and motor activities of the body are important determinants of human cognition, which in turn shape the structure and use of language (Lakoff & Johnson, 1999). This effect in general is called ‘embodied cognition’ (Wilson, 2002). Pfeifer and Bongard (2006) could show that thought is tightly constrained by the body, and at the same time enabled by

this body. We are thrown into this world and directly connected to our environment, through all our senses and metaphorical interpretation schemata. We cannot escape from this (even death might just be another, although radical transformation of our relationships to our environment).

In the past, Jaspers and Heidegger expressed their concerns that technology alienates us from ourselves and from our environment. This concern is debated and vivid till today. But based on the works of Ihde, Latour and Borgmann, Peter-Paul Verbeek presented a modern view how artifacts are reflecting our culture but at the same time shaping our existence and experience (Verbeek, 2010). We have to understand that artifacts are the results of certain creation and production processes which are by themselves culturally determined. These kinds of production processes can also be discussed under the umbrella of 'technology'. "We must understand that there are four major types of these 'technologies' with each a matrix of practical reason: (1) technologies of production, which permit us to produce, transform, or manipulate things; (2) technologies of sign systems, which permit us to use signs, meanings, symbols, or signification; (3) technologies of power, which determine the conduct of individuals and submit them to certain ends or domination, an objectivising of the subject; (4) technologies of the self, which permit individuals to effect by their own means or with the help of others, a certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform themselves in order to obtain a certain state of happiness, purity, wisdom, perfection, or immortality" (Foucault, 1988, p. 18). The most promising view on technology in general and artifacts in particular is that these artifacts are 'prosthesis' of our shortcomings as human beings. After our birth, we as human beings are the most unspecific species on earth in terms of skills and knowledge, we have to be educated for many years before becoming a productive and responsible member of society; on the other side, this enables us to be open-minded, inventive (i.e. because we have to), and at the end highly adaptive. Humans are extremely inventive to overcome all our shortcomings; the best phrasing is that we design permanently new types of *prosthesis* to enrich our life (De Preester, 2011). Design in general, and technology in particular is in its essence 'prosthetic design' (Clark, 2005). All these kinds of 'prosthesis' enlarge the scope of our meaningful relationships to our environment (L. Thompson & Cupples, 2008).

"Humans do not see and act on the physical qualities of things, but on what they mean to them" (Krippendorff, 2006).

Accepting this view, we can conclude that technology is part of our 'curtain's fabric', our ways to relate to our world because it is a constituent component of this world. But why was it so difficult to understand this very important insight?

Implications for Design

In this section, we go into the consequences of the above section (the-four-Aristotelian-types-of-causation and about-causation-and-ontology) for design. We rephrase our findings in practical terms and illustrate them by examples from the field of design. We adopt the common definition of design *as the creation of a plan or convention for the construction of an object or a system* (Wikipedia, 2015a). This includes industrial design, architecture and interaction design. From the above section, we take the idea that objects and in a more general term product-service-systems (PSS) have also a cause which lies in the future. From last section, we conclude that technology and design not only shape the world, but also shape the way we perceive the world. Moreover, we are *thrown into* this world in which we have to *act*. We shall argue that these ingredients constitute the basis for increasingly important tasks for designers: (1) raise awareness to the Final Cause of things and (2) give priority to Action.

In Interaction design, as a sub-discipline of contemporary Industrial Design, it means that the actions implied by an artifact are more important than the static properties of the artifact. Action is considered very important for the design work itself. This is also why several scholars in design adopt more action-oriented definitions of design, such as the definition by Herbert Simon as

"the process by which we devise courses of action aimed at changing existing situation into preferred ones" (Simon, 1998),

which is also adopted by Ken Friedman who begins his paper by the statement that

"design involves solving problems, creating something new, or creating less desirable situations to preferred situations" (Friedman, 2003).

Therefore, *Reflection on action* is becoming a central paradigm in the Interaction Design community (Schön, 1983).

We shall explain more about this in the section below. At a larger scale, it means that designers create visions of the future, raising awareness for the long term and global consequences of human actions and technological developments. We begin with the global perspective.

