



On Breaking Functional Fixedness: How the Aha! Moment Enhances Perceived Product Creativity and Product Appeal

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How do consumers react to products assembled from existing components? Nine studies in both the lab and the field demonstrate that consumers evaluate products as more creative and more appealing when they consist of components that originally served entirely different functions. When consumers realize that the intended functionality of a component is not fixed, but versatile, they experience an aha! moment, which in turn enhances perceived product creativity and product appeal. This research bridges engineering and consumer research providing theoretical contributions to the product design and creativity literature. The findings of this research have substantive implications for designing sustainable products, especially for product upcycling, the process of transforming old or used components into new products.

Keywords: product domain distance, functional fixedness, creativity, aha moment, product design, upcycling, sustainability

Almost every product consists of multiple components. For instance, a messenger bag consists of a durable strap, waterproof lining, and an attractive exterior shell. Manufacturers usually design these product

components from scratch, but they can also use components from other products with similar functions. For instance, when designing a new messenger bag, a manufacturer may use the straps, linings, and shells from backpacks, fanny packs, or handbags. Companies can also use components from distant product domains, where products have dissimilar features and functions. For example, the Swiss brand Freitag makes messenger bags with used car seatbelts as durable straps, discarded bicycle inner tubes as waterproof linings, and old truck tarpaulins as outer shells. Similarly, the outdoor clothing producer Patagonia makes overnight bags out of pieces of old jeans, and Southwestern Airlines sell bags and wallets from scraps of leather airplane seats. Instead of reusing discarded product components, manufacturers can also use new product components from related or distant product domains. For example, the video game producer Nintendo incorporates accelerometers from automobile airbag systems to track user movement in its Wii game controllers, and the home appliances manufacturer SMEG uses new components of the Fiat 500 car in the design of some of its refrigerators.

This phenomenon is intriguing because previous research suggests that consumers perceive products

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consisting of components from distant product domains as inferior. Indeed, if product components are not intentionally designed for said products, potential buyers may have doubts about the product's quality and functionality (Goldenberg and Mazursky 2002; Maimon and Horowitz 1999). However, instead of examining *products* with novel benefits (e.g., combining a phone with a shaving machine to be able to shave while making a call), we examine the consequences of using product *components* differently than originally intended, without changing the functionality of the product itself (e.g., a beard-shaving machine that consists of the motor from an electric toothbrush). Because products with complex and novel functions can increase uncertainty (Berlyne 1970), we will ensure a basic, unaltered level of functionality of the product and manipulate whether a product component serves a different function. In nine studies, we propose a novel mechanism that explains why consumers evaluate product with components from a distant domain as superior in terms of creativity and appeal. When consumers realize that the intended functionality of a product component is not fixed but rather versatile, they experience a positive aha! moment. The sudden realization that existing product components can be employed in a distant domain enhances product appeal through an increase in perceived creativity.

This article makes three main contributions. First, we introduce the concept of product domain distance into the product design literature. Past research has explored the impact of product domain distance in the context of strategic brand decisions, for instance, by demonstrating that product domain distance can predict the success of brand extensions (Goedertier et al. 2015; Park, Milberg, and Lawson 1991; Parker et al. 2017; Zhang and Sood 2002). Instead of focusing on the compatibility between two distant product categories in brand extensions, our research documents the importance of product domain distance in the context of product design. We show that consumers perceive products as more appealing when they consist of components from a distant, rather than close, product domain. Our findings provide novel insights on how to design more appealing products.

Second, our research contributes to the creativity literature. Prior research mainly focused on the challenge of generating creative ideas or products (Dahl and Moreau 2002; Franke, Poetz, and Schreier 2013; Goldenberg and Mazursky 2002; Goldenberg, Mazursky, and Solomon 1999; Hargadon 2005; Ward 2004). For instance, problem solvers from distant yet analogous domains have the capacity to generate more creative solutions, ideas, or products compared to those from the same domain (Acar and van den Ende 2016; Dahl and Moreau 2002; Franke et al. 2013; Jeppesen and Lakhani 2010). Instead of examining the creative performance of individuals, we introduce the aha! moment as a novel driver of perceived product creativity. We propose that the sudden realization that the

functionality of a product component is not fixed but versatile enhances perceived product creativity. Such eureka or aha! moments have been documented among problem solvers who “actively” generate solutions for a problem (Schilling 2005). We contribute to the creativity literature by demonstrating that “passive” consumers can also experience an aha! moment, even without actively engaging in a problem-solving process.

Third, we develop a broad and general framework that helps us understand emerging trends such as upcycling (Forbes 2019)—the practice of using old or discarded product components to create novel products. Whereas prior research has proposed sustainability as the main driver behind the appeal of upcycled products (Braungart, McDonough, and Bollinger 2007; Wilson 2016), we document that perceived creativity may be an overlooked driver behind their allure. We contribute to the existing body of knowledge by empirically documenting how specific product characteristics of upcycled products can enhance their appeal and by identifying conditions under which this is more likely to occur. In this regard, our findings have implications not only for how to best promote upcycled products (Kamleitner, Thüridl, and Martin 2019) but also for how to best design upcycled products to stimulate product demand.

THEORETICAL BACKGROUND

In this article, we contend that consumers perceive products as more creative and appealing when they consist of components from a distant (vs. close) product domain. We define product domain distance in terms of (dis)similarity in product features and product functions (Dai and Scott 2005; Landau and Lehr 2004; Liao, Tanner, and MacDonald 2020). Dis(similarity) is a common means to establish domain distance (domain distance theory; Tourangeau and Sternberg 1981). For instance, the product domain distance between cars and trucks is smaller than the distance between cars and aircrafts, because the product features and functionalities are more similar for cars and trucks than for cars and airplanes. Since manufacturers design products with specific features to address specific functions (“form follows function”), features and functions are often intertwined and therefore difficult to separate from each other. Indeed, product design consists of the features of a product together with its function (Ulrich 2011).

When developing new products, designers usually rely on knowledge from close product domains (Amabile 1983; Weisberg 1999) because the search effort to locate useful ideas is typically lower in close (vs. distant) domains (Acar and van den Ende 2016; Martin and Stewart 2001). For example, it is easier to locate a useful car component in the truck domain (close domain) than in the aircraft domain (distant domain). Moreover, products made with

components from close (vs. distant) product domains are more likely to function effectively (Goldenberg and Mazursky 2002; Maimon and Horowitz 1999), because the function of “close” components would typically be similar in the new product.

One reason why designing products with components from a distant domain is less common may be rooted in functional fixedness (Duncker 1945). Functional fixedness is the inability to realize that something with a known, specific use may also perform other functions. It is reflected in the human tendency to associate products and their components with one specific function (Duncker 1945; McCaffrey 2012). For example, people are cognizant that a hammer is a tool consisting of a heavy head and a handle used to drive nails into softer materials, a mug is a container with a handle used for drinking hot beverages, or a candle is an object composed of a wick and wax used to illuminate a room. People are frequently unable to envision how these products and their components could be used in new ways (Defeyter and German 2003; Duncker 1945; German and Barrett 2005). Functional fixedness can prevent individuals from developing new ideas and/or products because they fail to see how existing products could be used outside of their usual context (McCaffrey 2012). For example, the function of a hammer is to drive nails into softer material, but as illustrated by the Alternate Uses Task (Guilford 1967), a hammer can also be used to perform completely different functions, as a paperweight, doorstop, or dumbbell. The product components, rather than the product itself, can also perform different functions. For example, the candle wick could be used to tie things together (after scraping the wax away to free the string), and the handle of a mug could be used as a clothing hook (after gluing the handle to a wooden plank). We put forth the notion that products consisting of components from a distant product domain may elicit positive reactions among consumers in terms of product creativity and product appeal.

We base our hypothesis that product domain distance enhances perceived product creativity on the concept of “function sharing” in mechanical design (Ulrich and Seering 1988). The logic behind this design concept is to simultaneously implement multiple functions within a single product component to make designs more efficient and innovative. For example, Black & Decker developed a motor meant for a wide range of products including drills, sanders, saws, and grinders (Hvam et al. 2017). This sharing of components across different products resulted in remarkable innovations and growth (Utterback et al. 2006). We argue that consumers evaluate a product more positively when they realize that it consists of components that can function in ways they had not previously considered. This is particularly the case when product components stem from distant product domains, such as using the motor of an electric toothbrush to propel a toy car.

We posit that when consumers encounter products consisting of components from distant product domains, they may experience an aha! or eureka moment—a sudden realization, insight, or comprehension accompanied by a sense of surprise—similar to what problem solvers experience when they find a solution to a problem (Schilling 2005; Tik et al. 2018; Topolinski and Reber 2010). Aha! moments are frequently associated with a positive affective response (Gruber 1995; Topolinski and Reber 2010) and typically occur when individuals find a solution to a problem, such as overcoming functional fixedness—the realization that a component can be used for other purposes (e.g., using a candle wick as a string). Rather than documenting aha! moments among “active” problem solvers like inventors and product designers, we propose that “passive” consumers may also experience an aha! moment when they discern that functional fixedness has been overcome. We propose that this aha! moment enhances perceived product creativity and, as a result, product appeal.

We center our conceptualization of perceived product creativity on originality and innovativeness. While creativity, originality, and innovativeness are often used as synonyms and regarded as interchangeable (Acar, Burnett and Cabra 2017; Hirschman 1980), scholars differ in how they conceptualize creativity. For example, many innovation and creativity scholars conceptualize creativity as a two-dimensional construct consisting of “novelty” and “usefulness” (Hennessey and Amabile 2010; Runco and Jaeger 2012). Ideas are not creative if they are not novel, but some level of usefulness (or feasibility) is also essential to distinguish a creative idea from a merely strange or bizarre one (Rietzschel, Nijstad, and Stroebe 2010). For instance, using a hammer as a hat is certainly novel but is not very useful. A “hammer hat” is therefore not a creative idea. While conceptualizing creativity in terms of both novelty and usefulness has merit in certain contexts (e.g., for idea selection after idea generation processes), scholars studying *perceptions* of creativity have documented that novelty is a better and more important predictor of perceived creativity than usefulness (Diedrich et al. 2015; Runco and Charles 1993). This is despite evidence that a certain level of usefulness is required to generate a perception of creativity (Goldenberg and Mazursky 2002). For example, an umbrella made out of newspapers may render the product meaningless and useless, at least in terms of protecting the user from rain rather than sun. We assume that a novel product marketed in a specific domain will provide a basic level of usefulness, as there is little demand for a useless product.

