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Designing products for material simplifiers: antinomy or prospective for design?

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Abstract

Considering the growing change towards material simplicity of consumers which consists in rejecting the consumer society by decreasing material needs and their consumption we interrogate in this research the possibility of products to support its transition of consumers. We address in a matrix product characteristics adaptation to pathways of consumers stemming from non-voluntary to radical disadopters. The main question of this work interrogates how products can address the disadoption/material simplicity phenomenon.

Keywords: sustainability, product design, human behaviour, material simplicity

1. Introduction

A growing awareness of climate change is driving a radical shift toward material simplicity (Rebouças and Soares, 2021), which involves rejecting the consumer society by decreasing material requirements and their consumption (Daoud, 2011). More broadly, this material simplicity aligns with materialism critiques, sustainability, and a degrowth society (Rebouças and Soares, 2021). Individuals exhibit different levels of low-carbon behaviors and encounter different routes towards their engagement, ranging from opponents to radicals (Oates et al., 2008).

Finding solutions to support pathways towards material simplicity without imposing constraints on consumers is a current appeal (Rebouças and Soares, 2020). Furthermore, it has been alleged that traditional technological innovation and user-centric design principles are introducing novel functionalities to products without any consideration for ecological sustainability (Gnanasekaran et al., 2021, Lehmann and Parker, 2017). It is imperative that the design be future-oriented to facilitate the transition towards sustainable products and uses. This is what Tonkinwise (2015) described as "transition design". Because people have different levels of material simplicity, we can't come up with a unique solution.

Hence, our objective is to provide designers with guidance in designing products that would facilitate and encourage voluntary material simplicity pathways of consumers towards their material simplicity engagement. It appears that addressing the material simplicity of consumers is distinct from addressing the sustainability of products. In fact, we distinguish our approach from the large field of research dealing with eco-design. What matters here isn't what the product is made of or how it affects the environment, but rather how it can help material simplifiers ease their way out of materialism habits. This research asks the following questions: how can designers address the material simplicity phenomenon? Are products capable of facilitating the material simplicity of consumers? In this study, our literature review leads us to construct a matrix that blends product features with material simplifier levels.

2. Mismatch between material simplicity of consumers and current product design principles

2.1. The rising of climate change awareness and consumption behaviors changes

In accordance with the escalating awareness among the population regarding climate change, a significant number of individuals are actively engaged in a radical shift towards a low-carbon lifestyle. Indeed, individuals adopt a voluntary simplicity lifestyle (Rich et al., 2020) whereby reducing consumption, achieving self-reliance, and focusing on material simplicity are recognized and targeted as beneficent for the environment due to the reduction in product and energy consumption. According to McDonald et al. (2006, p. 515) voluntary simplifiers "are individuals who have freely chosen a frugal, anticonsumer lifestyle that features low resource use and environmental impact". This willingness is not motivated by financial difficulties or any other external constraint. It is a way of thinking that is multidimensional. As mentioned by Elgin and Mitchell (1977, p.13), voluntary simplicity embraces "frugality of consumption, a strong sense of environmental urgency, a desire to return to living and working environment which are of a more human scale, and an intention to realize our higher human potential both psychological and spiritual in community with others". Material simplicity is one of the main aspects of this behavior (Rebouças and Soares, 2021) which consists of rejecting the consumer society by decreasing material needs and their consumption (Daoud, 2011). More specifically, it consists in buying and using fewer products, and choosing sustainable products (McDonald et al., 2006). Individuals are able to reject, reduce, reuse, and redirect their product consumption (Balderjahn et al., 2021). More broadly, this material simplicity aligns with critiques of materialism, sustainability, and degrowth society (Rebouças and Soares, 2021). It is notably related to the degrowth technology phenomenon described by Kerschner et al., (2018) as going back to essential uses and consumption of technological products. Decreasing purchases of products' can be correlated with decreasing individuals' carbon footprint and adoption of low-carbon behaviors (Blackburn et al., 2023).