Actions for Global Design

First, we discuss the idea that any PSSs have also a cause which lies in the future. We are used to traditional cause-and-effect relationships in design, where the cause lies in the past (efficient cause) or in the present (material cause, formal cause). For example, we can describe a fluorescent lamp and say that the ultraviolet light causes a phosphor coating on the inside of the bulb to glow. The same can be done for undesired cause-and-effect relationships, like if we say about injection molding that the split of the mold into two halves can cause parting lines or flash lines, or when we describe a car engine and say that carbon deposits may cause internal engine knock. This is the kind of cause-and-effect relationships adequately described by the laws of physics.

If we say that the cause of a PSS lies in the future, we refer to situations where humans use objects, services and systems to achieve certain goals. Axes are made to chop trees and hammers are designed for people to hammer nails into wood. It is because we want to get nails into the wood, we will buy a hammer. That is why the hammer is designed in the first place. Chairs and tables caused the hammer, the nails, the glue, etc. to be created. It is the power of human imagination, seeing potential, serendipity and experience, and human cooperation, which make this kind of final causation possible.

When humans managed to make more sophisticated tools and eventually entire systems of tools during the industrial revolution, science and engineering were developed and cultivated to improve the efficiency of the tools, which is what brought us microscopes, telescopes, guns, steam engines, telephones, cars, factories, atomic bombs, radios, helicopters, televisions, satellites, power plants, computers and so on. In view of the great economic success of these development and in view of the great power obtained by the communities having access to these tools, the positivist rational thinking of science and engineering has become the dominant paradigm for thinking about the artifacts in our lives and about their design. This is the paradigm which deals with the efficient cause, the material cause, and the formal cause. But amidst these successes, we almost forget that there is no absolute third-person perspective truth, only a sophisticated technology-mediated lens to see the world. And we almost forget that it is human desire and human imagination that set the direction of the future that causes new things to come into existence.

For several centuries we could live with the impression that there is a big uncharted, unexplored territory to be discovered and that these "objective" discoveries could be exploited for human fruit and benefit. This was most clear in the sense of explorers such as Christopher Columbus, Marco Polo, Vasco Da Gama, David Livingstone, Henry Morton Stanley, and many more, but by now the whole world surface has been charted. There are still things to be discovered deep inside the earth and in the ocean, in chemistry, in physics and biology but the simple growth model is gradually reaching its limits. It is not just that there is no more uncharted territory, but natural resources turn out limited, and pollution has to be taken into account as well. One clear signal of this understanding was the first report to the Club of Rome in 1972, which includes as one of the conclusions that

"if the present growth trends in world population, industrialization, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years." (Meadows, Meadows, Randers, & Behrens, 1972).

There is a task here for designers: both to visualize possible futures with the effect of raising awareness and stimulating debate, *and* to design objects and systems that are caused (in the sense of Final Cause) by a strong and beneficial vision of the future (e.g. striving for sustainability). A good example of such a designer was Richard Buckminster Fuller (1895-1983). In his book *Operating Manual For Spaceship Earth* in 1969, he emphasizes that the earth is one limited and connected place, a kind of mechanical vehicle which has to be sustainable in itself. For example he writes: "The fossil fuel deposits of our Spaceship Earth correspond to our automobile's storage battery which must be conserved to turn over our main engine's self-starter. Thereafter, our 'main engine,' the life regenerating processes, must operate exclusively on our vast daily energy income from the powers of wind, tide, water, and the direct Sun radiation energy."

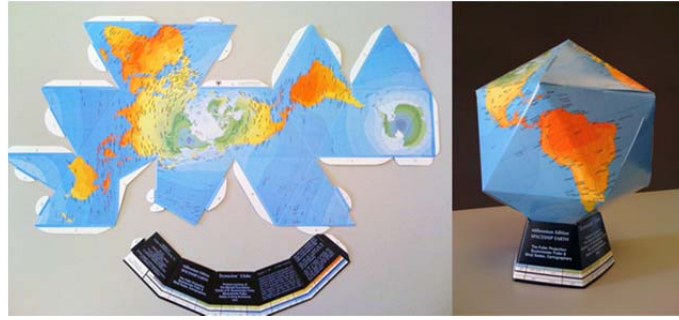


FIG. 2: DYMAXION AIR-OCEAN WORLD MAP 1954 FINAL VERSION FOR AN ICOSAHEDRON, WITH FOLDING LINES. [FREE DOWNLOAD FROM [HTTP://COMMONS.WIKIMEDIA.ORG/WIKI/ FILE:FULLER_PROJECTION_ROTATED.SVG](http://commons.wikimedia.org/wiki/File:Fuller_projection_rotated.svg)]

