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The Curious Case of the *Refrigerator–TV*: Similarity and Hybridization

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Abstract

This article examines the role of similarity in the hybridization of concepts, focusing on hybrid products as an applied test case. Hybrid concepts found in natural language, such as *singer songwriter,* typically combine similar concepts, whereas dissimilar concepts rarely form hybrids. The hybridization of dissimilar concepts in products such as *jogging shoe mp3 player* and *refrigerator TV* thus poses a challenge for understanding the process of conceptual combination. It is proposed that models of conceptual combination can throw light on the judged future success and desirability of hybrid products in general. The composite prototype model proposes two stages of conceptual combination. In the first stage, the concepts are aggregated into an *additive* hybrid, simply by forming the union of the two sets of attributes. In the second stage, any conflicting attributes are identified and resolved, often with the introduction of emergent attributes, resulting in an *integrative* hybrid. Across four studies that varied the similarity and type of hybrid products, similar and integrative hybrids were valued more than dissimilar and additive hybrids. Critically, though, dissimilar hybrids were also highly valued if they were integrative. Results supported the two stages proposed by the composite prototype model, and implications for other models of hybrid formation are discussed.

Keywords: Convergence; Hybrid products; Feature addition; Feature integration; Conceptual combination; Similarity

In studying a wide sample of noun–noun combinations, Wisniewski (1997) found three primary ways in which they could be interpreted. Two of these (relation linking and property mapping) have been the subject of considerable interest (e.g., Costello & Keane, 2001;

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Estes, 2003b; Gagné, 2000; Gill & Dubé, 2007; Wisniewski & Love, 1998). Of interest to our present studies is Wisniewski's third form of interpretation involving formation of a hybrid. A hybrid concept is one whose members belong in each of two single concepts. Most hybrid concepts naturally occurring in language are combinations of similar constituents such as singer-songwriter or fridge-freezer (Wisniewski, 1996, 1997). Generating hybrid interpretations for noun–noun combinations was most common in Wisniewski's data when two similar concepts were involved, just as in the case of biological hybrids between adjoining species such as donkeys and horses (Wisniewski, 1996, 1997).

In the world of everyday artifacts, traditional hybrid products (i.e., combinations of two existing but previously separate base products in a single object) have also tended to combine similar rather than dissimilar concepts. Many of these classic products, such as the sofa–bed, fax–phone, and refrigerator–freezer, have been in production for decades, suggesting that long-standing insights from cognitive science about the role of similarity in hybrid formation may constitute an efficient new product development strategy, yielding products with sustainable market success. In contrast to traditional hybrid products (HPs), however, many of the latest HPs combine dissimilar base products from sometimes strikingly different superordinate categories. Recent product launches include a mobile phone that monitors the user's glucose level (Fox News, 2008), a radio-toaster (The Telegraph, 2011), and even the ''Nike+'', a hybrid of a Nike jogging shoe and Apple's iPod. The *Wall Street Journal* summarized this new phenomenon by pointing to ''a recipe for creating new products: take two completely separate [dissimilar] categories. Combine'' (Gibbert & Mazursky, 2007). This ''recipe'' appears to contradict the existing conceptual combination literature, which suggests that people actually resist forming hybrids of dissimilar concepts (e.g., Wilkenfeld & Ward, 2001; Wisniewski, 1997). Thus, dissimilar hybrids are unlikely (Wisniewski, 1996), implausible (Costello & Keane, 2000) or even impossible (Hampton, Green, Lewis, & Estes, 2001), representing overextensions of their constituent concepts (Hampton, 1988), Why, then, do we see this recent surge of dissimilar HPs in the marketplace, and (how) can models of conceptual combination explain the prevalence of these products?

Our conceptual lever for addressing the challenge of dissimilar HPs is previous research in consumer behavior, focusing on the effects of the constituent products' degree of similarity (Gibbert & Mazursky, 2009). Practically speaking, the result of each stage of hybrid formation is of particular interest, as each stage might lead to different types of HPs that we see in the marketplace. Specifically, the consumer products might be aggregated first into an *additive* hybrid, simply by forming the union of the two sets of functions. For example, to create a combination of a flashlight and a pair of slippers, a designer would initially construct a conceptual representation that aggregated together the attributes of flashlights (bulbs, batteries, switches) with those of slippers (soft, warm shoes for indoors). Subsequently, the hybrid product could become more *integrative*, if the second stage of conceptual combination is used to identify conflicting attributes, and to resolve them by altering the original products and by introducing emergent attributes. For example, walking in the slippers could recharge the battery, while a pressure sensor could be used to turn the light on when the slippers are worn. It is very probable that this resolution of conflicting

attributes and identification of emergent attributes arises from a scenario construction or perceptual simulation process, whereby one imagines the hybrid more fully than is possible with a simple attribute aggregation (Barsalou, 1999, 2009; Hampton, 1987, 1988; Lynott & Connell, 2010; Wu & Barsalou, 2009). Our question is the extent to which this type of secondary processing is likely to improve the viability and desirability of a hybrid product.

How people evaluate novel products has been the subject of much research (for a review, see Henard & Szymanski, 2001). Less has been done on the question of the value of HPs. Two ways can be identified in which they may gain value. One is the simple fact that a single product has a dual function—there is a 2 for 1 aspect to the hybrid, as in an opener that both removes wine corks and beer caps. Here the value of the hybrid should be simply that one only needs one object rather than two. A second more exciting aspect of a hybrid product comes, however, when the hybrid extends the functionality of the two individual components. We propose that it is this extended functionality, arising from the second stage in a process of conceptual combination, which can give a HP particular desirability for the consumer. In the studies to be reported below we therefore distinguish additive and integrative hybrids, and consider how they are valued under different conditions.

Differentiating between additive and integrative hybrids in the context of similar and dissimilar HPs also makes important theoretical contributions to both the cognitive science and the consumer behavior literatures. First, the conceptual combination literature has pointed to three main ways of combining noun concepts: relational, property, and hybrid interpretations (Wisniewski, 1997). While the former two have been studied extensively (e.g., Costello & Keane, 2000, 2001; Estes, 2003a,b; Estes & Glucksberg, 2000; Gagné, 2000; Wisniewski, 1996, 1997; Wisniewski & Love, 1998), hybrid combinations have attracted relatively less interest, perhaps because relational and property interpretations occur much more frequently in language comprehension (from 30% to 70%) than hybrid interpretations (only around 10%, Costello & Keane, 2001, p. 256). As such, studying hybrids in the marketplace, which is replete with both similar and dissimilar HPs, may provide new insights into hybrid formation. For example, current models assume that hybridization results from a process of structural alignment and comparison (Wisniewski, 1996, 1997). However, because dissimilar concepts are more likely to induce an integration process than a comparison process (Estes, 2003a; Golonka & Estes, 2009; Simmons & Estes, 2008; Wisniewski & Bassok, 1999), the prevalence of dissimilar HPs in the marketplace suggests that integration may also support hybridization.

Second, the consumer behavior literature has investigated additive hybrids (e.g., Johar, Maheswaran, & Peracchio, 2006; Stremersch & Tellis, 2002; Thompson, Hamilton, & Rust, 2005), but little research has examined integrative hybrids. For example, Gill and Lei (2009) studied the addition of new functionalities to products, but integrative HPs were not explicitly examined. To illustrate, they described an MP3 player–GPS by listing the features of the MP3 player and then adding that it also contains a GPS system. Similarly, Rajagopal and Burnkrant (2009) described to participants a hybrid of a GPS navigation system and a radar detector, but the HP did not link their functions in any way. By contrast, an *integrative* hybrid would build on emerging properties (Hampton, 1987, 1988). For instance, the

GPS–MP3 player might alert one to the particular songs associated with certain locations (e.g., when passing recording studios in Liverpool or London, as does the Garmin Rock Navigator, http://www.garminrocknavigator.it), and the GPS–radar detector might alert drivers to an alternative route when radar is detected. Thus, applying cognitive models of hybrid formation to HPs could extend the toolbox of new product development and consumer behavior. To achieve these synergies methodologically, we employ manipulations from cognitive science, pairing them with outcome measurements (i.e., perceived novelty and market success) from consumer behavior.

