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ABSTRACT

Complex novelty like new technologies can be exciting in terms of promising possibilities, but people might also feel that they do not exactly grasp its meaning or purpose. We argue that to become interested in complex novelty, it is key that people have a sense that they can cope with it. In three experiments we showed that people who have relatively high coping potential are more interested in complex novelty than people who have relatively low coping potential. Specifically, interest in complex novel products and inventions increased after increasing product-specific understanding (Experiments 1 and 2) and after inducing a more general state in which people can tolerate complex novelty (Experiment 3). Theoretical and practical implications are discussed.

In the future, people may control devices with their brainwaves, influence the weather with cloud-making machines, and clean their house using robotic cleaning flies. This is just a snapshot of the numerous new products and technologies that are currently being developed[1] and that may find their way into people's daily lives. Innovation may provide people with many new and useful things, and people most likely first hear about new developments via news coverage or through websites that focus specifically on technological innovation. Journalists, bloggers, and developers communicate about what is new, and the widespread attention on, for instance, products introduced at the yearly Consumer Electronics Show (see cesweb.org) suggests that many people are interested in new and innovative things.

Interestingly, however, many new products fail (the estimated failure rate ranges from 40% in Castellion & Markham, 2012, to 75% in Schneider & Hall, 2011; see also Cierpicki, Wright, & Sharp, 2000).[2] So, even though new products and technologies may be exciting, useful, and often enthusiastically communicated about, success is sometimes hindered. The question is how to introduce novel products to increase the chance that people will become interested in these products. One issue may play a role: Novelty can be challenging because it may come with unfamiliarity and difficulty in understanding it (e.g., Mukherjee & Hoyer, 2001; Rindova & Petkova, 2007; see also Oreg, 2003; Oreg & Goldenberg, 2015). This does not concern "simple" novelty like new flavors or modernized package design but rather is an issue of complex novelty like technological change. Complex novelty is the combination of atypicality/unfamiliarity (novelty) and difficulty understanding this at first sight (complexity: see also Berlyne, 1960, 1971; Silvia, 2005). People may resist complex novelty because they experience uncertainty regarding its purpose and meaning (see also Antioco & Kleijnen, 2010; Carbon & Schoormans, 2012; Castaño, Sujan, Kacker, & Sujan, 2008; Hoeffler, 2003; Kleijnen, Lee, & Wetzels, 2009; Oreg & Goldenberg, 2015). So, to become interested in complex novelty, it is key that people have a sense that they can cope with it. This has concrete implications for how complex novelty should be introduced to people.

Complex novelty

Complex novelty can be exciting in terms of promising possibilities, but people might also feel that they do not grasp exactly what it is or what it is for (see also Berlyne, 1971; Hoeffler, 2003; Mukherjee & Hoyer, 2001). For instance, robotic cleaning flies may offer the prospect of saving the time normally allotted to cleaning, however, it is not really clear how these little robots find dirt or what it means that they fly around in one's house. This lack of understanding might present people with an information gap, which can make them curious and motivated to find out more (e.g., Loewenstein, 1994; Noordewier & Van Dijk, 2016; Silvia & Kashdan, 2009). At the same time, it can challenge people's preference to understand their environment and their need

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for certainty, predictability, and structure (e.g., Abelson et al., 1968; Gawronski & Strack, 2012; Kay, Whitson, Gaucher, & Galinsky, 2009; Noordewier & Breugelmans, 2013; Proulx, Inzlicht, & Harmon-Jones, 2012). As such, not understanding complex novelty may actually lower interest rather than promote interest, as people may find complex novelty difficult to deal with.

Research on the appraisal structure of interest also points to the importance of feeling able to deal with complex novelty. In particular, it has been argued that feeling interested is driven by a combination of a novelty-complexity appraisal and a coping potential appraisal (Silvia 2005; see also Kashdan & Silvia, 2009; Silvia, 2008). The novelty-complexity appraisal refers to the evaluation of an event as new, unexpected, complex, hard to process, surprising, mysterious, or obscure. The coping potential appraisal is the estimation of having the skills, knowledge, and resources to deal with an event (cf. Silvia, 2005). Complex novelty obviously meets the first appraisal, but the question is whether people experience sufficient levels of coping potential to experience interest, as the complexity component may actually interfere with this. So, the more complex and novel a product is, the less likely it becomes that people experience coping potential. This is also in line with Berlyne's notion (e.g., Berlyne, 1960, 1971) that people want to avoid things that become too novel because they are too arousing (see also Noseworthy, Di Muro, & Murray, 2014) and findings that show that "most advanced, yet acceptable" works best in industrial design (cf. Blijlevens, Carbon, Mugge, & Schoormans, 2012; Hekkert, Snelders, & Van Wieringen, 2003).

Coping with complex novelty

It is important to note that this logic provides clear directions on how to increase interest in complex novelty. By increasing people's coping potential with complex novelty, their interest in complex novelty should increase as well. This can be done in different ways. First, when product-specific understanding increases, people should experience more coping potential and interest. Possible ways to do this are, for instance, communicating how a new product is similar to a known product and providing information on how the product works. Second, a more general subjective coping potential experience could increase interest in complex novelty as well, for instance, by inducing a state in which people feel able to deal with complex novelty or can tolerate and possibly even enjoy the unfamiliarity and difficult-to-understand component of complex novelty.

Different studies support the notion that product-specific understanding increases interest. For instance, it has been found that interest in art is positively related to understanding the meaning of the artwork (e.g., provided via titles of abstract art or extra information about a poem; Millis, 2001; Silvia, 2005), given that people have sufficient time to process the meaning of the information (Leder, Carbon, & Ripsas, 2006). Also, research has shown that interest in an unclear task was highest when people experience moderate levels of self-efficacy, whereas low and high self-efficacy resulted in lower interest because the task was respectively too difficult or too easy (Silvia, 2003). In addition, in a theoretical analysis of technological change and product design, Rindova and Petkova (2007) argued that people might be better able to cope with novel technologies when they are presented in a familiar product design, because the familiarity makes it easier to comprehend.[3] Finally, Carbon and Leder (2005) showed that innovative product design becomes more attractive when people are repeatedly exposed to it (see also Carbon & Leder, 2007), presumably because the extra elaboration increases their understanding of the product. Taken together, these insights suggest that when introducing complex novelty, interest might be increased by making it easier to understand rather than only highlighting the innovative elements.