In the decades before that he had already created several inventions which he considered them part of a more general project to improve humanity's living conditions. He called several of them Dymaxion (dynamic + maximum + tension). The Dymaxion house was meant to be mass-produced, affordable, easily transportable and environmentally efficient. The Dymaxion car was designed in 1933 with light-weight materials, based on aerodynamic principles, and aiming at fuel-efficiency. His Dymaxion map (1943) and later his Airocean World Map (1954) considering the inevitable breaking lines of the map are put into the oceans (see Figure 2), so the map highlights the connectivity of the continents, highlighting is earlier "one-town world" view. The wish for, and the vision of a more sustainable world in which cars and houses are energy efficient is the main (final) cause for this car, this house, and this map. Buckminster Fuller had to study principles of geometry and invent new geometric principles in order to create this map.

It is also remarkable that the Dymaxion map was designed with the purpose of showing the connectedness of the world, in other words that it was a deliberately designed tool to present a certain vision. At the same time, the positivist language referring to "truth" is used in the patent description:

"It is an object of my invention to provide a sectional map of the world, or of a portion of its surface, which is so constructed that its parts can be assembled to give a truer over-all picture of areas, boundaries, directions and distances than is possible with any type of plane surface map heretofore known." (Buckminster Fuller, 1946).

Also note that Buckminster Fuller did not only write about his vision of the world and its future, as an active designer he took action by designing objects and systems and have made them realized, even if his actions were only steps in the right direction.

Now we discuss a second example of a designer who presented visions of possible futures and who also used his talent as a designer and as a leader of design teams to take actions towards such future: Stefano Marzano. In his own words:

"But it is not technology that determines human destiny, but rather people themselves, in how they decides to use this technology. The future does not just happen by itself. It can be influenced by those who are prepared to shoulder the responsibility of making decisions today. Inaction is also action." (Marzano, 1992).

In these sentences the reader recognizes the thrownness and the primacy of action. Marzano always had the presentation of visions accompanied by actions of his design team, also used as a tool for innovation inside the company he worked for (mostly Philips). The results of the actions were published in booklets such as *Flying over Las Vegas* (Marzano, 1992), *La Casa Prossima Futura* (Marzano, 1999), *New Nomads* (Marzano, Green, Van Heerden, & Mama, 2001), *Seeds for Growth* (Marzano, 2008), and *A vision on healthcare in 2050* (Marzano, 2009). Each of these speeches, reports or booklets contains a collection of envisioned or even worked-out design proposals, most of which are not ready for production yet, but some of which would give rise to more practical products later, which *did* get realized. He clearly stated: "The future is made by those who take responsibility for it today" (1992).

Actions for Interaction Design

In interaction design, the concept of affordance has got a central position. Instead of considering the meaning of an object to be given by a semiotic code, the meaning of an object is more and more often defined as the action possibilities afforded by the object (see Figure 3). The basis for this has been laid by the ecological perception of Gibson

and the philosophy of Merleau-Ponty. It has been picked-up and put to use in design by Norman (1996), Hummels, Smets, Overbeeke (1998) and others. And with the shift from static aspects of meaning to dynamic aspects of meaning comes a shift from static aesthetics to dynamic aesthetics.