The rest of the article is organized as follows. First, we discuss cognitive research on similarity as well as additive and integrative hybrids. We then present a series of four empirical studies. For generality, we employed a variety of different methodologies to manipulate the type of hybrid, with increasing degrees of experimental control and depth of analysis and decreasing numbers of HPs used as stimuli. Study 1 starts off by using evidence from HP examples ($n = 90$) that were actually available in the marketplace at the time of the study. Studies 2 and 3 then examined how similarity of the two products in an HP interacts with additive versus integrative hybridization in its effect on product evaluation. Study 2 constructed a factorial design using materials selected from Study 1, while in Study 3 we explicitly presented participants with additive and integrative HPs that we created ourselves. Our final study focused attention on a single pair of HPs, differing only in the similarity of the products combined. This time, participants were asked to generate their own interpretations of the hybrids using a methodology from earlier psychological research. As a final step, we used content analysis of participants' solutions to establish that their first and second interpretations were primarily additive and integrative, respectively.

1. Conceptual framework: Similarity, dissimilarity, and hybrid formation

Corresponding to the psychological results suggesting that dissimilar hybrids are infrequent, research in marketing and consumer behavior shows that product bundles, that is, combinations of products for which separate markets exist (for example, selling a personal digital assistant and a wireless service constitutes a product bundle as consumers can purchase either separately) are evaluated more positively when the products are related (e.g., personal digital assistant and wireless service) than when they are unrelated (e.g., personal digital assistant and electric razor), even though unrelated bundles might be perceived as more novel (Johar et al., 2006; Stremersch & Tellis, 2002). The consumer behavior literature also suggests that, in general, hybrids of similar products are preferred over hybrids of dissimilar products (Gibbert & Mazursky, 2009; Gill, 2008). Moreover, the addition of related and similar features, while yielding lower novelty ratings, leads to more positive evaluations than the addition of unrelated and dissimilar features (e.g., Gill, 2008; Gill & Lei, 2009). In view of these findings we propose that, other things being equal, hybrids of similar products should be judged less novel and be evaluated more positively than hybrids of dissimilar products.

In addition to the similarity of the hybrid, we also predicted that the type of hybrid would influence its evaluation. The conceptual combination literature provides different accounts of hybrid formation (e.g., Costello & Keane, 2000, 2001; Hampton, 1987, 1988; Thagard, 1997; Wisniewski, 1997). Two basic schools of thought can be identified. First, while Costello and Keane's model focuses primarily on language understanding, it can also provide an account of the formation of hybrid products. Their model is based on an algorithmic process that searches through many possible interpretations of a combined concept and settles on the one that maximizes the three constraints of diagnosticity, plausibility, and informativeness. Their single-stage model predicts that, after several iterations, people will settle on the optimum solution, optimal in that it best satisfies the three constraints (Costello & Keane, 2000; pp. 308–310). The second school of thought is more directly concerned with the creative processes underlying hybrid formation, as exemplified by Hampton's composite prototype model (Hampton, 1987, 1988; see also Smith, Osherson, Rips, & Keane, 1988; Thagard, 1997). Specifically, the composite prototype model distinguishes between additive and integrative hybrids (Hampton, 1987, 1988). In the case of an additive HP, products are aggregated together into a single product. Someone combining, say, a hairbrush and a radio would simply imagine a product of a certain size, with handle, bristles, amplifier and speakers, power cord, etc. At this stage, the new product will be considered to have all of the typical properties and functions of each base product (Hampton, 1987, 1988). An integrative HP shifts attention to requirements stemming from the relations and potential incompatibilities between the two products. For instance, the radio could not have large bass speakers if it is hand-held, and there may be a risk of electric shock if the object is applied to one's head. In response to these problems the coherence and appreciation of the hybrid may be improved by creating new links between functions of the two concepts, and finding situations where these links can resolve usage problems through a kind of situated simulation (Barsalou, 1999, 2009; Lynott & Connell, 2010).

This act of situating the links in a concrete usage context is likely to be key to successful integration. As Barsalou describes it, people imagine a situation in which the two products have been combined, and then play out the likely consequences through a process of mental simulation. Importantly, though, if a simple interpretation is available, people may not spontaneously simulate such elaborate, contextual representations of the hybrids. That is, in many cases a shallow, ''good-enough'' representation may suffice without the need for an elaborate simulation (Ferreira & Patson, 2007). But in other cases, individuals may be induced or prompted to engage in a mental simulation, imagining a usage situation where two products interrelate meaningfully. To illustrate this process, Hampton (1997) described a study in which participants were explicitly asked to imagine ''impossible'' objects such as a fruit that was also a kind of furniture (e.g., a banana-couch). Only a minority of participants was able to generate a successful solution to the problem, but those who did produce strongly integrative conceptual combinations often elaborated with particular situations. When faced with the problem that bananas are perishable whereas a couch is not, incompatibilities for such a fruit-furniture hybrid were resolved either by imagining a situation with particularly durable fruit that took a long time to decay, or with a specific type of furniture

that needed regular replacement to remain ''fresh'' (Hampton, 1997). Thus, hybridization of dissimilar concepts may require more contextual elaboration.

The marketing and consumer behavior literatures provide evidence that links between products and usage situations are seen as attractive (Goldenberg & Mazursky, 2002). For example, the color of a plastic lid for paper coffee cups can be linked to the temperature of the coffee so as to indicate when the coffee is safe to drink (e.g., the normally white lid is red when the coffee is too hot). As another example, Nike and Apple launched the new HP ''Nike+'', mentioned earlier, which combines the highly dissimilar products jogging shoe and mp3 player. A chip produced by Apple is inserted into the sole of a Nike jogging shoe, thereby turning the shoe into a step-counter, which connects the shoe to Apple's mp3 player iPod. This product uses the proprietary ''Tune Your Run'' technology where the iPod displays information about the distance run, pace, and calories burned and even allows the runner to select specific songs with a faster rhythm, enabling people to ''turn on, at exactly the right moment, the one song that always gets you through the home stretch'' (http://www.apple.com). On the basis of these observations from the literature and the marketplace, we propose that, other things being equal, integrative hybrids should be evaluated more positively than additive hybrids.

In addition to these hypothesized main effects of similarity and hybrid type, we also hypothesized that these two factors would interact. Specifically, whereas dissimilar products may benefit greatly from the second stage of hybrid formation, similar products may not benefit to the same extent. Similar products tend to have similar functions and share similar roles in a usage situation (e.g., Markman & Wisniewski, 1997; Wisniewski, 1996). As suggested above, hybrids of similar products are therefore readily appreciated, appear more familiar (and consequently less novel), and tend not to require new functionalities to explain why those products were combined or to resolve functional incompatibilities between them. For these similar hybrids, a simple good-enough interpretation is sufficient for positive evaluations. Dissimilar products, in contrast, tend to have different functions and fulfill different roles in usage situations (Estes, Golonka, & Jones, 2011; Estes & Jones, 2009). Hybrids of dissimilar products are therefore more likely to need new functional links to resolve incompatibilities and increase coherence if they are to be positively evaluated. Thus, we also hypothesized that the similarity of the base products should interact with the type of combination, in that dissimilar products should gain relatively more in terms of positive evaluation from integrative hybridization than should similar products.