We propose that using one or more product components from a distant (vs. close) product domain will improve perceived creativity (which we conceptualize in terms of originality and innovativeness). Consider two backpacks, one made from discarded truck tarp (distant product domain) and the other from the outer shell of a discarded messenger

bag (close product domain). Assume that these backpacks are sold on Etsy.com, a global online marketplace, and the market “requirements” for new product introductions have therefore been met. Because the backpacks can both carry goods, they are equally useful. We propose that the backpack will be perceived as more creative (in terms of originality and innovativeness)—and therefore more appealing (Dahl and Moreau 2002; Horn and Salvendy 2006)—when it consists of product components from a distant product domain. Using a component from a distant domain (e.g., pieces of tarp from a truck) transcends functional fixedness (triggering the aha! moment), as compared to using a component from a close product domain (e.g., pieces of discarded messenger bags).

H1: Components from a distant (vs. close) product domain enhance perceived product creativity and hence, product appeal.

H2: The positive effect of product domain distance on perceived product creativity is mediated by the experience of an aha! moment.

We predict that the positive effect of product domain distance on product creativity and appeal will weaken when it is easier to overcome functional fixedness. For instance, when product designers use fully decomposed materials (such as plastic resin from PET bottles), they do not (need to) overcome functional fixedness. The full deconstruction of a product into raw, basic constituents destroys said product’s original function entirely (McCaffrey 2012). Consequently, consumers may no longer associate a particular function with the product materials (Krikke, van Harten, and Schurr 1998). In the case of full deconstruction, the original function is completely eliminated and the intensity of consumers’ aha! moment may therefore be diminished.

Another method for overcoming functional fixedness is to provide a “function-free” description of a product component (McCaffrey 2012). Simply stating the material, shape, and/or size of a product component (e.g., “a thin, rectangular piece of metal 0.75 in. long by 0.25 in. wide” rather than “a prong of an electrical plug”) reduces the likelihood of becoming fixated on one particular function. In the context of a “function-free” description of a product component, it is easier, relatively speaking, to identify other functionalities besides those originally intended by the designer. In sum, we predict that the positive effect of product domain distance will be attenuated when it is easier to overcome functional fixedness (e.g., when a product is fully decomposed, or in the context of a “function-free” description). When functional fixedness is easier to overcome, we predict that the aha! moment will be weaker, and the effect of product domain distance on product creativity and appeal will be dampened.

H3: The positive effect of product domain distance on perceived product creativity and appeal is attenuated when it is relatively easy (vs. difficult) to overcome functional fixedness.

However, while individuals often associate creativity with superior value, discovery, innovation, and positive change (Andrews and Smith 1996; Hennessey and Amabile 2010), creativity is not always valued. For example, Mueller, Melwani, and Goncalo (2012) and Staw (1995) contend that people regard creative ideas as more novel but also less useful, because they are often unsure whether novel ideas are practical and reliable (Amabile 1996; Rietzschel et al. 2010; see also Goldenberg and Mazursky 2002). Although we predict that product domain distance will enhance perceived creativity, this positive effect may not necessarily translate into increased product appeal.

We propose that the relationship between perceived creativity and product appeal depends on consumers’ personality traits, specifically their openness to experience. Openness to experience is one of the Big Five personality traits that denotes receptivity to new ideas and new experiences (Goldberg 1993; John and Srivastava 1999; McCrae 1993). Consumers who are more open to experience seek unconventional and unfamiliar experiences, appreciate original and unusual ideas, and like novelty and variety in their daily routines. Consumers who are less open to experience seek refuge in familiar surroundings, appreciate conventional and predictable ideas, and like routine and traditions. Openness to experience is conceptually related to creativity, because individuals who are more open to experience are not only more creative (George and Zhou 2001; McCrae 1987), they are also more likely to appreciate creative ideas or content such as art, music, or literature (John and Srivastava 1999). Although we expect that product domain distance will enhance creativity perceptions regardless of a consumer’s openness to experience, we predict that consumers who are less open to experience will be less appreciative of creativity, because of their tendency to reject anything novel. Specifically, we propose that consumers who are less (vs. more) open to experience will evaluate the appeal of a product made with components from a distant (vs. close) domain less favorably.

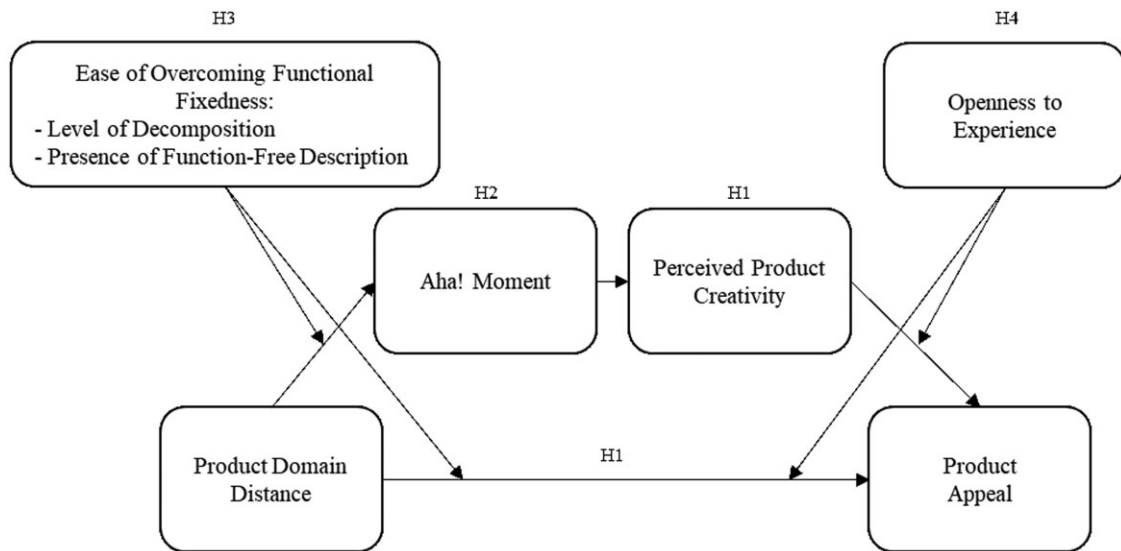
H4: The positive effect of product domain distance on product appeal is reduced when consumers are less (vs. more) open to experience.

OVERVIEW OF STUDIES

We test our predictions in nine studies with different products, study designs, and product samples. As stimuli, we use upcycled products made from old product components (studies 1A–1C and 2B–4B), as well as more

FIGURE 1

CONCEPTUAL MODEL



conventional products made from new product components (studies 1B follow-up and 2A). In studies 1A–1C, we provide correlational and causal evidence for the hypothesized relationships between product domain distance, product creativity, and product appeal (hypothesis 1). Studies 2A–3B demonstrate the role of the aha! moment (hypotheses 2 and 3) and provide process evidence through measured and manipulated mediation approaches. Finally, studies 4A and 4B show that the effect of distance on product appeal is attenuated for consumers who are less open to experience (hypothesis 4). Figure 1 provides an overview of the conceptual model.

STUDY 1A

Study 1A aims to provide evidence for the hypothesized relationships between product domain distance, product creativity, and product appeal by using secondary data. We focus on upcycled products consisting of old components from close versus distant product domains, including a necklace made of soda can pieces, glasses made from beer bottle bottoms, and cufflinks made of bike chain fragments.

Method

We recruited 609 participants ($M_{\text{age}} = 36.10$, 38% female, Amazon Mechanical Turk) who each rated a set of 20 upcycled products, randomly selected from a total sample of 200 upcycled products (randomly sampled from the online shop Etsy.com; web appendix A). Given that all of these products were sold on an online platform, we assume

that the market requirements for product introductions have been met and that the products provide a basic level of usefulness. For each upcycled product, participants saw the product's picture together with the source and target product category labels. For instance, we described a clock made from a used hubcap as: "old product—hubcap"; "new product—clock." To prevent common-method bias, we used a multi-informant approach and randomly assigned participants to one of three conditions (between participants).

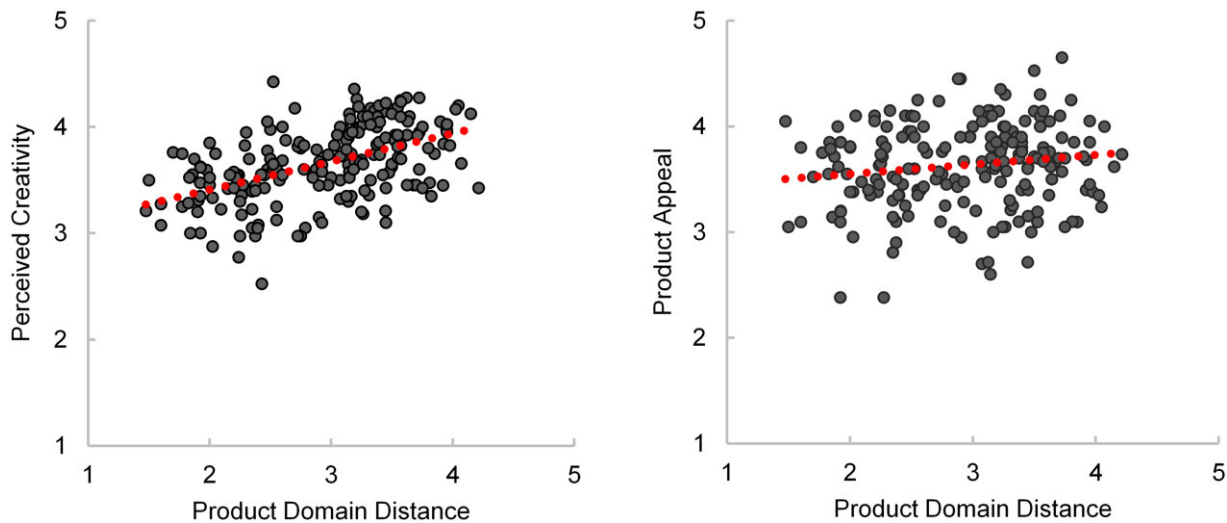
In one condition, participants rated the distance between the source and the target product domains ("To what extent is a [source product] similar to a [target product]?"; "To what extent is the function of a [source product] similar to the function of a [target product]?"; 1 = "very dissimilar," 5 = "very similar"; $r = 0.93$; reverse coded). In a second condition, participants rated perceived creativity ("To what extent is the [target product] innovative?"; 1 = "not innovative at all," 5 = "very innovative"; "To what extent is the [target product] original?"; 1 = "not original at all," 5 = "very original"; $r = 0.85$). In a third condition, participants rated product appeal on a 5-point star scale (1 star = low appeal, 5 stars = high appeal). This experimental approach ensured that the product ratings of the three variables came from different participants. We aggregated the data at the product level (about 20 ratings per product), yielding 200 observations.