FIG. 3: MUJI JAPANESE TABLEWARE / TEA SET, MUG BY MASAHIRO MORI (2004): THE HANDLES PROVIDE AN AFFORDANCE FOR INDIVIDUALS WITH HANDS. (FREE DOWNLOAD FROM [HTTP://COMMONS.WIKIMEDIA.ORG/WIKI/FILE:2004_MUJIWANOSYOKKI-TEASETMUG_MASAHIRO-MORI.JPG](http://commons.wikimedia.org/wiki/File:2004_mujiwanosyokki-teasetmug_masahiro-mori.jpg))

The beauty or ugliness of a design proposition appears during the interaction with it: fun and playfulness are getting more and more attention (Blythe, Overbeeke, Monk, & Wright, 2004). A good example is the alarm clock designed by Stephan Wensveen, which offers multiple degrees of freedom so that the user can also choose between different interaction styles and can add his/her own aesthetic qualities to the interaction as such (Wensveen & Overbeeke, 2004).



FIG. 4: A TEACHER IN ACTION DURING A DESIGN COURSE AT IDI IN ZHEJIANG UNIVERSITY IN HANGZHOU, CHINA. (PHOTO FROM ZHEJIANG [HTTP://WWW.IDI.ZJU.EDU.CN/BLOG/2011/11](http://www.idi.zju.edu.cn/blog/2011/11))

The idea of giving priority to action also applies to the designers themselves. It is something in which design differs from many other disciplines, where the mainstream development of the past decades was to put more and more knowledge into the language of the computer. As Lyotard wrote:

"We can predict that anything in the constituted body of knowledge that is not translatable in this way will be abandoned and that the direction of new research will be dictated by the possibility of its eventual results being translatable into computer language" (Lyotard, 1984).

There is a movement in design which rejects this idea since it would weaken not only the aesthetic and multi-sensorial sensitivity of the designers, it would also weaken their readiness for action. A good example of this arises in designing for rich interaction (Frens, 2006), where both low-fidelity and high-fidelity prototypes are made to explore the aesthetic qualities of the interaction. In particular the card-board models are hand-made and the fact that the designer makes them, touches them and plays with them in his or her own hands adds to the designer's understanding of the affordances and the aesthetic qualities. In (Frens, 2006) Frens offers a framework for exploration

which can be used to design for rich interaction. The late Kees Overbeeke formulates it very clear in (Ross, 2008) when he describes the choice for the name of his group “Designing quality in interaction” as follows: “We thought for quite a while and finally chose this title because of the focus on aspects such as intuition and the quality aspects of the designing itself. It’s about the actual, physical part of the design.” This puts extra demands on the studios and education schools and departments where Interaction design is done. In an internal advisory report of the Department of Industrial Design at TU/e, one of the recommendations was:

“‘Making for exploration’ asks for accessibility, even leading to the conclusion that for productive design work the workspace should coincide with the making space. It asks for a change in mindset, as students and staff should realize that we are not designing in our minds at our workplace only to implement those ideas in a different location. Instead we are designing with our hands as well as our minds and that should be in the comfort of our design studio.” (Feijs et al., 2013).

It also means that teachers should not assume that classical lecturing conveys the right attitude or skills. We believe that the teacher should also show his willingness to use his own hands, engage in actions instead of conveying words only. In Figure 4 we see students and teachers in action during a course on Integrating Technology for Intelligent Products, Systems and Services at the International Design Institute (IDI) in Zhejiang in 2011. Rather than just teaching knowledge, the teachers of the Industrial Design department of TU/e feel it is often better to convey knowledge, skills and attitude together. The question is not whether the teacher is very good in cardboard modeling; the point is that he *does* cardboard modeling.



FIG. 5: WORKSHOPS ON INTERACTIVE PATINA OF CULTURE ORGANIZED BY TU/E DESIS LAB IN TAICAN, JIANGSU PROVINCE IN NOVEMBER 2014. CHINA. (PHOTO FROM JUN HU’S FACEBOOK PAGE)