2. Study 1

Study 1 tested the hypotheses that in the range of HPs already available for purchase, similar HPs would be valued more than dissimilar HPs, and integrative HPs would be valued more than additive HPs. We first asked young consumers to scout the market for examples of HPs that were actually for sale at the time of the data collection, and then we solicited similarity and evaluation ratings of these HPs from trained expert judges.

2.1. Method

2.1.1. Generation of HPs

Three hundred eighteen undergraduates in a basic marketing course participated for pay. In the first session of the course, students were introduced to the concept of HPs, and they were given four examples to explain and illustrate the concept further (sofa–bed, fax–phone, camera–phone, and slippers–flashlight). They were then asked to submit examples of such HPs, including a short description of the example, a photo, and further leads for finding more information about the example (e.g., websites, newspaper clippings). At the end of the semester, each unique example was compensated with a €10 book voucher, redeemable at the university bookshop. One hundred fifty-eight unique examples of HPs were submitted. Via an internet search we identified those products that were actually sold in the marketplace at the time of data collection. HPs that were only available by secondhand sales from sites such as eBay were excluded. Sixty-eight of the HPs, including Frisbee-video camera and duster-cocktail shaker, were excluded by these criteria, leaving 90 HPs for further study (see Appendix).

2.1.2. Classification of HPs

Three expert judges were shown pictures of the 90 HPs and independently classified each product as either additive or integrative. All three judges were senior industrial designers who held postgraduate degrees (at least MSc or equivalent), had a record of at least 15 years of experience in designing consumer goods, taught at university, and held high-ranking positions in industry (at least vice president or equivalent). HPs were classified as integrative if the function of one constituent product was linked with the function of the other constituent product. For instance, the thermometer-pacifier was classified as integrative because the thermometer itself becomes a pacifier. It enables early detection of fever, which is less likely when these functions are not linked. In contrast, the Swiss army knife-USB memory unit was classified as additive because the constituent products are merely attached without any links between individual functions. That is, the two constituents are combined for convenience in handling but do not share functionalities. The HPs were presented in a single random order to all three judges. The judges agreed unanimously on 54 (60%) of the 90 classifications (where chance would be only 22 of 90, χ^2 (1) = 42.2, $p < .001$), and the remaining 36 HPs were classified according to the majority. Forty-four of the HPs were classified as additive, and 46 were classified as integrative. (The less than perfect agreement may reflect the fact that in a real-world sample the difference of additive vs. integrative functionality is one of degree rather than a simple dichotomy.)

2.1.3. Evaluation of HPs

The three expert judges also evaluated these 90 HPs. Specifically, they rated the usability and expected market success of each HP on a scale from 1 (low) to 7 (high). The mean pairwise correlation among judges on each scale was +.76, and the scales correlated at +.78, so the ratings were combined across judges and scales to create an *evaluation* score for each HP, with higher scores indicating more positive value. Results are reported below.

2.1.4. Similarity of HPs

Finally, 27 MBA students rated the similarity of the two base products within each of these 90 product pairs. The product pairs were presented in a single random order on a large screen via PowerPoint in a classroom setting, and for each pair participants circled a number from 1 (very dissimilar) to 7 (very similar) on a response sheet. Two additional HPs that were used in Study 4 were also rated but are not included in the analyses reported below.

2.2. Results and discussion

Overall, the rated similarity of the hybrids' constituent products significantly predicted the hybrids' evaluations [$r(88) = +.76$, $p < .001$]. As shown in Figure 1, this strong positive relationship between similarity and evaluation was evident among both additive and integrative hybrids. Integrative hybrids were evaluated higher ($M = 4.43$, $SE = .33$) than additive hybrids [$M = 2.88$, $SE = .24$; $t(88) = 3.78$, $p < .001$]. That is, whereas the integrative HPs were distributed fairly uniformly along the vertical axis of evaluation (see the black circles in Figure 1), the additive HPs tended toward the lower end of the evaluation scale (gray squares). Integrative hybrids were also rated more similar ($M = 4.08$, $SE = .19$) than additive hybrids [$M = 3.06$, $SE = .15$; $t(88) = 4.28$, $p < .001$]. Whereas the integrative HPs tended toward the right of the similarity scale (along the x-axis), the additive HPs were clustered toward the left. In sum, similar hybrids were valued more than dissimilar hybrids, and integrative hybrids more than additive hybrids. These results thus support our hypotheses that, other things being equal, similar HPs are evaluated more positively than dissimilar HPs and integrative HPs are evaluated more positively than additive HPs.

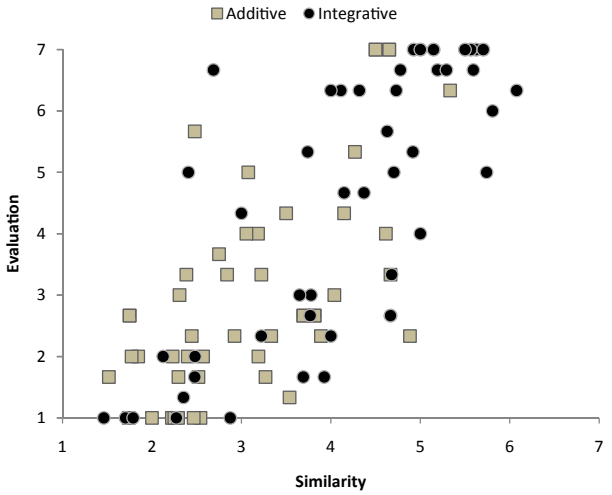

Fig. 1. Evaluation (i.e., usability and likely market success) of additive and integrative hybrids as a function of constituent similarity in Study 1. The similarity of hybrids' constituent products significantly predicted the hybrids' evaluations, $r = +.76$.

The use of actual HPs available in the marketplace supports the external validity of these results. (Note that the selection of 90 HPs contains very few that were likely to be familiar to our participants, so they could only evaluate them on the basis of the picture and descriptions we provided). However, a limitation of this approach is that it is less controlled—it reflects unknown selective sampling in which products have been developed, which are judged by students to be worth reporting, and which were available to buy. These unknown sampling effects may explain why we unexpectedly found that the integrative hybrids tended to be more similar than the additive ones. According to our account, we would expect similar hybrids to be quite effective without the need for further integration. In fact, consideration of the eight integrated hybrids with similarity >5.5 suggests that this was the case. These were items such as Skis–Snowboard, Heater–Air Conditioner, and PlayStation–DVD player. In each case the very close similarity of the two products was such that integration could occur without any need for new or emergent structure or characteristics. A simple clip could turn your skis into a snowboard, and the circuitry of a Play Station can be easily adapted to play DVDs. At the top end of the similarity scale, it may be that the close alignment of structure and function provides integration without the effort normally required to construct an integrated hybrid from dissimilar products.

Also, as suggested above, a key to successful integration is situating links between products in a concrete usage scenario. People reflect not only on the parts and function of an object in isolation but also on the usage situation where it might be put. This process, however, is not automatic, but it may require explicit prompting (cf. Ferreira & Patson, 2007). When prompted, people may imagine a situation in which the two products have been combined, and then play out the likely consequences (Barsalou, 1999, 2009; Lynott & Connell, 2010). As such, a second limitation of Study 1 was that it did not control for whether participants considered the product in a concrete usage situation. This raises the question, would the products be evaluated differently if they were considered in the context of a usage situation? Study 2 was designed to address this question. A final limitation of the Study was that the same judges first judged hybrid type, and then gave evaluations. In the remaining studies these variables were kept separate.