Results and Discussion

Perceived product creativity is significantly and positively related to product domain distance ($r = 0.49$, $p <$

FIGURE 2

RELATION BETWEEN PRODUCT DOMAIN DISTANCE, PERCEIVED CREATIVITY, AND PRODUCT APPEAL



NOTE.—Linear regression lines (dotted lines) resulting from the significant linear regression of distance on product appeal ($p = .039$; $R^2 = 0.021$) and of distance on perceived creativity ($p < .001$; $R^2 = 0.238$).

.001) and product appeal ($r = 0.30$, $p < .001$). Product domain distance is significantly and positively related to product appeal ($r = 0.15$, $p = .039$; figure 2). We also tested whether creativity mediates the relationship between distance and appeal. A mediation analysis (all mediation analyses are based on 5,000 bootstrap samples, bias corrected) confirms that this relationship is mediated by perceived creativity ($b = 0.09$, $SE = 0.02$, 95% CI: [0.05, 0.14]).

These results provide first empirical support for the predicted relationships across 200 different upcycled products. We sampled these products from an online platform and they varied in numerous ways, such as the nature of the target product (from diapers to bird feeders), the nature of the source product (from Nespresso capsules to vinyl records), and the product domain distance (from a book cover to a tablet cover and from a fire hose to a shaving kit). The next studies experimentally validate these results and test for causal relationships.

STUDY 1B

Study 1B aims to experimentally test the relationship between product domain distance, perceived creativity, and product appeal. Whereas study 1A examined naturally occurring variations across a diverse set of 200 products from different product categories, the experimental design in study 1B tests the relationships in a more controlled setting, enabling us to isolate the causal effect of product

domain distance. We predict that, while keeping all product features constant (i.e., usefulness, category, design, sustainability, and source product appeal), perceived creativity should mediate the effect of product domain distance on product appeal (hypothesis 1).

Method

We randomly assigned 363 participants ($M_{\text{age}} = 35.50$, 50% female, MTurk) to one of three conditions of a 3 (product domain distance: high, low, control; between participants) \times 3 (product replicates: side table, key ring, pendant lamp; within participants) mixed model design experiment. We exposed all participants to identical pictures of the product replicates. We manipulated product domain distance by varying the product descriptions across conditions. In the high distance condition, we described the product as consisting of a product component from a dissimilar domain (e.g., a side table made with wood from a whiskey barrel); in the low distance condition, we described the product as consisting of a product component from a similar domain (e.g., a side table made with wood from an old side table); in the control condition, the product was described as a basic product (e.g., a side table made with pieces of wood) (table 1). Each product replicate was taken from a random product domain distance condition.

A pre-test confirmed that the distance between the domains of the source and target product is significantly

TABLE 1
STIMULI STUDY 1B

Product	Control	Low distance	High distance
Side table [picture] Brand: Madena tables Diameter: 12" Height: 25"	Characteristics: made with pieces of wood	Characteristics: made with pieces of wood taken from an old side table	Characteristics: made with pieces of wood taken from an old whiskey barrel
Key ring [picture] Brand: Keytel Pendant size: 1.6" × 1.1"	Characteristics: the pendant is refurbished metal	Characteristics: the pendant is an old refurbished metal key ring	Characteristics: the pendant is an old refurbished metal fork
Pendant lamp [picture] Brand: Lightist Height: 11" Diameter: 9"	Characteristics: the shade holder is glass	Characteristics: the shade holder is glass and is a holder from another lamp	Characteristics: the shade holder is glass and is a wine bottle

NOTE.—The images included in the stimuli could not be reproduced due to copyright reasons.

greater in the high (vs. low) distance condition across all replicates ($p < .001$). Furthermore, the pre-test showed that the source products used in the high distance condition were not rated as more attractive than the source products in the low distance condition (i.e., consumer attitudes, appeal, and coolness; side table: $p = .809$; key ring: $p = .971$; pendant lamp: $p = .570$) (see [web appendix B](#) for details on all studies' pre-tests). Hence, any differences found in the main study cannot be attributed to differences in the attractiveness of the source products. Participants rated the appeal and creativity of the target product on the same scales as in study 1A (perceived creativity: $r = 0.88$). We randomized the order of the three questions.

Results and Discussion

Two mixed model ANOVAs show that product domain distance has a significant effect on perceived creativity ($F(2, 358) = 13.40, p < .001, \eta^2 = 0.07$) and product appeal ($F(2, 358) = 5.55, p = .004, \eta^2 = 0.03$; see [table 2](#) for means and SDs). Participants in the high distance condition rated the upcycled product significantly higher in terms of creativity and appeal than those in the low distance condition (creativity: $t(358) = 4.29, p < .001, d = 0.55$; appeal: $t(360) = 3.14, p = .002, d = 0.40$) and the control condition (creativity: $t(358) = 4.65, p < .001, d = 0.60$; appeal: $t(360) = 2.55, p = .011, d = 0.33$). There was no significant difference in creativity or appeal between the low distance and control conditions (creativity: $t(358) = 0.37, p = .715, d = 0.05$; appeal: $t(360) = -0.58, p = .562, d = -0.08$). Furthermore, the interaction between distance and the product replicates factor was insignificant (creativity: $F(2, 358) = 1.53, p = .218, \eta^2 = 0.01$; appeal: $F(2, 358) = 0.50, p = .609, \eta^2 < 0.01$), indicating that the effects are robust across replicates.

Finally, a mediation analysis using distance as multicategorical independent variable formally confirmed that the effect of product domain distance on product appeal is mediated by perceived product creativity (high distance vs.

low distance: $b = 0.34, SE = 0.08, 95\% CI: [0.18, 0.50]$; high distance vs. control: $b = 0.37, SE = 0.08, 95\% CI: [0.21, 0.53]$) (see [web appendix C](#) for details). In sum, higher distance between the source and target product domains increases the perceived creativity of the target product, which in turn increases its appeal.

Follow-Up Study

Seeking to generalize our results beyond the category of upcycled products, we replicated this main effect with products consisting of new and unused product components. In a pre-registered follow-up study ($N = 402, M_{age} = 27.21, 50\%$ female, Prolific; pre-registration: <https://aspre-dicted.org/79qe8.pdf>), we show that the effect of product domain distance on product creativity and appeal occurs regardless of whether the existing product component is old (i.e., already used for another product) or new (i.e., never used before). We randomly assigned participants to one of four conditions of a 2 (product domain distance: high, low) \times 2 (type of component: old vs. new) between-participants design experiment. We manipulated product domain distance by varying the product descriptions across conditions. In the high distance conditions, we described the product as being made out of an existing product component, either old or new, from a distant domain (i.e., a hanging lamp made using a new/old horn from a gramophone); in the low distance condition, we described the product as being made out of an existing product component, either old or new, from a close domain (i.e., a hanging lamp made using a new/old shade from an outdoor lamp; see [web appendix A](#) for stimuli and [web appendix B](#) for pre-test on distance and attractiveness of the source product). Participants rated the product's creativity (i.e., originality and innovativeness; "What is your opinion about this lamp"; 1 = "It's not very innovative," 7 = "It's very innovative"; 1 = "It's not very original," 7 = "It's very original"; $r = 0.70$) and appeal ("What is your opinion about this lamp"; 1 = "It's not very appealing," 7 =

TABLE 2
PERCEIVED CREATIVITY AND APPEAL MEANS (AND SDS) PER PRODUCT

Product	Creativity			Appeal		
	Control	Low distance	High distance	Control	Low distance	High distance
Side table	3.31 (1.03)	3.24 (0.97)	3.86 (0.94)	3.70 (0.89)	3.51 (0.84)	3.91 (0.93)
Lamp	3.26 (0.98)	3.43 (1.03)	3.75 (0.98)	3.16 (1.01)	3.20 (1.06)	3.48 (1.02)
Key ring	2.80 (1.17)	2.84 (1.11)	3.51 (1.20)	3.18 (1.16)	3.12 (1.08)	3.38 (1.15)
Overall	3.13 (0.99)	3.17 (0.95)	3.71 (0.97)	3.35 (0.81)	3.29 (0.73)	3.60 (0.79)

NOTE.— All means in the high distance condition are significantly higher than those in the low distance condition and the control condition. All means in the low distance condition are not significantly different from the means in the control condition.

“It’s very appealing”; 1 = “I do not rate it very positively,” 7 = “I rate it very positively”; $r = 0.81$).

Two ANOVAs with product domain distance and type of component as fixed factors reveal significant main effects of product domain distance on creativity ($F(1, 398) = 27.53, p < .001, \eta^2 = 0.07$) and product appeal ($F(1, 398) = 5.32, p = .022, \eta^2 = 0.01$). Participants in the high distance condition rated the product significantly higher in terms of creativity and appeal than did participants in the low distance condition (creativity: $M_{\text{High}} = 4.89, SD = 1.47$ vs. $M_{\text{Low}} = 4.16, SD = 1.37$; appeal: $M_{\text{High}} = 4.50, SD = 1.62$ vs. $M_{\text{Low}} = 4.13, SD = 1.60$). The ANOVAs also revealed significant main effects of the type of component on creativity ($F(1, 398) = 16.54, p < .001, \eta^2 = 0.04$) and product appeal ($F(1, 368) = 7.06, p = .008, \eta^2 = 0.02$), such that products consisting of old components are perceived as more creative and more appealing compared to products consisting of new components. However, the two-way interaction effects proved insignificant for both creativity and appeal (creativity: $F(1, 398) = 0.00, p = .959, \eta^2 = 0.00$; appeal: $F(1, 398) = 0.56, p = .454, \eta^2 < 0.01$; table 3), indicating that the observed effects occur regardless of whether the existing product component has been used before or not. This generalizes our proposed effect beyond the realm of upcycled products. Finally, a mediation analysis formally supported the conclusion that perceived creativity mediated the effect of product domain distance on product appeal ($b = 0.25, SE = 0.05, 95\% \text{ CI: } [0.15, 0.35]$). These results are consistent if we run mediation analyses separately for the old and new component conditions (old: $b = 0.24, SE = 0.07, 95\% \text{ CI: } [0.11, 0.38]$; new: $b = 0.26, SE = 0.08, 95\% \text{ CI: } [0.11, 0.42]$) (see web appendix C for details). In sum, a higher product domain distance increases perceived product creativity, which in turn increases product appeal.

STUDY 1C

In studies 1A and 1B, we documented the main effect of product domain distance on product appeal and the mediating role of perceived creativity. In study 1C, we tested the

effect of product domain distance on appeal using a consequential measure.

