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ABSTRACT: Organizations increasingly initiate Internet-based innovation-contest communities through which individuals can interact and contribute to the innovation process. To successfully manage these communities, organizations need to understand what roles members assume, how they communicate and vary in their contribution behavior. In this exploratory study, we investigate the heterogeneous roles of contest participants based on an international innovation-contest community. We identify six user types associated with various behavioral contribution patterns by using cluster

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and social network analysis. The six user types further differ in their communicative content and contribution quality. Our paper contributes to a better theoretical understanding of distinctive user types in innovation-contest communities, their role in the community, and their contribution to the success of innovation contests in the era of social software. From a managerial perspective, the study provides guidance for contest platform design and appropriate reward structures.

Key words and phrases: co-creation, innovation contests, online communities, user contribution, user roles.

Crowdsourcing [53] has become a popular method to access users' creativity and knowledge and to benefit from collaborative innovation [5, 21, 86, 107, 108]. Among the various forms of applications on the Web, online idea and design contests [65, 106] are increasingly used to leverage the creativity, skills, and intelligence of thousands of individuals on the Internet [14, 43, 72, 87, 88]. Many contests only allow final contributions from individual or team efforts and do not disclose these ideas to other participants, avoiding collaboration and joint improvement. An increasing number of contests, however, allow joint idea development as in open-source software communities (e.g., Apache Firefox) or in open-content creation communities (e.g., Wikipedia). Such virtual platforms enable interaction with other like-minded peers, building relationships, and establishing a sense of community. Users can collaborate, discuss, share insights, and learn from the aggregate knowledge and feedback of others, while still competing for prizes [54].

This phenomenon of combining collaboration in the community and competition for prizes has been labeled "communitition" [54]. An idea and design contest provides opportunities for generating new individual ideas and supports the potential for collaborative innovation. We refer to this form of contest as an "innovation-contest community." This kind of hybrid institution, including both cooperation and competition, is increasingly used in the form of Web 2.0–based innovation initiatives [16]. There is growing interest in the question of whether this hybrid form is beneficial for innovation, but so far the empirical results have been inconclusive [16, 54]. The success of innovation-contest communities hinges on the users' willingness to participate, to share ideas and contribute innovative solutions, to recombine, modify, and integrate knowledge that others have provided [4, 34, 41, 85]. The stability, persistence, and outcomes of a community depend on the initiator's ability to mobilize, accommodate, and manage the heterogeneity of the users [28]. To understand *whether* and *how* the hybrid structures found in innovation contests lead to innovation, a better understanding of the users' roles, behavior, and contributions is needed.

While we have a sound understanding of users' engagement and their different roles in open-source software (OSS) or open-content communities [7, 28, 95], little is known about participants' roles and their contributions in hybrid structures such as innovation-contest communities. Here the initiative is centered on a certain brand or company, whereas participants collaborate and compete for prizes at the same time, are motivated by incentives, and are highly heterogeneous in terms of skills, experience, and backgrounds.

This paper therefore aims to explore the heterogeneity of participants in a hybrid contest community structure. Specifically, we suggest that different roles are encountered in innovation-contest communities that relate to the quality and kind of contributions. By exploring heterogeneity, we expect to gain a better understanding of the new and increasingly popular form of innovation-contest communities. We investigate the user[1] roles and contributions based on a major, international and highly successful innovation contest. We apply cluster and social network analysis to explore interactions and contributions. This allows us to identify a typology of six different community member types. Through interpretative analysis of posted comments we gain a deep understanding of the meaning of interactions and contributions that also differ across member types.

Our paper is structured as follows. In the next section, we review the literature on user roles in online communities, concluding with a justification of our exploratory research in the context of online *innovation-contest communities.* We then introduce our research setting and our method before we describe the results derived from our analysis. In the final section of the paper, we discuss the theoretical and managerial implications of our findings and delineate the limitations of this study.

