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Integrating Problem Solvers from Analogous Markets in New Product Ideation

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Who provides better inputs to new product ideation tasks, problem solvers with expertise in the area for which new products are to be developed or problem solvers from "analogous" markets that are distant but share an analogous problem or need? Conventional wisdom appears to suggest that target market expertise is indispensable, which is why most managers searching for new ideas tend to stay within their own market context even when they do search outside their firms' boundaries. However, in a unique symmetric experiment that isolates the effect of market origin, we find evidence for the opposite: Although solutions provided by problem solvers from analogous markets show lower potential for immediate use, they demonstrate substantially higher levels of novelty. Also, compared to established novelty drivers, this effect appears highly relevant from a managerial perspective: we find that including problem solvers from analogous markets versus the target market accounts for almost two-thirds of the well-known effect of involving lead users instead of average problem solvers. This effect is further amplified when the analogous distance between the markets increases, i.e., when searching in far versus near analogous markets. Finally, results indicate that the analogous market effect is particularly strong in the upper tail of the novelty distribution, which again underscores the effect's practical importance. All of this suggests that it might pay to systematically search across firm-external sources of innovation that were formerly out of scope for most managers.

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1. Introduction

When people seek a novel solution to a complicated problem and lack the skill to solve it themselves, they might consider consulting a person with more expertise. But whom? Most scholarly research on problem solving has focused on personal characteristics of the problem solver, and also managers seeking contributors to new product ideation projects will focus on personal characteristics such as experience, creativity, or lead userness as dominant search criteria (von Hippel 1986, Amabile et al. 1996, Terwiesch and Xu 2008). The market origin of the potential problem solver is hardly seen as an issue. Almost automatically, managers will limit the search to their own market. In most cases, they will consider experts from the firm's internal research and development, marketing, or design department. Even managers following an "open innovation" approach usually look for specialist experts among customers, suppliers, or even competitors *within* their markets (Laursen and Salter 2006). After all, such experts have the most knowledge about the market in question. On the other hand, it is a well-known problem that familiarity with a problem blocks creativity and the identification of novel solutions. Individuals tend to focus on alternatives within or in close proximity to their dominant field of expertise (Cyert and March 1963). This problem, known as "functional fixedness" or "local search," looms larger as problem solvers' expertise in the focal area increases (Katila and Ahuja 2002), particularly in tasks that require novel solutions, i.e., when the required knowledge is located on some distant peak of the search landscape (Gavetti et al. 2005).

In this article we introduce a novel approach to overcome such local search biases in new product development. We argue that not only the personal characteristics of problem solvers but also their market origin matters. Being located in what we refer to as an analogous market, i.e., a market that is analogously related with the focal target market in terms of sharing similar relational characteristics of the problem, provides problem solvers with two systematic advantages. First, they might draw on knowledge about solutions that already exist in "their" markets but are unknown in the target market. Second, they might be more likely to provide creative solutions to a target market problem than individuals from the target market because they are not mentally constrained by existing target market solutions. To test whether these systematic differences enable problem solvers from analogous markets to come up with ideas that are more novel than those from target market problem solvers, we conduct a unique symmetric experimental study. It allows us to isolate the effect of market origin from potentially confounding sample selection biases. The participants were 213 problem solvers from the three analogous markets of roofing, carpentry and inline skating, which share the analogous problem of using safety gear to prevent serious injuries and to make improvements in the comfort of such gear. Any of the participants contributed ideas to the analogous problems in all three markets, allowing us to compare problem solvers' capabilities for providing solution ideas to target market versus analogous market problems while effectively controlling for person-related characteristics.

Our findings demonstrate that there is indeed an "analogous market effect": solutions provided by problem solvers from analogous markets show substantially higher levels of novelty. Specifically, we find that calling in problem solvers from an analogous market (instead of the target market) increases the novelty of solutions provided for a given target market problem by almost two-thirds of the gains from asking lead users (LUs) instead of average problem solvers. To illuminate the effect's potential economic impact, we juxtapose it to a seminal 3M case study demonstrating that ideation projects involving lead users from analogous markets yielded projected sales that are \$128 m higher on average than more traditional 3M projects (Lilien et al. 2002) with customers from the target market. The effect sizes found in our study allow for the speculation that the "analogous market" effect in this context might have accounted for additional projected sales of more than \$40 million per project. Moreover, results indicate that the analogous market effect is particularly strong in the upper tail of the novelty distribution, which is of specific managerial relevance since only the best ideas are considered for further development. Finally, it is found that the effect is particularly pronounced when the analogous distance between the markets increases, which bears additional theoretical and managerial implications.

Novelty, which we define as the extent to which a new product idea or problem solution is original and thus new in light of current market offerings, is the key objective of most new product ideation tasks (Dahl and Moreau 2002). Yet, it is only one of the two constituent conceptual elements of innovation. The term innovation typically comprises "invention" (which results from the novelty of a solution) and "usefulness," i.e., the extent to which an idea can be directly converted to a product that generates immediate benefits for a potentially large number of users. Research on new product ideation has emphasized the importance of analyzing both two conceptual dimensions separately for practical and theoretical reasons (Moreau and Dahl 2005). Regarding this second side of the innovation coin, we find that originating from an analogous market decreases the immediate use potential of the idea. As we argue in our general discussion, the net effect of involving problem solvers from analogous markets in new product ideation will depend on the specific objectives of the firm as well as differences in organizational strategies and capabilities.

2. Analogies and Their Value in Creative Thought

If two entities (A and B) are seen as "analogous," it means that they share *relational* predicates but no or only few *object attributes* (Gentner 1983). For example, the hydrogen atom (A) can be seen as analogous to our solar system (B) because its relational structure is similar (the electron revolves around the nucleus just as the planets revolve around the sun), although its characteristics as an object are not (e.g., the sun is large, hot, and yellow; the nucleus is not). Analogical thinking, i.e., transferring knowledge from an analogous source domain to solving a problem in the target domain, has been a topic of enduring interest in cognitive psychology literature. Scholars have studied the process steps underlying analogical thinking, the effects of using analogies on the novelty of problem solutions, and the factors that moderate this effect (Gick and Holyoak 1980, Gentner 1983, Holyoak and Thagard 1995). For example, Dahl and Moreau (2002) demonstrate that drawing on "far" versus "near" analogies increases the likelihood of generating particularly novel solutions. If only deep-structured relational attributes are similar between two entities, we speak of a far analogy (the solar system and the hydrogen atom). If the similarity is based

on more obvious surface-level attributes, it is a near analogy ("our" solar system and other planetary systems). If one aims to design a new freeway system in a given city, for example, this means that it might be more promising to draw on a far analogy such as the human circulatory system compared to a near analogy such as the traffic system in a different city (Dahl and Moreau 2002).

Since novelty is considered the distinguishing feature in creative work, analogies of this kind are particularly valuable for generating radically new products that might become a source of revenue growth and long-term competitiveness of a firm. It is interesting and noteworthy, however, that research in the field of new product development has modeled analogical transfer almost exclusively as an activity carried out by a person (or a team) from the *target market*. This also appears to be the standard procedure in practice. Kalogerakis et al. (2010) provide an in-depth analysis of 16 cases of new product development projects in which analogical thinking was employed. They found that in each case the teams limited themselves to accessing and using analogous knowledge that had been stored within the team or the client, and as a result they concluded that "there is a strong tendency toward the usage of local knowledge" (p. 433). Also creativity techniques such as the "Synectics" brainstorming method are primarily geared toward uncovering local knowledge about analogous solutions that problem solvers are unaware of (Gordon 1961). Because local knowledge about analogous solutions worth transferring is necessarily limited, it is no surprise that Kalogerakis et al. (2010) find that in the majority of cases, only "near" analogies were used (solutions or principles developed in former projects). Dunbar (1997) reports that a bias toward near analogies is also the norm in science: He finds that only 2 of 99 analogies used by molecular biologists were completely out of the scientists' domains.

3. The "Analogous Market" Effect

In this study, we test a different means of accessing analogous knowledge: the integration of potential *problem solvers from analogous knowledge domains*, that is, markets with similar relational characteristics (such as similar problems or customer needs) but no or only few similar product attributes. As an example of such an analogous relationship, consider the market for products designed to prevent infection in medical surgery and the market for computer chip manufacturing. Although these markets are entirely distinct in most surface-level attributes (suppliers, customers, use context, products, etc.), the underlying need to remove impurities from the air is relevant to both markets. Both surgeons and computer chip manufacturers require clean air. A transfer of innovation-related knowledge from the analogous market of computer chip production to the target field of medical surgery reportedly provided valuable input for new product development (Herstatt et al. 2002).

