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Insidious Side Effects of Design

And How to turn them into values of sustainability in design

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Abstract: The purpose of this paper is to propose a way of using the concept of sustainability in design of technical artefacts. Given the recent efforts in designing a more sustainable environment of the artificial, there is a need for an *explication* of the concept of sustainability as characteristic to the design of technical artefacts. I argue that technical artefacts are designed as sustainable based on the extent side effects are addressed with the design. I present necessary and sufficient conditions in the presence of which the design of technical artefacts falls under the concept of sustainability in design, and argue for the usefulness of the resulting conception of sustainability. The proposed paper is a philosophical approach to a conceptual analysis and as such is aimed at contributing to the epistemology of design.

Key words: sustainable design, side effects, technical artefacts, values.

1. Introduction

Sustainability in design of technical artefacts is a concept richly represented by empirical examples, and explanations are offered in scientific literature about the value of sustainability delivered by design. Technical artefacts tend to be considered ‘sustainable’ whenever they are designed so as to respond to depletion of virgin resources, overload of the Earth’s capacity to absorb wastes (i.e., its biocapacity), and emissions of hazardous pollutants affecting climate change, to mention a few examples. Thus, commonly, sustainability is associated with a positive value delivered by the artefact and this is being considered a sufficient condition for sustainability in design of technical artefacts. My concern is that the aforementioned condition may not be as sufficient as generally assumed. While it certainly seems *necessary* for design to deliver such positive values in order to count as *sustainable*, that in itself is not *sufficient*, as I shall argue in this paper. We appear to have a relatively good mutual understanding of what is intended by the term sustainability. However, the term tends to be informal and the design solutions only loosely correspond to the intentions. Therefore, the concept of sustainability in the design of technical artefacts, I find, needs to be clarified. To do so, I will attempt to *explicate* the concept in terms of necessary *and* sufficient conditions for design of technical artefacts to count as sustainable.

An explication, as defined by Carnap, takes place when we give more exact terms based on logic or empirical explanations to an imprecise and a pre-scientific concept (Carnap 1950:3-8). My aim here is to propose a way we may explicate sustainability in design, and I submit, it directly concerns the extent to which side effects are addressed by design.

2. Effects of Design

The significance of an object is in its properties the effects of which help us to realise our goals. If we perceive technical artefacts as mere physical objects, we are, to an extent, limiting the scope of analysis where visible and easily imaginable characteristics are the defining qualities of an artefact. We then exclude the functions, uses, dispositions to various effects, and lastly values that are willingly or unwillingly attained with the technical artefacts. All these pertain to the technical artefact but are, strictly speaking, not a part of the physical object. Vermaas et al. argue that besides the physical object, the technical artefact is constituted by a function and a use plan (Vermaas et al. 2011). My study particularly concerns the effects afforded by the object; and the object, I propose, renders more than its intended functions and the uses we ascribe to the technical artefact.

When it comes to an analysis of designing artefacts, their functions and structures, their capacities to affect other objects, or their propensity to be affected by the other objects, our understanding is obtained through the powers of properties to cause effects. Such properties are dispositional. *Dispositions* make an artefact what it is (Mumford 1998:9, Groff 2008:2). For a technical artefact to fulfil its intended function, materials and substances with certain dispositions are selected as elements, which then constitute the structure of the artefact. Dispositions afford the effects that endow technical artefacts with their instrumental values, such as the sharpness of a knife, and the permeability of a filter. An instrumental value refers to that intended function which is valuable to the user. The instrumental value remains valuable whether the technical artefact is in function or not, although the value is lost when it no longer has the capacity to perform as intended (also see Vermaas et al. 2011:15). Therefore, the instrumental value is what is obtained as

the ends, and as van de Poel proposes - as the good end with a positive value (van de Poel 2009:980).
Furthermore, dispositions render utility values. Utility values are afforded by properties selected for the technical artefact, which make the artefact useful (and beneficial) besides its intended instrumental value, such as breathable, soluble, hydrophobic or hydrophilic, fire resistant, elastic, durable, biodegradable and so forth. Most, if not all, mass produced artefacts are instrumental and have more than one utility value. So, for instance, bathroom tiles water-proof the walls (their instrumental value) and are also easily cleanable (a utility value); similarly, a window permits natural light into the room while also enabling views and natural ventilation. (A toothbrush, in comparison, has a very simple value profile - it can only be used for cleaning small objects such as teeth).
Dispositions display the true characteristics of a technical artefact and essentially are there to support the specific and purposed utility values of the technical artefacts. It is by recognising the dispositions that we can design artefacts with certain utility values. Unlike the instrumental value, the utilities can remain valuable when a technical artefact is no longer able to fulfil its intended function.