Method

We purchased 130 upcycled keychains on Etsy.com (hand made with re-used pieces of parachute fabric). Half of the keychains were red and blue, whereas the other half were blue and turquoise; we counterbalanced these colors across experimental conditions. We set up a small pop-up sales booth on a university campus to sell the keychains. Participants could purchase a keychain for €1 and were told (truthfully) that all money collected would be donated to UNICEF to help children in need. Participants could choose between the two different types of keychains. We conducted a within-participants design with two conditions (product domain distance: high, low) by describing half of the keychains as being made by “repurposing the fabric of parachutes” (high distance), and the other half as being made by “repurposing the fabric of other keychains” (low distance) (see web appendix A for stimuli and web appendix B for pre-test on distance and attractiveness of the source product). We packaged the keychains into small paper bags to make the differentiation between conditions more convincing. For the duration of the study, we consistently displayed 10 keychains at the booth: 5 keychains from the high distance condition and 5 keychains from the low distance condition. To avoid scarcity effects (Mittone and Savadori 2009), we replaced every keychain that was sold with another keychain from the same condition, thus ensuring that the number of available keychains per condition was constant over time. We stopped collecting data once all 120 keychains were sold. We kept nine additional keychains on the display table to consistently display the same number of products.

The booth was open for 2 days. Participants were persons who stopped at the sales booth to purchase a keychain. While the selling price was €1, participants could donate more if they wanted to. A research assistant blind to the research hypotheses approached people to invite them to buy a keychain. The research assistant asked them to choose between a “keychain made from reused parachute

TABLE 3
STUDY 1B FOLLOW-UP: PERCEIVED CREATIVITY AND APPEAL MEANS (AND SDS) PER PRODUCT

Source component	Creativity		Appeal	
	Low distance	High distance	Low distance	High distance
Old component	4.45 (1.23)	5.17 (1.40)	4.41 (1.53)	4.66 (1.57)
New component	3.87 (1.45)	4.61 (1.49)	3.86 (1.64)	4.35 (1.67)
Overall	4.16 (1.37)	4.89 (1.47)	4.13 (1.60)	4.50 (1.62)

NOTE.— All means in the high distance condition are significantly higher than those in the low distance condition.

fabric” or a “keychain made by reusing the fabric of other keychains.” Another member of the research team recorded purchase information (e.g., keychain type, keychain color, time, additional information).

Results and Discussion

A two-proportion *z*-test shows that participants were significantly more likely to purchase a keychain consisting of a component from a distant (vs. close) domain ($z = 4.72$, $p < .001$). Specifically, we sold 82 keychains in the high distance condition and only 38 keychains in the low distance condition. We raised €148.16 in total, which we donated to UNICEF. This study shows our predicted main effect with actual purchasing data.

STUDY 2A

In studies 2A and 2B, we aim to provide more detailed process insights about experiencing the aha! moment (hypothesis 2). In study 2A, we show that the aha! moment mediates the effect of distance on creativity and appeal. In study 2B, we replicate this effect in another product category and show that the effect increases when using a larger number of components from a distant domain.

Method

We randomly assigned 242 participants ($M_{\text{age}} = 35.81$, 42% female, MTurk) to one of two conditions (product domain distance: high, low) of a between-participants design experiment. Participants first saw a picture of a side table, comprised of reused components of an old product and described as such (the nature of the source product was not disclosed). We subsequently informed participants that the table was either made reusing components of a whiskey barrel (high distance condition), or of another side table (low distance condition) (see [web appendix A](#) for stimuli and [web appendix B](#) for pre-test on distance and attractiveness of the source product).

Next, participants indicated to what extent they experienced an aha! moment using the following scale: “Learning about this product gave me a novel insight,”

“Learning about this product made me feel like I solved a puzzle,” “Learning about this product gave me an aha! moment,” “Learning about this product made me feel surprised” (1 = “strongly disagree,” 5 = “strongly agree”; $\alpha = 0.89$). The scale captures the main dimensions of the aha! moment construct, which refers to a flash of insight and sudden realization or cognizance of having a solution to a problem, accompanied by a sense of surprise, akin to what problem solvers experience when functional fixedness is overcome (Bowden and Jung-Beeman 2003; Schilling 2005; Tik et al. 2018; Topolinski and Reber 2010). Finally, participants rated the products on creativity ($r = 0.75$) and appeal as in study 1B. We randomized the order of the three questions.

Results and Discussion

Two ANOVAs, one on perceived creativity and one on product appeal, revealed significant main effects of product domain distance (creativity: $F(1, 240) = 18.81$, $p < .001$, $\eta^2 = 0.07$; appeal: $F(1, 240) = 5.06$, $p = .025$, $\eta^2 = 0.02$). Participants in the high distance condition rated the table as significantly more creative ($M_{\text{High}} = 4.18$, $SD = 0.85$ vs. $M_{\text{Low}} = 3.65$, $SD = 1.03$) and appealing ($M_{\text{High}} = 4.10$, $SD = 1.04$ vs. $M_{\text{Low}} = 3.81$, $SD = 0.96$) than did those in the low distance condition. A third ANOVA revealed that participants experienced a significantly stronger aha! moment when the domain distance from the source product was higher versus lower ($M_{\text{High}} = 3.45$, $SD = 1.04$ vs. $M_{\text{Low}} = 3.12$, $SD = 1.11$; $F(1, 240) = 5.75$, $p = .017$, $\eta^2 = 0.02$).

A sequential mediation analysis provided formal evidence for a significant sequential mediation effect ($b = 0.17$, $SE = 0.04$, 95% CI: [0.09, 0.26]) (see [web appendix C](#) for details). In line with our theorizing, these results suggest that the aha! moment can explain why higher distance increases perceived creativity and product appeal.

STUDY 2B

Thus far, we have compared products made with a single component taken from a high versus low distant domain. In study 2B, we aim to manipulate the intensity of the aha!

moment, not by comparing low versus high distance components, but by increasing the number of product components taken from distant domains. Specifically, we ask participants to rate a product made either with zero, one, two, or three new product components that all stem from a distant domain.

Method

We randomly assigned 480 participants ($M_{\text{age}} = 38.34$, 58% female, MTurk) to one of four conditions (number of distant components: zero, one, two, three) of a between-participants design experiment. We exposed participants to an identical picture of a messenger bag from the brand More-Than-Hip and gave them information about the product's components (i.e., bag shell, shoulder strap, and bag details). In the zero distant components condition, none of the product components were taken from a distant domain; in the one distant component condition, one component of the product was taken from a distant domain (i.e., bag shell made from tarpaulin usually used to cover truck cargo); in the two distant components condition, two components of the product were taken from a distant domain (i.e., bag shell made from tarpaulin usually used to cover truck cargo; shoulder strap designed for car seat belts); in the three distant components condition, all three components of the product were taken from a distant domain (i.e., bag shell made from tarpaulin usually used to cover truck cargo; shoulder strap made from car seat belts; bag details made out of an inner tube for mountain bikes) (see [table 4](#) and [web appendix B](#) for pre-test on distance).

Next, we measured the intensity of the aha! moment ($\alpha = 0.84$) and perceived product creativity ($r = 0.86$), using the same measures as before. As a measure of product appeal, we measured participants' liking of the bag ("What is your opinion about this bag?," 1 = "I like it less than a usual messenger bag," 7 = "I like it more than a usual messenger bag").

Results and Discussion

We ran three ANOVAs to perform three tests of linear contrasts. We compared the mean differences in the aha! moment, creativity perceptions, and product appeal between the zero, one, two, and three distant components conditions. Results show a positive and significant linear contrast for all our variables (aha! moment: $F(1, 476) = 48.24$, $p < .001$, $\eta^2 = 0.10$; creativity: $F(1, 476) = 87.84$, $p < .001$, $\eta^2 = 0.17$; appeal: $F(1, 476) = 22.34$, $p < .001$, $\eta^2 = 0.05$), which indicates that with a greater number of distant components, participants experience a more intense aha! moment and also find the product more creative and more appealing ([figure 3](#)). However, as seen in [figure 3](#), the effect of distance seems to reach a plateau when two distant components are used. This suggests that excessively increasing the distance may not necessarily lead to additional positive product perceptions.

Importantly, we find that consumers experience a stronger aha! moment and also rate the bag as more creative and appealing when at least one (vs. no) component comes from a distant domain (aha!: $p = .003$, $\eta^2 = 0.04$; creativity: $p < .001$, $\eta^2 = 0.06$; appeal: $p = .007$, $\eta^2 = 0.03$).

STUDY 3A

Study 2B aimed to increase the intensity of the aha! moment, while studies 3A and 3B attempt to experimentally decrease the intensity of the aha! moment. More specifically, studies 3A and 3B seek to provide additional process evidence for the aha! moment by manipulating how easy it is to overcome functional fixedness. The conceptual logic is that when a product component is decoupled from a particular function, it is easier (relatively speaking) to overcome functional fixedness. In study 3A, rather than manipulating product domain distance, we manipulate ease of overcoming functional fixedness by varying the level of decomposition (partial vs. full) of a

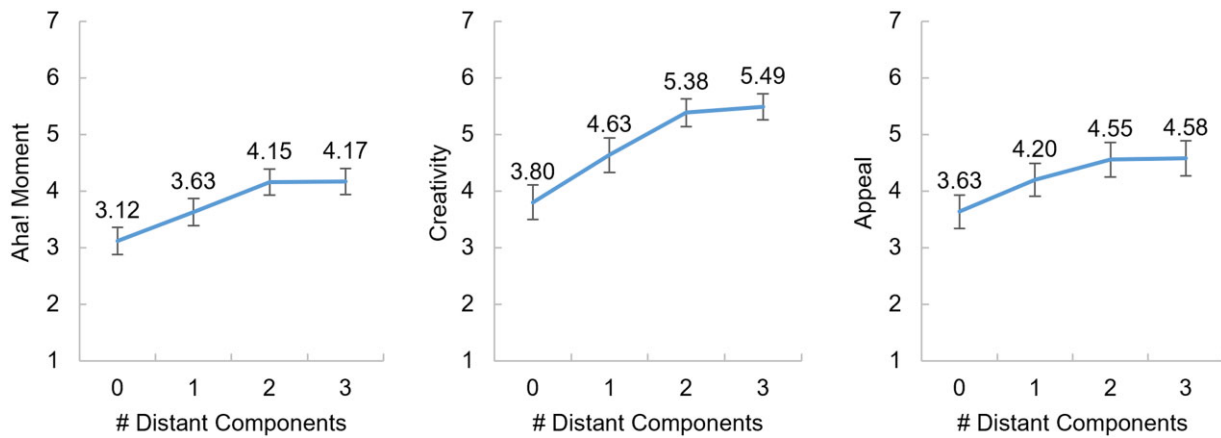
TABLE 4
STIMULI STUDY 2B

Messenger bag Sleek, strong, and durable are words that describe the Madrid messenger bag best. Available in different colors. [bag picture]			
0 distant components	1 distant component	2 distant components	3 distant components
Bag: tarpaulin fabric [tarpaulin picture]	Bag: tarpaulin usually used to cover trucks cargo [truck picture]	Bag: tarpaulin usually used to cover trucks cargo [truck picture]	Bag: tarpaulin usually used to cover trucks cargo [truck picture]
Shoulder strap: a nylon band [band picture]	Shoulder strap: a nylon band [band picture]	Shoulder strap: designed for car seat belts [seat belt picture]	Shoulder strap: designed for car seat belts [seat belt picture]
Bag details: rubber strips [strips picture]	Bag details: rubber strips [strips picture]	Bag details: rubber strips [strips picture]	Bag details: inner tube for mountain bikes [tube picture]

NOTE.—The images included in the stimuli could not be reproduced due to copyright reasons.