It is important that this logic also seems to hold in a more general sense, such that people in a general state of high coping potential (rather than related to product-specific features) are possibly also more interested in complex novelty. Indirect evidence indeed supports this notion. For instance, when people experience high as opposed to low personal control, they are more likely to accept disorder and randomness (e.g., Rutjens, van Harreveld, van der Pligt, Kreemers, & Noordewier, 2013; see also Kay et al., 2009) and thus possibly also novelty. In addition, people who feel certain are more likely to go for novel products, whereas people who feel uncertain are more likely to prefer familiarity (Oishi, Miao, Koo, Kisling, & Ratliff, 2012; see also van Horen & Pieters, 2013). Finally, people who focus on fascination or growth appreciate novelty more than people who focus on danger or maintaining or attaining security (Carbon, Faerber, Gerger, Forster, & Leder, 2013; promotion vs. prevention focus, Gillebaart, Förster, & Rotteveel, 2012).

Although rather diverse and not always focusing on *complex* novelty, these findings suggest that contextual factors related to coping potential predict preferences for novel or disorderly targets. Translating this to interest in complex novelty, this suggests that when people are in a state of high coping potential, they feel they can deal with the unfamiliarity and difficulty component of complex novelty, whereas when they are in a state of

low coping potential, this same unfamiliarity and difficulty component can be experienced as challenging or even stressful (e.g., Oishi et al., 2012). As such, people are predicted to be more interested in complex novelty when they feel they have high versus low coping potential. When introducing complex novelty, it is therefore important to do this in settings where people feel they can cope.

In sum, we predict that people who experience high coping potential are more interested in complex novelty than people who experience low coping potential. To test this hypothesis, we measure interest in complex new products (Experiments 1 and 2) and recent inventions (Experiment 3), after increasing product-specific understanding (Experiments 1 and 2) or after increasing coping potential using an autobiographical recall task (Experiment 3). In all studies, we included novelty and complexity measures. This allowed us to test the (in) dependence of the novelty-complexity and coping potential appraisals.

Pretest

To select complex novel stimuli for Experiments 1 and 2, we conducted a pretest. We selected 12 complex novel products based on an Internet search. An Amazon's Mechanical Turk (MTurk) sample ($N = 30$; U.S. participants only and at least 96% of previous studies completed, i.e., hit rate; age/gender information unavailable[4]) viewed pictures of the products in random order, including the product name: robot vacuum cleaner, Mercator Personal Manager Bracelet, Sci-Fi LED watch, iTaste 134 E-Cigarette, Orbit Dry Ice Washing Machine, flexible 6-in. organic light emitting diode (the picture made it clear that this was a phone), vibrating ring alarm, Bio Polymer Refrigerator, MAB Computerized Cleaning Flies, Smart stop smoking wearable device, flexible wrist computer, and Headbones conduction headphones.

Each product was evaluated on 7-point scales, ranging 1 (*not at all*) to 4 (*moderately*) to 7 (*extremely*), in terms of interest (interesting, boring [reverse coded]; overall $\alpha = .88$[5]), novelty (novel, familiar [reverse coded]; overall $\alpha = .90$), complexity (complex, simple [reverse coded]; overall $\alpha = .92$), and coping potential ("I feel able to understand the product," "I have a sense of what this product can be used for," "I am unsure how to try this product [reverse coded]" reliably adapted from Silvia, 2005; overall $\alpha = .93$). The four products chosen for the main study were rated as interesting, but not extremely so (to avoid ceiling effects), relatively low in terms of coping potential and high on novelty and complexity (see Table 1). The products were Orbit Dry Ice Washing Machine, Bio Polymer Refrigerator, MAB Computerized Cleaning Flies, and Mercator Personal Manager Bracelet.[6] In the next two studies, we tested whether increasing understanding of these products would also increase interest in them.

Table 1. Mean (standard deviation) interest, coping potential, novelty, and complexity of the four products selected for the main study (pretest).

	Dry Ice Washing Machine	Bio Polymer Refrigerator	MAB Robotic Cleaning Flies	Personal Manager Bracelet
Interest	6.35 (0.84)	6.62 (0.78)	6.05 (1.12)	5.93 (1.09)
Coping potential	3.51 (1.60)	4.18 (1.71)	2.77 (1.36)	4.37 (1.59)
Novelty	6.25 (0.97)	6.35 (0.77)	6.07 (1.04)	5.55 (0.95)
Complexity	5.90 (1.28)	6.15 (1.07)	6.02 (1.07)	5.33 (1.20)

Note. Other products in the pretest were not selected because they were rated as relatively familiar (means equal or smaller than 4; vacuum cleaner, e-cigarette), relatively simple (means equal or smaller than 4; e-cigarette), relatively high coping potential (means equal or higher than 4.5; LED watch, e-cigarette, phone, ring, flexible arm computer, headphones), or relatively low interest (means lower than 5.5; vacuum cleaner, e-cigarette, stop smoking device).

Experiment 1: Similarity to a familiar product

In Experiment 1, we tested whether communicating similarity of a complex novel product to a comparable familiar product would increase interest in it. Previous research showed that communicating analogies of a new product to something known increases product comprehension (Feiereisen, Wong, & Broderick, 2008; Gregan-Paxton, Hibbard, Brunel, & Azar, 2002). Based on this, we predicted that communicating similarity of a complex novel product with a comparable familiar product would increase coping potential and interest in the product.