Individuals exhibit different levels of low-carbon behaviors and experience different routes toward their engagement ranging from awareness to high engagement (Howell, 2013). Consequently, these routes can achieve different levels of carbon footprint reduction that are not necessarily below the "average carbon footprint" (Howell, 2013, p. 281). Numerous methodologies have been developed for evaluating the various levels of low-carbon lifestyles in the literature such as: the "carbon capability" which encompasses not only behaviors and practices but also the decision-making process and collective involvement of individuals who wish to change (Whitmarsh et al., 2011). Additionally, the "low-consumption lifestyles" measure (Rich et al., 2020) evaluates attitudes and behaviors related to frugality, sustainability, pragmatism, and material simplicity. Several groups of voluntary simplifiers have been identified , exhibiting varying levels of commitment to a low-consumption lifestyle. These groups can be used to illustrate numerous groups of material simplifiers, highlighting the main features of voluntary simplifiers. The levels range from opponents to radicals (Oates et al., 2008). The first level encompasses individuals who are not convinced by this movement and are content with their materialistic lifestyle. They are non-voluntary and therefore pro-consumerism (Erdoğmuş and Karapinar, 2015; Oates et al., 2008). A second group is composed of people who are aware of the relation between ecological issues and their materialist consumption lifestyle. They are aware but they don't necessarily take action. A third level is made up of beginners who are starting to live with less stuff and stop buying things on impulsive (Erdoğmuş and Karapinar, 2015). A fourth level is comprised of simplifiers who possess the ability to purchase in accordance with their material simplicity values (Erdoğmuş and Karapinar, 2015; Oates et al., 2008). They are moderate because they still buy products, but they have gotten rid of superfluous products (Bekin et al., 2005). Even though they are involved, they aren't radicalized. Then, there are radicals who are anti-materialist and adhere to rigorously follow their anti-consumption values (Oates et al., 2008). They can be seen as disadopters who completely stopped one specific consumption (Lehmann and Parker, 2017). They got rid of this particular consumption, and as a result, they went through a process of abandoning the product's usage and possession. Consequently, disadopters are engaged in a process of reducing their needs and possessions.

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There is a current appeal for finding solutions (products and services) that favor this voluntary simplicity without forcing consumers (Rebouças and Soares, 2021). We shouldn't force certain kinds of products, for instance, low-tech ones, even though some low-tech definitions overlap numerous factors sought by simplifiers: decreased resource consumption in technology, new or extended service lives, or back to basics to name a few (Tanguy et al., 2023). We aim to guide designers in designing products that support and favor voluntary material simplicity. Although the ecological crisis certainly requires drastic measures, it seems preferable to have steady incentives. Furthermore, potential solutions could be perceived as a threat to companies' revenue objectives, but they can also be viewed as an opportunity to develop adapted new products that would satisfy these consumers, which is likely to spread (Erdoğmuş and Karapinar, 2015). As a result, this occurrence of material simplicity raises questions regarding the significance of product design principles in addressing what can be interpreted as the manifestation of a novel consumer need.

2.2. Product design reconsideration in line with material simplicity

Considering the impact of global warming and its ill effects on human health, conventional technological advancements and user-centered design principles are now cited as aiding the expansion of global carbon footprint and resource depletion. Indeed, focusing on a multitude of user requirements and innovative technological advancements to satisfy them primarily leads to the addition of novel functionalities to products without any consideration for environmental impact (Gnanasekaran et al., 2021, Lehmann and Parker, 2017). Accordingly, relying on Fry's defuturing design philosophy (2019) the authors Preist et al. (2016, p.1328) mention that in the field of Information Technology (IT) innovation, "a human-centered design process is not necessarily humanity-centered". In this acknowledgment, we reconsider the ecological consequences of the technology push/pull principles, and of user-centric design practices. Certainly, pulling the endless needs of people and pushing technological gadgets onto the market appears detrimental to the ecology. As per the study on climate change, Kozubaev et al. (2020, p. 400) posit that design futuring principles are a means for the design to "comment on—and potentially change—the present". The defuturing design philosophy can therefore be seen as an invitation to reconsider the future of technological products by revising downboard product innovation and favoring degrowth technology. Consequently, the design should be geared towards the future so that we can move towards wise products and uses. Tonkinwise (2015) described this as "transition design". The author demonstrates the limitation of designing end-to-end, static products that are the final product of a problem-solving endeavor. It seems that designing products for long sociomaterial perspectives is more wise. Reversely addressing short-term consumer and technical issues would be a trap. Irwin (2015, p. 231) describes the transition design as a "design-led societal transition toward more sustainable futures and the reconception of entire lifestyles". This reinterpretation of the design appears to be perfectly aligned with the material simplicity of consumers. Despite this, it is primarily focused on its concept and few on product features and their uses. Degrowth-oriented technologies are what we need to discover (Vetter, 2018).