Literature Review: User Types in Online Communities

Online communities have become an important and widely studied economic and cultural phenomenon [10, 20, 42, 56, 79, 84]. Research in various contexts—including communities of practice [25], OSS communities [50, 52, 64, 94], distributed collaboration systems such as Wikipedia [6, 61, 99] consumer communities [60, 101]—points out that, in order to successfully manage these communities, one needs to understand the different roles that individuals play within these groups [93, 99]. It is important to find ways of mobilizing, accommodating, and managing the heterogeneity of individuals, as these divergent forces influence the stability, persistence, and outcomes of a community [28]. Researchers have become interested in understanding how different members contribute to knowledge creation and sharing and how it can be harnessed for the mutual benefit of users, the community, and the organization [26, 105].

Previous studies provide important insights into the identification and conceptualization of different member roles in online communities. Kim [58], for example, has classified the rituals and stages of social behavioral patterns in different online communities. He proposes that community members go through a life cycle and change their roles, beginning as *visitors;* gradually becoming participating *novices, regulars, leaders;* and finally *elders.* Based on users' interest in certain topics and in the building of social relationships, Kozinets [60] conceptualizes four user types in virtual communities of consumption: *tourists, minglers, devotees,* and *insiders. Tourists* do not have strong social ties to the group and are characterized by a superficial interest in the consumption activity. *Minglers* keep up strong social ties, but are only superficially interested in the consumption activities. *Devotees* maintain a strong interest in consumption activity, but have few social attachments to the group. *Insiders* are those with strong social ties and strong personal ties to consumption activities. Much of the current work in identifying key members within an online community has focused on the frequency of participation and the volume of contributions. Füller et al. [42], for example, categorize three different user types in an online basketball consumer community based on their posting frequency: *lurkers,* who rarely contribute and passively observe communication; *posters,* who contribute regularly to topics of interest, and *frequent posters,* who contribute almost daily. A rich body of research in the context of OSS has delivered valuable insights into the frequency and different types of contributors in the innovation process [93]. Based on participation volume and frequency, Koch and Schneider [59] found a high concentration of developer activity among a very small group of "active programmers" who are responsible for providing the majority of code lines. In addition to the volume of participation, Nonnecke and Preece [75] also considered the type of interaction. Thereby, they contended that open-source projects not only consist of a few *developers* and a larger number of *discussants* in forums but also of passive, silent peripheral listeners and observers, who do not actively participate (the *lurkers*). A similar result was found in the context of community-based production models such as Wikipedia. Arazy and Nov [6], for instance, found that in large-scale computer-supported collaborations, unequal team compositions are recommended, that is, a few highly active individuals and many relatively inactive outsiders. Ye and Kishida [103] identified eight user roles in OSS communities, including *project leader, core member, active developer, peripheral developer, bug fixer, bug reporter, reader,* and *passive user,* while Viegas and Smith [91] identified *pollinators, debaters, bursty contributors, newcomers,* and *question askers* as user types in an online conversation newsgroup community.

Some previous studies also applied a social network perspective to investigate distinctive user types. Social networks capture the structure of direct and indirect relationships among people and offer socioeconomic resources to individuals in the form of social capital [18]. In their micro-structural analysis of particular actors in the network of an open-source community, Toral et al. [89] identified so-called *brokers* who behave as intermediaries between *expert software developers* and *peripheral users.* They bridge this gap by facilitating information flows and knowledge sharing, and thereby helping OSS projects to engage in a discourse and co-learning experience with their user communities. Also based on social network measures, Cross et al. [25] identified *central connectors, brokers,* and *peripheral players* in a virtual community of practice. Nolker and Zhou [74] map conversational relationships based on participants' degree-centrality measures, using a combination of relation-based centrality measures derived from network analysis and behavioral-based measures from the information retrieval realm. In this way, they identified *leaders, motivators,* and *chatters* as the three key member roles in an online knowledge-sharing community.