In addition, for exploratory purposes we included a measure of individual differences in innovativeness and curiosity (Curiosity and Exploration Inventory [CEI-II]; Kashdan et al., 2009). The CEI-II measures the extent to which people are motivated to look for new knowledge and experiences and embrace the uncertainty and unpredictability of everyday situations. The Innovativeness scale (Goldsmith & Hofacker, 1991) measures the extent to which people are early versus late adopters of novel products (Rogers, 2003). We predicted that high curious people and people who are often the first in knowing or owning novel products might be less affected by communicating similarity than low curious people or people who are late in knowing or owning novel product. These people are more likely to be interested in the products independent of our manipulation because the complexity is not necessarily challenging (and maybe even exciting; see Kashdan et al., 2009) and interest in novelty is part of being an innovative person (see Goldsmith & Hofacker, 1991).

Method

One hundred participants were recruited on MTurk (U.S. participants only; hit rate = 96%; age/gender information unavailable). First, they filled out the CEI-II (Kashdan et al., 2009; e.g., "I am at my best when doing something that is complex or challenging"; $\alpha = .91$), followed by the Innovativeness scale (Goldsmith & Hofacker, 1991; e.g., "In general, I am among the first in my circle of friends to buy new products or technologies."). For the Innovativeness scale, we specified each item such that it referred to novel products or technologies ($\alpha = .83$). Then, they were randomly assigned to one of the two conditions: similarity versus control condition.

Participants viewed pictures from the four complex new products selected in the pretest and evaluated each product before viewing the next one. In the *control condition*, they saw the pictures with the product title: Orbit Dry Ice Washing Machine, Bio Polymer Refrigerator, MAB Computerized Cleaning Flies, Mercator Personal Manager Bracelet. In the *similarity condition*, they saw the pictures with the product title as well as similarity information: The Orbit Dry Ice Washing Machine works just like a regular washing machine, but without water and soap / The Bio Polymer Refrigerator works just like a regular refrigerator, but with a special gel to keep your products cool / The MAB Computerized Cleaning Flies works like a regular vacuum cleaner, but with multiple small cleaning objects that move independently and automatically find dirt / The Mercator Personal Manager Bracelet works like your personal assistant, which you can wear as a bracelet.

Participants evaluated the products sequentially and in the same order. Below the product information, participants could complete the dependent measures. First, we measured interest in the product by asking to what extent they agreed with the following four statements about the product (reliably adapted from Silvia, 2005; $\alpha = .89$): "I think this product is interesting," "I think this product is boring (reverse coded)," "This product makes me feel curious," and "I would like to try this product." Then we measured coping potential ($\alpha = .83$), novelty ($\alpha = .71$), and complexity ($\alpha = .80$) using the same items as in the pretest. All questions could be answered on scales ranging from 1(*not at all*) to 4 (*moderately*) to 7 (*extremely*). After evaluating all four products, the study ended and participants were thanked and debriefed.

Results

In this and subsequent studies, we did not conduct null hypothesis significance tests, but instead we calculated effect sizes to measure the magnitude of effects (Trafimow & Marks, 2015; see also Lakens, 2013). Specifically, we report Glass's Δ when we compare means relative to a control condition (with the standard deviation of the control condition; Experiments 1 and 2) and Cohen's d (with pooled standard deviation) when we compare experimental groups without a control condition (Experiment 3). Note that Glass's Δ belongs to "the d family effect sizes" (cf. Lakens, 2013) and like Cohen's d represents a standardized mean difference. In addition, when referring to main effects or interactions, we also report partial eta-square (η_p^2) or standardized betas (βs) where relevant.

Results showed that (see Table 2) participants in the similarity condition reported more interest in the products ($M = 5.80$, $SD = 0.90$) than participants in the control condition ($M = 5.43$, $SD = 0.97$; Glass's $\Delta = 0.38$). In addition, participants in the similarity condition reported more coping potential with the product ($M = 4.59$, $SD = 1.08$) than participants in the control condition ($M = 4.14$, SD = 1.02; Glass's $\Delta = 0.44$). Finally, participants in the similarity versus control condition rated the products fairly similar in terms of novelty ($M = 5.48$ SD = 0.93 vs. $M = 5.30$, $SD = 0.87$; Glass's $\Delta = 0.21$) and complexity ($M = 4.94$, $SD = 1.20$ vs. $M = 4.87$, $SD = 0.88$; Glass's $\Delta = 0.08$).

Next, we checked the effects of individual differences in curiosity and innovativeness, using standardized means for the Curiosity (CEI)[7] and Innovativeness scale.

Curiosity

The effect size of the interaction between similarity/control condition and curiosity on complexity was $\eta_p^2 = .03$, and on coping potential $\eta_p^2 = .04$ (other interaction effect sizes, $\eta_p^2 < .014$). In addition, the effect size of the main effect of curiosity on interest was $\eta_p^2 = .10$, and on coping potential $\eta_p^2 = .05$ (other curiosity main effect sizes, $\eta_p^2 = .00$). The effect size of the main effect of similarity/control condition on interest was $\eta_p^2 = .04$, and on coping potential $\eta_p^2 = .05$ (other similarity/control effect sizes, $\eta_p^2 < .012$).

To interpret the Curiosity × Similarity/Control Condition interactions, we ran a regression with similarity/control condition, low/high curiosity (standard

Table 2. Mean (standard deviation/standard error) interest, coping potential, novelty, and complexity as a function of condition (similarity vs. control; Experiment 1).

	Similarity	Control	Glass's Δ
Interest	5.80 (0.90/0.13)	5.43 (0.97/0.14)	0.38
Coping potential	4.59 (1.08/0.15)	4.14 (1.02/0.15)	0.44
Novelty	5.48 (0.93/0.13)	5.30 (0.87/0.12)	0.21
Complexity	4.94 (1.20/0.17)	4.87 (0.88/0.13)	0.08

deviation below/above the mean, following Aiken & West, 1991; for all estimated means and βs, see Table 3), and the interactions on coping potential and complexity. For complexity, there was a Curiosity × Similarity/Control Condition interaction with $\beta = .31$ (other effects: βs between −.17 and .22). For coping potential, there was a Curiosity × Similarity/Control Condition interaction with $\beta = -.30$, and a low/high curiosity main effect with $\beta = .40$. High-curious people reported almost equal levels of coping potential in the similarity and control condition ($M_{similarity} = 4.64$ vs. $M_{control} = 4.58$, $\beta = .03$), whereas low-curious people reported higher coping potential in the similarity condition than the control condition ($M_{similarity} = 4.55$ vs. $M_{control} = 3.72$; $\beta = .39$). For high-curious people the similarity did not change their coping potential, whereas for low-curious people it increased.