3. Study 2

Sixteen of the HPs from Study 1 were selected to provide an orthogonal contrast of similarity and hybrid type. Participants were first prompted to describe a potential usage context for each HP, and then they evaluated those HPs. Because similar base products are characterized by similar functions (Markman & Wisniewski, 1997; Wisniewski, 1996), an integrative HP linking these functions would not represent a big improvement on the additive HP. By contrast, the functions of dissimilar products may actually complement each other (Estes & Jones, 2009; Estes et al., 2011), so that combining them integratively would greatly improve their novelty and evaluation. We therefore predicted an interaction of similarity and type of HP.

3.1. Method

3.1.1. Participants

Fifty-one MBA students participated for partial course credit. Participants were randomly assigned to a similar or a dissimilar condition.

3.1.2. Materials

The classifications and similarity ratings from Study 1 were used to select 16 HPs for use in Study 2. The HPs were selected to vary orthogonally in similarity (similar, dissimilar) and type (additive, integrative), so that between each type the HPs were matched as closely as possible for similarity. Thus, there were four HPs in each cell of a 2 (similarity) × 2 (type) design. The selected HPs in each condition were as follows: dissimilar additive (watch-ski pass, pen-firelighter, TV-shower, jacket-GPS), dissimilar integrative (watch-tie holder, tie-iPod pocket, camera-mp3 player, sushi-USB), similar additive (salt-pepper shaker, post it-marker pen, phone-hard drive, and ruler-calculator), and similar integrative (blanket-pullover, desk-bed, ski-snowboard, trolley-car seat). The similarity ratings in each condition were as follows: dissimilar additive (M = 2.01, SE = .22), dissimilar integrative (M = 2.01, SE = .25), similar additive (M = 4.54, SE = .28), and similar integrative (M = 4.67, SE = .30).

3.1.3. Design and procedure

Each participant received one of two booklets that each contained eight HPs. One booklet contained all similar products, and the other all dissimilar constituent products. Within each booklet half of the HPs were integrative and half additive. HPs were presented in a single random order for all participants within each condition. To induce a specific usage situation and hence highlight the additive or integrative nature of the hybrids, participants were first prompted by the question ''In what circumstances would this combination be useful to consumers?'' A text box for participants' responses appeared below each HP. Finally, participants rated the novelty (''new''), usability (''usable''), purchase intention (''I would buy it''), and likely success (''Likelihood of market success'') of each HP, in that order. Response scales ranged from 1 (low) to 7 (high).

3.1.4. Data analysis

Following prior research (e.g., Moreau, Markman, & Lehmann, 2001), the four measures were submitted to Principal Component Analysis with Varimax rotation. The analysis confirmed that there were two underlying factors, one with 61% of the variance reflecting evaluation (usability, purchase intention and likely success) and a second with 26% of the variance reflecting novelty. The four measures were therefore collapsed into these two dependent variables and submitted to a 2 (similarity: similar, dissimilar; between-participants) × 2 (type: additive, integrative; within-participants) mixed MANOVA.

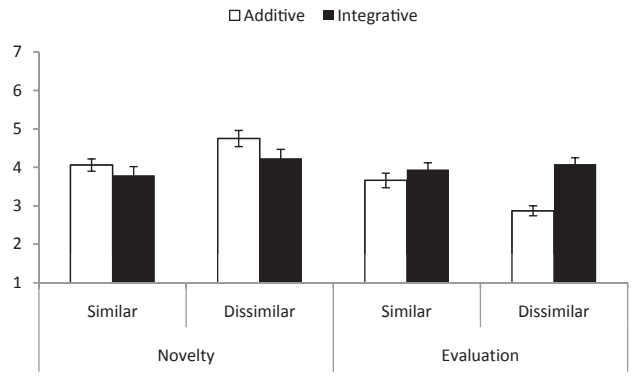

Fig. 2. Novelty and evaluation ($M \pm SE$) of additive and integrative hybrids with similar or dissimilar constituent products in Study 2.

3.2. Results and discussion

Results are illustrated in Figure 2. Additive hybrids were rated significantly more novel than integrative hybrids [$F(1, 49) = 8.05$, $p < .01$], and dissimilar hybrids were rated significantly more novel than similar hybrids [$F(1, 49) = 4.50$, $p < .05$]. The interaction was not significant ($p = .37$). In terms of evaluation, integrative hybrids were valued significantly more than additive hybrids [$F(1, 49) = 48.41$, $p < .001$]. However, this main effect of type interacted significantly with similarity [$F(1, 49) = 18.78$, $p < .001$]. As evident in the figure, the effect of HP type (additive or integrative) on evaluation was much greater among dissimilar products [$t(24) = 7.55$, $p < .001$] than among similar products [$t(25) = 1.97$, $p = .06$]. This interaction supports our hypothesis.

Overall, Studies 1 and 2 demonstrated that the very same integrative HPs of dissimilar products were perceived differently depending on whether participants were induced to also think about concrete usage situations in which the HP might be employed. In Study 1, the dissimilar integrative HPs were poorly evaluated (see Figure 1 where only two of the 11 integrative products with similarity <3 achieved any degree of positive evaluation). However, in Study 2, with the additional instruction to imagine a usage situation, the dissimilar integrative HPs were valued as much as the similar integrative ones.

A limitation of both studies was that the links for the integrative HPs were inferred from the perceptual stimulus (the picture of the product, see Gregan-Paxton, Hoeffler, & Zhao, 2005), and the usage situations were generated by the participants themselves. To improve experimental rigor in testing our hypothesis, it was desirable to employ a design where participants' interpretations of the links and usage situations could be better controlled. Thus, Study 3 used a more stringent design where the actual links and usage situations were explicitly spelled out, so as to provide a more reliable distinction between additive and integrative HPs.

4. Study 3

The purpose of Study 3 was to replicate and extend the results of the previous study, while using tighter control on the interpretations of the different types of HPs (additive vs. integrative). In contrast to Study 2, this time we provided participants with concrete descriptions of additive and integrative HPs. In line with the composite prototype model, additive HPs were characterized as aggregating the two base products, but without linking these products in concrete usage situations where the HPs might be employed. By contrast, integrative HPs were described as having attributes that stem from linking the products, and usage situations were suggested for the HP.

4.1. Method

4.1.1. Participants

One hundred forty-six undergraduates participated voluntarily in a classroom setting.

4.1.2. Materials and procedure

Each of four base products was paired with one similar product and one dissimilar product to create eight HPs. The similar HPs were computer mouse + telephone, USB memory device + laser pointer, thermometer + dummy (''pacifier'' in American English), and slippers + torch (''flashlight'' in American English). The dissimilar HPs were computer mouse + alarm clock, USB memory device + pocket knife, thermometer + whistle, and slippers + tape measure. The similarity of each product pair was assessed in the experiment, as described below.