FIGURE 3

RELATION BETWEEN THE NUMBER OF DISTANT COMPONENTS AND AHA! MOMENT, PERCEIVED CREATIVITY, AND APPEAL



NOTE.— Bars indicate 95% confidence interval.

source product. We predict that the aha! moment will be less intense and that ratings of product creativity and product appeal will be lower when it is easier to overcome functional fixedness (hypothesis 3).

We expect that it is easier to overcome functional fixedness when product designers use fully (rather than partially) decomposed materials, because the full deconstruction of a product into raw, basic constituents destroys said product's original function entirely (McCaffrey 2012). Consequently, the decomposition of a product into its raw material should allow consumers to fixate less on the typical use of a product or its components (Krikke et al. 1998). A pre-test ($N = 100$; see web appendix B for details) confirms this assumption: people find it easier to think of other product functions when the product is fully (vs. partially) decomposed.

Method

We randomly assigned 451 participants ($M_{\text{age}} = 25.42$, 40% female, Prolific) to one condition of a three (level of decomposition: partial, full, control) condition between-participants design experiment. We exposed participants to an identical picture of a coat rack from the fictitious brand Wran and gave them information about the product's design. In the partial decomposition condition (where functional fixedness is difficult to overcome), we described the product as made from a partially decomposed wooden surfboard; in the full decomposition condition (where functional fixedness is easy to overcome, relatively speaking), we described the product as made from old wooden surfboards that had been totally decomposed into raw wood; in

the control condition, we described the product as made from a piece of old wood (web appendix A).

Next, we measured the intensity of the aha! moment ($\alpha = 0.79$) and perceived product creativity ($r = 0.74$), as before. As a measure of product appeal, we measured participants' (hypothetical) willingness to pay ("How much would you be willing to pay at maximum for Wran's coat rack?" in \$; $M = 23.36$, $SD = 31.75$).

Results and Discussion

Three independent ANOVAs produced significant effects of the level of decomposition on consumers' aha! moment ($F(2, 448) = 24.48$, $p < .001$, $\eta^2 = 0.10$), perceived product creativity ($F(2, 448) = 48.28$, $p < .001$, $\eta^2 = 0.18$), and willingness to pay ($F(2, 448) = 10.06$, $p < .001$, $\eta^2 = 0.04$). Specifically, participants in the partial decomposition condition experienced a stronger aha! moment than participants in the full decomposition condition ($M_{\text{Partial}} = 4.22$, $SD = 1.14$ vs. $M_{\text{Full}} = 3.86$, $SD = 1.33$; $t(448) = 2.39$, $p = .017$, $d = 0.28$) and control condition ($M_{\text{Control}} = 3.18$, $SD = 1.43$; $t(448) = 6.89$, $p < .001$, $d = 0.79$). These patterns were similar for perceived creativity ($M_{\text{Partial}} = 5.18$, $SD = 1.22$ vs. $M_{\text{Full}} = 4.69$, $SD = 1.45$; $t(448) = 3.00$, $p = .003$, $d = 0.35$; $M_{\text{Control}} = 3.63$, $SD = 1.52$; $t(448) = 9.60$, $p < .001$, $d = 1.11$). Participants in the partial decomposition condition were also willing to pay more money for the coat rack than those in the full decomposition ($M_{\text{Partial}} = 31.94$, $SD = 29.66$ vs. $M_{\text{Full}} = 22.24$, $SD = 42.48$; $t(448) = 2.70$, $p = .007$, $d = 0.31$) and control conditions ($M_{\text{Control}} = 15.96$, $SD = 15.10$; $t(448) = 4.45$, $p < .001$, $d = 0.51$). These results indicate that consumers value a product that

consists of a partially decomposed product more than a product that consists of a fully decomposed product—holding constant product domain distance.

A sequential mediation analysis using the level of decomposition as a multi-categorical independent variable provides evidence for the predicted sequential mediation effect ($b = 1.16$, $SE = 0.43$, 95% CI: [0.47, 2.17]) (see [web appendix C](#) for details). Overall, this study provides additional evidence for the role of the aha! moment and perceived creativity in explaining product appeal. Most importantly, it shows that when it is more difficult to overcome functional fixedness (i.e., partial decomposition), the effect of product domain distance on product appeal is stronger compared to when it is easier to overcome functional fixedness (i.e., full decomposition).

STUDY 3B

In study 3B, we aim to provide additional evidence for the conceptual framework by manipulating the ease with which functional fixedness can be overcome. In addition to product domain distance, we manipulate the description of the source component. Specifically, we predict that providing a “function-free description” of a product component (i.e., articulating the material, shape and/or size; [McCaffrey 2012](#)) reduces the likelihood of people becoming fixated on one particular function, thus making it easier (relatively speaking) to identify other functionalities beyond those originally intended. As a result, we predict that a function-free description will reduce the intensity of the aha! moment (and relatedly, perceived creativity and product appeal). However, this will only occur if the function-free description is associated with a component from a distant product domain, for which consumers might experience functional fixedness. We predict that it will not occur if the function-free description is associated with a component from a close product domain, for which consumers are less likely to experience functional fixedness (and thus the aha! moment) in the first place. We pre-registered the study and our predictions (<https://aspre-dicted.org/yb5jyf.pdf>).

Method

We aimed to recruit 600 participants and we obtained 602 ($M_{\text{age}} = 30.60$, 58% female, Prolific). Similar to the choice-based design used in study 1C, we manipulated product domain distance within participants by exposing participants to two backpacks. One backpack (“Burty”) consisted of a component from a close domain (i.e., “fabric taken from dry bags”), whereas the other backpack (“Cartl”) consisted of a component from a distant domain (i.e., “fabric taken from cargo trucks”).

We manipulated between participants whether the components of the backpacks contained a function-free

description or not. We randomly assigned participants to one of three experimental conditions (function-free description: absent; close product; distant product). In the function-free description “absent” condition (the baseline condition), we described the source of the component and displayed pictures of a dry bag and a truck. Consistent with our prior studies that did not include function-free descriptions, we expect participants to find the distant (vs. close) component product more appealing because of a more intense aha! moment and enhanced perception of creativity (as a result of overcoming functional fixedness).

In the two function-free description “present” conditions, we provided a function-free description (“The fabric is tarpaulin, which is a cloth usually made of polyethylene”) and a picture of the function-free component (i.e., a picture of tarpaulin) for either the product with a close domain component (Burty) or for the product with a distant domain component (Cartl) (see [web appendix A](#) for stimuli and [web appendix B](#) for pre-tests regarding distance and perceived attractiveness of the source product). We expect that the stronger aha! moment and creativity perceptions for the distant component product predicted in the baseline condition will be less intense when the function-free description is associated with a distant (vs. close) component product domain. Put differently, we expect that the function-free description will matter primarily for the product consisting of a distant component. Functional fixedness is high for this product, and the use of function-free descriptions should therefore make it easier to overcome functional fixedness. The provision of the function-free description for the product consisting of a close component should matter less, because functional fixedness is low and it is already easy to overcome functional fixedness.

To test these predictions, we asked participants to indicate for which backpack they experienced a stronger aha! moment (measured with the same items as in previous studies; 1 = “Burty’s backpack,” 7 = “Cartl’s backpack”; $\alpha = 0.66$) and which backpack they found more creative (“Which backpack is more original?,” “Which backpack is more innovative?,” 1 = “Burty’s backpack,” 7 = “Cartl’s backpack”; $r = 0.38$). As a measure of product appeal, participants indicated which backpack they found more appealing (“Which backpack is more appealing?,” “Which backpack would you rate more positively?,” 1 = “Burty’s backpack,” 7 = “Cartl’s backpack”; $r = 0.64$).

Results and Discussion

We first tested whether participants rate the product consisting of a distant (vs. close) component higher in terms of the aha! moment, creativity, and appeal in the baseline condition (i.e., we tested for the main effect). Because we employed a choice-based within-participants design, we tested this effect by running t -tests against the scale mid-

point of the three measures ($=4$). The t -tests revealed that consumers have a significantly stronger aha! moment and higher creativity perceptions and find the product more appealing when it consists of a distant (vs. close) domain component, which replicates the main effect of study 1C in a choice-based design experiment (aha!: $M = 4.68$; $t(200) = 9.97$, $p < .001$, $d = 0.70$; creativity: $M = 5.24$; $t(200) = 12.44$, $p < .001$, $d = 0.88$; appeal: $M = 4.31$; $t(200) = 2.51$, $p = .013$, $d = 0.18$).

We next tested whether the presence of a function-free description associated with the distant component product moderates our main effect. Three ANOVAs produced significant main effects on the aha! moment ($F(2, 599) = 8.41$, $p < .001$, $\eta^2 = 0.03$), creativity ($F(2, 599) = 5.20$, $p = .006$, $\eta^2 = 0.02$), and product appeal perceptions ($F(2, 599) = 3.34$, $p = .036$, $\eta^2 = 0.01$). Specifically, compared to participants in the baseline (“function-free absent”) condition and the “function-free description close” condition, participants in the “function-free description distant” condition indicated a significantly less intense aha! moment, as well as lower creativity and lower appeal perceptions (function-free distant vs. baseline: aha!: $M_{\text{FFdistant}} = 4.34$, $SD = 0.97$ vs. $M_{\text{baseline}} = 4.68$, $SD = 0.97$; $t(599) = -3.44$, $p < .001$, $d = -0.34$; creativity: $M_{\text{FFdistant}} = 4.78$, $SD = 1.62$ vs. $M_{\text{baseline}} = 5.24$, $SD = 1.41$; $t(599) = -3.00$, $p = .003$, $d = -0.30$; appeal: $M_{\text{FFdistant}} = 3.99$, $SD = 1.86$ vs. $M_{\text{baseline}} = 4.31$, $SD = 1.74$; $t(599) = -1.82$, $p = .070$, $d = -0.18$; function-free distant vs. Function-free close: aha!: $M_{\text{FFclose}} = 4.70$, $SD = 1.07$; $t(599) = -3.65$, $p < .001$, $d = -0.37$; creativity: $M_{\text{FFclose}} = 5.16$, $SD = 1.68$; $t(599) = -2.53$, $p = .012$, $d = -0.25$; appeal: $M_{\text{FFclose}} = 4.43$, $SD = 1.75$; $t(599) = -2.50$, $p = .013$, $d = -0.25$). There was no difference between the baseline and function-free close conditions (aha!: $p = .833$, $d = 0.02$; creativity: $p = .639$, $d = 0.05$; appeal: $p = .494$, $d = 0.07$; figure 4). These results indicate that the effect of domain distance on the aha! moment, creativity, and product appeal is attenuated when it is easy to overcome functional fixedness (i.e., when the distant product component includes a function-free description).