Innovativeness

The effect size of the main effect of innovativeness on interest was $\eta_p^2 = .05$. In addition, the effect size of the main effect of similarity/control condition on interest was $\eta_p^2 = .03$, and on coping potential $\eta_p^2 = .04$. The effect sizes of the interactions between similarity/control condition and innovativeness were negligible, $\eta_p^2 < .006$, and so were other effect sizes, $\eta_p^2 \leq .013$. The effect of similarity on interest was thus independent of individual differences in innovativeness.

In line with our predictions we found that communicating similarity of a complex novel product to a comparable familiar product increased interest in it. Communicating similarity also increased coping potential with the complex novel product, and based on the appraisal structure of interest (Silvia, 2005), we assume that the increased interest is explained by this increased coping potential. It is important that communicating similarity did not affect ratings of novelty or complexity of the products. The increased coping potential cannot be explained by the product seeming more familiar or simple. This finding also suggests that the two appraisals underlying interest (novelty-complexity and coping potential) can be influenced separately and thus jointly but independently predict interest.

It should be noted, however, that besides communicating similarity (e.g., "works like a regular vacuum cleaner"), we also gave participants some extra information about how the complex novel products work (e.g., "works with multiple small cleaning objects that move independently and automatically find dirt"). Consequently, we cannot be certain that it is the similarity, the information, or a combination of both that drives our effect. In the next study, we therefore manipulated similarity and information separately.

Table 3. Estimated interest, coping potential, novelty, and complexity as a function of low versus high curiosity in the similarity versus control condition.

	Low Curiosity			High Curiosity		
	Similarity	Control	β	Similarity	Control	β
Interest	5.46	5.19	.14	6.13	5.67	.24
Coping potential	4.55	3.72	.39	4.64	4.58	.03
Novelty	5.40	5.42	−.01	5.56	5.17	.22
Complexity	4.79	5.05	−.16	5.15	4.69	.22

Note. βs in the table represent the comparison of the control versus similarity condition in the regression. βs for the main effects for low/high curiosity: interest = .25/coping potential = .40/novelty = −.14/complexity = −.17. βs for the Similarity/Control Condition × Low/High Curiosity interaction: interest = .09/coping potential = −.30/novelty = .19/complexity = .32.

Experiment 2: Similarity and information

In Experiment 2, we presented participants with the same complex novel products as in Experiment 1. Next to a control condition that gave only the product title, we communicated similarity, gave information about how it works, or both. Because all this would increase people's understanding of the product, we predicted that relative to the control condition, communicating similarity, information, and similarity + information would all increase coping potential and interest in the complex novel product.

We improved our manipulation in three ways. First, to more clearly communicate similarity in the similarity condition and to distinguish it from the information on how the products work, we now explicitly stated "similar to" (rather than "works just like" in Experiment 1). In addition, we improved the information on the Orbit Dry Ice Washing Machine, such that it now explained what is new about it, like the information about the other products. Specifically, we stated "works with dry ice to clean clothes" rather than "works without water and soap," which could be interpreted as an advantage and focuses less on the innovative part. Finally, in this study, products were now presented in random order rather than in the same order.

Method

Similar to Experiment 1, participants were recruited on MTurk ($N = 200$; 80 female, 120 male; $M_{age} = 32.93$ years, $SD_{age} = 10.24$; all American; education distribution was 0.5% none, 18.5% high school/GED, 35% some college, 39% bachelor's degree, 5.5% master's degree, 1.5% doctoral degree/PhD). They were randomly assigned to conditions and viewed pictures of the products with a product title. In the control condition, this was all they

saw and read. In the similarity condition, participants read the following: Orbit Dry Ice Washing Machine: similar to a regular washing machine / Bio Polymer Refrigerator: similar to a regular refrigerator / MAB Computerized Cleaning Flies: similar to a regular vacuum cleaner / Mercator Personal Manager Bracelet: similar to a personal assistant. In the information condition, participants read the following: Orbit Dry Ice Washing Machine: works with dry ice to clean your clothes / Bio Polymer Refrigerator: works with a special gel to keep your products cool / MAB Computerized Cleaning Flies: works with multiple small cleaning objects that move independently and automatically find dirt / Mercator Personal Manager Bracelet: works with software in a bracelet to keep you organized. In the similarity + information condition, participants read both the similarity and information (i.e., combination of sentences of the similarity and information condition just described). Interest ($\alpha = .90$), coping potential ($\alpha = .80$), novelty ($\alpha = .69$), and complexity ($\alpha = .75$) were measured in the same way as in Experiment 1.

Results

Inspection of the mean novelty of the separate products showed that the bracelet was overall evaluated as less novel ($M = 4.48$) than the other products (means ranged between 5.82 and 5.83). Also, the bracelet was evaluated as less complex ($M = 4.34$) than the other products (means ranged between 5.18 and 5.65). In the time between the data collection of Experiments 1 and 2, several smart watches have been introduced to the market, and it seems reasonable to assume that the bracelet became less novel and less complex to participants. Therefore, the bracelet is not a suitable product to test our reasoning, and we excluded the ratings of this product from the main analyses. Including the bracelet in the analyses resulted in a similar but weaker pattern of results.