To summarize, some user types have been identified across context and identification characteristics and yield important insights. It can be expected that some of the user types identified may apply to innovation-contest communities. However, some of these previous findings may well be limited to the specific investigated domain and be only partially relevant to the context of innovation-contest communities. Innovation-contest communities differ substantially from OSS, consumption communities, and other online knowledge-sharing communities. First, they are initiated by and centered on a sponsoring company, and the winning contributor(s), in most cases, receive(s) a financial reward. Second, participants cooperate (by giving feedback, evaluating others' ideas and solutions, asking questions, giving advice, etc.) and compete (for the prize) at the same time [54]. Third, while OSS offers private user value for the software being developed, there is no such benefit for all the participants in an idea or design-contest community, since usually only a fraction of the ideas or solutions submitted become marketable products. Fourth, open-software development as a knowledge-intensive activity requires highly skilled programmers, experience, and intensive learning [94]. In contrast, participants in innovation-contest communities are highly diverse in their backgrounds, and studies on innovation contests have shown that the best solutions often do not come from people within the domain but rather from "outsiders" [63]. While some of the user types identified in previous studies may be found in innovation-contest communities, others might be irrelevant or of minor importance. In addition, roles that are uniquely specific to innovation-contest communities as hybrid structures might not have been considered in previous studies or might not be identified by certain identification mechanisms. Therefore, we consider further research into the roles of participants as an important step to gain a better understanding of the functioning and success of innovation contests. The understanding of the work done by community members is necessary to build tools or reward systems that help the community to accomplish tasks [61].

There is a long debate on whether competition or cooperation is more beneficial in diverse disciplines and contexts such as economics [48], game theory [15], knowledge sharing [90], team performance [8], innovation [83], and problem solving [82]. Social interdependence theory [30, 57] argues that the structure of interdependencies among individuals determines cooperative and competitive behavior among them. Positive levels of interdependence lead to cooperative interactions in terms of higher expectations of assistance and support, harmony, and trusting and friendly relationships, whereas negative interdependencies result in competitive interactions such as pursuing individual goals and win-lose rewards, increasing mistrust, and restricting information and resource exchange [45]. Deutsch [30] argues that hybrid structures are a weaker and more unstable version of strong cooperative or strong competitive structures. However, little research exists on the combination of cooperative and competitive structures [36, 45]. Also, in the context of innovation, it has been concluded that the relationship among competition, cooperation, and innovation is ambiguous [16, 66]. Some studies find that cooperation positively influences the development of innovative ideas, while others argue that competition leads to more innovation (for a review, see [16]).

Innovation contests are defined as "IT-based and time-limited competitions . . . calling on the general public or a specific target group to make use of their expertise, skills or creativity in order to submit a solution for a particular task previously defined by the organizer who strives for an innovative solution" [1, p. 335]. Hence, they are built on the principles of competition. However, as most of these competitions are designed to draw on the collective innovative capability of communities, they also include Web 2.0 community functionalities that foster the interaction, information exchange, topic-related discussion, community building, and so forth that facilitate cooperation [16]. Most innovation contests are hybrid structures (facilitating cooperation and competition). In their review of innovation contests, Bullinger et al. [16] found that 40 out of 72 analyzed platforms integrate Web 2.0 applications to facilitate cooperation. Adamczyk et al. [1] conclude in their literature review that reward systems including monetary or nonmonetary rewards (competition focus) and intrinsic motivation (community feedback, functionalities to support interaction and communication and information exchange) are typical design elements.

There is limited but growing interest in the question of whether cooperation and competition ("coopetition" or "communitition") lead to innovative solutions [16, 54]. The empirical results are inconclusive. While Hutter et al. [54] found that ideas submitted by users combining cooperative as well as competitive behavior show a higher probability of being highly ranked by community evaluation and victory, Bullinger et al. [16] conclude from a qualitative study that there is a U-shaped relationship between cooperative orientation and innovativeness, indicating that either very high cooperative or very low cooperative behavior leads to the most innovative results. A medium degree of cooperation is less promising. In a field experiment with innovation tournaments, Wooten and Ulrich [102] found that the quality of submissions is positively associated with directed feedback. To understand whether and how these hybrid structures found in innovation contests lead to innovation, a better understanding of the users' roles, behavior, and contributions in these communities is needed. The previous literature on open-source and open-content communities, as briefly described above, is of little help here, as these communities are not hybrid structures. Therefore, the purpose of this paper is to better understand users' roles, behaviors, and contributions in hybrid innovation contests.

