

Can a Light Switch Be Beautiful?

Aesthetic Appreciation of Products as Means

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Abstract

Research in design aesthetics usually focuses on how products are experienced as they appear to the senses. The everyday experience of products is not an experience of appearance only, though. It can be shaped by knowledge of designers' intentions gained through sources such as press releases, marketing campaigns, critical reviews, and guesswork. In this paper, we explore the aesthetic appreciation of products in relation to perceived designers' intentions, as an assessment of *means* by which designers try to achieve certain aims. We report on an interview study in which participants reflected on a series of products in these terms. The participants' reflections indicate that the appreciation of a product depends on a perceived set of alternatives assumed for both the product and the aim. Determinants of aesthetic pleasure such as novelty are based on these assumed alternatives, rather than on mere product appearance. Ultimately, we find that a product can be perceived to be beautiful not only because of how it looks, but also because of how it works as a means to achieve a given aim.

Keywords

Aesthetic experience; Aesthetic pleasure; Design aesthetics; Product experience; User experience

Light switches are not usually thought to be beautiful because they are not particularly good-looking. However, the aesthetics of designed products can transcend appearance. Take for instance the Aware Puzzle Switch (Figure 1). Seen as an object on the wall, it might not seem very beautiful. But what if it were perceived *in relation* to its designers' intention of encouraging people to save energy? This switch has been designed in such a way that its visual pattern is broken when the light is on, so that people are driven by their innate need for order to restore the pattern and thus turn the light off (Broms, 2011). The switch can be perceived to be very beautiful when seen as a means to attain its designers' aim. Often, yet inadvertently, designed products are seen in this way. Press releases, marketing campaigns, critical reviews and guesswork, among other mechanisms, promote a perception of products that involves reflecting on designers' intentions.



Figure 1: Aware Puzzle Switch designed by Looove Broms and Karin Ehrnberger as part of the Aware project of the Interactive Institute in Sweden.

In this paper, we explore the aesthetic appreciation of products in relation to perceived designers' intentions, as an assessment of *means* by which designers try to achieve certain aims. Our exploration is grounded in the idea that the experience of products is not merely shaped by product properties, but by designers' intentions that can be either known explicitly or inferred (Crilly, 2011). It is also grounded in an understanding of products as artifacts in the sense of being defined by intentions (Bloom, 1996; Dipert, 1993; Hilpinen, 1992), not only because they result from the intentional actions taken during the design process (Galle, 1999), but also because they are intended to fulfill the aims that designers set during that process to influence the world around them (Hekkert & Van Dijk, 2011). In this conceptual framework, the aesthetic assessment of products can be addressed as an assessment of means to achieve certain aims.

As is the case for literature dealing with the aesthetics of artifacts broadly considered, not just as physical objects, but as "certain types of intentional events (e.g. utterances and performances)" (Dipert, 1993, p.11) including science experiments (Crease, 2004), logical argumentations (Walsh, 1979), mathematical demonstrations (Hardy, 1967), and chess moves (Margulies, 1977), literature in design suggests that products can be aesthetically assessed as means, particularly through the principle of maximum-effect-for-minimum-means. This principle, which is implied in references to economy (Zelanski & Fisher, 1984), efficiency (Macnab, 2012), and Occam's razor (Lidwell, Holden, & Butler, 2010), is considered to be a core principle of design aesthetics (Hekkert, 2006; Hekkert & Leder, 2008). Therefore, it does not only indicate that products can be assessed as means, but that this assessment of products is an *aesthetic* assessment.

In order to explore the aesthetic appreciation of products in this sense, we conducted an interview study in which participants were asked to reflect on a series of products as the means to achieve the original designers' aims. Thinking about design intentions and being articulate about them is not necessarily an easy task for people, as it requires a certain level of design literacy. To sample from a design literate population, we selected design students as participants, a group that is aware of the process from which products emerge and the intentions guiding that process. Thus, our study benefits from the participants' capacity to reflect on products as means to achieve certain aims. For the same reason, our findings do not reflect lay people's assessment of products directly, but rather unveil a perceived set of alternatives that influences the appreciation of products when the products are experienced in relation to perceived designers' intentions, regardless of whether people are aware of this influence or not. In this sense, this paper provides an insight into what seems to be a frequent, yet unnoticed, experience of products, as well as into an unexplored, yet potentially central, area of design aesthetics.