Consequent to the above, I propose to consider the effect which delivers a value and is afforded by a dispositional property a *known desired effect*. To design technical artefacts is to ascribe certain utility values to the known desired effects which contribute to the artefact's instrumental value. This means, the known desired effects deliver certain utility values which are definitive to the characterisation and structuring of the artefact, thus supporting its function.

3. Dispositions and Side Effects of Design

Properties are dispositioned to participate in certain causal processes associable with the particular disposition, and no other way can be expected from the property (Ellis 2008/2002:82). It follows that physical objects, and the elements they contain, are subject to physical laws, and therefore harbour dispositional properties to cause effects irrespective of the intentions of the designer. The object, to put it simply, affords effects which are designed into the artefact, which may or may not be known, or be of any use to the designer, or the user; yet these effects may escape a critical evaluation of the artefact (Franssen 2009:923). Such effects are generally referred to as *side effects*. And side effects, I propose, have everything to do with dispositions.
To support my claims, firstly, dispositions are accepted within the structure of a technical artefact although they are not necessarily desirable properties of the artefact. Properties of such kinds are present in most industrially produced technical artefacts. A wine glass possesses the disposition of fragility, among other properties, but surely we cannot refer

to this disposition as a desirable one. The same applies to the toxicity of the nitrogen dioxide emitted from combustion engines. Another example: an average water flushing toilet is designed to flush up to 6 litres of water per flush of around 0.025 litres of urine. Large volumes of wastewater, without further utility value in this design, are literally produced within the structure of the artefact.
In addition, some dispositions manifest themselves even though the artefact no longer fulfils its function. The materials and substances continue to exist, so to say, without their previous utility values. Plastic containers of short-lived substances such as cosmetics have the power to remain durable even a long time after disposal. The properties of the plastics, irrespective of our needs, manifest their powers when safely holding the cosmetics for us, but just as well when ending up as debris in our landscapes and oceans. Another example of a high environmental impact is phosphorus in water reservoirs around agricultural areas of the Baltic region causing hazardous eutrophication. Common fertilisers are produced containing virgin phosphorus, which is an essential nutrient for a growth of crops and plants. Applied in agricultural fields, the substance eventually leaks into the groundwater and is flushed into larger water reservoirs such as rivers, lakes and seas. The phosphorus is bound to soil particles and therefore is found in abundance in sea beds. There, it promotes eutrophication, which is an oversupply of nutrients inducing a rapid growth of simpler plants such as algae and plankton. When decaying, these simpler plants deplete the oxygen in the water thus significantly impeding the existence of other marine life forms. Thus, the eutrophication reduces the water quality to a level where over time it has become a hazardous element to the regular marine sediment conditions causing the dying of the Baltic Sea. Nonetheless, the phosphorus as a valuable substance is readily available for retrieval from the sea beds, as its utility value is entirely the same as its virgin resource counterpart. With the retrieval process the hazardous eutrophication side effect is also addressed and the water reservoir is revived.

The significance of the above is that when we conceive of the durability of plastics and the nutritiousness of phosphorus as a disposition in addition to perceiving it as merely a desirable property which bears a desired utility value, we recognise a causal model where the plastic, for instance, is dispositioned to be durable also in conditions where we no longer need it to be. (It is this understanding of the properties, I believe, that has led to an integration of the value of sustainability in design.)
Based on the above, in the design of technical artefacts, properties are selected for a purpose of the desired effect *during* the function of the artefact. Any powers of the properties to cause effects other than intended, i.e. which do not serve the functional purpose, may render values or disvalues which wouldn't be considered during the initial process of designing the artefact (for discussion on disvalues see van de Poel 2009). Hence, what then is achieved as a result of the structure having dispositional properties,

is not exactly defined within the conception of the technical artefact. Dispositions, therefore, are a significant point of analysis of technical artefacts and of the relation between technical artefacts and the environments they occupy while in use and after. Dispositions and the effects they afford 'extend' the perceived technical artefact, as conceptualised by Vermaas et al (2011). Technical artefacts offer more than what their design asks for. And what is offered, in some cases might be more significant than what was intended.