The type of HP was manipulated by describing each HP with either additive or integrative attributes. To this end, each HP was described using four attributes. The first two attributes of each HP always consisted of one attribute of each of the constituent products (i.e., *base* attributes). For instance, the HP *torch-slippers* had the attributes ''provides light at the press of a button'' (property of *torch*) and ''comfortable shoes for indoor use'' (property of *slippers*). The other two attributes of each HP were either additive or integrative. An *additive attribute* is true of one of the constituent products and does not functionally link the two constituent products. For example, the *torch-slippers* were described with the additive attributes ''energy efficient LED lights'' (attribute of *torch*) and ''fleece-lined for extra comfort'' (attribute of *slippers*). An *integrative attribute*, in contrast, functionally links the two constituent products and suggests specific usage situations. The *torch-slippers* were described as having the function ''see where you're going at night without waking others'' and ''light switches on automatically when shoes are put on.'' We attempted to maximize the similarity of the attributes across each yoked pair of similar and dissimilar HPs. For instance, *telephone–computer mouse* was described with the integrative attributes ''phone numbers dialed on keyboard'' and ''uses music stored on computer for ringtone,'' whereas *alarm clock–computer mouse* was described with the integrative attributes ''alarm time is entered on keyboard'' and ''uses music stored on computer for alarm sound.''

Thus, there were eight HPs, four similar and four dissimilar, and each HP was described with four attributes: two base attributes and either two additive attributes or two integrative attributes. Each participant judged one HP in each of the four conditions of the similarity × type factorial design, and all participants rated each base product only once (in either a similar or a dissimilar HP, and with either additive or integrative attributes).

Below each product description was a series of rating scales ranging from 1 (''certainly not'') to 7 (''certainly''). We increased the number of scales from Study 2 to confirm the validity of the two factors of Novelty and Evaluation found previously, and consequently to improve the reliability of the measurements. Participants were asked to rate each HP on each of the following properties: novelty (''new''), usability (''usable''), originality (''original''), benefit (''beneficial''), likability (''I like it''), purchase intention (''I would buy it''), success (''Likelihood of market success''), familiarity (''Are you familiar with the product?''), and prior use (''If so, did you use it?''). A rating of similarity (''are the two product categories similar?'') was also included as a manipulation check. Questions were presented in the order listed above, and participants indicated their ratings by circling a number on the scale.

4.1.3. Data analysis

As in the preceding experiment, PCA with Varimax rotation confirmed two principal factors of novelty and evaluation. The first factor, which explained 52% of the variance, yielded high loadings for usability, benefit, likability, purchase intention, and success (all > .82). The second factor, which explained 21% of the variance, yielded high loadings for novelty, originality, and familiarity (negative loading). Therefore, composite scores of *evaluation* and *novelty* were created by averaging the appropriate measures. All analyses reported below were conducted on these composite measures, which were analyzed via repeated measures MANOVA. We conducted one set of analyses that included all participants, and another set of analyses that excluded all participants who claimed prior use of one or more of the HPs on the ''prior use'' measure. Because these two analyses yielded identical patterns of statistically significant results, we report only the former analyses below.

4.2. Results and discussion

We first tested whether our manipulation of HP similarity was valid. Indeed, the similar HPs were rated significantly more similar ($M = 2.99$, $SE = .12$) than the dissimilar HPs [$M = 1.88$, $SE = .08$; $F(1, 145) = 90.21$, $p < .001$]. With rated similarity as dependent variable, neither the main effect of type (additive or integrative) nor the similarity × type interaction approached significance. Thus, the manipulation of HP similarity was validated.

Mean novelty and evaluation scores are illustrated in Figure 3. As in the preceding experiment, similar HPs were judged slightly but significantly less novel than dissimilar HPs [$F(1, 145) = 6.96$, $p < .01$]. Type of HP had no effect on novelty scores, nor did it interact with HP similarity (both $p > .10$). Overall, integrative HPs received higher evaluations than additive HPs [$F(1, 145) = 7.14$, $p < .01$], and similar HPs were more valued than dissimilar

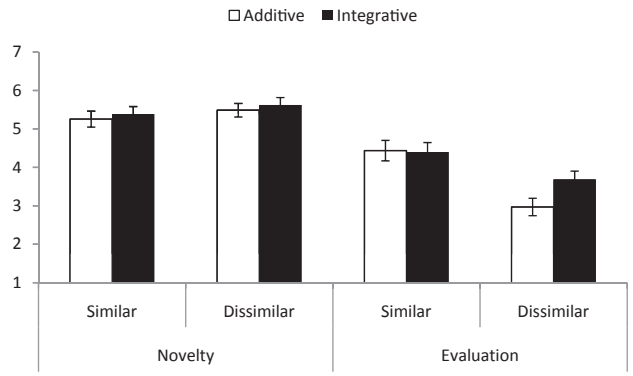

Fig. 3. Novelty and evaluation ($M \pm SE$) of additive and integrative hybrids with similar or dissimilar constituent products in Study 3.

HPs [$F(1, 145) = 102.46$, $p < .001$]. These two findings replicated the results of Study 1. Most important, however, the critical interaction of similarity and type was also significant [$F(1, 145) = 12.78$, $p < .001$]. To examine this interaction in more detail, we conducted paired comparisons of the additive and the integrative HPs within the similar and the dissimilar conditions separately. Relative to additive attributes, integrative attributes significantly increased the evaluation of dissimilar products [$F(1, 145) = 26.25$, $p < .001$], but had no effect on similar products ($p = .84$). Dissimilar HPs were generally poorly evaluated, but describing them with integrative attributes increased evaluations. In contrast, similar HPs generally received higher evaluations regardless of whether they were additive or integrative.

Study 3 therefore replicated the interaction between similarity and type of HP seen in Study 2, but under more controlled conditions (using detailed descriptions of additive vs. integrative attributes). As previously shown, additive hybrids were evaluated more positively when they were similar. In Study 3 this effect did not disappear altogether for integrative hybrids, but the effect was greatly reduced. Thus, when a pair of products is dissimilar, being presented with a concrete description of the integrative hybrid (that is, presenting the links between the two products within a given usage situation) has a strong effect on the evaluation of the product. On the other hand, when the products are similar, there is no corresponding advantage to be seen.

5. Study 4

To provide further converging evidence, in Study 4 participants were given examples of similar and dissimilar pairs of products, but instead of describing them ex ante (as in Study 3), participants were asked to generate and describe the HP themselves. We predicted that without any further task constraints, participants would rely simply on the first stage of the composite prototype model, creating a ''good-enough'' representation

by forming an additive hybrid (Ferreira & Patson, 2007; Hampton, 1987; Wilkenfeld & Ward, 2001). To induce more integrative processing, half of the participants were then asked for a second way to combine the same two products (following the method in Ratneshwar, Barsalou, Pechman, & Moore, 2001) and were asked to reflect on the usage situations in which the product would be situated (following the method of Study 2).

A content analysis was then conducted in which judges decided whether participants' first and second solutions were additive or integrative HPs. According to the composite prototype model, additive solutions should be more likely on participants' first attempt at interpreting the HPs, whereas integrative solutions should be more likely on the second attempt. In addition, similar HPs should be evaluated more positively on the first attempt at interpretation, because similar HPs tend to be easily integrated, and integrative HPs are evaluated more positively (see Study 1). A second interpretation of a similar HP, after already generating one relatively successful interpretation, is unlikely to be as good. On the other hand, dissimilar HPs should be evaluated more positively on the second attempt, when the search for another means of combination should trigger integrative combination of products. Study 4 tested these predictions.

5.1. Method

5.1.1. Participants

Eighty students participated for partial course credit. Assignment of participants to conditions was random. The data of nine participants who indicated prior use or familiarity with the presented products were discarded, leaving 71 participants, ranging between 17 and 19 in each of the four conditions.

5.1.2. Materials

The similar and dissimilar HPs were, respectively, a *radio-phone* and a *pillow-phone*. In the similarity rating task of Study1, the *radio-phone* received a mean rating of 4.44, whereas the *pillow-phone* had a lower mean rating of 1.74.