The Study

Our study took the form of a series of one-to-one semi-structured interviews with thirty-three students from the Faculty of Industrial Design Engineering at Delft University of Technology, who received academic credits in return for their participation. During the interviews, the participants were provided with pictures of three products (printed in full color and measuring 20 by 15 centimeters) and texts (consistent in structure and comprising between 14 and 20 words) explaining the original designers' aims. For simplicity, these materials (Figure 2) will be referred to as "the aim(s)" and "the product(s)" from now on. Each interview lasted an average of 27 minutes, focusing on the appreciation of products as means to achieve given aims, but also on the appreciation of products as affected by knowledge of designers' intentions. This paper focuses on the former topic, with the other topic to be reported elsewhere.



Figure 2: Stimulus materials: (a) Cross-Cultural Memory Game by Sara Emami, (b) De Goedzak by Simon Akkaya, and (c) Patroon by Asako Takahashi.

The interviews were conducted in a private well-lit meeting room of the Faculty of Design Engineering at Delft University of Technology. After being taken through a standard procedure to establish their informed consent, the participants were asked two guiding questions about each of the products in relation to the corresponding aim: "What do you think of this product as the means to achieve this (aim)?" and "Do you think this product is a beautiful means to achieve this (aim)?" The stimulus materials were presented in three different sequences to avoid order effects.

The interviews were audio-recorded and transcribed. During the interviews, the participants made gestures towards the stimuli and used pronouns such as "it", "this" and "that" to refer to them. These partial utterances left an incomplete audio record and transcript. We addressed this issue by substituting the relevant gestures and pronouns with "(the) product" and "(the) aim" according to the meaning intended by the participants in the statements quoted throughout this paper. These and other editorial substitutions appear within square brackets.

The participants' statements were coded with a combination of a number and a letter as they were transcribed: numbers from 1 to 33 were used to identify the participants speaking, while letters "a", "b", "c" were used (as in Figure 2) to identify the stimulus materials to which they referred in each of their statements. These codes are provided

within parentheses at the end of each statement quoted in this paper. For instance, “(33b)” identifies an utterance by participant 33 about stimulus materials “b”.

The transcripts were reviewed iteratively and analyzed following an inductive approach. This led to a series of findings, which involved: firstly, distinguishing the assessment of the product as a means from other possible assessments of the stimuli; secondly and most importantly, discovering that this assessment is based on a perceived set of alternatives assumed for both the product and the aim; and thirdly, exploring the qualities that lead the product to be aesthetically appreciated as a means.

Findings

Assessing the product as a means

The participants assessed the stimuli in three distinct ways. Firstly, they assessed the aim considered independently of the product in statements such as “this is a lovely goal” (14a), and “I don’t like this aim actually” (19c). Secondly, they assessed the product considered independently of the aim, as a mere object, in assertions such as “[the product] is a nice object to have in your kitchen” (5c), and “I’m not very much attracted to the object itself” (26b). Thirdly, they assessed the product in relation to the aim. Our focus is on this latter assessment, which must be distinguished from the other two.

The assessment of the product in relation to the aim was identified in statements such as the following, in which the participants referred to a “fit”, “link” or “connection” between the product and the aim: “as a designer, when I think about the product, I like it because it fits the purpose” (30a); “I like the link between the design [product] and the idea [aim]” (31c); “I am a designer myself or want to be a designer myself, so I look at [the product] with a different perspective, like: what would be the process behind coming up with [it], connecting it to this certain goal or aim?” (28c). We interpret such assessments as revealing an appreciation of the “product-as-means”.

The appreciation of the product-as-means was found to be independent of both the appreciation of the “aim-in-itself” and that of the “product-as-object”. One participant declared: “I like the product, but not especially the goal of the product [however] I think it’s a good way of doing it” (4c). Although she did not particularly like the aim, she could still appreciate the product as a way of pursuing it, which indicates that the appreciation of the product-as-means is independent of the appreciation of the aim-in-itself. Another participant stated: “the goal is quite a nice goal, but I’m not sure if the product itself can achieve this goal [still] as an object, it is nice” (8b). He responded positively to the aim and the product objectively considered, but not to the product as a way of achieving the aim, which indicates that the appreciation of the product-as-means is not only independent of the appreciation of the aim-in-itself, but also of that of the product-as-object.

The findings presented in the following sections concern the appreciation of the product-as-means only. In a tacit manner, we refer to it exclusively from now on. It is important to keep in mind, nonetheless, that this appreciation on which we focus is different from the appreciation of the aim-in-itself and that of the product-as-object. It involves neither an assessment of the aim considered independently of the product, nor of the product considered independently of the aim, but an assessment of the product in relation to the aim, i.e., as a means (Figure 3).