What are the underlying mechanisms why integrating problem solvers from analogous markets might generate value? One obvious reason is that the analogous market may be more *advanced* (Lilien et al. 2002). In this case, the (less advanced) target market can, of course, profit from importing superior solutions, solution principles, and more experienced, qualified, or creative solution providers. However, it is unclear whether computer chip manufacturing is technologically more advanced than the medical surgery equipment industry. Importantly, we argue that the value of accessing analogous markets stems from two conceptual drivers that are independent of asymmetries in the technological maturity of the two markets. In other words, we propose an independent "mere analogous market effect": Even if an analogous market is similarly or even less advanced, its potential problem solvers might still provide valuable solutions.[1]

The first factor is the *arbitrage* of existing solutions. Let A be a market in which a novel solution to a problem is being sought, and let B be a market that is analogously related to A. In both markets, there are sets of solutions to the shared problems (sets a and b, respectively). If b is a complete subset of a, nothing can be gained from transferring b to A. Such a complete overlap is theoretically possible, but it appears extremely unlikely from an empirical standpoint. Only if A is *far* more advanced than B would a situation be possible in which all solutions in b already exist in A. It is more realistic to assume that beyond some overlap ($a \cap b$), at least some elements in b' are unknown in A ($b' \neq a$). Recall that the markets are only analogically related, not identical. Different surface-level market structures, regulatory and competitive forces, customer requirements, etc. will induce different priorities when actors in A and B apply their problem-solving capabilities, most likely resulting in elements from b that are disjunctive from a (see Jeppesen and Lakhani 2010, Page 2007). Accessing an actor from analogous market B to solve a problem in target market A will therefore bring about the possibility of getting access to b. From A's perspective, b' is more novel

[1] Our analysis focuses on comparing the quality of ideas stemming from analogous versus target market problem solvers (the analogous market effect). Thus, one limitation is that we cannot test whether our approach (drawing on analogous market problem solvers) is any better than the one suggested by extant research on analogical thinking (drawing on target market solvers who are actively stimulated to draw on analogies). We take up this issue in our general discussion.

than from the perspective of *B*. In the example of computer chip manufacturing and medical surgery, it might be that the former focused their attention specifically on contamination resulting from production machinery and the latter more on pollution from human beings, thus opening up the possibility of learning from each other. In a similar vein, medical imaging problems (e.g., detecting very small features like early-stage tumors) could be solved in an innovative fashion by the arbitrage of existing solutions from the military (analogous market); problem solvers in this market had long tried to improve any kind of pattern recognition (e.g., to detect enemies from large distances), and solutions from the military appeared highly innovative to the medical imaging problem (von Hippel et al. 1999).

The second factor is the greater *creativity* of people due to their analogous market origin. Research on problem solving reveals that individuals generally are heavily constrained by their past experience, which leads to functional fixedness (Duncker 1945). This effect implies that people unconsciously stick to mental schemes and problem-solving strategies that have proven helpful in the past, which impedes them from coming up with truly novel solutions (Chrysikou and Weisberg 2005, Audia and Goncalo 2007). Past problem-solving success induces a shift from exploring new knowledge to exploiting existing knowledge (March 1991). As argued above, only in very extreme constellations will the individuals' experience in target market *A* be identical to the experience of individuals in analogously related market *B*. In most instances, their mental schemes and problem-solving strategies will differ somewhat. This means that with regard to a problem from *A*, actors from *B* are less likely to be blocked by functional fixedness. The latter might have a fresh and unbiased perspective and therefore come up with novel ideas and original solutions to which the target market experts are "blind." This might be the reason why IBM has not invented PC software, Microsoft has not invented search engines, Google has not invented social networks, and Facebook will most likely also miss a future radical innovation out of their scope.

Anecdotal evidence for the importance of the individuals' structural position in an analogous market can be seen in distributed innovation projects, for example, in the composition of lead user teams in practical applications of the lead user method. In earlier projects, firms searching for radical innovations focused on identifying lead users from their own industries, in particular from their own customer base. However, a remarkable trend toward systematic searches for lead users in analogous markets has emerged. As an example, Lilien et al. (2002) present the case of a lead user project at 3M designed to identify better ways to prevent infections associated with surgery. Among others, a specialist in theatrical makeup, who is also confronted with preventing infections when adhering materials to the skin, substantially contributed to what was considered a breakthrough product concept for 3M. More generally, the often-described effects of the heterogeneity of team members' professional backgrounds on innovativeness can be seen as indirect support for our argument (Singh and Fleming 2010). Based on the discussion of both mechanisms, we can predict the following:

Hypothesis 1 (H1). *Problem solvers from analogous markets will provide more novel solutions in new product ideation within a given target market than problem solvers from the target market, all other things being equal.*

Scholars studying innovation have emphasized that the novelty of a solution alone is no guarantee of a successful new product. Innovations thus are conceptualized as inventions that are used in a market context. This means that although novelty is considered the main driver of successful innovation, it is not enough. Solutions must also be useful, that is, they have to contribute to solving the actual problem (Moreau and Dahl 2005); ideally, they can be converted directly into a product that generates immediate benefits for a potentially large number of users. Individuals from analogous markets lack familiarity with the context of the actual target market problem as such. The fact that understanding the underlying nature of a problem is an important precondition for successful problem solving has been well known for a long time (Gagne 1970, Volkema 1983). Especially when problems are novel, complex, and ill-structured (as is often the case in new product ideation tasks), it is very difficult to fully shift problem information from one locus to another. In other words, the information is "sticky" (von Hippel 1994). The articulation and definition of a problem may not compensate for an insufficient understanding of its very nature, solution constraints, problematic side effects, important contextual factors, and so forth (Nelson 1982). In terms of direct fit with target market structures, problem solvers from analogous markets will therefore be at a disadvantage compared to their target market counterparts. If potential solvers do not have a precise understanding of the problem, their solutions are not likely to match it perfectly. The result might be a lower degree of (immediate) usefulness.

Hypothesis 2 (H2). *Problem solvers from analogous markets will provide solutions with a lower degree of usefulness in new product ideation within a given target market than problem solvers from the target market, all other things being equal.*

4. Method

4.1. Overview of the Experiment

We designed the following experimental study to test our predictions. We first identified three different markets that have an analogous relationship, i.e., they share a similar problem, but the producers, products, use contexts, and customers differ vastly. We then recruited independent random samples of potential problem solvers from each of the three markets and asked them to provide (1) a solution to a problem in "their own" (target) market and (2) solutions to analogous problems in the two analogous markets. The three problem-solving tasks were presented in random order to avoid order effects (i.e., problem solvers either started with idea generation for their target market or for one of the two analogous markets). Thus, each participant in our experiment took on both structural positions, responding from the perspective of a problem solver who originates from the target market and from an analogous market. The individual characteristics of participants in the target market and in the analogous markets are thus identical. Given that the sample size is also symmetric across the three markets, individual characteristics cannot confound our results in the aggregate. We also account for potential systematic differences in the markets chosen (such as technological advancement), because each of the three markets serves both as a target market and as an analogous market. We therefore eliminate sample selection bias and the resulting alternative explanations. The ideas were evaluated by independent market experts. Notably, in rating the novelty and usefulness of ideas, these experts were blind to the origin of problem solvers and blind to the specific research questions underlying this project.

Specifically, this experimental design allows us to analyze the resulting data in two ways (see Figure 1). First, we can analyze the data at the individual level. We can test whether one and the same problem solver generates more novel and less useful ideas for the analogous markets versus his/her own target market. The main test is whether solutions for target market problems are more novel and less (immediately) useful overall if they come from analogous market problem solvers as opposed to the canonical practice of employing target market problem solvers, all other things being equal (market-level analysis).

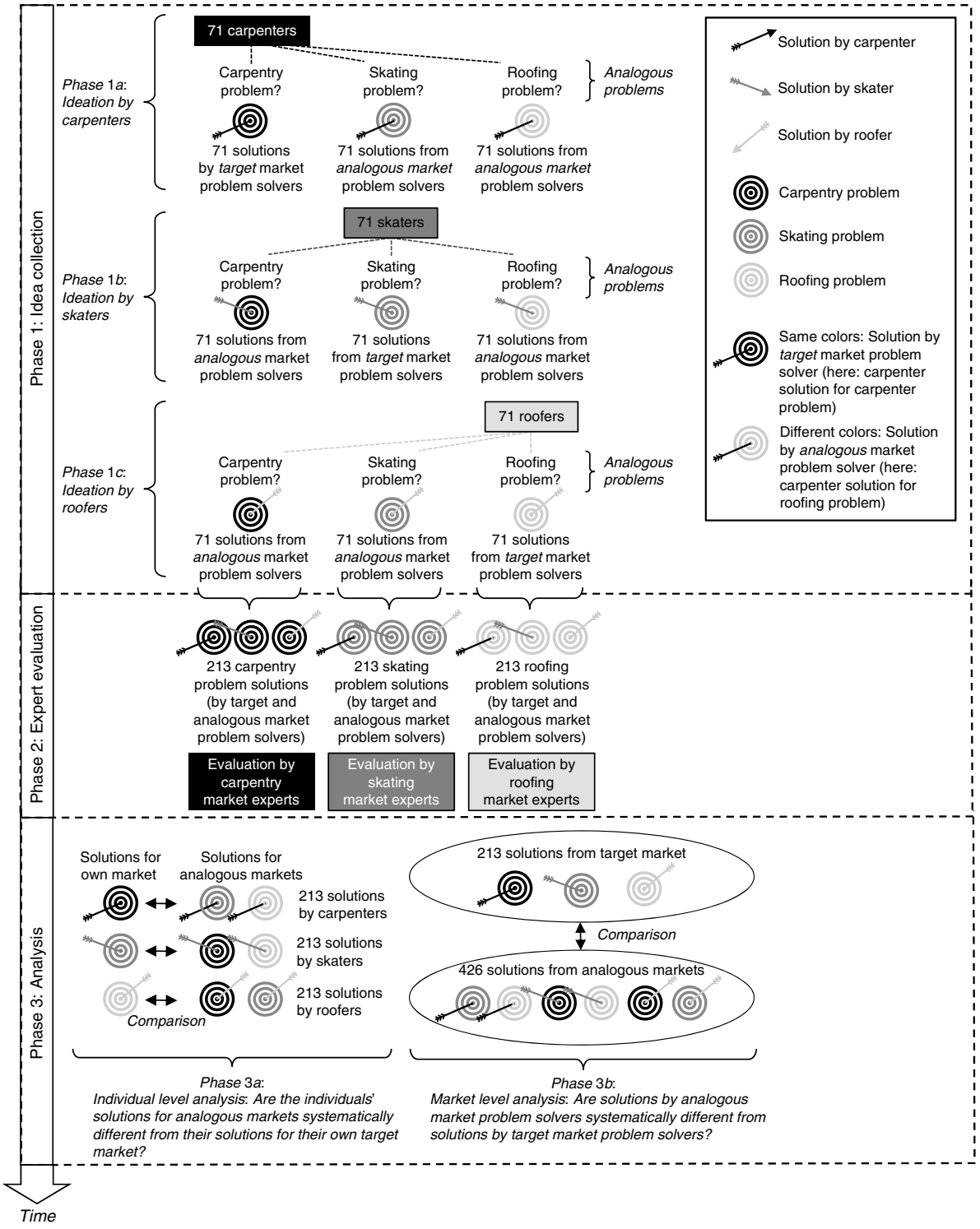
4.2. Identification of Appropriate Analogous Markets