5.1.3. Design and procedure

A 2 (similarity) × 2 (attempt: single, double) fully randomized design was used. Consistent with prior studies (Markman & Wisniewski, 1997; Wilkenfeld & Ward, 2001), we asked participants to produce interpretations of the HPs. For each HP, participants were asked, ''What would be the best way of combining the two products?'' Participants were then divided into two groups. Those in the Single Attempt condition were simply asked to rate the novelty and evaluation of their solution. Those in the Double Attempt condition did not rate their first attempt. Instead, they were asked to think of a second way to combine the products and to consider in what circumstances this combination would be useful to consumers. They then rated the novelty and evaluation of that second combination of the products. The two dependent variables were calculated as in Study 3, by averaging the answers to the respective scales.

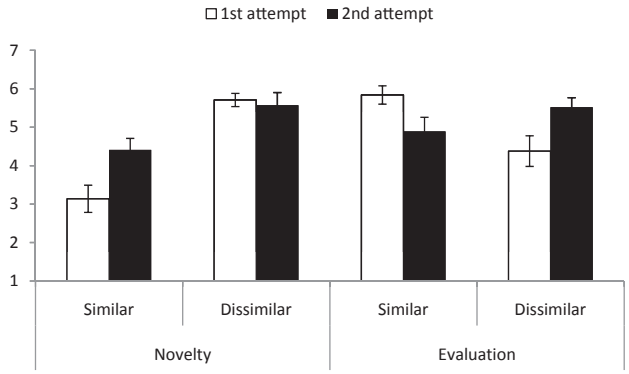

Fig. 4. Novelty and evaluation ($M \pm SE$) of similar (radio-phone) and dissimilar (pillow-phone) hybrids on first and second attempts in Study 4.

5.2. Results and discussion

Figure 4 portrays the mean novelty and evaluation ratings across conditions. Data were analyzed via two-way MANOVA with similarity (similar, dissimilar) and attempt (first, second) as between-participant predictors of novelty and evaluation ratings. In the novelty analysis, the dissimilar HP *pillow-phone* was rated significantly more novel than the similar HP *radio-phone* [$F(1, 65) = 38.80$, $p < .001$]. Overall, the HPs were rated marginally more novel on the second attempt than on the first [$F(1, 65) = 5.63$, $p = .06$]. As shown in Figure 4, however, these main effects were qualified by a significant interaction [$F(1, 65) = 5.51$, $p < .05$]. Whereas the similar HP was rated significantly more novel on the second attempt than on the first [$F(1, 32) = 7.51$, $p < .01$], the dissimilar HP was highly and equally novel on both attempts ($F < 1$). Presumably the similarity of phones and radios led to low novelty ratings, as there are familiar analogous hybrids of electronic products (clock radios, camera phones). Second attempts led to less familiar ways of combining the two products. On the other hand, the dissimilar pair *phone-pillow* was already novel, and its novelty did not change at the second consideration.

The analysis of participants' evaluations revealed a significant crossover interaction [$F(1, 67) = 10.62$, $p < .01$] without main effects. As predicted, the similar HP was rated more positively at the first attempt than at the second attempt [$F(1, 33) = 4.52$, $p < .05$], whereas the dissimilar HP received higher evaluations at the second attempt than at the first attempt [$F(1, 34) = 6.15$, $p < .05$]. In the Single Attempt condition, the evaluations for the dissimilar HP (*pillow-phone*) were relatively low. However, generating a second product idea, along with reflecting on the situation in which it could be used, improved the evaluation of the dissimilar HP. A different pattern was observed for the similar HP (*radio-phone*). Solutions stemming from the first stage of the composite prototype model yielded high ratings of evaluation. Thus, inventing a second product combination solution and its usage situation did not enhance evaluation ratings, but in fact reduced them.

In our theoretical introduction we assumed that first attempts would tend to be additive, and second attempts integrative. To test this assumption, we conducted a content analysis of

Table 1
Solutions for the dissimilar HP (pillow-phone) on first and second attempts in Study 4

Attempt	Examples
1	A pillow that emerges (and inflates) from the phone using a quasi-airbag system
1	A phone out of which unfolds a pillow
1	A phone underneath a pillow
1	A cordless phone which is in the pillow and can be taken out when needed
1	A phone found inside a special compartment in a pillow, with an alarm clock
1	A phone attached underneath a pillow with a massage function
1	A phone at the end of a pillow with a speaker rather than handset
1	A pillow with an inbuilt phone, to which a headset is attached
1	An integration using two small pillows as the speakers
1	A very large pillow (more of a mat) with a house phone attached on the side
1	A pillow-phone with 'arms' which stick out on either side, one holding the buttons, the other for the handset
1	A vibrating phone in a pillow, with buttons on the side for operation
2	Phone inside pillow equipped with voice command
2	A portable phone integrated into a pillow, with speaker and microphone being in the pillow, with a separate number board which can be put away, all connected to a central phone unit.
2	A phone integrated into a pillow in the shape of a standard house phone handset, such that the parts of the phone (microphone, etc.) are where they would have been had the pillow actually been a standard phone
2	A phone within a rectangular pillow with the number board on the right and a handset on the left, leaving space for the head in between
2	A phone integrated into a pillow
2	A pillow with an integrated phone which tracks life signs(breathing, blood pressure, hearth rate etc.), and rings alarm in case of danger, followed by ringing of emergency services if sleeper does not respond
2	A rectangular pillow with a soft phone attached to it (i.e., the phones parts are attached on top of the pillow and are soft)
2	A phone integrated into a pillow with sensors such that when the weight of one's head is detected, the phone ring tone is muted
2	A cordless or mobile phone made of soft material (which you can rest on)
2	A phone integrated into a neck pillow (those often used whilst travelling), so that the speakers can be close to ears
2	A pillow shaped like a racing chair headrest, with inbuilt speakers and microphone
2	A relax pillow which plays music when it feels pressure
2	A phone-pillow which contains a microphone and speaker so one talks and listens into the phone, and answers by squeezing it
2	An inflatable pillow-phone which deflates on ringing into a normal handset (depuffs), though the subject can also talk into it when 'puffed' if desired
2	An integration such that the phone's buttons can be found on the corners of the pillow, the speakers being inside the pillow and the microphone in one of the corners
2	A mobile phone out of which inflates a neck pillow (horse shoe shaped) on which the user can rest and chat at the same time (possibly with massage function)
2	A pillow attached on the back of the house phone handset so that it can lean on one's shoulder while chatting
2	A vibrating phone in a pillow, to which one speaks Viva Voce, and punches to answer
2	A set of pillows that are also walky talkies, thus allowing communication between people in bed

Table 2
Solutions for the similar HP (radio-phone) on first and second attempts in Study 4

Attempt	Examples
1	A radio integrated into a mobile phone, to which ear phones or speakers can be attached
1	A standard house phone with an integrated radio
1	A telephone with a radio function
1	A house phone with radio function such that people put on hold can listen to the radio, or owner can listen when on hold
1	A portable radio with a cordless phone hub, where the phone (detachable) can be left to charge
2	A radio which is also a phone, such that when you are listening to music and receive a call, you can answer with the radio (which stops playing music), hearing via speakers
2	A radio with phone function such that it turns on when someone is calling, or changes radio station or emits a preset sound

participants' different HPs in each of the two conditions. A research assistant, who was blind to the objective of the experiment, first clustered like solutions produced for the dissimilar HP *pillow-phone* (see Table 1) and for the similar HP *radio-phone* (see Table 2). The clustering process yielded 38 different solutions. Three experts (the same as those who participated in Study 1) then judged whether each of the 38 solutions to the two HPs (i.e., those in Tables 1 and 2) was additive or integrative. Agreement was high, with unanimous agreement on 29 of the items (76% compared to an expected chance rate of around 25%). Disagreements were settled by majority judgment. On the first attempt, solutions were more likely to be additive (13 solutions) than integrative (4 solutions). The second attempt, in contrast, was more likely to produce integrative solutions (17) than additive solutions (4). This differential pattern on first and second attempts was significant ($\chi^2(1) = 12.5$, $p < .001$). The solutions produced on the first attempt largely consisted in aggregating the two objects without any attempt to link the products, identify conflicts, and resolve them in concrete usage situations. For example, respondents merged pillow and phone by coming up simply with ''a cordless phone which is in the pillow and can be taken out when needed'' (see Table 1). In contrast, the solutions produced on the second attempt exhibited conceptual change and integration of products in the context of usage situations. For example, second solutions included ''a phone integrated into a pillow with sensors such that when the weight of one's head is detected, the phone ring tone is muted'' (see Table 1).