Closely related are the workshops on Interactive Patina of Culture (IPoC) organized by DESIS Lab of Technische Universiteit Eindhoven (TU/e), such as those IPoC workshops by Jun Hu, Mathias Funk and Yu Zhang done in Taican, Jiangsu Province in 2014 and 2015. In Figure 5 an impression is given of the workshop in 2014. We see a combination of screen-based interactive art, projection mapping and scale models of interactive objects being made in a variety of materials such as cardboard and Arduino. For an excellent tutorial on the basics of cardboard modeling, we refer to Frens’ site (Frens, 2012) and for more background information on the IPoC we refer to (Frens et al., 2013) and (Hu, Frens, Funk, Wang, & Zhang, 2014). We mention these workshops because they show how it is possible to translate the philosophical notion of action into practice. In our view, it is not only possible, but it is mandatory. The notion of action appears in several ways which reinforce each other:

- The workshops are not about conveying knowledge but learning happens in a setting where all participants perform all kinds of actions and learn by doing. Development is done in cycles of action and reflection.

- The products, systems, or artworks under construction are not just designed with mental and visual tools, but also by acting out with the whole body, making scale models, experiencing the prototypes, and so on. In this way, the Cartesian separation between *mind* and *body* is less likely to create an unintended bias. The bodily knowledge is used in an early phase and in a direct way (not only reading a book about the affordances for the human hand, but just using one's own hands).

Of course this way of thinking and acting is not easy to accommodate in present-day knowledge institutes (i.e. most higher educational programs). A studio would be easier to manage if all designers just need a computer and the design work would be easier to evaluate if all data are in text and database formats. But we believe it is worthwhile to give priority to action in the real world.

General Conclusions

How can we now utilize on these insights based on phenomenology and alternative hermeneutic view in contrast to Cartesian science? Can we learn something useful for design? Yes, we can! Over the last decades, Overbeeke and Hummels have advocated the following design premises ((2010), p. 2):

"1. Design is about our lives, about our being-in-the-world. Fundamental to this is the sensing of the world as an interactive activity in which experiencing the world is primary to any thinking. Therefore, it is necessary to take a scientific and a philosophical stance. As the basis for our stance, we have chosen Gibson's (1986) theory of perception and Merleau-Ponty's (2002) view on phenomenology. Both of them claim that the world is inherently meaningful on a sensing or experiential level. Intuition and common sense should therefore be high on the agenda. They should be exploited to the maximum. As Voltaire said: 'Le sens commun n'est pas si commun.' Common sense is not so common.

2. Reflection comes second: and it is always a reflection on action. A design theory consequently must be a theory of action and the embodied in the first place, and a theory of meaning in the second, not the other way round. Reflection on action is the source of knowledge.

3. Interaction Design nowadays is about interaction with intelligence, i.e., an interaction with the ungraspable. The ungraspable—and here we are talking mainly about the ungraspable quality of many innovations in electronics —has to be made graspable again. Our bodies are mechanical: all interaction is essentially mechanical, or tangible. We have few other ways to interact with the world. Therefore embodiment is essential.

4. Beauty, and thus beauty in interaction, is an experiential and social given. It is not just a quality of an object. It is the way an object speaks to us, calls us, affords us, puts us into contact with others, is meaningful to us, shares its inner horizon with us. Thus considered, beauty emanates from our unity with the world. It is pre-reflective."

By taking this clear stance, Overbeeke and Hummels expected to combine the rational with the experiential, to reconcile *thinking* (rationality) with *feeling* (intuition). This might not be the only approach (see also (Varela, 1996)), but they and we too believe it is *one* successful way to advance *Interaction Design* towards a truly transformative level, a level that can lead to useful and sustainable innovations and can enable and guarantee our lives worth living.

We tried to resolve the old problem of direct access to nature versus access only through a conceptual layer (representational layer, resp.) by providing two main arguments: (1.) humans are social creatures and have to communicate with each other; this communication can only be done through a conceptual layer; (2.) this conceptual layer is our only way to capture our environment, and this can only be done through a first person perspective.

The most important consequence is that a third person view does not exist: the God's eye view is impossible for humans! (Bauer, 2007) Even more, design is an exceptionally suited discipline to take the lead guiding science into the future where science sets people really free by overcoming established dogmas (Sheldrake, 2012), as any good science did in the past (Beauregard et al., 2014). In a nutshell, we *cannot* jump out of the loop of our 'thrown-ness' into this world! Therefore we have to subscribe to *conscious design*: being aware and acting responsible!

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