STUDY 4A

The results of the studies presented thus far suggest that the positive effect of product domain distance on product appeal is due to enhanced creativity perceptions. However, the relationship between product domain distance and creativity appears to be stronger (at least directionally) than the relationship between product domain distance and appeal,¹

suggesting that enhanced perceptions of creativity may not necessarily lead to an increase in product appeal. Consumers may recognize the enhanced creativity, but this increase in originality and innovativeness does not automatically ensure that they will like the product. We explore this possibility in the next two studies, where we focus on the relationship between creativity and appeal.

In studies 4A and 4B, we test whether the effect of product domain distance on appeal is moderated by consumers’ openness to experience. We expect the effect of product domain distance on product appeal to be attenuated when consumers are less likely to value creativity. Prior research suggests that openness to experience predicts whether creative output, such as art, music, or literature, is appreciated (John and Srivastava 1999). Although all consumers, regardless of openness to experience, should generally perceive a product as creative when it consists of components from a distant domain, we expect that consumers who are less open to experience will find the product less appealing (hypothesis 4). For these consumers, product appeal should be less affected by perceived creativity. We will measure and manipulate openness to experience in studies 4A and 4B, respectively.

Methods

We randomly assigned 224 participants ($M_{\text{age}} = 35.14$, 60% female; convenience sample) to one condition of a 3 (product domain distance: high, low, control; between participants) \times 4 (product replicates: bag, table, lamp, shelf; within participants) mixed design experiment. In each condition, participants rated six products (two filler products and four target product replicates). The product replicates were the same across the three conditions; we manipulated only the description of the four product replicates (similar as those in study 1B; see web appendix A for stimuli and web appendix B for pre-test on distance and attractiveness of the source product). In the high distance condition, we told participants that the product consisted of a component from a distant domain (e.g., a lamp made from reclaimed whiskey bottles). In the low distance condition, we told participants the product consisted of a component from a close domain (e.g., a lamp made from reclaimed lampshades). In the control condition, we did not provide any product description. Participants rated product appeal on a 5-point scale (“How would you rate this [product] on a scale from 1 to 5?” 1 = “poor,” 5 = “excellent”).

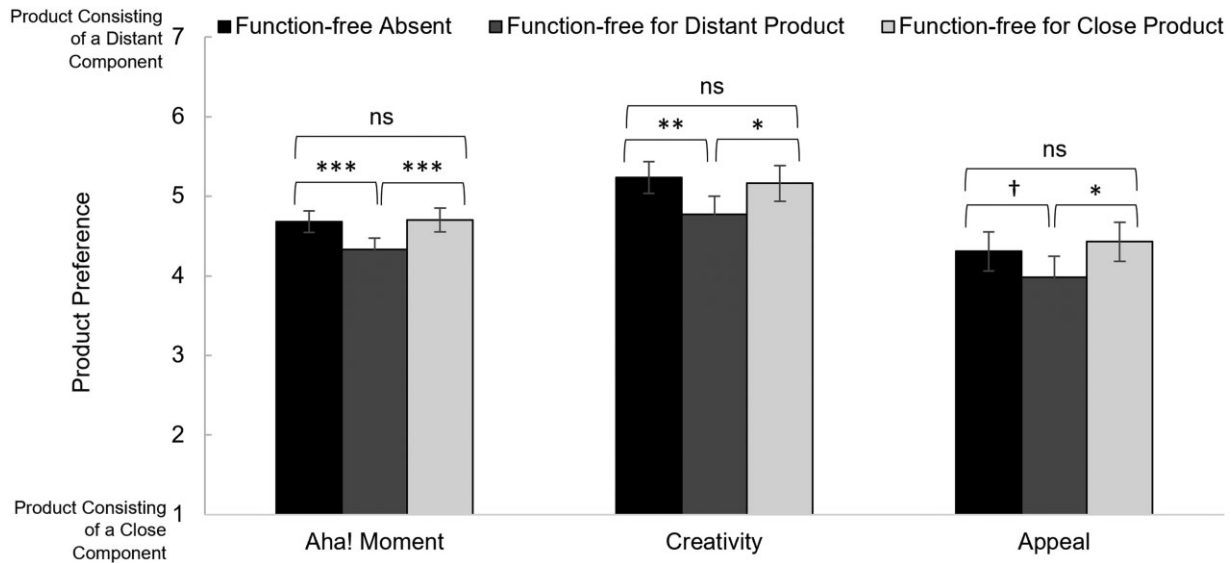
After rating the products, participants completed the 10-item Openness to Experience (OtE) scale (John and Srivastava 1999; exemplary items—“I see myself as someone who is curious about many different things,” “I see myself as someone who has an active imagination,” “I see myself as someone who values artistic, aesthetic

¹ Comparison relation distance creativity versus distance appeal in study 1A: $r = 0.49$ versus $r = 0.15$; $z = 3.82$, $p < .001$; study 1B: $r = 0.27$ versus $r = 0.21$; $z = 0.78$, $p = .219$; study 2A: $r = 0.27$ versus $r = 0.14$; $z = 1.44$, $p = .075$; study 2B: $r = 0.49$ versus $r = 0.39$; $z = 1.96$, $p = .025$; comparison differences from the mid-point scale for creativity versus appeal in the baseline condition of study 3B: diff =

1.23 versus diff = 0.68, $p < .001$; product domain distance was not manipulated in study 3A.

FIGURE 4

MODERATING EFFECT OF EASE TO OVERCOME FUNCTIONAL FIXEDNESS



NOTE.—†Marginally significant at $p < .10$ level; *significant at $p < .05$ level; **significant at $p < .01$; ***significant at $p < .001$; ns = not significant. Bars indicate 95% confidence interval.

experiences”) (1 = “strongly disagree”; 7 = “strongly agree”; $\alpha = 0.76$, $M_{\text{Grand}} = 5.01$, $SD = 0.75$, $\min = 2$, $\max = 7$). Importantly, participants’ OtE scores did not differ across conditions ($M_{\text{High}} = 4.93$, $SD_{\text{High}} = 0.75$; $M_{\text{Low}} = 5.09$, $SD_{\text{Low}} = 0.82$; $M_{\text{Control}} = 5.02$, $SD_{\text{Control}} = 0.66$; $F(2, 221) = 0.89$, $p = .412$).

Results and Discussion

A mixed model ANOVA on product appeal shows a significant effect of distance on appeal ($F(2, 221) = 6.32$, $p = .002$, $\eta^2 = 0.05$). Participants in the high distance condition perceived the products as significantly more appealing than participants in the low distance condition ($M_{\text{High}} = 3.79$, $SD = 0.71$ vs. $M_{\text{Low}} = 3.47$, $SD = 0.84$; $t(221) = 2.70$, $p = .008$, $d = 0.44$) and the control condition ($M_{\text{High}} = 3.79$, $SD = 0.71$ vs. $M_{\text{Control}} = 3.39$, $SD = 0.65$; $t(221) = 3.35$, $p < .001$, $d = 0.55$). Participants’ product appeal ratings did not differ between the latter two conditions ($M_{\text{Low}} = 3.47$, $SD = 0.84$ vs. $M_{\text{Control}} = 3.39$, $SD = 0.65$; $t(221) = 0.71$, $p = .481$, $d = 0.12$). The interaction between distance and the product replicates factor was not significant ($F(2, 221) = 1.47$, $p = .233$, $\eta^2 = 0.01$; table 5), which indicates that the effect is robust across replicates.

A moderation analysis using distance as multicategorical independent variable formally confirmed that the effect of product domain distance on the appeal of the

products is moderated by openness to experience (high distance vs. low distance: $b = 0.51$, $SE = 0.15$, 95% CI: [0.22, 0.80]; high distance vs. control: $b = 0.69$, $SE = 0.17$, 95% CI: [0.36, 1.02]). Specifically, directly comparing the high and low distance conditions, a floodlight analysis with the Johnson–Neyman technique revealed that consumers scoring high on openness to experience ($M_{\text{OtE}} \geq 4.79$) rated the product as significantly more appealing when it consisted of a distant (vs. close) domain component. For consumers with moderate scores on the openness to experience scale ($2.93 < M_{\text{OtE}} < 4.79$), there was no significant effect of distance on appeal. Interestingly, if consumers score very low on openness to experience ($M_{\text{OtE}} \leq 2.93$), they would rate the product as significantly less appealing when it is made out of an existing product component from a distant (vs. close) domain. Figure 5 illustrates the results (for expository reasons, we dichotomized openness to experience at the mid-point scale).

STUDY 4B

Study 4B aims to provide further evidence for the documented moderation effect by manipulating openness to experience. Because it is notoriously difficult to manipulate an individual’s personality experimentally, we test our conceptual framework in a gift-giving context and

manipulate the personality trait of the gift recipient. We predict that gift-givers will be less likely to purchase a product consisting of components from a distant (vs. close) product domain for recipients who value creativity less (i.e., those characterized by low levels of openness to experience).

Method

We randomly assigned 484 participants ($M_{\text{age}} = 39.89$, 54% female, MTurk) to one condition of a 2 (openness to experience: high, low) \times 2 (product domain distance: high, low) between-participants design experiment. Participants read a short description of a friend who was presented as either high or low in openness to experience. The descriptions contained personality characteristics reflecting varying levels of openness to experience (John and Srivastava

1999). In the high openness to experience conditions, the friend was described as someone who likes variety in their day-to-day life, craves novelty, is willing to try out new activities, values novel and innovative ideas and situations, and tends to be intellectually curious and imaginative in outlook and behavior. In the low openness to experience conditions, the friend was described as someone who is very resistant to new experiences, seeks refuge in familiar surroundings and the “tried-and-tested” predictability of traditions, prefers habitual situations and routines, gains comfort from the familiarity of their usual environment, and tends to be conventional and traditional in outlook and behavior. We then showed participants pictures of two side tables (table A and table B) and asked them to indicate which one they would buy for their friend. In the high distance conditions, table A consisted of a product component from a distant domain (i.e., wood from a whiskey barrel), whereas table B was a conventional product (i.e., made with standard pieces of wood). In the low distance conditions, table A consisted of a product component from a close domain (i.e., wood taken from another side table), whereas table B was a conventional one (i.e., made with standard pieces of wood) (see [web appendix A](#) for stimuli and [web appendix B](#) for pre-test on distance and attractiveness of the source product).