We looked for three markets that met the following criteria: (1) the markets had to be related to each other by sharing an analogous problem; (2) the markets needed to be clearly delineated with regard to producers, products, and customers (in particular, the problem solvers could *not* be active in more than one market); (3) solving the problem should be comparably important in each of the markets (to have similar incentives for developing a solution); and (4) problem solvers in each market needed to be accessible by means of a random sampling process. Following an exploratory pilot study based on secondary data research (Internet and professional journals) as well as interviews ($n = 20$), we identified the area of safety gear as an appropriate field of study. Safety gear is important in a wide variety of professions and sports, with many of the markets sharing the common problem of limited comfort and fit. This problem, which manifests itself in the form of pain, impressions on the skin, and restricted movement, causes the users of safety gear to dislike or even refrain from using it despite its importance in protecting them from injury. The need to improve the comfort of safety gear is therefore an appropriate common denominator among the markets studied (i.e., the analogous relationship). To identify specific markets in which safety gear plays a role, we conducted a second pilot study, which involved interviews with 30 experts in various markets. In those interviews, the need to improve the comfort of safety gear was confirmed by in-depth input on market and product-specific problems and current statistics regarding injury rates. The final selection of the three most appropriate analogous markets for our study was based on how fully they met the four selection criteria mentioned above. In the end, we decided on the three analogous markets of (1) *carpenters* using safety masks to protect themselves from dust and toxic vapors, (2) *roofers* using safety belts to prevent themselves from falling, and (3) *inline skaters* using knee and elbow protection to prevent injuries in the case of a fall or crash. These markets are related by an analogous (but not identical) problem, they are sufficiently independent, the need for novel solutions is comparable, and problem solvers appeared to be accessible by means of random sampling. Notably, carpenters and roofers constitute a nearer analogous relationship with some common surface-level attributes (both are professionals and craftsmen), whereas the two groups' relationship to inline skaters represents a far analogy (because the latter are hobbyists and use safety gear in recreational activities). We will account for this experimental feature in our analysis below; as indicated above, this will allow us to explore whether our results are affected by the specific problem solvers' distance from the markets for which they generated ideas.

4.3. Sampling and Sample Characteristics

From the national population of roofers, carpenters, and inline skaters, we drew a random sample

Figure 1 Overview of Research Process



of 1,030 potential problem solvers (330 carpenters, 400 roofers, and 300 inline skaters). The population of roofers and carpenters consisted of all those registered with the national Federal Economic Chamber. The sample of inline skaters was randomly drawn from the members of inline skating clubs and participants at inline skating competitions. To reach the club members, we contacted all nationally registered inline skating clubs ($n = 21$) and asked members to submit their contact information using an online tool developed specifically for that purpose. The participants in three inline skating competitions were contacted directly during the respective events and asked to provide their contact information for a research project.

Table 1 Sample Characteristics

	Age	Gender	Personal creativity[a]	Lead userness[a]	Technical expertise[a]	Avg. time for ideation
	Mean (SD)	Frequency	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Carpenters (M1)	46.35 (9.44)	Male: 70 Female: 1	3.60 (1.00)	2.34 (0.59)	3.02 (0.98)	2.00 (0.76)
Roofers (M2)	44.48 (12.26)	Male: 67 Female: 4	3.37 (1.08)	2.62 (0.69)	2.49 (0.84)	2.09 (0.78)
Inline skaters (M3)	32.61 (9.58)	Male: 44 Female: 27	3.81 (0.84)	2.75 (0.76)	3.29 (1.11)	2.33 (0.70)
Δ (M2) − (M1)	n.s.[b]		n.s.[b]	$p < 0.05$[b]	$p < 0.01$[b]	n.s.[b]
Δ (M3) − (M1)	$p < 0.01$[b]		n.s.[b]	$p < 0.01$[b]	$p < 0.10$[b]	$p < 0.01$[b]
Δ (M3) − (M2)	$p < 0.01$[b]		$p < 0.01$[b]	n.s.[b]	$p < 0.01$[b]	$p < 0.10$[b]
Overall	$p < 0.01$[c]	$p < 0.01$[d]	$p < 0.05$[c]	$p < 0.01$[c]	$p < 0.01$[c]	$p < 0.05$[c]

Note. $N = 71$ problem solvers per market.
[a]Five-point scales (1 = very low; 5 = very high).
[b]Least significant difference test.
[c]ANOVA.
[d]Chi-square test.

In preparation for the telephone interview, we sent members of our sample a short letter in which we introduced the research project and asked them to participate once they were contacted. To avoid demand effects, we told participants that the purpose of the project was to find solutions to typical user problems with safety gear. The ensuing interviews showed that this objective appeared highly plausible to participants. As an incentive, we announced a number of noncash prizes (total value, €1,150) to be raffled off among all participants. The data collection process resulted in a total of 306 interviews (99 interviews with carpenters, 85 with roofers, and 122 with skaters), making for a satisfactory response rate of 30.0% among the carpenters, 21.3% among the roofers, and 40.7% among the inline skaters. A comparison between early and late respondents does not show significant differences in any of the variables measured. Additionally, we compared those participants we needed to contact more than twice with the "easier" participants and again found no significant differences. We can therefore expect that nonresponse bias is not a concern in our study.

A check for potential overlaps between the three markets showed that 14 roofers reported to have experience with inline skating. We eliminated these overlaps from the sample because their market origin is inherently confounded. The size of this sample decreased from 85 to 71 roofers. We did the same check in the sample of carpenters (15 overlaps) and inline skaters (3 overlaps). To avoid sample size artifacts and to obtain a symmetric sample, we further reduced carpenters and inline skaters to a sample size of 71 by means of random elimination. Unequal cell sizes in the three markets would have posed a threat to internal validity, because more draws in one market could have increased the probability of observing a few truly exceptional ideas (Gross 1972, Terwiesch and Ulrich 2009; see also Blyth 1972 on the related risk of a Yule–Simpson effect). The 213 problem solvers (71×3 markets) provided a total of 639 solutions (213×3 problems), with one-third originating from target market problem solvers and two-thirds from analogous market problem solvers. Table 1 summarizes key differences between the three subsamples. The results underscore the adequacy of our symmetric research design (in which all participants belong to both a target market and two analogous markets and sample sizes across the three markets are symmetric; for measurement items, see §4.5).

4.4. Experimental Procedure and Stimuli

We used standardized telephone interviews to collect the data. The interviewers were 17 master's program students at two of the authors' university (a large European business university). To avoid interviewer effects, we held an extensive interviewer training session prior to data collection and developed standard schemes for assisting respondents with questions and problems. We randomly assigned interviewers to the interviewees from the three different markets. The interview began with a short introductory text. We then asked about the interviewees' experience using safety equipment in their own domain and—potentially—any of the analogous domains (to check for confounding overlaps). We then gave them an initial problem statement (Table 2) and asked them to come up with ideas for possible solutions. To standardize the conditions, we limited the response time to five minutes.[2] The answers were documented in

[2] We constrained the problem-solving activities to five minutes per market because a pretest had revealed that 15 minutes (idea generation for three markets) was the maximum time participants were

Table 2 Problem Statements Used in Data Collection (Identical for All Participants)

Market	Problem statement (experimental stimuli)
Roofing	Roofers often work at high elevations. To protect people from falling, safety belts are required. Unfortunately, these belts dent the skin, cause workers to sweat, and often lead to pain in the abdominal area. As a result, safety belts are often not used properly. *How could we improve the safety belts to ensure that they are actually used*?
Carpentry	In carpentry, there is often a problem with breathing toxic vapors and dust. Currently this problem is solved by means of safety masks. Although these masks provide protection against toxic vapors and dust, they leave impressions on the skin and carpenters tend to sweat under the masks. As a result, they often don't use them. *How could we design the safety masks to solve this problem*?
Inline skating	Knee injuries are common in inline skating. Especially novice inline skaters often have painful experiences in this respect. Although kneepads provide a solution to this problem, they are often not used. As possible reasons, skaters mention restricted movement as well as sweating. *How could we design the kneepads to overcome that problem*?

detail by the interviewers. We informed participants when they were about to exceed the time limit and asked them to complete their thought at that moment. We proceeded in a similar manner with the second and third problem statements. As noted above and to avoid potential biases due to carryover or learning effects, we randomly varied the order of the three problem statements.

We had formulated the problem statements on the basis of insights from the pilot studies and in such a way that they were easy to understand and allowed creative solutions. Prior to the main data collection process, we had successfully tested them in a pilot study with $n = 10$ problem solvers from the chosen markets and refined certain details in the statements. After the third ideation task was completed, we asked participants about a number of control variables. We had successfully pretested the entire procedure with $n = 20$ respondents in the three markets.