Figure 3: The appreciation of the product-as-means involves neither an assessment of the aim-in-itself (A) nor of the product-as-object (P), but an assessment of the product in relation to the aim, a relation represented by the continuous line in this figure.

Assuming a set of alternatives

The appreciation of the product on which we focus in this paper is relative by definition because it involves an assessment of the product *in relation to the aim*. Through our study, however, we discovered that this appreciation is relative in two other additional senses. On the one hand, the participants assessed the product *in relation to alternative products* by which the same aim could be achieved. On the other hand, they assessed the product *in relation to alternative aims* that could be achieved by means of it. We consider these to be the two main findings of our study.

1. The product is assessed in relation to alternative products. When asked what they thought of the product as the means to achieve the aim, the participants offered answers like: “I think there are multiple ways to do that, this [product] is one of them” (20b); “there must be a better way” (2c); “this [product] is trying to solve an actual problem and in the way that [it] is doing it, I don’t really like it” (24a); “this is a nice topic [aim], but I would implement it in a different way” (17c); “I think there are better ways to achieve this [aim]” (15b). They assessed the product in relation to other existing or imagined products that they perceived as leading to the same aim. This indicates that the appreciation of the product is based on the assumption that many alternative products can be related to a single aim (Figure 4).

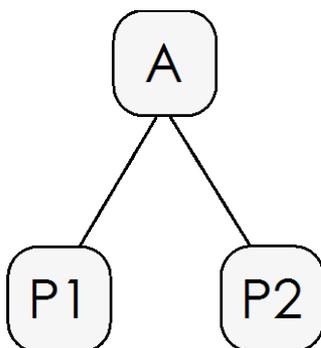


Figure 4: The appreciation of the product is based on the assumption that many alternative products (P1, P2) can be related to a single aim (A).

2. The product is assessed in relation to alternative aims. Although De Goedzak (Figure 2, “b”) is not an ordinary trash bag, one of the participants categorized it as such and thought of an aim relevant to products of that category, i.e., recycling, which can be contrasted with the original designer’s aim, i.e., altruism. He reflected:

I would imagine that this [product] would cost more [than an ordinary trash bag] because it doesn't use the regular kind of ink for coloring trash bags, or trash bags aren't colored at all sometimes. I would imagine that this would be more eco-unfriendly and I think that the big aim or the big thing you aim for with trash bags [is] that you recycle as good as possible [...] For the goal as a trash bag, [the product] doesn't correspond, or at least [to] my purposeful aim for a trash bag, [the product] doesn't fit (15b).

This participant assessed the product in relation to an alternative aim that he assumed that could (or should) be satisfied by means of it. This indicates that the appreciation of the product is based on the assumption that a single product can be related to many alternative aims (Figure 5).

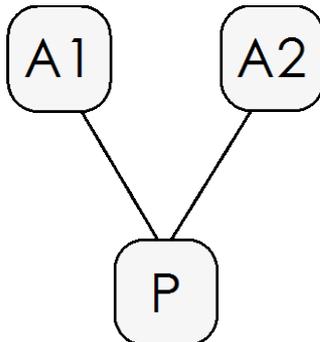


Figure 5: The appreciation of the product is based on the assumption that a single product (P) can be related to many alternative aims (A1, A2).

From our two main findings, it is possible to deduce that the appreciation of the product is based on the assumptions that many alternative products can be related to a single aim, on the one hand (Figure 4), and that a single product can be related to many alternative aims, on the other (Figure 5). Hence, the appreciation of the product depends on a perceived set of alternatives assumed for both the product and the aim (Figure 6). This appreciation involves the assessment of a given product in relation to alternative products related to the same aim, as well as the assessment of a given aim in relation to alternative aims related to the same product. Most importantly, it involves the assessment of a given product-aim relationship in relation to alternative product-aim relationships.

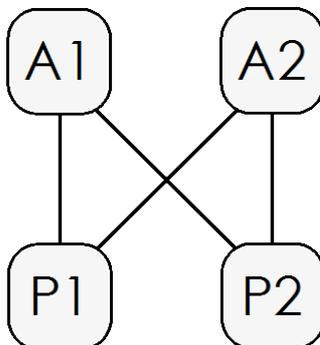


Figure 6: The appreciation of the product depends on a perceived set of alternatives assumed for both the product (P1, P2) and the aim (A1, A2).