Results showed that (see Table 4) compared to participants in the control condition ($M = 5.26$, $SD = 1.12$), participants reported more interest in the products in the similarity condition ($M = 5.74$, $SD = 0.91$; Glass's $\Delta = 0.43$), and somewhat more in the information condition ($M = 5.59$, $SD = 1.23$; Glass's $\Delta = 0.29$), and the similarity + information condition ($M = 5.59$, $SD = 1.22$; Glass's $\Delta = 0.29$). In addition, compared to participants in the control condition ($M = 3.57$, $SD = 1.12$), participants reported to have more coping potential in the similarity condition ($M = 4.12$, $SD = 0.96$; Glass's $\Delta = 0.49$), the information condition ($M = 4.31$, $SD = 1.20$; Glass's $\Delta = 0.66$), and the similarity + information condition ($M = 4.15$, $SD = 0.83$; Glass's $\Delta = 0.52$).

Of interest, and different from Experiment 1, compared to participants in the control condition ($M = 5.53$, $SD = 0.78$), participants rated the products as more novel in the similarity condition ($M = 6.08$, $SD = 0.86$; Glass's $\Delta = 0.71$) and the information condition ($M = 5.98$, $SD = 0.97$; Glass's $\Delta = 0.58$). Novelty ratings in the similarity + information condition ($M = 5.68$, $SD = 1.14$; Glass's $\Delta = 0.19$) were fairly similar to those in the control condition. Finally, compared to participants in the control condition ($M = 5.22$, $SD = 1.03$), participants rated the products as somewhat more complex in the similarity condition ($M = 5.49$, $SD = 0.98$, Glass's $\Delta = 0.26$) and the similarity + information condition ($M = 5.46$, $SD = 1.02$, Glass's $\Delta = 0.23$), whereas complexity ratings were fairly similar in the information condition ($M = 5.38$, $SD = 1.09$, Glass's $\Delta = 0.16$).

Discussion

Taken together, Experiment 2 shows that people are more interested in complex novelty after communicating how the product is similar to a comparable familiar option and/or by giving information on how the product works. Comparing the current findings to those of Experiment 1, it thus seems that both similarity and information can increase interest. This makes sense, as they both increase people's understanding of the product. Interestingly, however, Experiment 2 shows that the strongest effects were obtained by communicating similarity. Although it is difficult to exactly unravel why this is the case based on the current data, this finding is important for product developers who want to

Table 4. Mean (standard deviation/standard error) interest, coping potential, novelty, and complexity as a function of condition (similarity vs. information vs. similarity + information vs. control; Experiment 2).

	Similarity	Information	Similarity + Information	Control Condition
Interest	5.74 (0.91/0.13) Glass's $\Delta = 0.43$	5.59 (1.23/0.17) Glass's $\Delta = 0.29$	5.59 (1.22/0.17) Glass's $\Delta = 0.29$	5.26 (1.12/0.16)
Coping potential	4.12 (0.96/0.14) Glass's $\Delta = 0.49$	4.31 (1.20/0.17) Glass's $\Delta = 0.66$	4.15 (0.83/0.12) Glass's $\Delta = 0.52$	3.57 (1.12/0.16)
Novelty	6.08 (0.86/0.12) Glass's $\Delta = 0.71$	5.98 (0.97/0.14) Glass's $\Delta = 0.58$	5.68 (1.14/0.16) Glass's $\Delta = 0.19$	5.53 (0.78/0.11)
Complexity	5.49 (0.98/0.14) Glass's $\Delta = 0.26$	5.38 (1.09/0.15) Glass's $\Delta = 0.16$	5.46 (1.02/0.14) Glass's $\Delta = 0.23$	5.22 (1.03/0.15)

introduce their complex new product. Rather than only focusing on the innovative components of their product, they need to address people's feeling that they can cope with the innovation. That this works best by explaining how the product is similar to an already known option is probably not the first thing that comes to mind when wanting to introduce a complex novel product. The next study tests whether the coping potential logic also holds when a more general state of coping potential is induced.

Experiment 3: Recall coping potential

In Experiment 3, we asked people to recall a situation in which they experienced high versus low coping potential before they evaluated different recent inventions. Based on previous autobiographical recall procedures (e.g., De Hooge, Nelissen, Breugelmans, & Zeelenberg, 2011; Noordewier & Breugelmans, 2013), we reasoned that when people recall such an event, this would temporarily affect feelings of coping potential. Specifically, the recall was assumed to make memories accessible (e.g., Higgins, Rholes, & Jones, 1977) and result in the spreading of activation of related constructs via an associative network (e.g., Berger & Fitzsimons, 2008; Collins & Loftus, 1975; Neely, 1977). This temporarily actives feelings and associations related to high versus low coping potential. Prior to evaluating the inventions, the manipulation aimed to induce a general psychological state in which people are less or more able to tolerate the unfamiliar and difficulty component of complex novelty (see also Smith & Semin, 2007). It thus constitutes a contextual manipulation of coping potential rather than a product-specific manipulation. We predicted that people who were in a state of high coping potential would be more interested in complex novel inventions than people who were in a state of low coping potential.

Method

We recruited 103 participants ($M_{age} = 36.93$ years, $SD_{age} = 11.37$; 59 male) on MTurk. Settings were the same as in Experiments 1 and 2 (96% hit rate, United States only). Nationality was distributed as 101 Americans, 1 Italian, and 1 Asian. Educational level was distributed as 11 high school/GED, 33 some college, 41 bachelor's degree, 12 Master's degree, and six doctoral degree/PhD. Participants were randomly assigned to conditions and were asked to recall an event in which they had high versus low coping potential. After general instructions, we explained what we meant with high [low] coping potential:

> Coping potential is the extent to which one is able to deal with an event. In some situations, people have low coping potential and in other situations, people have high coping potential. In this study, we are interested in high [low] coping potential situations. Having high [low] coping potential means that you have [lack] the skills, knowledge, or resources to deal with an event. So, even if [when] things are complicated, unfamiliar, or unclear, someone with high [low] coping potential is able to [cannot] deal with it. Please take a moment to think about high [low] coping potential and what this means to you.