4.5. Measurement of Control Variables

Research has documented several individual-level characteristics of the problem solver that might be related with the novelty of one's ideas. In our study, we specifically control for personal creativity, lead userness, and technical expertise. First, we measured the participants' personal creativity. Using the Buffalo Creative Process Inventory (Puccio 1999) as a basis, we first carried out a pilot study ($n = 48$) to test the applicability of this scale to our setting and reduced the original nine-item scale to four items ("I enjoy spending time looking beyond the initial view of the problem," "I enjoy working on ill-defined, novel problems," "I enjoy stretching my imagination to produce many ideas," "I like to work with unique ideas"), but still maintained a reliable scale for measuring personal creativity (Cronbach's alpha = 0.82). Second, we measured participants' "lead userness," which has often been documented as a robust predictor of an idea's novelty (Franke et al. 2006), using a six-item measure ("I usually find out about new products and solutions earlier than others," "I have improved and developed safety gear myself," "I am dissatisfied with the existing safety gear," "In my opinion, there are still unresolved problems with safety gear," "I have needs as a carpenter/roofer/inline skater that are not covered by the safety gear products currently offered on the market," "I often get irritated by the lack of sophistication in safety gear"; items adapted from Franke and Shah 2003, Franke et al. 2006; Cronbach's alpha = 0.57). Third, we measured the respondents' technical expertise using four items adapted from a scale developed by Franke et al. (2006) ("I can repair my own safety gear," "I can help other carpenters/roofers/inline skaters solve problems with their safety gear," "I am handy and enjoy tinkering," "I can make technical changes to my safety gear on my own"; Cronbach's alpha = 0.67). Items for these variables were averaged for further analysis. Note that they might be particularly relevant to an idea's novelty (but less so with regard to its usefulness). All items were measured on five-point scales (where 1 equaled not at all accurate, and 5 equaled very accurate). Finally, we also measured the actual time respondents needed to provide solutions to the three problem statements and captured the respondents' age and gender. All these variables serve as controls for the market-level analysis to account for any differences in problem solvers between markets (Table 1; for interconstruct correlations, see Appendix A).

4.6. Evaluation of Ideas

We had eight independent experts in the three markets (three carpentry experts, two roofing experts, and three inline skating experts) evaluate the quality of the solutions in terms of novelty and usefulness. Experts were selected on the basis of the following criteria: (1) high levels of personal use experience, (2) a sound understanding of other users'

willing to invest. Imposing this time constraint *per market* was important to avoid excessive idea generation for the first market(s) and thus to preclude substantially lower time investments in the other market(s). Although this procedure appeared mandatory for our study design, we note that future research, if possible, might look at the evolution of revised or multiple ideas over time (by granting substantially more time for ideation). In this way, one might explore whether more time for ideation could eventually reduce the potential negative effect of target (analogous) market problem solvers on the idea's novelty (usefulness).

problems with safety gear in their respective domains (e.g., based on a certain function in a community/professional association or on involvement in education or training activities), (3) outstanding market knowledge with respect to current standards and the latest products within their markets, and (4) a good understanding of technical aspects related to how safety gear and other relevant components within their domains function. For example, our inline skating experts pool included an athlete who had won 20 national speed-skating championships. All roofing and carpentry experts had passed the examination for the master craftsman's certificate, had a minimum of 20 years' professional experience and taught at vocational schools within their respective domains.

The evaluations were carried out in half-day workshops, thus ensuring a consistent framework and equivalent evaluation standards. In line with a procedure for expert rating outlined by Krippendorff (2004), the experts first participated in introductory training sessions in which they were informed about the evaluation criteria and the respective rating scales. The aim of this step was to ensure that all experts had a comparable understanding of the task and of the rating standards to be applied. Second, each expert independently rated the novelty and usefulness of ideas generated for his or her specific target market. They were blind to the sources of the ideas, which were presented in random order. It is also worth noting that the experts were quite enthusiastic about the quality of some of the solutions. Some expressed willingness to support or even to commercialize the most promising ideas, which certainly supports the external validity of the data.

We measured an idea's novelty using two items, namely, the extent to which an idea reflects a truly creative thought and the extent to which the concept is different from products currently available on the target market (Moreau and Dahl 2005, Schulze and Hoegl 2008), and we merged the five-point rating scales into a single index (Cronbach's alpha $= 0.90$). An idea's usefulness was also measured with two items, namely, the degree of usefulness to solve the problem and the number of users who would find it useful (Besemer and O'Quin 1987, Moreau and Dahl 2005); these items were likewise merged into a single index (Cronbach's alpha $= 0.91$).

We used a software tool that allowed us to track individual rating processes and calculate differences in ratings among the experts immediately after each individual evaluation step was completed. We informed the experts of the differences in their ratings and asked them to reveal the reasons why they had assigned a given value to each solution. Based on this discussion, the experts were allowed—but not required—to individually adapt and refine their ratings if the arguments convinced them. Interrater reliability was assessed by calculating Krippendorff's alpha for each item. Krippendorff's alpha is a conservative index that measures agreement among multiple raters and is considered a highly rigorous measure for assessing interrater reliability for rating scales such as those employed in this study (values of 0.67 and greater are generally considered to be satisfactory; Krippendorff 2004). The agreement coefficients in our study are all well above the recommended threshold values, with the lowest alpha still exceeding 0.70. To allow a valid comparison of ideas *between* markets (and thus to avoid potential biases resulting from different points of reference among experts from different markets), we standardized the averaged novelty and usefulness scores (z-transformation).

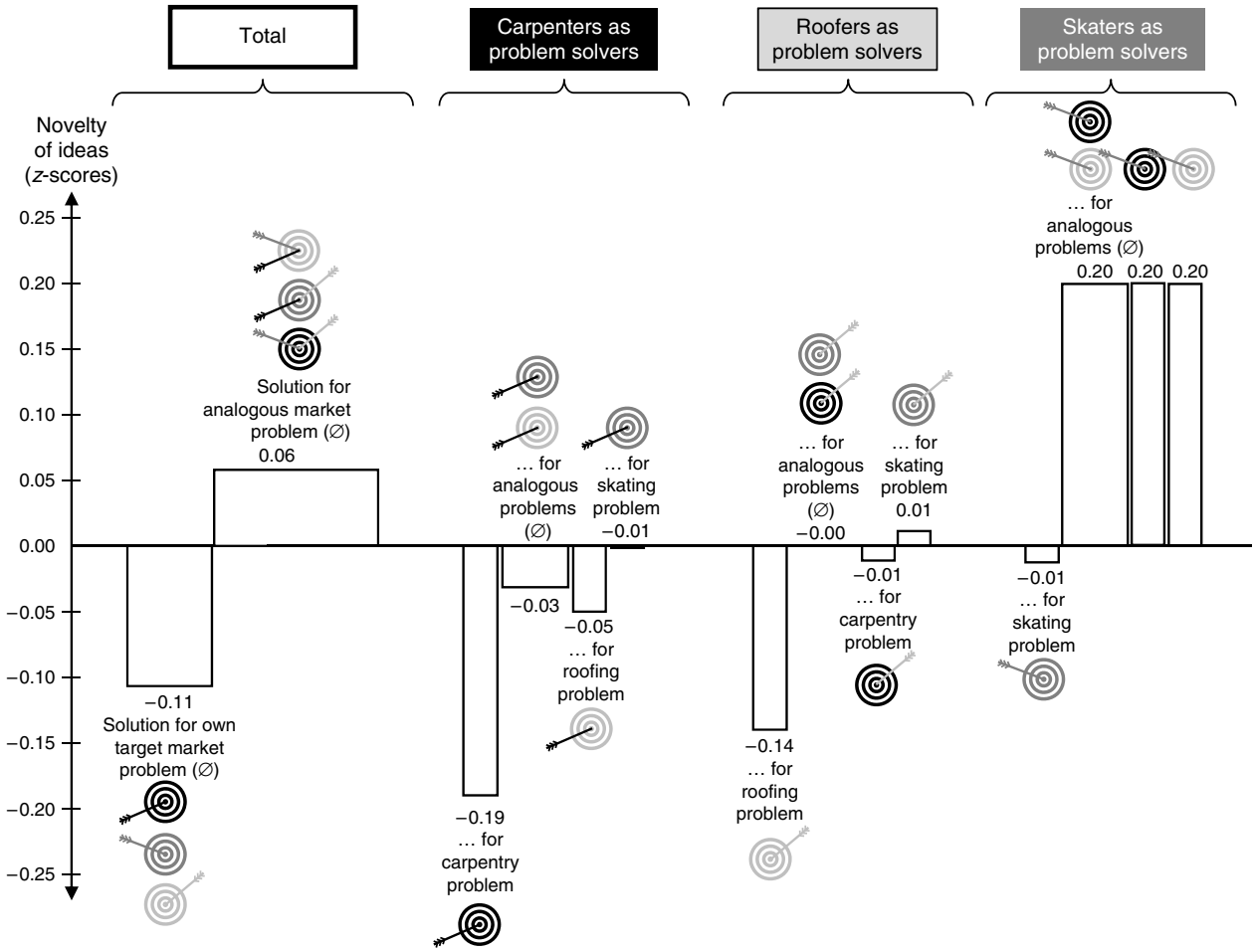
5. Findings

We first present the analyses in which we compare the individual problem solvers' solutions for their own market with their solutions for the two analogous markets (individual-level analysis). This analysis does not yet constitute a formal test of our hypotheses; instead, it provides a microfoundation of the predicted analogous market effect. We then proceed with the market-level analysis, which formally tests our hypotheses in a multivariate setting. Here, we test whether solutions from analogous markets are systematically different from target market solutions for solving target market problems in the aggregate (H1 and H2). In both analyses, we first present results regarding novelty as the dependent variable and then proceed to discuss usefulness.