3. Designing products that carry pathways towards material simplicity

3.1. From immutable to pathways of product uses towards material simplicity levels

Considering the different levels of behaviors, practices, and intentions to change among individuals we assume that we cannot address the whole process of lowering their carbon lifestyle with similar strategies aiming at the same and highest level of low-carbon lifestyle maturity. Furthermore, there can be mismatches between the ideals and intentions of individuals and their actions in relation to low-carbon lifestyles (Howell, 2013). Indeed, discontinuing the usage of a product may prove to be challenging at times, leading to nostalgic feelings or more negative emotions such as frustration (Lehmann and Parker, 2017). As a result, future studies must find ways to support these different levels of material simplicity, ranging from novice to radical (Rebouças and Soares, 2021). It can be perceived as a process with many steps towards the complete disadoption of product use (Lehmann and Parker, 2017). Because there are a lot of ways to engage and levels of material simplicity, it's hard to find a solution that fits all the situations.

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It represents a complete transformation of the existing paradigm. The purpose of products is no longer to incite dependence and encourage adoption, but rather to empower consumers to master their material simplicity by empowering them. According to Marchand and Walker (2008), simplifyers tend to favor understandable goods, both in terms of structure and operation. The following features should be found in the product's offer. We're also interested in shifting from a lifecycle-centric discourse to one of use cycles and paths towards radical material simplicity. Instead, the designer should focus on the possible uses. Could the design be flexible enough to make the product evolve, even if it is already sold? Does this need to change as well?

3.2. Match between products features and pathways toward disadoption

Which product features could fit and support levels of material simplicity? Three strategies in product design that could favor sustainable product use were identified by Lilley et al. (2005), similar to Norman's concept of affordability, eco-feedback and "intelligent" product systems. Additionally, the following list, which is not complete, comes from considering the features designers might want to focus on. In this proposal, our objective is not to produce radical innovation, but to list several existing features already found in today's products. Even though literature and public policies reveal a major interest in e-waste management, especially on individual behaviors (Islam et al., 2021), we choose to illustrate these features with a broader range of products. We intend to demonstrate that such features are generic enough to cover multiple product categories. Hence, a shift towards novel practices is presently feasible, irrespective of the product.

- **Product's operational data and information**: Most users require minimal information about the right ways to use products. The basic information usually found in user manuals covers product capability (what it can do), operating range, and handling instructions. They're rarely read, they're provided for legal reasons (warranty, garbage collection...), but they rarely aim to show you how to use the thing ethically and make it last longer. Information can also be furnished regarding the consequences of actual utilization. For instance, some shower heads show how much water they use right away. This pertains to the field of eco-feedback. This kind of monitoring has already been done in the car industry to check how much fuel is being used. It has shown to help drivers be more environmentally friendly. It is used extensively in the field of energy efficiency, specifically electricity consumption (Conklin et al., 2015). Informing the user embeds a formative dimension that enhances the sustainability of its use and might help low simplifiers to progress in their maturity. Such eco-feedbacks also imply emotional responses that could influence the use of the product (Bao et al., 2018). The balance between positive and negative feelings is still elusive. Negative feelings such as shame or guilt, proved effective in promoting immediate behavior change, but could also cause users to abandon these solutions and, consequently the product. Ultimately, the provision of information can be regarded as a contribution to the revealing-concealing structure outlined in Kiran (2012).
- **Product modularity**: modularity has been widely used in designing products and has proven numerous benefits from the perspective of sustainable design (Sonego et al., 2018). Modularity is often taken into account during the production and disposal phases of the product's lifecycle. It is less common in the use phase. In this case, modularity focuses on extending the lifespan of the product by providing capacity for "upgrades, maintenance and repairs" (Sonego et al. 2018). On the manufacturer side, modularity helps to make maintenance easier, reduce production costs, and reduce the number of references. In this study, we aren't using Modular Product Design to design products. In this article, we consider modularity to be a feature of the designed product and a property of its structure. On the user's end, modularity offers a way to tailor the offer by letting consumers compose the product among various available functionalities for upgrading (or here, downgrading) the product. It is already part of the automotive industry, where buyers choose options before taking delivery of the product. In this instance, the downgrading would be implemented throughout the entire use phase. These modules are, however, assembled at the factory and are not interchangeable once purchased. The modularity feature should allow for the evolution of the product over time and, in any case, after its manufacture. Users may be required to select modules based on their targeted and limited energy consumption, for example, by