To summarise, in addition to the known desired effects afforded by the dispositions, some dispositions are selected by the design of the artefact: however, the effects they afford are suspended from the evaluations of the artefact. These effects I refer to as *known undesired effects*. (This however does not exclude them from being evaluated as waste or by-products elsewhere). Lastly, with regard to the effects, I find, as much as we may attempt to know the causal production of each property, some causal powers we fail to recognise. Therefore properties may generate *unknown undesired effects*. Thus, through the instrumental nature of technical artefacts, what is being made useful carries along both known and unknown side effects.
However, it is particularly the side effects that give rise to ways of seeking solutions through design. As I further explore, artefacts resulting from such design are what we have come to characterise as sustainable technical artefacts.

3. Side Effects and Sustainability

Sustainability, as a general concept, is commonly referred to as a fair treatment of the natural environment and fellow humans of this and the coming generations. As mentioned above, it takes into account the depletion of resources, environmental degradation, an array of pollution hazards, or basically anything that may impede the sustaining of all life on Earth. The way we create the artificial, therefore, has a lot, if not everything, to do with our role in the sustaining. For this reason we have developed several methods to assist in making a more sustainable environment of the artificial. These are, to name but a few of the most recognised, Life Cycle Assessment, DGNB and Cradle to Cradle certification systems, and lately, Circular Economy principles.
Technical artefacts that have characteristics of a sustainable artefact, regardless of the method applied during its design, are usually either instrumental in attaining sustainable ends, for instance renewable energy technologies, LED lights, electrical vehicles, and lately, technologies for object sharing; or having specific structural compositions such as biodegradable, recyclable and reusable elements. And so, those artefacts that are not

instrumental for sustainable goals, or are not structured as characteristic of sustainable objects, are not referred to as sustainable artefacts.

Nevertheless, if not to categorise the different interpretations of sustainability in design, but to pinpoint the common denominator in all such artefacts, we will find that sustainability in design pertains to addressing side effects. A wind turbine is an instrument in addressing the side effects of fossil fuel based energy production, while biodegradable plastics address the hazardous side effect of regular plastics, and so forth. And so, an effect bearing a negative value or a disvalue, is countered with dispositional properties rendering either a positive instrumental or utility value.

3.1 Trade-offs and Value Retrieval

In the design of technical artefacts not all values are equally attainable as these might be conflicting. For instance, the value of a renewable energy producing wind turbine conflicts with the value of biocapacity due to the perdurability of the turbine blades. Therefore, while the functional effect of the wind turbine renders value of sustainability, its structure creates hazards to the environment. Most, if not all, designs unavoidably contain a potential for value conflicts which result in trade-offs. (For a more detailed discussion of value conflicts and trade-offs see van de Poel 2009, and van de Poel and Royakkers 2011). Trade-offs arise where by enabling one desired effect, another effect is maintained that is undesirable.

Trade-offs produce some of the side effects of the design of technical artefacts: those that are known to the designer and in essence deliver undesirable conditions associated with the artefact. These are the emissions and leakages and such kinds. In addition, as considered here, the side effects of artefacts no longer evaluated as usable when consumption cycles are completed are also a product of trade-offs, such as a wind turbine blade, a disposable plastic knife, etc.

In the light of trade-offs resulting in known undesirable effects, how does the instrumental value of a wind turbine justify hazardous dispositional properties of its blades, for instance? The answer lies in the notion of value retrieval. Value retrieval essentially is based on the nature of dispositions, as exemplified earlier by the phosphorus as a nutrient retrieved from sea beds. Since dispositions can afford effects bearing utility values irrespective of intentions of a designer, the dispositions enable new schemes in design attaining new utility values. As such, the notion of retrieval supports minimising the sourcing of virgin resources and a need for production of new materials. Therefore, the value retrieved and the material or the substance returned to consumption cycles add to the characteristics of sustainable technical artefacts.