5.1. Individual-Level Analysis

5.1.1. Novelty as Dependent Variable. Will problem solvers generate more novel solutions in new product ideation for analogous markets compared to their solutions for their own target markets? To provide an answer to this question, we performed a repeated measures analysis of variance (ANOVA) with the standardized ideas' novelty scores as the dependent variable. In the first analysis, we compare the novelty score for the target market idea with the averaged novelty score of the two corresponding analogous market ideas. We control for the market origin of problem solvers (carpenters, roofers, inline skaters) by adding this group variable as a between-subject factor. We can therefore assess whether pooling across the market origins of problem solvers (i.e., being from one of the three markets) affects our results. We find that problem solvers' ideas for their target market are, on average, indeed significantly less novel ($M = -0.11$) than their ideas for the analogous markets ($M = 0.06$, $F = 4.83$, $p < 0.05$). Importantly,

Figure 2 Novelty of Ideas Generated by Problem Solvers for Target vs. Analogous Markets



we find that the repeated measures factor does not interact with market origin ($F = 0.08$, $p = 0.93$), which indicates that the positive analogous market effect on novelty is independent of the specific market origin of problem solvers; the main effect of market origin was also insignificant ($F = 1.94$, $p = 0.15$). The respective individual means are depicted in Figure 2.

To assess whether the observed analogous market effect might be driven by one particularly high value for one specific market, we repeated this analysis by comparing the problem solvers' scores for their target market ideas with their scores for the two analogous market ideas separately (i.e., the within-subject factor had three levels: one for the target market idea and two for analogous market ideas). The results are parallel to the ones reported above: we find that the novelty of problem solvers' ideas varies as a function of whether they were generated for their target market ($M = -0.11$) versus the analogous markets ($M = 0.05$ and $M = 0.07$, respectively; $F = 2.47$, $p = 0.09$).[3] Importantly, we again find that the repeated measures factor does not interact with market origin ($F = 0.06$, $p = 0.99$; main effect of market origin, $F = 2.17$, $p = 0.12$). Follow-up contrasts revealed that target market ideas are significantly less novel than both analogous market ideas ($p = 0.05$ and $p = 0.07$, respectively). At the same time, the problem solvers' two analogous market ideas did not differ in terms of novelty ($p = 0.81$). In sum, these findings provide a microfoundation for the first analogous market hypothesis: Problem solvers generate more novel ideas for analogous markets than for their own target market. The structural position of problem solvers matters.

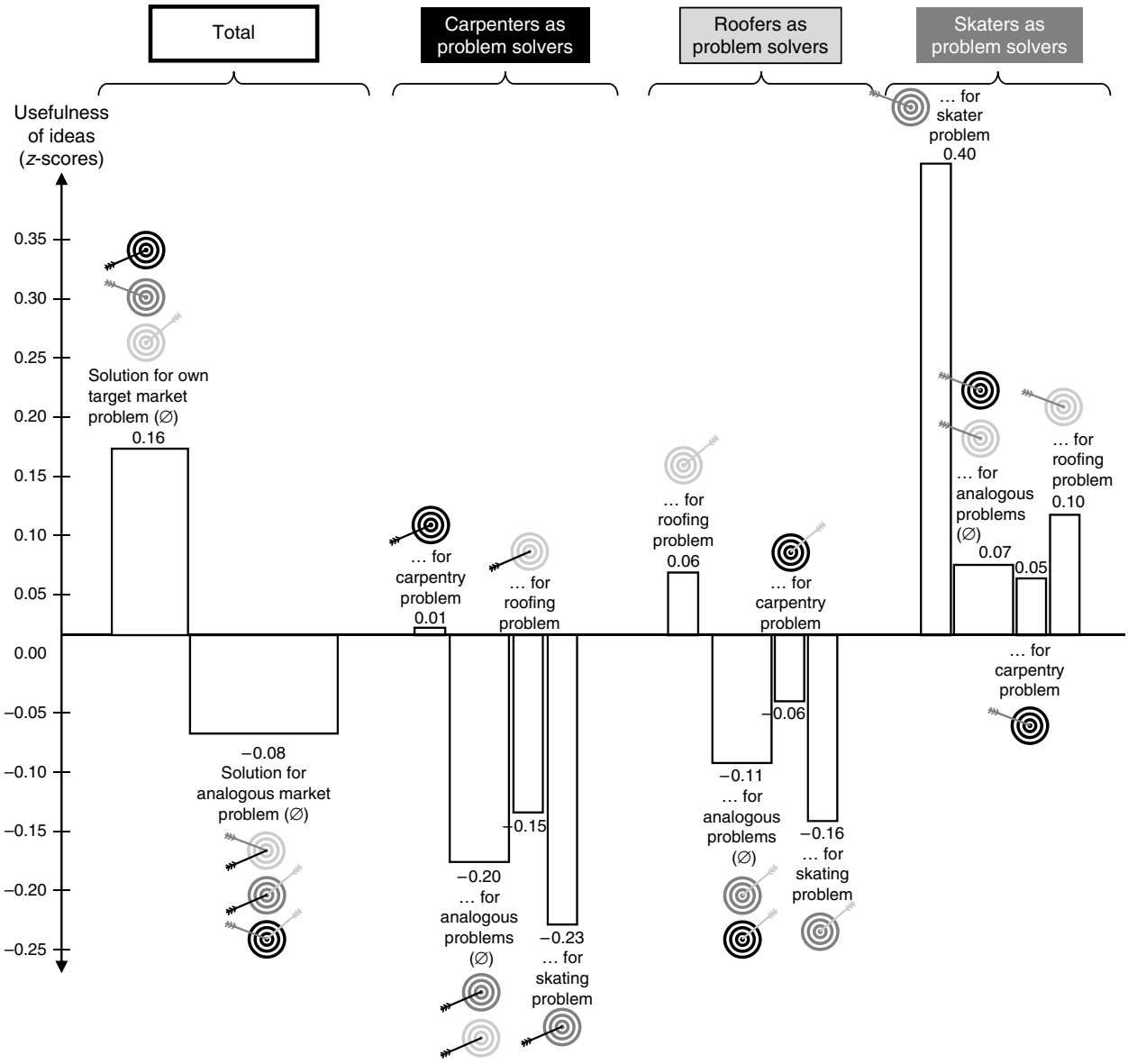
If we examine the novelty of the different analogous "pairs," another interesting pattern emerges: The analogous market effect is smaller for the pairs of roofers and carpenters (roofers → carpentry problem, carpenters → roofing problem) than if both roofers and carpenters are compared with skaters (roofers → skating problem, carpenters → skating problem). It is also interesting that the analogous market effect is somewhat stronger among skaters than in the other two groups (difference: 0.21 versus 0.16 and 0.14). One interpretation might be that there are systematic

[3] The results of a Mauchly test confirm that the assumption of sphericity is not violated ($p = 0.58$).

differences between individuals across markets, and skaters are simply more creative (some evidence for this can be seen in personal creativity differences; see Table 1). However, another explanation might be that the problem solvers' analogous distance might (additionally) impact the idea's novelty: As we argued in the method section, inline skaters are contextually farther away from carpenters and roofers than roofers are from carpenters. We explore this pattern in greater detail in §5.2.1.

5.1.2. Usefulness as Dependent Variable. The same analytical logic was applied to provide an answer to the question of whether problem solvers will generate solutions with lower (immediate) usefulness in analogous markets versus their own target market. We compared the usefulness score of the target market idea with the averaged usefulness score of the two corresponding analogous market ideas, and a repeated measures ANOVA reveals that the problem solvers' ideas for their target market are characterized by significantly higher usefulness ($M = 0.16$) compared to the analogous market ideas ($M = -0.08$, $F = 9.26$, $p < 0.01$). Once again, we find that the repeated measures factor does not interact with market origin ($F = 0.38$, $p = 0.68$), which indicates that the negative analogous market effect on usefulness is independent of the specific market origin of problem solvers (the main effect of market origin was significant, which indicates that the general level of the ideas' usefulness differed across market origins of problem solvers: $F = 4.96$, $p < 0.01$). The respective individual means are depicted in Figure 3.

Figure 3 Usefulness of Ideas Generated by Problem Solvers for Target vs. Analogous Markets



As in the case of novelty, we repeated this analysis by comparing the problem solvers' scores for their target market ideas to their two analogous market ideas separately. The results are again parallel: we find that the usefulness of ideas varies as a function of whether they were generated for the target market ($M = 0.16$) versus analogous markets ($M = -0.05$ and $M = -0.10$, respectively; $F = 4.53$, $p < 0.05$).[4] We again find that the repeated measures factor does not interact with market origin ($F = 0.32$, $p = 0.87$; main effect of market origin, $F = 4.76$, $p = 0.01$). Follow-up contrasts revealed that target market ideas exhibit significantly higher usefulness than both analogous market ideas ($p < 0.05$ and $p < 0.01$, respectively). At the same time, the problem solvers' analogous market ideas did not differ in terms of usefulness ($p = 0.62$). In sum, this provides a convergent microfoundation that also underpins our second hypothesis: Problem solvers generate ideas with lower (immediate) usefulness for analogous markets versus their own target market. Looking at the different individual markets, we again observe a pattern that suggests that analogous distance might additionally influence our findings: The analogous market effect is particularly strong for skaters as problem solvers (difference: 0.33 versus 0.17 and 0.21), and both carpenters' and roofers' solutions to the skating problem exhibit lower usefulness than their solutions for the "nearer" analogous market.