Then, we asked participants,

> Please describe an event in your life that was complex or unfamiliar you had high [low] coping potential; you had [lacked] the skills, knowledge, or resources to deal with it; so, you could [could not] understand the situation and you were able/unable to deal with it.

Note that both in the low and the high coping potential condition, participants were asked to recall a complex or unfamiliar event. We did this to avoid that the content of the recall would be different in terms of complexity. We asked participants in the high [low] coping potential condition to recall the situation by responding to the questions, What was complex or unfamiliar about the event? How did you realize that you understood [did not understand] the event? How did you realize that you could deal [were unable to deal] with the event? Which skills, knowledge, or resources did you have that enabled you [were you lacking that prevented you] to deal with the event? Stories were diverse. Participants, for instance, recalled events related to work challenges, moving house, death, illness, addiction, money issues, or accidents. Some reported examples of coping are staying calm, relying on social support, using experience (high coping potential) versus feeling overwhelmed, not knowing what to do, and lacking experience (low coping potential).

To get a better understanding of the content of the stories and similarities or differences between conditions, two independent coders who were blind to condition rated the material. They rated "To what extent is the situation complex?" ($r = .61$; $N = 97$[8]), "To what extent could the person deal with the situation?" ($r = .86$; $N = 92$), and "To what extent could the person influence the situation (i.e., control)?" ($r = .60$; $N = 94$) on 1 (*not at all*) to 7 (*extremely*). Finally, they rated "What was the valence of the situation?" on 1 (*negative*) to 7 (*positive*; $r = .64$; $N = 94$) and coded the type of situation (e.g., work, illness, death, relations).

After aggregating the ratings of both coders, we compared the means between high and low coping potential conditions. This showed that the high coping potential stories reflected a higher ability to deal with the situation ($M = 5.48$, $SD = 0.88$) than the low coping potential

stories ($M = 2.16$, $SD = 0.91$; $d = 3.71$). In addition, the high coping potential stories reflected more controllability ($M = 4.06$, $SD = 1.76$) than the low coping potential stories ($M = 2.91$, $SD = 1.37$, $d = 0.73$). Also, the high coping potential stories were somewhat more positive ($M = 2.81$, $SD = 1.04$) than the low coping potential stories ($M = 2.26$, $SD = 0.81$, $d = 0.59$) and somewhat less complex ($M = 5.45$, $SD = 0.92$) than low coping potential stories ($M = 5.66$, $SD = 0.85$, $d = -0.24$). Finally, the distribution of the type of situations was 26.5% work, 12.7% death, 9.8% illness, 7.8% relations, 5.9% money, 4.9% computer or technical issues, 4.9% accidents or mechanical failure, 3.9% education, 2.9% moving house, 15.7% other (e.g., addiction, low self-esteem), and 4.9% missing (e.g., no clear information).

High as compared to low coping potential stories thus reflected higher ability to deal with the situation and higher controllability, which confirms that people indeed recalled situations in which they had relatively high versus low coping potential. The differences in valence and particularly complexity were unanticipated but compared to the other findings relatively weak.

After the recall task, we asked people to report their level of coping potential ("How would you rate your current coping potential?" from 1 [*low coping potential*] to 7 [*high coping potential*]). Then the study continued to the evaluation of three recent inventions. Participants read, in random order, approximately 100-word descriptions of three inventions: (a) a temporary electronic tattoo, able to read brain wave activity, that could allow people to control machines with their mind; (b) nano sensors for health monitoring, implants that can monitor molecules and health of cells; and (c) a cloud machine, a weather modification device that can influence the climate. For each invention, we measured interest (i.e., "This invention is interesting," "This invention is boring [reverse coded]," "This invention makes me feel curious," and "I would be interested in more information about this invention"; $\alpha = 88$; reliably adapted from Silvia, 2005) and coping potential (i.e., "This invention is hard to understand [reverse coded]," "I have a sense of what the invention can be used for," $\alpha = .68$; sufficiently reliably adapted from Silvia, 2005). All items could be answered on 7-point scales from 1 (*not at all*) to 7 (*extremely*).

Finally, participants were asked various background questions. First, to be able to check for potential mood differences, we asked, "How do you feel right now?" on a scale from 1 (*negative*) to 7 (*positive*). Then, to be able to check whether recalling a high versus low coping potential event was equally difficult, we stated, "We asked you to describe a recent event in your life that was complex, unfamiliar, or ambiguous with a certain level of coping potential. How difficult was it to come up with this event?" The scale ranged from 1 (*not at all*) to 7 (*extremely*).

Then, as previous knowledge about the inventions could affect coping potential independent of our manipulation, we asked, "Please indicate to what extent you knew about the existence of the inventions before you participated in this study?" for each invention separately (i.e., "Did you know about … ") from 1 (*not at all*) to 7 (*in great detail*). For the tattoo ($M = 1.18$, $SD = 0.68$), the cloud machine ($M = 1.83$, $SD = 1.45$), and the nano sensors ($M = 1.64$, $SD = 1.30$), ratings were very low, which shows that the inventions were indeed novel to participants.

Finally, we asked participants to report their gender, age, nationality (American, other; open question), educational level (none; high school/GED; some college; bachelor's degree; master's degree; doctoral degree/PhD; not sure), and whether they had previously participated in a study on coping potential and inventions (i.e., we ran a pilot a couple of months before this study; yes/no—nobody indicated to have participated before). After completing the background questions, participants were thanked and fully debriefed.

Results and discussion

A comparison of the general coping potential measure in the high versus low coping potential recall condition (see Table 5), showed that, as predicted, participants who recalled a high coping potential situation reported higher levels of coping potential ($M = 5.78$, $SD = 0.85$) than people who recalled a low coping potential situation ($M = 4.69$, $SD = 1.67$; $d = 0.82$). In addition, participants in the high coping potential condition were more interested in the invention ($M = 5.91$, $SD = 0.77$) than participants in the low coping potential condition ($M = 5.40$, $SD = 0.90$; $d = 0.61$). Finally, participants in the high coping potential condition reported somewhat more coping potential with the invention ($M = 5.15$, $SD = 0.86$) than in the low coping potential condition ($M = 4.85$, $SD = 1.07$; $d = 0.31$).