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choosing between a big-size screen or a camera embedded in a cellphone. Users may decide to stop using some features or switch to different ones as their needs change. The modules that were abandoned could then be shared, sold, refunded, given, or just recycled. Since energy consumption is one of the main concerns for people who want to be more sustainable (Coskun et al., 2015), the ability to switch from one type of energy to another is an option. The transition from electrical power to decarbonized energy should be made effortless by the utilization of products that anticipate the transition. It is possible to implement such a strategy with modularity, but design has to integrate the specific constraints of changing the nature of energy. From electrical to muscular power, to solar energy or bio-reactors, each type of resource necessitates a distinct interface that must be seamlessly integrated into the product. Beyond adding or leaving functionalities, modularity can also be thought of as a way to chain components in order to achieve, temporarily or for a longer time, extra power or extra capacities for a specific need. A prevalent notion that has been proposed is the potential for enhancing electrical power by incorporating additional cells in autonomous appliances, provided that the actuators are appropriately sized. But you can also add another whisk to a mixer. The first axiom of Axiomatic Design states that the functions requirement should be independent. Therefore, separating the functional requirements from the design is a method to create products that can adapt to the changing needs of the customer, which in turn generates the functional requirements (as per Cooper and Gutowski, 2017). Some scenarios, such as "design for sub-assembly upgrade" and "design for component reuse," are interesting. The stakes in this vision of modularity are primarily centered on interfaces rather than a specific manufacturing process, despite their close correlation.

- **Product throttling**: voluntary limitation of a product's performance is a common way to preserve the integrity of products, as long as those of the users are respected. This feature must be compared with Lilley's et al. "intelligency" embedded in the product for "decreasing the potential for irresponsible environmental or social behaviour" (Lilley et al. 2005). Limited power on vehicles, electronic chips, or audio devices, for instance, is frequently mandated by regulations and safety considerations. Most users don't have much control over these limitations. Nevertheless, allowing users to set energy consumption limits or establish a maximum usage duration could enhance product longevity by avoiding product overheating. It would reduce energy consumption, decrease technology addiction, or just reduce negative externalities. There are two possible approaches: a threshold can be set by the user or the designers. Furthermore, such a threshold could be determined based on product usage data. It is also possible for the product to automatically adapt once a sufficient understanding of the typical usage is acquired through experience, such as the evolving heat pump regulation regulations.
- **Hackable products:** in accordance with the democratization of technology and the utmost autonomy of users, products may be modified, enhanced, or repaired by users. Allowing such user actions implies that they possess the abilities and readily available resources (e.g., tools, materials, etc.) to carry out such actions. The design of the product must be able to be understood by the user. Open design is a trend that offers great chances for such a scenario. Richardson (2016) advocates for Open Design, specifically the use of pre-hacked products to circumvent Latour's "black box." Released specifications of the product allow advanced users to alter their products by re-designing them. This kind of product requires a proactive approach from users and is not intended for low-simplifiers. It implies that users have a clear view of their trajectory and are able to forecast the next step of their path.
- **Product obsolescence**: obsolescence is often seen as a negative thing, whether people want to do it or not. Yurtsever (2023) says that planned obsolescence goes against green marketing. This argument is deemed valid in the context of standard consumer demands, where quality obsolescence contravenes the consumer's desire to extend the lifespan of the product. Obsolete products are no longer a concern, provided that their disposal doesn't have a negative impact on the environment. The field of materials research has taken on the challenge of compostable engineering materials, primarily polymers, thereby enabling a novel method of product disposal that could compete with the conventional recycling process (Mojo, 2007). As per a progression of decreasing usage, culminating in the final stage of abandonment, obsolescence can be deemed

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a virtue provided that the product's lifecycle closely aligns with the path of use. The end of the life of the product is correlated with the disappearance of the need if correctly anticipated. Unless certain components are scheduled for a second life, every component of the product should reach the wear or ruin stage at the same time, which means that each component should have a roughly equal Mean Time To Failure. So, engineers need to choose the right materials and check how long the product will last. This will help the product last longer and fit the user's plan to stop using it.