5.2. Market-Level Analysis

So far, we have found evidence that one and the same individual, on average, creates *more* novel ideas characterized by *lower* levels of (immediate) usefulness when asked to provide solutions for analogous markets compared to his or her own target market. In this section, we proceed with the market-level analysis, which allows us to test our hypotheses formally in a multivariate setting. We test whether aggregate solutions from analogous markets are systematically different from target market solutions for solving target market problems (H1 and H2). The analysis also allows us to compare the strength of the analogous market effect with an established predictor of novelty, namely, an individual's lead userness. In addition, we can more thoroughly explore the market distance pattern described above. Will the effects found hold in a multivariate analysis where we can control for systematic differences between individuals across markets (by controlling for different levels of e.g., personal creativity, etc.)? Again, we will first analyze the dependent variable of novelty and then turn to usefulness.

[4] The results of a Mauchly test again confirm that the assumption of sphericity is not violated ($p = 0.57$).

5.2.1. Novelty as Dependent Variable. We first performed an ANOVA on the standardized novelty scores with the market origin of problem solvers (target versus analogous market) as a between-subject factor that reproduces the mean results obtained from the within-subject analysis reported above: For target market problems, analogous market problem solvers generate more novel ideas ($M = 0.06$) compared to target market problem solvers ($M = -0.11$, $F = 4.22$, $p < 0.05$). Next, we performed multiple ordinary least squares (OLS) regressions to assess the relative impact of the problem solvers' market origin vis-à-vis established individual-level predictors of an idea's novelty.[5] In particular, we included the following additional variables in this and all the other regressions reported below: the respondents' lead userness, technical expertise, personal creativity, time for ideation, age, gender, dummies for the 17 student interviewers, dummies for the three pools of market experts, and dummies for the three market origins of problem solvers. Most importantly, the multivariate regression model produces a significant analogous market effect, which supports H1 ($b = 0.19$, $p < 0.05$; see Model 1 in Table 3). In addition, and in line with extant research, we also find that the problem solvers' lead userness is positively and significantly related to the ideas' novelty ($b = 0.16$, $p < 0.05$). The effects of both the other conceptual individual-level variables—personal creativity and technical expertise—are insignificant, a finding we will interpret in the discussion section. Finally, we note that time for ideation also positively affected novelty ($b = 0.24$, $p < 0.001$), which can be seen as a proxy for the respondents' efforts (the more effort put into idea generation, the better the ideas).[6]

To gain a better understanding of the importance of the analogous market effect, we compare it with the individuals' lead userness (the only significant conceptual variable). To do so, we calculated the predicted novelty scores for representative groups. First, the predicted means for target ($M = -0.13$) versus analogous market problem solvers ($M = 0.06$) closely match the observed means reported above, which indicates that the inclusion of all the control variables hardly affected our results. Their difference (effect size) is 0.19. Second, the predicted novelty means for an average problem solver versus the individual with the highest lead user characteristics in the target market

[5] The OLS regressions presented here are based on normal standard errors (SEs). As a robustness check, we reestimated the models presented in Table 3 using robust SE to account for the 213 respondent clusters (i.e., three ideas per respondent). As shown in the appendix, the results are hardly affected and the significance patterns remain identical.

[6] We also checked whether time for ideation interacts with the analogous market effect, but found no significant interaction.

Table 3 Analogous Market Effect on Ideas' Novelty and Usefulness (Pooled Analysis for Markets)

	DV: Novelty of ideas (*z*-scores)				DV: Usefulness of ideas (*z*-scores)			
	Model 1[a]		Model 2[b]		Model 3[a]		Model 4[b]	
	b	(SE)	*B*	(SE)	*b*	(SE)	*b*	(SE)
Analogous market effect	0.19	0.08*	0.12	0.05*	−0.22	0.08**	−0.12	0.04**
Individual-level variables[c]								
Personal creativity	0.02	0.04	0.02	0.04	0.04	0.04	0.04	0.04
Lead userness	0.16	0.06*	0.16	0.06*	0.03	0.06	0.03	0.06
Technical expertise	−0.02	0.04	−0.02	0.04	0.03	0.04	0.03	0.04
Control variables[d]								
Time for ideation (min.)	0.24	0.05***	0.25	0.05***	0.21	0.06***	0.20	0.04***
Age (in years)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gender	−0.08	0.13	−0.07	0.13	0.02	0.12	0.02	0.12
R^2	0.11		0.11		0.14		0.14	
F-value	2.82***		2.86***		3.78***		3.80***	

Notes. The results do not change if we use robust (instead of normal) SEs (i.e., adjusting the SEs for the 213 respondent clusters); see Appendix B for details. OLS regressions, $N = 639$. DV, dependent variable.

[a]Coding of analogous market effect: 0 = idea originates from a target market problem solver; 1 = idea originates from an analogous market problem solver.

[b]Coding of analogous market effect: 0 = idea originates from a target market problem solver; 1 = carpenters for roofing problem, roofers for carpentry problem; 2 = carpenters for skating problem, roofers for skating problem, skaters for carpentry problem, skaters for roofing problem.

[c]Five-point rating scales (1 = very low; 5 = very high).

[d]All models included 16 dummies for the student interviewers, two dummies for the pools of market experts, and two dummies for the market origin of problem solvers as additional control variables. The regression coefficients reported above account for these controls.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ (two-sided).

have an effect size of 0.30 ($M_{\text{Novelty average problem solver}} = -0.13$, $M_{\text{Novelty lead user}} = 0.17$; Figure 4). This means that including problem solvers from analogous markets alone accounts for 63% of the effect of involving lead users instead of average problem solvers.

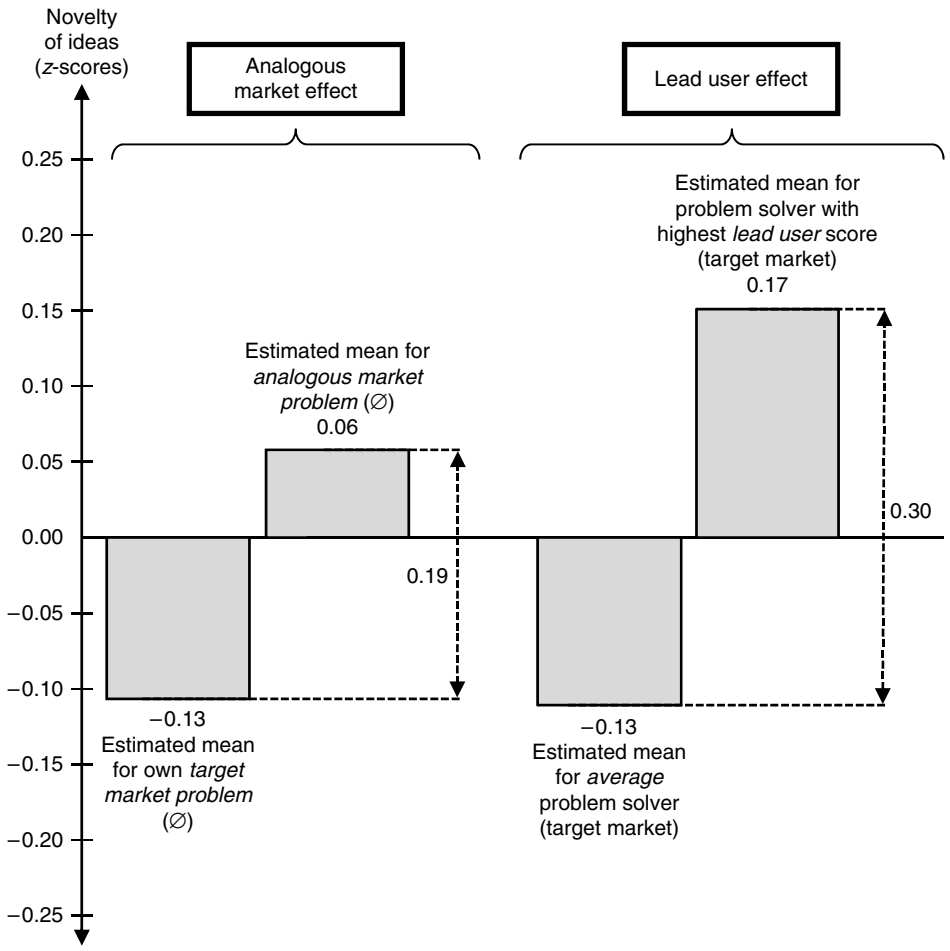
We now assess whether the market distance pattern described in §5.1.1. holds in a multivariate analysis. To this end, we recoded the market origin of problem solvers from target versus analogous markets accordingly (idea for problem solvers' own target market = 0; carpenters for roofing problem, roofers for carpentry problem = 1; carpenters for skating problem, roofers for skating problem, and skaters for carpentry/roofing problem = 2). Interestingly, we find that the newly created market distance metric is positively and significantly related to the ideas' novelty ($b = 0.12$, $p < 0.05$; see Model 2 in Table 3). This indicates that even if we control for individual difference variables, a higher distance from the market for which ideas were generated significantly increases novelty. Again, the only additional theoretical variable that proved significant in this model was an individual's lead userness ($b = 0.16$, $p < 0.05$).