Table 5. Mean (standard deviation/standard error) coping potential (general and with the invention) and interest as a function of recall condition (high vs. low coping potential; Experiment 3).

	High Coping Potential	Low Coping Potential	Cohen's *d*
General coping potential	5.78 (0.85/0.12)	4.69 (1.67/0.23)	0.82
Interest in invention	5.91 (0.77/0.11)	5.40 (0.90/0.12)	0.61
Coping potential with invention	5.15 (0.86/0.12)	4.85 (1.07/.15)	0.31

Next, we compared the coping potential conditions in terms of reported mood. Participants in the high coping potential condition had a somewhat more positive mood ($M = 5.51$, $SD = 0.94$) than participants in the low coping potential condition ($M = 5.13$, $SD = 1.21$; $d = 0.35$). Pearson correlation analyses showed that mood correlated moderately with interest ($r = .31$) and with coping potential ($r = .58$), whereas it did not correlate with coping potential with the invention ($r = .04$). When we convert the Cohen's *d*s to correlation coefficients (e.g., Rosenthal, 1994), we see that the effect of coping potential recall is stronger on interest ($r = .29$) and coping potential ($r = .38$) than on mood ($r = .17$), whereas the effect on coping potential with the inventions is almost similar ($r = .15$). These analyses show that mood does not provide a strong alternative explanation for our findings.

Finally, we checked correlations between the knowing about the inventions before participating in the study and the dependent measures. This showed that knowing before hardly correlated with coping potential ($r = .09$) and only weakly with interest ($r = .19$). A somewhat stronger relationship was found with coping potential with the invention ($r = .27$), which makes sense, as people who reported to know about the inventions before participating in the study are likely to have a better understanding of it than people who reported to know less about it.

In sum, in line with our predictions we found that people who experienced more coping potential were more interested in complex novelty. Although effects on specific coping potential with the invention were weaker, it seems likely that the interest was higher in the high versus low coping potential condition because people felt more able to deal with the unfamiliar and complex component of novelty.

General discussion

Complex novelty like new technologies can be exciting in terms of promising possibilities. At the same time, people might feel that they do not grasp exactly what the product or invention is or what it can be used for (see also Berlyne, 1971; Hoeffler, 2003; Mukherjee & Hoyer, 2001). This lack of understanding might hinder the success of complex novel products and inventions. That is, feeling interested is driven by a combination of a novelty-complexity appraisal and a coping potential appraisal (i.e., having the skills, knowledge, and resources to deal with an event; Silvia, 2005). Yet the more complex and novel a product is, the more it interferes with people's preference to understand their environment (e.g., Abelson et al., 1968; Berlyne, 1971; Gawronski & Strack, 2012; Kay et al., 2009; Noordewier & Breugelmans, 2013; Proulx et al., 2012) and the less likely it becomes that people experience coping potential.

In agreement with this, we showed that people with relatively high coping potential are more interested in complex novelty than people with relatively low coping potential. We show this in two different ways: We increased coping potential by increasing product-specific understanding of the product through communication similarity and/or providing information on how the product works (Experiments 1 and 2). Moreover, we increased coping potential using an autobiographical recall procedure to induce feelings and association related to high (vs. low) coping potential (Experiment 3).

It is possible that with increasing product-specific understanding, coping potential is also affected in a more general sense. People could, for instance, feel more competent dealing with complex novelty, or the understanding could provide them with a base to become interested in other complex novel things (see also Carbon et al., 2013; Gillebaart et al., 2012; Oishi et al., 2012). Thus, besides increasing coping potential through product-specific understanding, the manipulations of Experiments 1 and 2 could also generalize to a more general feeling of being able to deal with complex novelty. Future research could test this by, for instance, investigating whether coping potential with one series of complex novel products can produce interest in another set of complex novel products. In addition, it could be investigated whether similarity or familiarity that does not directly affect product-specific understanding can increase coping potential and interest in complex novelty (e.g., product design that reminds people of something familiar; see also Carbon & Leder, 2005; Rindova & Petkova, 2007).

Low coping potential might be one of the reasons why many complex novel products fail (Castellion & Markham, 2012; Cierpicki et al., 2000; Schneider & Hall, 2011), as the uncertainty about its meaning or purpose might result in resistance rather than acceptance (see also Antioco & Kleijnen, 2010; Castaño et al., 2008; Hoeffler, 2003; Kleijnen et al., 2009; Oreg & Goldenberg, 2015). The finding that increasing coping potential increases interest in complex novelty fits a more general perspective on knowing states (cf. Keltner & Shiota, 2003; Silvia, 2008) that suggests that people first need to master a situation before they can appreciate it (e.g., Noordewier & Breugelmans, 2013; Noordewier, Topolinksi, & van Dijk, 2016). According to this perspective people will approach an unknown, unpredictable, or unstructured situation only when they feel they understand or able to cope with it.

Our findings have implications for how to introduce complex novelty. Complex new products and technologies are more likely to become successful when they are introduced in settings where people have high coping potential. People are more likely to be interested in complex novelty when they are, for instance, in control or certain as compared to lacking control or feeling uncertain (Oishi et al., 2012; Rutjens et al., 2013; van Horen & Pieters, 2013). It is also conceivable that there are situations of extreme levels of coping potential that might result in actively approaching complex novelty. For instance, when people experience boredom (Bench & Lench, 2013) or extreme levels of structure (Rutjens, van Harreveld, & Cunningham, 2016), the unfamiliar or puzzling nature of complex novelty might be pleasant mind activation.