Such product features ought to be feasible using contemporary design methods. The challenge is a change of mind in how marketing and commercial strategies are done.

4. A matrix for matching product features and material simplicity levels

The following table represents a preliminary attempt to propose a matrix that crosses different product features with potential users according to their material simplicity levels. It relies on assumptions of adequacy, which we justify below.

Table 1. Match between material simplifiers levels and product features

		Material Simplicity levels				
		Non-voluntary	Aware	Beginners	Moderates	Radicals
Product features	Information	X	X	X	X	
	Modularity		X	X	X	
	Throttling		X	X	X	
	Hackable			X	X	X
	Obsolescence				X	X

The Table 1 has been arranged to show the matrix as a diagonal result.

The initial observation is that, unless for being non-voluntary reasons, a variety of product features are capable of catering to the requirements of diverse user groups. Information about products is the only way to make people aware of the consequences of their consumption. By adopting a not-so-intrusive technology, users have the choice to neglect the provided information or slowly be impregnated by it. Information is considered a way to keep people aware of usage, no matter what the type of user is, as long as there's still a next step to take. This explains why radicals won't find this functionality convenient.

The modularity of products may be of interest to users who are willing to progress in the material simplicity pathway. Again, radicals possess the conviction to select the kind of products that best suit their requirements and, consequently, are not interested in modularity. This is even true for individuals who are approaching complete disadoption. However, some people might suggest using products that can either limit their performance automatically or allow users to adjust them themselves to meet their specific needs. Choosing between an intelligent regulation (decided by the product) or setting the threshold by themselves is a matter of maturity in their material simplicity pathway.

With the hackable products, we're addressing a category of users who have a proactive approach to material simplicity. They are gradually abandoning conventional consumer behaviors and shifting towards a more effective management of the product. Hence, they do not solely rely on the commercial offerings of modular alternatives, but rather seek to exert control over the artifact and tailor its utilization to their individual preferences. This implies that the user is given a certain degree of freedom, from the very beginning of the design process, to alter, mix, and alter the artifact beyond its original intent. Pre-hacked artifacts, like those described by Richardson (2016), are good choices for this category.

Ultimately, the topic of product obsolescence will solely be of interest to users who have reached a sufficient level of maturity in their pathway towards disadoption. The advantage of this approach is that it ensures that the product's end of life coincides with its completion of usage. Users might be reluctant to purchase a product if they're aware of its limited time of use. We assume that implementing a product that won't be disposed while it still has a remaining life potential should make the user feel less guilty.

The selection of product feature, for a particular profile of material simplifiers, is the responsibility of the designer. We are facing the same question as Shin and Bull (2019) when defining their eight design

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spaces in the framework of Design for Sustainable Behavior. After the delineation of the user profile, the designers must select a specific feature or a combination of features to implement into the product. The selection of such features is contingent upon pragmatic factors such as the capacity to tailor the features to the product's specific characteristics, and more subtle factors such as the actual efficacy of such features on the effective behavior of users. Further work is expected to provide a deeper understanding of simplifiers' preferences regarding features.

5. Conclusion and future work

This article presents a portrait of individuals who seek to alter their consumption trajectory in line with their ethical aspirations. The phenomenon of material simplicity was our focus. The underlying issue concerns the designer's capacity to guide the user along the more or less defined path, which is incompatible with the predominant model. By focusing on voluntary simplifiers, we address the desire to reduce consumption among a specific segment of the populace. Indeed, Rebouças and Soares (2021) show that voluntary simplifiers are mostly found in developed Western countries. Research is still lacking in other nations (Erdoğmuş and Karapinar, 2015). Consequently, we do not address other nations whose technological consumption is currently increasing as their carbon footprint.

Furthermore, the suggested functionalities are hazy and fail to reflect the wide range of technical configurations that products can employ. The limited examples that we have proposed enable us to discuss the sufficiency of these features in light of the user behaviors outlined in the literature. The next step in this research will focus on two main points: to check and possibly completing the first proposal of the matrix with experts. To understand why users pick up certain products features and material simplicity routes, we'll hold focus groups with experts from the sector and folks who support degrowth. The second, more general goal, is to probe existing design approaches, particularly those related to sustainable design, in order to identify those most suited to satisfy the requirements of these particular groups of users.

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