As a measure of product appeal, we asked participants to indicate which of the two products (table A; table B) they would buy as a gift for the described friend (“Which of these two side tables would you buy as a gift for your friend Alex?,” 1 = “definitely table B,” 5 = “definitely table A”); we also asked them to indicate (on the same

TABLE 5

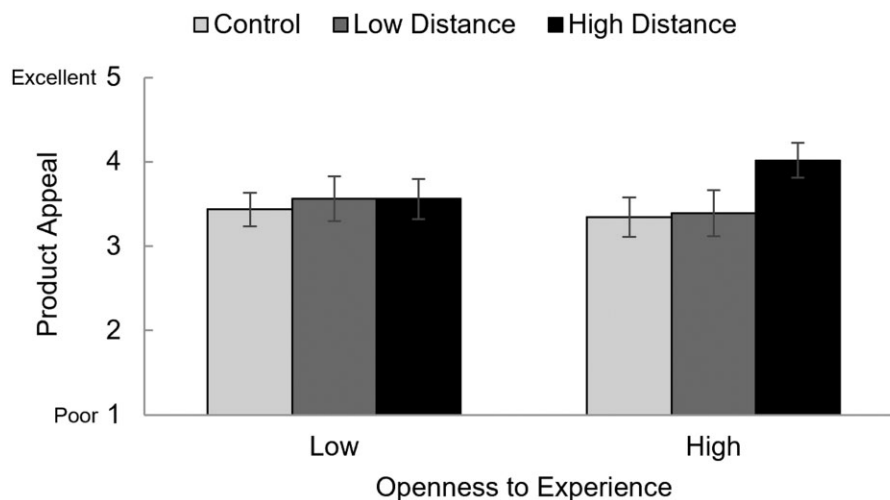
APPEAL MEANS (AND SDS) PER PRODUCT

Product	Control	Low distance	High distance
Bag	2.67 (1.06)	2.73 (1.19)	3.19 (1.18)
Table	3.44 (1.07)	3.57 (1.15)	3.85 (0.88)
Lamp	3.49 (1.04)	3.65 (1.16)	4.11 (0.95)
Shelf	3.94 (0.95)	3.94 (1.19)	4.03 (0.99)
Overall	3.39 (0.65)	3.47 (0.84)	3.79 (0.71)

NOTE.— All means in the high distance condition are significantly higher than those in the low distance and control conditions, except for the shelf. All means in the low distance condition are not significantly different from the means in the control condition.

FIGURE 5

MODERATING EFFECT OF OPENNESS TO EXPERIENCE



NOTE.— Bars indicate 95% confidence interval.

scale) which of the two products was more creative, using the same items as before ($r = 0.53$). Finally, as a manipulation check, participants rated the friend on the openness to experience scale.

Results and Discussion

Manipulation Check. We first ran a 2×2 ANOVA on the openness to experience measures. As expected, participants in the high (vs. low) openness to experience condition rated the friend higher on openness to experience ($M_{\text{High}} = 4.11$ vs. $M_{\text{Low}} = 2.66$; $F(1, 481) = 598.08$, $p < .001$, $\eta^2 = 0.55$). These results confirm that our manipulation was effective.

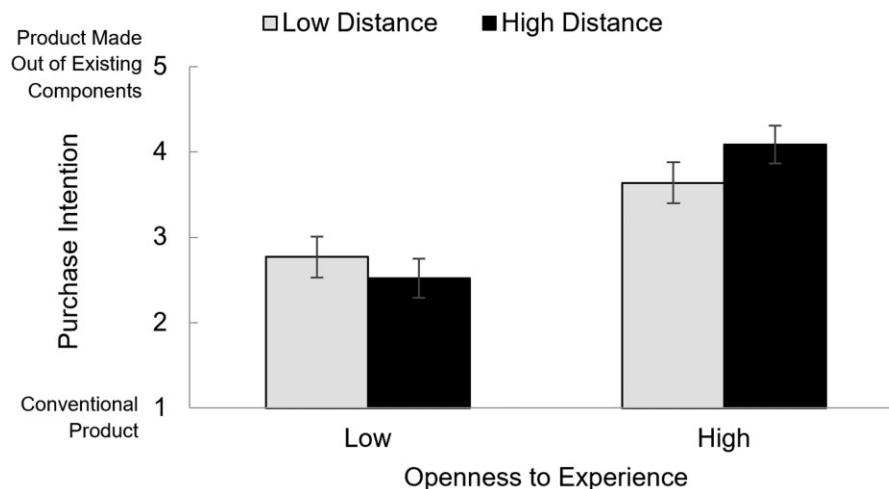
Product Appeal. A 2×2 ANOVA on product appeal reveals, in addition to a non-significant main effect of product domain distance ($M_{\text{HighDis}} = 3.31$, $SD = 1.48$ vs. $M_{\text{LowDis}} = 3.21$, $SD = 1.40$; $F(1, 481) = 0.71$, $p = .399$, $\eta^2 < 0.01$) and a significant main effect of openness to experience ($M_{\text{HighOtE}} = 3.87$, $SD = 1.30$ vs. $M_{\text{LowOtE}} = 2.64$, $SD = 1.30$; $F(1, 481) = 109.07$, $p < .001$, $\eta^2 = 0.19$), a significant two-way interaction ($F(1, 481) = 8.86$, $p = .003$, $\eta^2 = 0.02$). The effect of product domain distance on product appeal is moderated by openness to experience (figure 6). Participants in the high openness to experience condition rated the product made from preexisting components (vs. the conventional product) significantly higher on appeal when the distance between product domains was high (vs. low) ($M_{\text{High}} = 4.09$, $SD = 1.23$ vs. $M_{\text{Low}} = 3.64$, $SD = 1.34$; $F(1, 481) = 7.37$, $p = .007$, $\eta^2 = 0.02$). However, participants in the low openness to experience

condition did not rate the product made from preexisting components higher on appeal when domain distance was high ($M_{\text{High}} = 2.52$, $SD = 1.27$ vs. $M_{\text{Low}} = 2.77$, $SD = 1.32$; $F(1, 481) = 2.25$, $p = .134$, $\eta^2 = 0.01$). In addition, t -tests against the scale mid-point revealed that participants in the high openness to experience condition preferred the product made out of preexisting components over the conventional product, regardless of the product domain distance (high distance: $M = 4.09$, $SD = 1.23$; $t(121) = 9.76$, $p < .001$, $d = 0.88$; low distance: $M = 3.64$, $SD = 1.34$; $t(122) = 5.33$, $p < .001$, $d = 0.48$), whereas the opposite was true in the low openness to experience condition (high distance: $M = 2.52$, $SD = 1.27$; $t(119) = -4.17$, $p < .001$, $d = -0.38$; low distance: $M = 2.77$, $SD = 1.32$; $t(119) = -1.94$, $p = .055$, $d = -0.18$). This suggests that in a gift-giving context, a product made from existing components is already considered a more creative gift than a conventional product. As expected, participants rated the product made from existing components as more creative when made out of a component from a distant (vs. close) domain ($M_{\text{High}} = 4.00$ vs. $M_{\text{Low}} = 3.59$; $F(1, 481) = 16.25$, $p < .001$, $\eta^2 = 0.03$), regardless of whether the product was purchased for a person with high or low levels of openness to experience (the focal interaction was not significant: $F(1, 481) = 0.01$, $p = .938$, $\eta^2 = 0.00$).

In sum, consumers perceive products as more creative when product domain distance is high, regardless of their openness to experience. However, this enhanced perception of creativity does not increase product appeal when consumers are less open to experience.

FIGURE 6

MODERATING EFFECT OF OPENNESS TO EXPERIENCE



NOTE.— Bars indicate 95% confidence interval.

GENERAL DISCUSSION

This research provides new insights into how consumers react to products assembled from existing components. Although customers may have doubts about product quality when said product components are not intentionally designed for a particular purpose, our studies show that consumers may actually react positively to products that are assembled using components from distant product domains. More specifically, consumers perceive such products as more creative and appealing. Our studies document the critical importance of experiencing an *aha!* moment (i.e., the sudden insight that a product component can be used differently; breaking free from functional fixedness). We have documented the relationship between product domain distance, the *aha!* moment, product creativity, and product appeal in correlational as well as experimental studies with consequential measures. We found that when functional fixedness is more easily overcome (by using fully decomposed products or providing a function-free description of product components), the effect of product domain distance on product perceptions weakens. Finally, we have demonstrated that enhanced perceptions of creativity do not necessarily stimulate demand for these products as the strength of the relationship between product creativity and product appeal depends on consumer characteristics: product creativity does not translate into increased appeal when consumers are less open to experience.

Theoretical and Substantive Implications

Our work bridges the consumer research literature with the design and engineering literature (Ulrich and Seering 1988)—two domains that could potentially cross-fertilize each other. Our research highlights the importance of product domain distance in the design of new products by providing evidence that consumers perceive products as more appealing when they consist of components from a distant domain. These findings should help manufacturers understand how to design more appealing products, especially when product components are salient. That is, for example, the case for modular products—products characterized by a functional partitioning or subdivision into components (or modules)—that allow flexibility in construction and repairing (Schilling 2000). The modular design is used for products in many industries, from cars to furniture and from computers to smartphones (e.g., Fairphone). Despite the obvious benefits of modularity (e.g., ease of repair), consumers should have a lower preference for modular products (vs. integrated products) because they are uncertain about the quality and functionality of such products (Holt and Sherman 1986; Schilling 2000). Our results suggest that these negative connotations could be overcome by using (some) components that usually have a different function (e.g., using pipe tubes as legs for a stool). This

would boost the products' perceived creativity and appeal, potentially offsetting consumers' uncertainty about modular products. Another example is "build-your-own" products, which are sold in components that consumers need to assemble themselves (e.g., Ikea furniture). Since these products are sold as product components, designers could take inspiration from distant product domains for some of said components, with the aim to increase the creativity and appeal of the final products.

Second, our research contributes to the creativity literature. By introducing the *aha!* moment as a novel process, we have elucidated specific conditions under which conceptual knowledge about product design processes affects perceived creativity and in turn product appeal. Instead of comparing perceptually different products that would differ in perceived creativity (e.g., a six-legged chair vs. a four-legged chair; Goldenberg and Mazursky 2002; Horn and Salvendy 2006), we focus on products that are virtually identical in terms of perceptual features and that do not offer novel benefits. Put differently, we show that differences in perceived creativity stem from conceptual knowledge (e.g., a four-legged chair with legs made from billiard cues vs. legs from a discarded stool) rather than aesthetic, perceptual or visual differences between products or because of differences in functionality or usefulness. Indeed, we often presented identical product pictures across conditions. In this sense, our work contributes to research on source-dependent evaluations: that is, people evaluate an identical product differently if they believe that it was obtained due to performance or luck (Loewenstein and Issacharoff 1994), or that the product is the outcome of insight or effort (Scopelliti and Raimondo 2020), or that the product is physically or temporally closer to the brand origin (Newman and Dhar 2014; Smith, Newman, and Dhar 2016). Indeed, exposing consumers to information on different aspects of a product's creation can influence product evaluations (Fuchs, Schreier and van Osselaer 2015; Nishikawa et al. 2017; Reich, Kupor, and Smith 2018). Instead of focusing on whether a product is hand-made, crowdsourced, or made unintentionally, we focused on the role of functional distance and showed how the use of different components alters perceived creativity and product appeal of upcycled products.