Although the diagrams provided throughout this paper roughly represent product-aim relationships as being equally distant (notice that the lines connecting P1 and P2 to either A1 or A2 in Figure 6 are similar in length), the participants of the study suggested that the

product could be related to the aim in a more or less distant manner. For instance, one of them said: “to me, [the aim] sounds like something you can say about every product in your kitchen [...] or in your household” (22c). In this case, the relationship between the product and the aim is relatively distant, i.e., distant in relation to other possible product-aim relationships, because a large number of alternative products (all household products) can be related to the same aim. In contrast, the relationship between the product and the aim would be relatively close if only small number of alternative products, or even no alternative products, could be related to the same aim.

The issue of how distantly the product relates to the aim can be understood, as we just outlined, in terms of how specific the aim is with respect to the product, but also in terms of how achievable the aim is by means of the product. One of the participants made clear that even though designers can aim very high, products might be limited or insufficient means to achieve certain aims. He said: “I don't think you can achieve those kinds of goals with design, you've got it too high in your head if you think that you can make a change in this world as a designer” (28c). Thus, the product can be related to the aim in a relatively distant manner not simply because the aim is general, but because it is difficult to attain or even unattainable by means of the product. Conversely, the product can be related to the aim in a relatively close manner if the aim is easily attainable by means of the product.

In the previous paragraphs, we have qualified the aim as being specific or general, attainable or unachievable. It is important to clarify that these qualities are not absolute, but relative in the sense that they are ascribed to the aim in relation to other aims that can be related to the same product; for example, an aim is perceived to be specific only in relation to another aim that is perceived to be less specific or more general. Similarly, the qualities that can be appreciated in the product are relative in the sense that they are ascribed to the product in relation to other products that can be related to the same aim. The rest of our findings shed light on some of the qualities that can be aesthetically appreciated in the product in this relative sense.

What makes the product a “beautiful” means?

The participants predominantly assessed the product on coerciveness, explicitness and novelty. In terms of coerciveness, they made assertions like “[the product] forces you” (1c), and “[the product] is not really forced upon people” (27b); in terms of explicitness, they made assertions such as “[the product] is very obvious” (24b), as well as “if the product cannot explain what it wants, what it is for, then it's not good; you should see immediately what it's for” (2c). With regards to novelty, they considered the product to be “creative or modern” (29c), “novel” (14a), and “innovative” (32a). Due to our special interest in aesthetics, we will not discuss coerciveness and explicitness, but instead focus on novelty, which is known to be a determinant of aesthetic pleasure.

One of the participants perceived the product as “a modern and new and young way to recycle” (6b) in tacit comparison with other ways of recycling. This suggests that the product is not novel in absolute terms, but in relation to other products that are perceived to be less novel or more familiar means to reach the same aim. It further implies that the product is judged to be more or less aesthetically pleasing (insofar as it is judged to be more or less novel) in relation to other products, rather than according to its mere objective properties.

Another participant, who reported to like the product, described it as “a sort of embodiment or a visualization of a new, fresh, funny way of dealing with a known problem” (24b). This suggests that the product is not only novel with respect to alternative products

or “ways” that are relatively familiar, but with respect to the aim posed by a “known problem” and thus also relatively familiar. In this case, aesthetic pleasure seems to be attained from perceiving a relatively novel product in relation to a relatively familiar aim (Figure 7). Instead of the aesthetic appreciation of this particular relationship, we want to emphasize that the appreciation of novelty in the product is based on the perceived set of alternatives that we have been discussing. Other determinants of aesthetic pleasure could also be based on these assumed alternatives, rather than on mere product appearance.

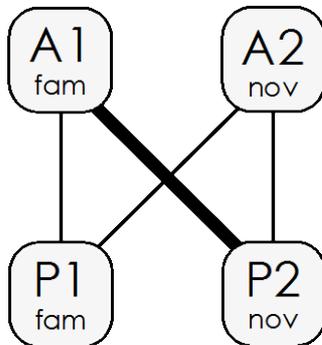


Figure 7: For one participant, aesthetic pleasure seems to be attained from perceiving a relatively novel product (P2 nov) in relation to a relatively familiar aim (A1 fam).