6. General discussion

The results of our studies provide a consistent story concerning the relation between the similarity of products, type of hybridization process and evaluations of the resulting HP. To summarize, converging evidence from a trajectory of studies using increasing experimental rigor and control suggests that when forming hybrids of similar products, the easiest and most successful form of hybrid is one that simply aggregates the attributes of the two similar base products. Dissimilar pairs of products suffer in evaluations when combined in this way,

because of incompatibilities. However, by prompting participants to consider simulating the HP in a situation of usage, and asking them to generate a second attempt at solving the hybridization problem, dissimilar HPs can be created through integrative hybridization and receive evaluations that are at least as high as those for similar HPs, while coupled with greater novelty.

In Study 1, participants collected real-world examples of HPs from the media and other sources. Analysis of those HPs available in the marketplace revealed that similar HPs were evaluated more highly than dissimilar, and that integrative hybrids received higher evaluations than additive. At the same time, Study 1 did not show the expected interaction of type of hybrid with similarity. We supposed that uncontrolled effects of sampling may have led to this result. Study 2 therefore adopted a balanced design using a subset of the products from Study 1. In addition, we prompted participants to consider the circumstances in which the combination might prove useful, with the aim of triggering the mental simulation processes that are likely to generate an appreciation of integrative hybrids. With this more controlled design, the predicted interaction was observed. Similar HPs were evaluated more highly than dissimilar, but only in the case where additive hybrids had been formed. With integrative hybrids there was no difference in evaluation between similar and dissimilar HPs.

Study 3 presented the participants with the exact properties and usage situations of the HPs, so that we could be sure that half the HPs were understood as additive and half as integrative hybrids. Once again, the predicted interaction was observed. In this case dissimilar HPs were generally evaluated less highly overall. However, within the dissimilar pairs (but not within the similar pairs), integrative HPs received higher evaluations than additive HPs.

Our final study focused attention on a single pair of HPs, differing only in the similarity of the products combined, and contrasted additive and integrative hybrids by asking participants to generate these HPs and usage situations themselves. Half the participants just made a single attempt at describing an HP, while the other half made a second attempt, and then evaluated the latter, having first reflected on its circumstance of use. In this final study there was a crossover interaction, with evaluations for first attempts favoring the similar HP, and evaluations for second attempts favoring the dissimilar HP. Qualitative analysis of the solutions confirmed that first attempts were primarily additive, and second attempts primarily integrative.

6.1. Theoretical contributions

The results make a number of contributions to the conceptual combination literature. First, Costello and Keane (2000) provide a general model of how people interpret novel noun–noun compounds, of which the formation of a hybrid concept is just one. All types of interpretation are assumed to result from a search through the different ways in which the two concepts can be aligned and placed in relation to each other—for example, by a property mapping (a zebra elephant is a striped elephant) or by a thematic relation (a jungle elephant is an elephant living in the jungle). The model assesses each interpretation against three constraints derived from the pragmatics of communication (diagnosticity, plausibility, and informativeness) and selects the solution that best fits these constraints. Although not directly a model of hybrid product formation (being more

concerned with language than with creative reasoning), it is clear that their model would also make predictions about the process of combining concepts for potential HPs. In particular, the three constraints suggest that the HP should retain salient attributes of its constituent products (diagnosticity), should not raise any major practical problems (plausibility), and should provide some novelty (informativeness). As the model works in a single stage, it would predict that first attempts at hybrid formation are likely to be the most successful. Second and subsequent solutions would require accepting products that meet the constraints less well, unless the search process has been inefficient for some reason. Indeed, our results indicate that a first solution is often the best, at least among hybrids of similar products. However, our results suggest that hybrids of dissimilar products benefit from a second attempt, which situates the HP in a concrete usage context, improving coherence of the combination.

Second, the results are consistent with and confirm the types of hybrids proposed by Hampton and others (Hampton, 1987, 1988; Thagard, 1997). The first type simply aggregates together the products into a single composite concept. We called this first interpretation an ''additive'' hybrid. The second then alters the constituent products of each combined concept to improve the coherence of the new HP. Particularly in response to perceived incompatibilities between the two base products, they may be adapted. We called this type of hybridization, involving the forming of links between the two separate base products ''integrative.'' The results of our studies point to common ground between the composite prototype model and constraint theory (Costello & Keane, 2000). Diagnosticity and plausibility take precedence over informativeness, as ''diagnosticity and plausibility together determine the primary acceptability of an interpretation with informativeness only entering in a logical sense to determine if an interpretation is or is not informative'' (Costello & Keane, 2000, p. 310). In Costello and Keane's model, the search for the best interpretation starts with diagnosticity and then the most diagnostic combination is subjected to the plausibility test. Plausibility requires interpretations to contain predicates that are consistent with prior experience (Connell & Keane, 2006), that is, the combined concept is one describing something participants already ''more-or-less know'' (Costello & Keane, 2000, p. 309). While sequencing the three constraints in the order of diagnosticity, plausibility, and informativeness may hold in the case of similar hybrids, combinations of dissimilar products put this hierarchy to a critical test. Diagnosticity may still be the most fundamental, first constraint. However, hybrids of dissimilar products are difficult to imagine (Hampton et al., 2001) and typically have not been seen before, so satisfying the plausibility constraint is not straightforward. In the case of dissimilar hybrids, therefore, informativeness seems to take the second place, substituting plausibility. As demonstrated by our manipulation, new attributes are created, old attributes are lost, so as to satisfy informativeness in the context of a given usage situation. Once this has been achieved, the new HP is put to the critical plausibility test (in our experimental design, the outcome variable of market success). Thus, by re-ordering the hierarchical relationship of the three constraints in the case of dissimilar HPs, our data point to a common ground between the composite prototype model and constraint theory.

Third, the present study of hybrids in a marketplace setting contributes to the unresolved debate regarding the different processes underlying conceptual combination (e.g., Costello & Keane, 2001; Wisniewski, 2001). Some researchers have differentiated between a comparison process and an integration process in conceptual combination (e.g., Estes, 2003a,b; Wisniewski, 1996, 1997; Wisniewski & Love, 1998). Whereas similar concepts naturally induce comparison leading to a possible property mapping interpretation (e.g., elephant clam = a very large clam), dissimilar concepts more naturally induce integration using a thematic relation (e.g., elephant house = a house for elephants, Golonka & Estes, 2009; Wisniewski & Bassok, 1999). By this account, hybridization is thought to require primarily a comparison process (Wisniewski, 1996, 1997). However, other researchers have not differentiated between comparison and integration processes, supposing instead that all combinations undergo the same basic interpretation process (Costello & Keane, 2000; Gagné, 2000). By examining both similar and dissimilar HPs, our results address this debate. The process of hybridizing similar concepts clearly involves comparison and alignment, as illustrated in Table 2, which provides the qualitative interpretations of the similar hybrids. In the case of dissimilar hybrids, however, we also find evidence of integration. Consider the differences between first and second interpretations for similar (Table 1) and dissimilar (Table 2) HPs. Both show little if any evidence of integration in the first stage. In the second stage, however, the two dissimilar products constituting the HP are clearly integrated into a concrete usage context. Thus, in the case of dissimilar HPs, the distinction between comparison and integration is less evident. Both processes seem to be at work to satisfy the informativeness constraint (what new information, which emergent properties arise from this combination of unassociated concepts?), and the plausibility constraint (where would I use this product?). These studies thus demonstrate conditions under which comparison and integration do not map directly onto similar and dissimilar concepts, respectively.