These results prompted us to differentiate the relative importance of the analogous market effect from the effect of relying on lead users instead of average problem solvers. We find that moving from target ($M = -0.13$) to *near* analogous market problem solvers ($M = -0.01$) corresponds to 40% of the effect of turning from average ($M = -0.13$) to lead users in the target market ($M = 0.17$), whereas relying on problem solvers in *far* analogous markets ($M = 0.10$) increases this relative importance to 77%.

Finally we reran our model using quantile regressions with the same set of independent variables. So far, we have assumed that any differences in the dependent variable of novelty are equally important. In reality, however, only very few ideas are really helpful and can be developed further or implemented, whereas the bulk of ideas will not advance to those stages, regardless of whether they are average or poor. Is the analogous market effect stronger or weaker in differentiating the lowest versus the highest quantile of ideas from the rest? Using quantile regressions, we can explore this managerially important question. We observe that the higher we set the threshold, the stronger the related coefficients become (see Model 1 in Table 4). In particular, we find that the analogous market effect is relatively weak and almost 10 times weaker for the 25th compared to the 75th percentile ($b_{25\%} = 0.03$, not significant (n.s.); $b_{75\%} = 0.28$, $p < 0.10$). Interestingly, the effect increases by more than 40% when moving from the 75th to the 85th percentile ($b_{85\%} = 0.41$, $p < 0.05$), and it remains strong and visible even at the 90th and 95th percentiles ($b_{90\%} = 0.34$, $p < 0.05$; $b_{95\%} = 0.34$, $p < 0.01$). This underlines the managerial relevance of our effect. Managers are mostly interested in the upper tail of the novelty distribution, and that is where the analogous market effect is particularly strong.

5.2.2. Usefulness as Dependent Variable. For usefulness as the dependent variable, we applied a similar procedure as we did for novelty. First, an ANOVA

Figure 4 Analogous Market Effect vs. Lead Userness (Novelty)



on the standardized usefulness scores reveals that analogous market problem solvers generate ideas for a target market problem that are characterized by lower (immediate) usefulness ($M = -0.08$) compared to problem solvers from the target market ($M = 0.16$, $F = 7.87$, $p < 0.01$), which reproduces the mean results obtained from the within-subject analysis reported above. Next, we performed multiple OLS regressions to assess the relative impact of the problem solvers' market origin vis-à-vis our other individual-level variables (technical expertise, lead userness, and personal creativity). In this and all the regressions below, we included the same control variables as in the regressions reported in §5.2.1. Most importantly, the multivariate regression model shows a significant analogous market effect, which supports H2 ($b = -0.22$, $p < 0.01$; see Model 3 in Table 3). The individual-level variables do not significantly impact the usefulness of ideas. Finally, we note that time for ideation positively affects usefulness ($b = 0.21$, $p < 0.001$), which can again be seen as a proxy for respondents' efforts (the more effort put into idea generation, the better the ideas).[7]

We then analyzed whether the market distance pattern also holds for usefulness. For this purpose, we recoded the market origin of problem solvers (target versus analogous market) in a similar way as we had done for novelty (see above). Importantly, we find that market distance is negatively and significantly related to the ideas' usefulness ($b = -0.12$, $p < 0.01$; see Model 4 in Table 3). This indicates that while controlling for individual-level difference variables, a higher distance from the market for which ideas were generated brings about a decrease in (immediate) usefulness. The individual-level variables do not significantly impact the usefulness of ideas. We find that moving from target market problem solvers ($M_{\text{Estimated}} = 0.14$) to problem solvers in *near* analogous markets ($M_{\text{Estimated}} = 0.01$) brings about a far weaker decrease in usefulness than moving to problem solvers in *far* analogous

[7] We again checked whether time for ideation interacts with the analogous market effect, but we found no significant interaction.

Table 4 Results of Quantile Regression

	DV: Novelty of ideas (*z*-scores)											
	25%		50%		75%		85%		90%		95%	
Model 1[a]	*b*	(SE)	*b*	(SE)	*b*	(SE)	*b*	(SE)	*b*	(SE)	*b*	(SE)
Analogous market effect	0.03	0.04	0.21	0.13^{+}	0.28	0.15^{+}	0.41	0.17*	0.34	0.17*	0.34	0.13**
Lead userness	0.02	0.03	0.24	0.10*	0.29	0.11*	0.28	0.13*	0.32	0.13*	0.22	0.10*
Pseudo-R^2	0.08		0.09		0.12		0.10		0.11		0.16	
	DV: Usefulness of ideas (*z*-scores)											
	25%		50%		75%		85%		90%		95%	
Model 2[a]	*b*	(SE)	*b*	(SE)	*b*	(SE)	*b*	(SE)	*b*	(SE)	*b*	(SE)
Analogous market effect	−0.03	0.13	−0.41	0.14**	−0.23	0.09**	−0.09	0.08	−0.06	0.10	−0.07	0.08
Lead userness	0.12	0.10	0.10	0.11	−0.03	0.06	−0.00	0.06	−0.01	0.08	0.02	0.06
Pseudo-R^2	0.10		0.11		0.07		0.08		0.06		0.08	

Notes. All models included the same additional control variables as in the OLS regressions (see Table 3). Quantile regressions, $N = 639$. DV, dependent variable.

[a]Coding of analogous market effect: 0 = idea originates from a target market problem solver; 1 = idea originates from an analogous market problem solver.
$^{+}p \leq 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$ (two-sided).

markets ($M_{\text{Estimated}} = -0.11$). (The lead user construct (n.s.) is not a meaningful comparison for Usefulness; therefore we refrained from calculating comparable means.)

Finally, we reran our model using quantile regressions (see Model 2 in Table 4). In contrast to our results for novelty, however, we do not detect a specific pattern in the data—i.e., the related coefficients do not become systematically stronger or weaker as we move closer to the upper tail of the distribution. Instead, the strongest effect is obtained for the median ($b_{50\%} = -0.41$, $p < 0.01$).

6. Discussion

6.1. Contribution

Who provides better inputs to new product ideation tasks? Problem solvers with expertise in the area for which new products are to be developed (target market) or problem solvers with expertise in contextually distant domains which share an analogous problem or need (analogous markets)? We argue that two mechanisms favor problem solvers from analogous markets. First, they may transfer existing solution information from the analogous market to the problem in the target market. Second, they may have lower constraints because they lack prior target market knowledge. Our various analyses show convergent evidence for an "analogous market" effect: Relative to target market problem solvers, individuals from analogous markets are indeed more likely to provide novel solutions to target market problems.

The magnitude of the analogous market effect is remarkable if we compare it with the effect of the well-established "lead user" construct (von Hippel 1986): including a random problem solver from an *analogous* market (instead of the target market) increases the expected novelty of the solution by almost two thirds of the gains from including lead users versus average problem solvers. A study by Lilien et al. (2002) allows us to get an understanding of the economic consequences of the analogous market effect. In their study, they analyzed the outcome of 47 new product ideation projects carried out by 3M. They found that whereas traditional projects based on the information obtained by average target market customers had projected sales of \$18 million on average, projects involving LUs from analogous markets resulted in \$146 million. As the authors argued, "This outcome differs from the outcomes of earlier studies of LU projects that reported generating ideas for valuable next-generation products rather than for breakthroughs. We speculate that this difference in outcomes is due to the 3M practice of identifying and learning from lead users outside . . . of the target market, a speculation that requires further investigation" (Lilien et al. 2002, p. 1055). Our data allow us to heed this call and decompose the contribution of the two different drivers of value. Assuming generalizability of our findings, the inclusion of problem solvers from analogous markets accounts for an additional value of over \$40 million per ideation project at 3M ($0.19/(0.19 + 0.30) * (\$146\text{ m} - \$18\text{ m})$). Certainly, the different study contexts preclude taking these figures literally. On the other hand, it can be argued that the relative importance of including problem solvers from analogous markets is even stronger in practical settings: Unlike in our study where we

took great care to neutralize the effect of potentially confounding sample selection biases, managers at 3M systematically targeted *advanced* analogous markets, which indisputably amplifies the analogous market effect. Furthermore, findings from quantile regressions demonstrate that the analogous market effect becomes even stronger when focusing on more novel ideas. Again, this is in line with managers who seek for breakthrough ideas, not average ideas. Finally, we found evidence that solutions provided by problem solvers from more distant analogous markets are more novel than solutions from nearer analogous markets, which is in line with extant research on individual problem solving (Ward 1998) and managerial efforts as visible in the 3M study.

However, the novelty of analogous market solutions comes at a price. We find that, on average, they show lower immediate usefulness, presumably because the problem solvers lack familiarity with the context of the actual target market problem. Thus, including problem solvers from analogous markets has both positive (higher novelty) and negative effects (lower usefulness). The net benefit of the two diametrically opposed effects will depend on the firm's objectives and capabilities. Is the goal radical innovation or rather incremental improvement? In many new product ideation projects, novelty is seen as the most critical and scarce resource (Dahl and Moreau 2002). The immediate usefulness of ideas is less of an issue, because it is clear that more radical innovations usually target initially small markets (Moreau and Dahl 2005). This indicates that filtering ideas by the criterion of immediate usefulness might constitute a problematically conservative filter (Schulze and Hoegl 2008). It is also easier to compensate for the lower immediate usefulness of ideas by complementing individuals from analogous markets with internal experts, which might be a good idea in any case. If a sequential process is more appropriate, one could also use the more novel ideas from analogous problem solvers as starting points for further development. Only when the firms' objectives are to limit risks and the firm is content with incremental innovations will immediate usefulness dominate over novelty. In summary, this means that in many cases managers are well advised to look outside their own market domains and to identify relevant analogous markets with similar problems or customer needs, but with different products, firms, and customers. We are aware that this involves a complete overhaul of current perspectives and practices; usually firms either rely on in-house experts or have a strong tendency to focus exclusively on customers, competitors, suppliers, etc., in their own market when searching for input from outside their boundaries (Laursen and Salter 2006).