Third, we offer a broad framework that helps explaining the success of emerging phenomena such as upcycling (i.e., the practice of creating *novel* products from *discarded* products). By introducing perceived creativity as an important driver of the appeal of upcycled products, we depart from existing explanations for upcycling (such as sustainability, vintage or unique appearance, craftsmanship, or the economic benefits of upcycling) (Braungart et al. 2007; Bridgens et al. 2018; Wilson 2016). The results of an additional field study also point to the importance of creativity (see web appendix D for all details). In this study, we compare more than 2,000 user reviews of upcycled and

conventional products from the online shop Etsy.com. Compared to user reviews of conventional products, user reviews of upcycled products contain significantly more keywords related to creativity (figure 7). These creativity keywords are even more prevalent than keywords related to sustainability—which is surprising, since sustainability is often regarded as one of the main reasons behind the appeal of upcycled products (Bridgens et al. 2018; Wilson 2016). Hence, these results confirm that creativity is an important and hitherto overlooked driver of the appeal of upcycled products, above and beyond the accounts currently found in the literature. Our focus on perceived creativity as a novel explanation has the advantage of not only explaining why upcycled products may at times be more appealing than non-upcycled ones but also why some upcycled products may be more appealing than other upcycled products (e.g., those that consist of components from distant product domains). Accordingly, our research has implications not only for the effective marketing of upcycled products (see also Kamleitner et al. 2019) but also for the effective design of such products (i.e., which components to use).

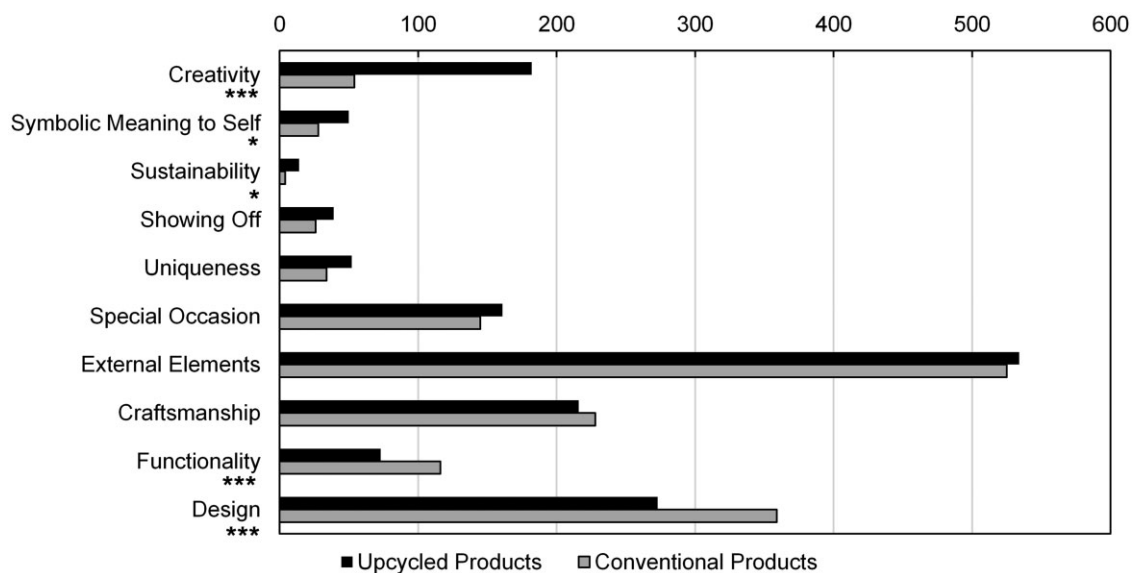
The focus of past research on sustainability may stem from a hazy conceptual distinction between various sustainable practices. Our results show that creativity perceptions emerge from the reuse of distant component to create products, a feature that does not characterize all sustainable practices. For example, a messenger bag is a *refurbished*

product when it is newly reconditioned; it is a *repurposed* product when it is used differently (e.g., by adding soil to the messenger bag and using it as a flower pot); it is a *recycled* product when it is made, for example, out of plastic resins from PET bottles; and it is an *upcycled* product when it is made, for example, out of a used truck tarp. We differentiate between these sustainable practices, based on the decomposition level of the existing product and the output of the sustainable practice.

Whereas refurbishing and repurposing do not require any decomposition of the old product, recycling requires a *full* decomposition of the old product into raw materials and upcycling requires a *partial* decomposition of the old product into components. As a consequence, whereas recycling destroys the function of the old product completely, upcycling preserves the function of the existing product at least partially, while refurbishing and repurposing keep the original function of the old product entirely intact. The level of decomposition has profound implications for functional fixedness and thus for product appeal as well. Moreover, whereas recycling and upcycling ultimately lead to a new product design, refurbishing merely leads to an upgraded version of an existing product (e.g., replacing the battery or screen of a smartphone). Likewise, repurposing refers to ascribing a novel function to an existing product without changing its design (e.g., using a wine bottle as a vase or a candle holder). Based on this categorization, our results suggest that creativity motives may drive the

FIGURE 7

FREQUENCY OF KEYWORDS IN REVIEWS OF UPCYCLED AND CONVENTIONAL PRODUCTS



NOTE.—This graph displays the absolute number of keywords associated with each coding category for upcycled and conventional products; total number of keywords: $N = 3,113$; total numbers of reviews: $N = 2,008$. *Significant at $p < .05$ level; **significant at $p < .01$; ***significant at $p < .001$.

appeal of upcycled and repurposed products, because their creation requires product designers to overcome functional fixedness. To conclude, our results allow us to disentangle different sustainable practices and suggest that the appeal of such sustainable products critically depends on how existing components are employed in the product design process.

Fourth, our findings have implications for a wide range of other product design contexts. In the context of user-generated products, for instance, it is common practice to use existing product components when designing new products. Users, unlike professional designers, frequently have to rely on existing components to create new products because they usually lack the capabilities and resources to customize every product component. For example, the first snowboards were made of components from other product categories, such as foot bindings from water skis. Using existing products or product components is also common practice in developing countries, where raw materials are often unavailable or too expensive. For example, the lack of resources due to poverty and commercial isolation force the people of Cuba to improvise: they have to repair products such as fans and TV antennas using old vinyl records and aluminum food trays (Motherboard 2013). Even in more developed economies that rely on just-in-time manufacturing or lean inventories, specific product components may be unavailable when faced with supply chain issues, such as during the Suez Canal blockage or COVID-19 pandemic. In situations such as these, manufacturers may depend on suppliers from different product sectors or use spare parts from companies they have never interacted with before. In addition, more and more companies implement sustainable practices to reduce the use of new resources. Because of the detrimental environmental and societal effects of overconsumption (e.g., resource extinction, pollution, conflicts for resources), governments and environmental agencies in the US and the EU have called for a more efficient use of existing resources (European Environment Agency 2019; U.S. Environmental Protection Agency 2006).

Limitations and Opportunities for Future Research

In our research, we isolated one design characteristic (i.e., product domain distance) that affects product appeal. We acknowledge, however, that isolating this factor is empirically challenging. Our use of multiple replicates within studies, the consistent pattern across multiple studies, the careful pre-testing, and the examination of 200 different products from Etsy.com give us confidence in the validity and robustness of our findings. Most evidently, we could not explore all factors affecting product appeal. Hence, future studies could empirically investigate the role of unexplored factors, such as component recognizability.

For example, the extent to which consumers can visually identify or recognize the product component may affect product appeal. On the one hand, higher recognizability of the product component may enhance perceived uniqueness—which drives product appeal for many consumers (Tian, Bearden, and Hunter 2001)—because the product is visually different from similar products with the same function. On the other hand, higher recognizability may reduce the aha! moment (i.e., the functionality of the component is more obvious and easier to detect), thereby decreasing perceived creativity and product appeal. In addition, higher recognizability could backfire because it would highlight the lack of unity among elements of the product design (i.e., visual dissimilarity between different components of the same design), which may in turn negatively affect consumer response (Veryzer and Hutchinson 1998).

Finally, future research could explore whether our results would generalize to products that offer an entirely novel function (e.g., combining a phone and a shaving machine). On the one hand, consumers may experience an aha! moment, which could lead to positive consumer reactions. On the other hand, past literature suggests that it may lead to negative consumer perceptions due to uncertainty about the final product's quality and functionality (Goldenberg and Mazursky 2002; Horn and Salvendy 2006). Because we kept the basic functionalities of all our products constant across our experimental studies, it is unclear whether our results would generalize to products that would offer novel functions compared to more regular products.

In sum, we have introduced product domain distance as an important factor in designing creative and appealing products. These findings can also explain the success of particular sustainable product manufacturing processes that reuse existing product components and can enlighten product designers, with the aim of increasing the use of existing resources to create new products that are appealing to consumers.

DATA COLLECTION INFORMATION

The first author collected the data for study 1A in two steps in the spring of 2020. First, the author collected a series of upcycled products from the online store Etsy.com. Afterwards, the author collected the data on product perceptions on MTurk. The first author collected data for study 1B in the spring of 2018 on MTurk, follow-up study 1B in the winter of 2022 on Prolific, study 2A in the spring of 2020 on MTurk, study 2B in the autumn of 2021 on MTurk, study 3A in the spring of 2021 on Prolific, and study 3B in the spring of 2022 on Prolific. The first author, together with a research assistant, collected the data for study 1C at the campus of the Technical University of

Munich, Germany, in the winter of 2018. Tina Umagliya Kankanangai, supervised by the first author, collected the data for study 4A from a convenience sample in the summer of 2018 as part of her master thesis at the Technical University of Munich. The first author collected data for study 4B in the autumn of 2019 on MTurk. Christina Neubig and Paulus Kilian, supervised by the second author, collected the data for the exploratory field study from Etsy.com in the summer of 2016 as part of their master theses at the Technical University of Munich. The authors collectively designed the studies. The first author analyzed the data and discussed the results with the other two authors. The data and the stimuli (including pictures for all studies) are stored in a project folder on the Open Science Framework: <https://osf.io/bf58y/>.

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