6.2. Related issues

Our studies have many connections to other areas of cognitive science that we have not had the space to develop here. We will briefly mention three. There is a large literature on similarity (Markman & Gentner, 1993; Medin, Goldstone, & Gentner, 1993; Tversky, 1977) that provides much of the theoretical background to models of conceptual combination. We have, treated similarity as an empirical measure (Study 1), but it is clear that featural overlap and structural alignment play a key role in whether products are seen as similar. We have, for example, suggested that the tendency of the most similar HPs in Study 1 to be judged as integrative is owing to the close structural alignment of very similar products such as a fork and a spoon. A second important area of related research concerns creativity. The second stage of processing that provides an integrative HP frequently requires creative thought processes to be brought to bear. Indeed, an early account of artistic and scientific discovery suggested that progress often resulted from attempts to synthesize opposing ideas (Rothenberg, 1979), and a more recent account attributes much of creativity to novel combinations of mental representations (Thagard & Stewart, 2011). The creation of novel integrative HPs should therefore provide a good test bed for studying processes of creativity. Finally, related

to creativity is the use of analogical reasoning in problem solving and consumer marketing. Like other forms of innovation, development of a new HP could rely heavily on finding analogous cases in other product domains (Markman, Wood, Linsey, Murphy, & Laux, 2009), while analogical associations between products, short of combining them into an actual hybrid, can generate positive affective responses (Goode, Dahl, & Moreau, 2010).

6.3. Practical implications

Our research also has managerial implications of practical value. The two stages underlying the composite prototype model provide a useful framework for examining the potential success of dissimilar HPs. For example, consider a HP involving the two dissimilar base products jogging shoe and mp3 player. An additive HP would probably be something like an mp3 player that is physically built into a jogging shoe, perhaps with speakers on the outside of the shoe. One wonders what the point of this additive HP would be. Yet the L.A.-based company Dadafootwear produced exactly such a hybrid. Dadafootwear physically built the mp3 player into the shoe's heel and tongue, with built-in speakers on each shoe. Control panels to adjust volume and change songs are on the tongue of the shoe, and if batteries run out, the shoe can be charged along with one's phone and other hand-held devices (http://www.dadafootwear.com/). Our studies above suggest that this product would be unsuccessful, and indeed, the production of this additive hybrid was stopped within a year of its launch (Gibbert & Mazursky, 2007).

The key implication for managers is not to stop at additive HPs but to move beyond addition to integration. Here, links between the two products are explored and these links are situated in concrete usage situations, testing for plausibility. It seems remarkable that it took product developers more than 25 years since the invention of the walkman to discover that jogging and portable music are used in the same usage situation and that creating certain links between the music one listens to and the way/speed with which one runs might be worth exploring (as in the case of the Nike+ hybrid of Nike jogging shoe and iPod mp3 player discussed above). As Hampton and Jönsson (2012) recently suggested, integration favors both base products such that both products' categories are fundamentally changed. And in fact, the Nike+ has been so successful that since 2010 Nike no longer produces jogging shoes that are not ''iPod compatible'' (Nike, 2011).

More generally, understanding consumers' evaluations of different kinds of HPs is highly desirable from a practical perspective. Convergence in the electronics and communication technology fields has brought about both types of hybrids, and it is currently unclear which ones will be evaluated more positively by consumers. As such, cognitive science might provide important leads for new product development and product innovation management. Conversely, HPs provide a new context for the study of key concepts of cognitive science, such as similarity and conceptual combination. To illustrate with a recent example, earlier generations of smartphones were additive hybrids in that they sported, for example, both GPS and a digital camera, but with no link between them. By contrast, recent integrative hybrids of GPS-camera such as Nikon's GP1 link their functions such that the GPS adds geographical identification metadata to various media such as photographs, video, websites, or RSS

feeds, thus helping users to find a wide variety of location-specific information (e.g., finding location-based news, websites, or other resources). As such, our study uses a model from cognitive science to address the question, Should smartphone manufacturers stick to the ''addition'' of GPS and camera or create an integration of the two (as Apple did in early 2009 with the second generation of the iPhone)? Our results indicate that integration promotes positive evaluation. In conclusion, we have demonstrated a close resonance between a model of conceptual combination developed in the cognitive sciences, and the evaluations of hybrids in the context of the development and marketing of novel consumer products.

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Appendix A: Products available in the marketplace (Study 1)

Knife	Mp3 player
Knife	USB memory
Computer mouse	Telephone
Headphones	Mp3 player
I-pod	Video player
Whisk	Thermometer
Jacket	Bluetooth
Telephone	Video player
Blanket	Pullover
Telephone	TV set
Drill	Screwdriver
Salt	Pepper
Fridge	TV set
Desk	Bed
USB memory	Bluetooth

Appendix A: (Continued)

Waistcoat	Heating system
Radio	Toaster
Egg poacher	Toaster
Altimeter	Knife
Sun visor	DVD player
Ring	Watch
Computer	Coffee maker
Ruler	Calculator
Coffee machine	Alarm clock
Phone	Camera
Phone	Mp3 player
Car	Boat
Watch	Skipass
Compass	Watch
Cell phone	Watch
Air filter	Lamp
Lamp	Scent
Comb	Mirror
Shower	CD player
Binoculars	Digital camera
USB memory	Laser pointer
Snowboarding helmet	Headphones
Ski	Snowboard
Playstation	DVD player
Pants	Shorts
Shoehorn	Scratchhand
Headphones	Microphone
Ice cream	Candy gum
Post-it index	Marker
Chopstick	Fork/knife
Tie	I-pod pocket
Rolling machine	Tobacco storage box
Lighter	Bottler opener
Camera	Mp3 player
Cardio	TV set
Sushi	USB stick
Pen	Firelighter
Yoghurt	Cereals
Clothes rack	Umbrella stand
Sunglasses	Bluetooth
Heater	Air conditioner
TV/DVD	VHS recorder
Grenade launcher	Assault rifle
Dishwasher	Shining agent
Mobile phone	Computer

Appendix A: (Continued)

Scooter	Car
Thermometer	Dummy
Chair	Table
Mobile phone	Hard drive
Thermos flask	Cup
Pencil holder	Alarm clock
Helmet	Can holder
Dough kneader	Bread baker
Sneakers	Roller skates
Slippers	Shiners
Keyring	Bottle opener
Helmet	Bluetooth
Webcam	Microphone
TV set	Shower
Headrest	DVD screen
Shaving razor	After shave
Belt buckle	Bottle opener
Trolley	Car seat
Compass	Pen
Alarm clock	Weather forecast
Bed	TV set
Screwdriver	Pen
Pen	Banknote checker
Whistle	Thermometer
Jacket	GPS navigator
Watch	Tieholder
Mug	Cookie reservoir
Fork	Spoon
Slippers	Lights
Hat	Fan