In addition, rather than only highlighting the innovative elements of complex new products or technologies, acceptance of complex novelty might be increased by making it easier to understand. This could be accomplished by communicating similarity to a familiar product, as done in Experiments 1 and 2, but probably also via familiarity in product design (Rindova & Petkova, 2007). This is important information for product developers, as it is likely and maybe even the default strategy to focus on what is new rather than on what is known. In fact, when we asked an MTurk sample to imagine that they were product developers that wanted to create "a buzz" about their new technological product, they did not make choices about effective communication that matched our findings. Specifically, participants ($N = 50$; 28 male, $M_{age} = 32.76$ years, $SD_{age} = 9.25$; all American; education distribution was 24% high school/GED, 32% some college, 38% bachelor's degree, 4% master's degree, 2% doctoral degree/PhD; four participants participated in one of the previous studies, which did not affect the pattern of results, so they were included in the analyses) evaluated the stimulus materials used in Experiment 2, in terms of "People would be curious to find out more about it," "The product would attract attention," "People would be interested in the product," and "The product would be evaluated as innovative" on 7-point scales from 1 (*not at all*) to 7 (*extremely*; product title only $\alpha = .96$; similarity, $\alpha = .95$; information, $\alpha = .93$; and similarity & information, $\alpha = .96$). Then they were asked to rank order the options from 1 (*most effective*) to 4 (*least effective*). Results showed that relative to only the product title ($M = 4.08$, $SD = 1.42$), the similarity text was expected to be less effective ($M = 3.62$, $SD = 1.27$, $d = -0.34$), whereas the information text ($M = 5.47$, $SD = 0.83$, $d = 1.20$) as well as the similarity & information text ($M = 5.36$, $SD = 0.93$, $d = 1.07$) was expected to be more effective. In line with this, in the rank ordering, only 5.5% chose the similarity text as most effective, whereas 14.5% chose the product title only, 45% the information, and 25.25% the similarity and information. So although our results showed that communicating similarity is the most effective strategy to increase interest in complex novelty, participants in this study actually think this is the least effective option.

Although we now focused on interest as a factor that is related to the success of complex novel products, it should be noted that interest does not necessarily always translate to acceptance. Interest in complex novelty is a necessary precondition of the adoption of complex novelty, but the relation between interest and acceptance is undeniably more complex than that. Practical issues (e.g., people cannot afford it or do not need it) might lower the interest–acceptance relationship, and after people find out more about the complex novel product, they could conclude not to like it (see also Muth, Raab, & Carbon, 2015, for a connection between interest, insight, and liking). Yet, although not everybody necessarily may want to *own* complex novel products like a dry ice washing machine or computerized cleaning flies, for the development of these products, interest could contribute to support, (crowd) funding, and ultimately success.

Also, when translating the current finding to possible applications, it is important to note that the effect sizes of the current studies are not extremely high. This may imply that real-life applications of the current logic require more intense coping potential interventions, such as giving people the possibility to interact with the product in addition to communicating similarity. Note, however, that the reported effect sizes are also somewhat attenuated by measurement error (i.e., lack of perfect reliability of scales). A way to correct for this is to estimate the "true" standard deviation by multiplying the reliability of the measure and the standard deviation (cf. Trafimow, 2014). Using this estimated standard deviation to calculate corrected effect sizes results in larger effects of coping potential on interest: Experiment 1, Glass's $\Delta = .43$; Experiment 2, Glass's $\Delta_{similarity} = .48$, Glass's $\Delta_{information} = .33$, Glass's $\Delta_{similarity+information} = .33$; Experiment 3, Cohen's $d = .69$.

Finally, although product developers might worry that increasing coping potential might make their product seem more like other products, and thus more ordinary, this is not what we found. Our manipulations increased coping potential in Experiments 1, 2, and 3, but evaluations of novelty and complexity of the products and inventions remained unaffected (Experiments 1 and 3) or increased (Experiment 2). This suggests that

the novelty-complexity and coping potential appraisals work independently (Silvia, 2005) and that it is indeed the ability to deal with complex novelty that predicts interest rather than decreased levels of novelty or complexity. Taken together, our findings suggest that people first need to feel able to cope before they can become interested in cleaning their house using robotic cleaning flies, creating rainfall on a hot summer day with a weather modification device, or turning on their television with a brainwave tattoo.

Notes

1. For brainwaves tattoo, see ideaconnection.com/new-inventions/temporary-tattoos-could-make-telekinesis-possible-06794.html; for cloud-making machine, see ideaconnection.com/new-inventions/cloud-making-machine-could-help-offset-climate-change-06674.html; for robotic cleaning flies, see electroluxdesignlab.com/en/submission/mab/links.
2. Failure rates differ somewhat between industries (e.g., in 2004 there were more failures in consumer goods/services [45%] than health care [36%]; cf. Castellion & Markham, 2012). See also the Best Practices study by the Product Development & Management Association.
3. A nice illustration of this logic is Horsey Horseless (cf. Rindova & Petkova, 2007), a car that was presumably invented in 1899 with a head of a horse (i.e., more familiar as means for transportation) attached to the front to make people feel more at ease with the strange new vehicle. For an image, and to read about the idea to make the horse head hollow to be able to put fuel in it, see http://content.time.com/time/specials/2007/article/0,28804,1658545_1657686,00.html.
4. Please note that because demographical information is unavailable in the Pretest and Experiment 1, we cannot check for potential selection biases.
5. All alphas reported in this pretest and subsequent studies are Cronbach's alphas on all relevant items.
6. For a picture and more information about the products, see Orbit Dry Ice Washing Machine (http://www.wired.co.uk/news/archive/2012-02/17/dry-ice-washing-machine), MAB Computerized Cleaning Flies (http://electroluxdesignlab.com/en/submission/mab/), Bio Polymer Refrigerator (http://inhabitat.com/zero-energy-bio-refrigerator-cools-your-food-with-future-gel/), and Mercator Personal Manager Bracelet (see http://www.designbuzz.com/mercator-personal-manager-besoms-a-fashion-accessory-for-the-trendy/).
7. For ease of presentation, we report results with the whole CEI scale rather than with the Embracing and Stretching subscales. Results using the subscales are comparable.
8. Note that there are sometimes missing data, as dimensions were coded only when information was available to accurately code it.

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