Two criteria should guide the selection of analogous markets: First, we recommend that managers should not confine the search to "near analogies" but also consider more far-analogous markets, where similarities are based on deep-structure relations. Here, the effects of avoiding functional fixedness and importing existing solutions will be particularly strong. Second, managers should select analogous markets that can be considered more advanced relative to the target market. Higher technological advancement can be assumed if the underlying problem is more extreme in the analogous market, if its consequences are more grave, or if firms and users have been looking for solutions with greater intensity for other reasons. Sheer volume (i.e., the number of firms and users) or the maturity of the market might also contribute to such advancement. For example, a firm in the inline skating market looking for ideas for protective gear might not choose the analogous markets of roofing or carpentry, but investigate *Jackass*-style extreme stunt shows (because the protection problem is more extreme there), protection gear for people with brittle bone disease (because the consequences are more grave for those suffering from this affliction), or the market for safety belts and other protection systems in cars (because the market is far larger). Within such advanced analogous markets, firms should look for individuals who display high levels of personal creativity, lead user characteristics and technical expertise, or other factors conducive to singling out the most valuable problem solvers. To overcome the weaknesses of problem solvers from analogous markets, it may be a good idea to let them interact with problem solvers from the target market. If they manage to combine their strengths and compensate for their respective weaknesses, the results should be even more beneficial.

In sum, our results contribute to extending the literature on analogical reasoning and the use of analogies in managerial problem solving (e.g., Gavetti et al. 2005). We also extend the existing literature on open innovation, boundary spanning, and local versus distant search (e.g., Katila and Ahuja 2002) by providing new insights as to where in the search landscape firms can obtain novel knowledge inputs as a basis for developing radical new products. Furthermore, we contribute to the discussion on marginality and contextual distance in distributed problem-solving networks (Fleming et al. 2007, Jeppesen and Lakhani 2010) and shed light on which members of a diverse crowd of potential problem solvers are located in the "right search neighborhoods" (Afuah and Tucci 2012, p. 366): those distant problem solvers for whom finding a solution implies a local search because of the

analogous relationship but who are not constrained by mental schemes from the target market.

6.2. Limitations and Avenues for Further Research

The superior novelty of analogous market solutions is based on two arguments, namely, that problem solvers are less functionally fixed and might already know of analogous solutions that can be transferred to solve the problem in the target market. We did not study which of these two conceptually different factors actually mediates the effect found and which of them plays a greater role. Theoretically, this could be attempted by a thorough content analysis of the 639 solutions obtained. However, we found that it is very difficult to decide whether a solution is based on lower functional fixedness, the transfer of existing solutions, or both. Directly asking participants brings about the risk of demand effects, and exploratory attempts revealed that the sources of their ideas are tacit knowledge, at least to a large degree. To shed more light on this issue, we thus recommend controlled experiments specifically designed for this purpose. It would be tempting to conduct such experiments with a view to analyzing which moderating factors (such as the individuals' cognitive capabilities) impact the importance of the two sources.

Our experimental design was not developed to measure a market-distance hypothesis. The exploratory evidence we found appears quite plausible; however, one must keep in mind that we are not able to formally disentangle the effect of greater distance from the potentially confounding effect of greater creativity among skaters. The skater sample was also composed of individuals who are significantly younger than the individuals sampled for the groups of carpenters and roofers. Thus, we acknowledge that our findings might be somewhat driven by the specifics of the skater sample. Again, controlled experiments are necessary to investigate how different degrees of distance influence the relevant dimensions of creative outcomes, ceteris paribus. Future research could also address other moderators of the benefits of accessing analogous market knowledge to generate innovations, such as the problem type (e.g., well structured or ill structured), type of industry (e.g., tangible products or services), or different groups of problem solvers (e.g., users versus employees of producers). We also note that we tested our predictions in only one empirical context (safety equipment) where we hand picked the three analogous markets (carpenters, roofers, inline skaters); despite the symmetric research design applied, we acknowledge that the empirical results might be seen as somewhat idiosyncratic, which also limits our speculation about the monetary impact in the 3M context. To further corroborate our findings, future research might look for ways to more generally test our theory (e.g., by choosing systematically different context fields and by more systematically screening and selecting a variety of analogous markets).

Another limitation of the experimental setting (as noted in the method section) is that we had to set a standardized time limit for the problem-solving exercises. Research on local search suggests that individuals will most likely start with what they are familiar with. This means that although we varied the starting task randomly, there might be some bias toward spontaneous, first-idea creativity. Future research is thus invited to loosen the time constraints we had to impose (preferably with stronger participation incentives) and look at the systematic evolution of revised or multiple ideas over time.

In this study, our only aim was to provide a clean test of our newly proposed analogous market effect. Thus we contrasted the quality of ideas generated by analogous market problem solvers for a certain target market problem with that of ideas generated by problem solvers from the target market. As a consequence, we cannot draw inferences as to whether our approach (drawing on analogous market problem solvers) is any better than the one suggested by extant research on analogical thinking (drawing on target market problem solvers who are actively stimulated to think analogously). One advantage of drawing on analogous market problem solvers is that this approach allows the project manager to control the analogous distance (which is not the case when analogical thinking is stimulated). Given that a firm is capable of applying appropriate open innovation search methods such as crowdsourcing to activate self-selection among problem solvers from analogous markets (Jeppesen and Lakhani 2010) or pyramiding to stimulate references into appropriate analogous domains (Poetz and Prügl 2010), it can freely decide which market is appropriate and also account for factors such as technological advancement (as outlined above). Future research that sheds more light on the relative performance of the two approaches might be a valuable next step in this area.

Finally, to show the "clean" effect of accessing analogous market knowledge, we ensured that there was no overlap between problem solvers from target markets and from analogous fields in our experiment. Thus, we are unable to analyze what happens when the two groups interact. If they combine their specific strengths and compensate for their respective weaknesses, they might generate solutions that are both highly novel and highly useful to solve the problem. We propose that due to their analogous relationship, the likelihood that they will find some common understanding is reasonably high.

But although this appears plausible and is in line with exploratory findings from lead user research (Lilien et al. 2002), theoretically they could also end up combining their specific weaknesses. Again, more research is warranted in this regard. Such analyses could also account for different interaction modes, such as "ad hoc" interaction or continuous exchange in communities or open idea generation platforms, to name just two examples.

Supplemental Material

Supplemental material to this paper is available at http://dx.doi.org/10.1287/mnsc.2013.1805.

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Appendix A. Correlations (Pooled Analysis for Markets)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) *Novelty of ideas*	1	0.202***	0.069+	0.173***	0.034	0.196***	−0.023	0.025
(2) *Usefulness of ideas*		1	0.047	0.061	0.037	0.107**	−0.044	0.051
(3) *Personal creativity*			1	0.189***	0.249***	0.141***	−0.069+	0.077+
(4) *Lead userness*				1	0.138***	0.243***	−0.060	0.113**
(5) *Technical expertise*					1	0.113**	−0.010	0.027
(6) *Time for ideation*						1	−0.040	0.042
(7) *Age* (in years)							1	−0.335***
(8) *Gender*								1

Note. $N = 639$.

$^{+}p < 0.10$; $^{**}p < 0.01$; $^{***}p < 0.001$ (two-sided).

Appendix B. Analogous Market Effect on Ideas' Novelty and Usefulness (Pooled Analysis for Markets; Robust SEs)

	DV: Novelty of ideas (*z*-scores)				DV: Usefulness of ideas (*z*-scores)			
	Model 1[a]		Model 2[b]		Model 3[a]		Model 4[b]	
	b	rSE	*b*	rSE	*b*	rSE	*b*	rSE
Analogous market effect	0.19	0.08*	0.12	0.05*	−0.22	0.08**	−0.12	0.04**
Individual-level variables[c]								
Personal creativity	0.02	0.04	0.02	0.04	0.04	0.04	0.04	0.04
Lead userness	0.16	0.07*	0.16	0.07*	0.03	0.06	0.03	0.06
Technical expertise	−0.02	0.05	−0.02	0.05	0.03	0.04	0.03	0.04
Control variables[d]								
Time for ideation (min.)	0.24	0.05***	0.25	0.05***	0.21	0.05***	0.20	0.05***
Age (in years)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gender	−0.07	0.13	−0.07	0.13	0.02	0.12	0.02	0.12
R^2	0.11		0.11		0.14		0.14	
F-value	3.42***		3.51***		3.63***		3.66***	

Notes. Here, we used robust (instead of normal) SEs (rSE; i.e., we adjusted the SEs for the 213 respondent clusters; three ideas per respondent). OLS regressions are shown; $N = 639$. DV, dependent variable.

[a]Coding of analogous market effect: 0 = idea originates from a target market problem solver; 1 = idea originates from an analogous market problem solver.

[b]Coding of analogous market effect: 0 = idea originates from a target market problem solver; 1 = carpenters for roofing problem, roofers for carpentry problem; 2 = carpenters for skating problem, roofers for skating problem, skaters for carpentry problem, skaters for roofing problem.

[c]Five-point rating scales (1 = very low; 5 = very high).

[d]All models included 16 dummies for the student interviewers, two dummies for the pools of market experts, and two dummies for the market origin of problem solvers as additional control variables. The regression coefficients reported above account for these controls.

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$ (two-sided).

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