Based on the above discussion, it would seem that the concept of sustainable design can be captured by the following three necessary and sufficient conditions: firstly, an instrumentality of artefacts in generating a positive value, mentioned earlier as generally considered sufficient for design to be sustainable; secondly, dispositional properties designed into the artefact and endowing the artefact with the specific utility values are helping to reduce side effects; and lastly, equitability of the artefact and all the processes associable with its designing, as the first two categories above would be no good if during design and use harmful side effects are induced to any parties within and external to the particular concerns of the design.

4. Conclusions

With this paper, I have introduced my work thus far in explicating the concept of sustainability. I have aimed to further the studies in sustainability in design by giving a more formal definition of what satisfies the conditions that characterise the concept of sustainability in design of technical artefacts.

I have argued that besides the desirable effects afforded by the dispositional properties of the object, the properties afford effects that are undesirable yet known, and undesirable though unknown. Thus, what is achieved by the structure of the designed artefact having dispositional properties during and post consumption cycles, carries along known and unknown side effects. Side effects stem from properties that are either intentionally or unintentionally suspended from evaluation processes in the design of technical artefacts. In addition, the design of technical artefacts may give rise to value conflicts, which in some cases are resolved with a retrieval of the traded off value.

I propose to characterise the design of sustainable technical artefacts in terms of the extent to which side effects are addressed with the design of the artefact. Based on the considerations in this paper, my initial attempt at explicating the concept of sustainability in design of technical artefacts results in the following definition:

> An act of design of a technical artefact is sustainable if and only if the following three necessary and sufficient conditions are appropriately satisfied:
> (1) Instrumentality of a technical artefact in addressing various side effects present in the artificial environments. The aim here is to replace designs producing unsustainable effects, or to retrieve value from side effects. This condition is satisfactory in relation to technical artefacts which do not fit any of the characteristics of sustainable artefacts. Examples: renewable energy technologies, LED lights, electric vehicles.

(2) Dispositional properties within the structure of the technical artefact afford utility values not necessarily directly associable with the artefact's instrumental function; the dispositions to harbour side effects producing disvalues are addressed. This condition concerns the structural composition of the artefact and the effects rendered by the design of the object. Examples: all recyclable, biodegradable, reusable/ retrievable materials and substances.
(3) The processes associable with the design of the artefact are equitable towards the natural environment and living beings. Meaning, these are known to not impose hazards to any parties, including parties initially not part of the design plan (e.g. future generations). Examples: eliminating use of rare minerals, addressing pollutants and biocapacity overload.

This is my initial proposal of how we should use the concept of sustainability so that we come closer to having an exact meaning of the concept leading to an exact translation of the intended values into design solutions.

References

Carnap, R. (1950) Logical Foundations of Probability. Routledge and Kegan Paul, London, UK.

Ellis, B. (2008/2002) Revitalising Causality: Realism about causality in philosophy and social science.(Originally published in The Philosophy of Nature: A Guide to the New Essentialism, Montreal and Kingston: McGill-Queen's Press, 2002, Chapter 4) Routledge, Oxon, UK

Franssen, M. (2009) Philosophy of Technology and Engineering Sciences. Elsevier, The Netherlands

Groff, R. (2008) Revitalising Causality: Realism about causality in philosophy and social science. Routledge, Oxon, UK

Mumford, S. (1998) Dispositions. Oxford University Press, New York, US

van de Poel, I. (2009) Philosophy of Technology and Engineering Sciences. Elsevier, The Netherlands

van de Poel, I. and Royakkers, L. (2011) Ethics, Technology and Engineering. Wiley-Blackwell, West Sussex, UK

Vermaas, P., Kroes, P., van de Poel, I., Franssen, M., Houkes, W. (2011) A Philosophy of Technology From Technical Artefacts to Sociotechnical Systems. Morgan & Claypool