Although determinants of aesthetic pleasure can be based on these assumed alternatives, the participants did not report an appreciation of the product in conventional aesthetic terms. When asked if they thought the product was a “beautiful” means to achieve the aim, most of them refused to use this adjective. One explained: “I wouldn’t use any kind of aesthetic-related words; I wouldn’t use something like ‘beautiful’ because I associate it more with something that has a form [...] a specific harmony, elements or colors” (17a). Another reflected on the connotation that the word “aesthetics” usually has in the design field: “I think in design most of the times [‘aesthetics’ refers] to the visual qualities of the object” (23a).

Most participants established a strict distinction between aesthetics and functionality. One of them stated: “I differentiate the aesthetic values from the functional values, so judging [the product] as a means is mostly on the functional area [...] I wouldn’t say that the function is ‘beautiful’” (12a). Accordingly, instead of the suggested adjective, they used the term “good” to describe the product. One of them explained: “I would be using ‘good’; it’s saying more about the functionality of the product [than ‘beautiful’]” (26b). In addition, they often mentioned the capacity of the product “to work” in assertions such as: “I think [the product] works really well” (3c), “this [product] works” (7b), “I think [the product] can work”, “this [product] won’t really work” (28b), and “[the product] will never work” (13c).

In terms of the distinction that we made when introducing our findings, most of the participants saw the assessment of the product-as-means as an assessment of function, rather than as an aesthetic assessment, which in turn they saw as an assessment of the product-as-object. Some participants, however, suggested that the product could be aesthetically appreciated because (of how) it works as a means to achieve the aim. One of them said: “for me [the product] would be attractive if it works [...] I really, really like function, so as long as it works, I don’t care that much [about] how it looks” (22b). Another two stated: “efficiency can be beautiful [...] an efficient use of material is aesthetically pleasing in the [sense that] you’re sure that [the product] is optimized” (15b); “I think efficiency can be beautiful [...] I think that the function of a product can make a product less ugly or more beautiful because it gives you a certain feeling of satisfaction” (33b).

The last two declarations indicate that there is an aesthetically pleasing way in which the product can work as a means to achieve the aim, i.e., efficiently. They suggest that one of the principles describing the aesthetic appreciation of the product is maximum-effect-for-minimum-means. This principle implies that aesthetic pleasure is attained from perceiving the product (means) that is judged to be the minimum among a number of perceived alternative products (means), in relation to the aim (effect) that is judged to be the maximum among a number of perceived alternative aims (effects) (Figure 8). What the terms “minimum” and “maximum” mean for design aesthetics is still to be examined.

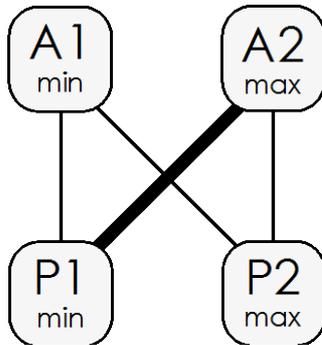


Figure 8: According to the principle of maximum-effect-for-minimum-means, aesthetic pleasure is attained from perceiving a relatively minimum product (P1 min) in relation to a relatively maximum aim (A2 max).

Discussion

The everyday experience of products can be shaped by knowledge of designers' intentions gained in a variety of ways. In this paper, we have explored the aesthetic appreciation of products in relation to perceived designers' intentions, as an assessment of *means* by which designers try to achieve certain aims. Through an interview study in which participants were asked to reflect on a series of products in these terms, this kind of appreciation was found to be dependent on a perceived set of alternatives assumed for both the product and the aim. The participants' statements suggested that determinants of aesthetic pleasure such as novelty are based on these assumed alternatives, rather than on mere product appearance. Furthermore, they indicated that a product can be perceived to be beautiful not only because of how it looks, but also because of how it works as a means to achieve a given aim.

Our findings have an important implication for research in design aesthetics, but also an undeniable limitation. Let us address this limitation first. As mentioned in the introduction, design students were chosen as participants for our study because of an expected minimum level of design literacy and capacity to comment on the intentions guiding the design process. Therefore, our findings do not reflect lay people's assessment of products directly. Instead, they unveil a perceived set of alternatives that influences the appreciation of products when they are experienced in relation to perceived designers' intentions, regardless of whether people are aware of this influence or not. In order to overcome the limitation of our study, future research could make use of alternative ways of sampling for design literacy. For example, people with no formal background in design could be pretested on their capacity to infer designers' intentions directly from products.