To this end, we combine the identification aspects of previous studies and quantitatively study contribution frequency and behavior as well as the social interaction and communication of individuals. In addition, we qualitatively interpret and evaluate the content of contributed comments in order to better understand the kind and meaning of interactions in the context in which these took place and developed. Comparing the kind of contributed comments as well as the quality of idea contributions across the identified types allows us to deepen the understanding of the heterogeneity of users' contribution behavior and their social interaction within innovation-contest communities. In the next section, the empirical setting is explained to provide detailed information concerning our investigated innovation-contest community.

Empirical Study

Research Setting

To investigate the roles and contributions of community members in innovation contests, we conducted an exploratory study [33, 46] based on the Swarovski jewelry design contest community (www.enlightened-jewellery-design-competition.com), a major international and highly successful initiative.[2] Swarovski invited participants from all over the world to engage in an online jewelry idea-and-design contest. This design contest is quite representative of many other virtual innovation contest platforms. The contest was open to professional designers and design students as well as to people who are generally interested in jewelry, gemstones, and related topics. More than 1,700 participants joined the contest to submit designs or contribute their evaluation, feedback, or suggestions on submitted ideas for further revision and improvement. In total, participants created more than 3,000 pieces of jewelry in different segments and contributed more than 23,000 evaluations and nearly 3,000 qualitative comments on the submitted designs. A lively community evolved across cultural boundaries as the contest spread from Austria to Brazil, China, India, Russia, Turkey, the United States, and Iran [11].

Method and Data Collection

In our analysis, we relied on log-file data of the Swarovski contest community. Every registered user was associated with a unique ID. Whenever the user logged in, the server automatically saved the data, logging a trace of the user's activities on the contest community platform in the server database. In this way, we retrieved the patterns of interaction and communication among the community members as well as the amount of contributed ideas. Thus, further idea evaluations as well as the content of the submitted comments could be obtained. We used a mixture of methods to enhance the trustworthiness and reliability of our data [29]. This combined quantitative methods, including cluster and social network analysis, with interpretive qualitative methods, which is regarded as useful in this setting [78, 98, 99]. This integrative reliance on structural quantitative data and detailed qualitative analysis of content and meaning of interactions and behavior allowed a more holistic and productive approach to refining the understanding of social roles and users' behavior [47, 99] than strictly following only one of these methods.

Cluster Analysis Based on Social Network and Contribution Measures

We first applied cluster analysis to social network and contribution data—including commenting and idea-contributing behavior—to identify different user types [37]. In an explorative phase of research, cluster analysis supports the generation of a typology by minimizing variation within and maximizing variation between groups. Subsequently, this identified typology has to be interpreted by the researcher [3]. Furthermore, computer-mediated communication allowed us to view the participants in the contest community as nodes in a social network connected by member–member relationships and to explore individual actor-based network measures. Individual nodes or clusters of similar nodes in the network can thereby be differentiated based on metrics drawn from network structure [97], which helps to provide new insights into members' roles and interactions in an innovation-contest community that would otherwise be misidentified [74].

Content Analysis Based on Qualitative Comments

In a second step, interpretative analysis was conducted based on evaluating the content of the qualitative comments contributed by community members [62]. To assess the different kinds of comments, we extracted the text of all the qualitative comments and categorized them [62, 68]. This interpretative approach allowed for the identification and understanding of members' behavior, their social roles, and the meaning of interactions in the context in which these took place and developed.

Analysis of Variance—Comparison of Contributions Across User Types

Finally, we relied on analysis of variance (ANOVA) in order to compare the kind of contributed comments as well as the quality of submitted idea contributions across the identified types of participants.

A combination of applying both a quantitative structural and interpretative content analysis is beneficial in this case. The fact that a certain individual is categorized to be a certain user type based on the structural position in the network that allows and supports a certain kind of behavior does not necessarily mean that this individual actually engages in this certain kind of behavior [47]. Only the analysis of qualitative content allows us to ensure that the content and context of behavior in the innovation contest community is aligned with the user types identified by quantitative structural data [47, 99]. We further complemented these steps by using ANOVA to finally be able to test whether our identified user types are also distinctive based on their kind (content) and quality of contribution.