As for the aforementioned implication, let us bear in mind that research in design aesthetics usually focuses on how products are experienced as they appear to the senses. Nonetheless, our findings suggest that aesthetic pleasure can be attained not just from perceiving product properties such as shape and color, but also from perceiving products

in relation to designers' intentions, as means to achieve given aims. Research in design aesthetics could therefore broaden its scope by questioning the strict boundary that is repeatedly traced between aesthetics and functionality (for a review of taxonomies of product experience tracing this boundary, see Crilly, Moultrie, & Clarkson, 2004; 2009), taking into account the ancient notion of beauty as aptitude (about this notion, see for instance Tatarkiewicz, 1980), and examining the principle of maximum-effect-for-minimum-means in depth.

This paper provides a basis for such an examination insofar as it identifies a perceived set of alternatives underlying the aesthetic appreciation of products. In conducting a conceptual study of what maximum-effect-for-minimum-means implies for design, this set of alternative products and aims could be addressed and further explored as a set of alternative means and effects. As represented in our diagrams, the set of alternatives could also guide the design of experimental studies; for example, Figure 8 suggests how to select stimuli for experimentally testing the aesthetic preference for a minimum-maximum product-aim (means-effect) relationship. Both products and aims (means and effects) used as stimuli in these studies could be manipulated according to a number of determinants of aesthetic pleasure –not just minimum and maximum– so as to ultimately manipulate the product-aim (means-effect) relationship aesthetically. By conducting studies such as these, research in design aesthetics will finally be able to explain how can beauty be perceived in products regardless of their appearance, even in a light switch.

Acknowledgments

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References

- Bloom, P. (1996). Intention, history, and artifact concepts. *Cognition*, 60(1), 1–29.
- Broms, L. (2011). *Sustainable Interactions: Studies in the Design of Energy Awareness Artefacts*. Linköping: Linköping University.
- Crease, R. P. (2004). *The Prism and the Pendulum: The Ten Most Beautiful Experiments in Science*. New York: Random House.
- Crilly, N. (2011). Do users know what designers are up to? Product experience and the inference of persuasive intentions. *International Journal of Design*, 5(3), 1–15.
- Crilly, N., Moultrie, J., & Clarkson, P. J. (2004). Seeing things: Consumer response to the visual domain in product design. *Design Studies*, 25(6), 547–577.
- Crilly, N., Moultrie, J., & Clarkson, P. J. (2009). Shaping things: Intended consumer response and the other determinants of product form. *Design Studies*, 30(3), 224–254.
- Dipert, R. R. (1993). *Artifacts, Art Works, and Agency*. Philadelphia: Temple University Press.
- Galle, P. (1999). Design as intentional action: A conceptual analysis. *Design Studies*, 20(1), 57–81.
- Hardy, G. H. (1967). *A Mathematician's Apology*. Cambridge: Cambridge University Press.

- Hekkert, P. (2006). Design aesthetics: Principles of pleasure in design. *Psychology Science*, 48(2), 157–172.
- Hekkert, P., & Leder, H. (2008). Product aesthetics. In H. N. Schifferstein & P. Hekkert (Eds.), *Product Experience* (pp. 259–285). Amsterdam: Elsevier Science Publishers.
- Hekkert, P., & Van Dijk, M. (2011). *Vision in Product Design: A Guidebook for Innovators*. Amsterdam: BIS Publishers.
- Hilpinen, R. (1992). Artifacts and works of art. *Theoria*, 58, 58–82.
- Lidwell, W., Holden, K., & Butler, J. (2010). Ockham's Razor. In *Universal Principles of Design: 125 Ways to Enhance Usability, Influence Perception, Increase Appeal, Make Better Design Decisions, and Teach Through Design* (pp. 172–173). Beverly: Rockport.
- Macnab, M. (2012). Efficiency: Go With The Flow. In *Design By Nature: Using Universal Forms and Principles in Design* (pp. 35–66). Berkeley: New Riders.
- Margulies, S. (1977). Principles of beauty. *Psychological Reports*, 41, 3–11.
- Tatarkiewicz, W. (1980). Beauty: History of the Concept. In C. Kasparek (Trans.), *A History of Six Ideas: An Essay in Aesthetics* (pp. 121–152). The Hague: Martinus Nijhoff.
- Walsh, D. (1979). Occam's razor. *American Philosophical Quarterly*, 16(3), 1–4.
- Zelanski, P., & Fisher, M. P. (1984). Economy. In *Design: Principles and Problems* (pp. 31–32). Belmont: Harcourt College Publishers.

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