Measures of Contribution Behavior

The identification of different user types was based on participants' idea contributions and their communication activities, as captured by actor-based centrality measures [38, 74, 77, 104]. As communication flows are directed, users can be either sources or targets of relationships [55]. This directionality results in two types of network measures describing "actors' locations" in a social network—out-degree centrality and in-degree centrality (degree prestige)—representing two types of visibility and prominence of actors [35]. As these measures capture different structural properties, it is recommended to consider both concepts in the context of directed ties to explore important differences between network actors [35].

Out-Degree Centrality

Out-degree centrality indicates the number of outgoing relationships of a node [38]. It measures the number of direct comments that a user writes on the ideas of others or of direct replies to other comments. It captures how actively a user participates and engages in the communication. It was calculated using UCINET 6 [13].

In-Degree Centrality

In-degree centrality or degree prestige captures the number of comments directed to a user [38], which was also calculated using UCINET 6 [13]. A participant who carries on many communicational relationships is considered to be prestigious [35]. Thus, the measure captures the ability of a user to be recognized by his or her peers for generating new, creative ideas, capturing attention, and arousing curiosity [13].

Number of Designs/Ideas

Despite commenting activity, users' active participation in the community can be characterized by their number of submitted designs/ideas. Research supports the assumption that creativity and innovation success is based not only on the quality of contributed ideas but also on idea quantity [76], which increases the probability that firms will find a new breakthrough innovation [44, 72]. To retrieve the number of designs/ideas submitted, we relied on the log file of the server [73].

Measures of Kind and Quality of Contribution

In order to assess how the types of participants identified differ in terms of the quality of their contributions, we captured the quality of submitted ideas as well as the kind of comments delivered. These measures were compared across the identified user types.

Quality of Designs/Ideas

The quality of contributed ideas is captured by community evaluations. All registered participants could evaluate the designs submitted by others based on a five-point scale of overall idea evaluation (1–5 crystals). This evaluation score was averaged per idea. For each user, the study considered the idea evaluated most highly.

Kind of Comments

To assess the different kinds of comments submitted, we extracted the text of all the qualitative comments and conducted an interpretative content analysis. The coding process started with the formulation of written coding instructions and definition of content categories based on already established categories found in the related literature [68]. Six established categories of classifying communication content in online interaction environments could be found, including "sharing experience," "asking questions," "offering suggestions," "evaluating ideas," "criticizing ideas," and "defending ideas" [17, 51]. The written instructions provided detailed descriptions as well as examples of comments falling into the different content categories. Next, a pretest of the developed coding scheme was conducted, where two coders independently categorized a randomly selected subset of 200 comments. In this coding

Table 1. Categorization of Qualitative Comments and Extracted Examples

Category	Description	Example
Critiques	Critic and disapproval	Horrible!, not much punch. there are no designs, just doing handicraft work!!
Support/motivation	Approval without reasons	nice!, Like it!, Beautiful!
Feedback	Approval with detailed reasons	This is a very unique idea. I like that the gems look like pieces of sand. It almost seems as if they would start falling the other way if you tipped the pendant over. A nice idea.
Constructive suggestion	Detailed suggestion and hints for further improvement of ideas	i like the object, but instead of just glueing a stone to it you could also think of making the whole thing or parts of it out of crystal ? ;)
Asking question	Asking question about the idea	Did you cast the stones in place? Is it a slide across or does it have a lip to help it stay closed?
Social relationships/gossiping	Comments are not related to the idea but concern social relationships	yes, of course I vote u where are u from? hey man, how are you? nice to see someone familiar here . . . hehe . . . yeah its been a while since the watch contest . . . and i thought i should give it a try here also . . . nice design btw ;)
Not applicable	No meaning, cannot be decoded	D++++++++; …;ز

process the two researchers were also open to new concepts arising, and developing and adjusting content categories inductively [46], such as *gossip/socializing.* This precategorization test was followed by a detailed discussion of assignment differences, revision of the coding scheme, and newly developed categories. This resulted in six final distinctive comment categories, displayed in Table 1, including *critique,* or criticizing ideas; *support/motivation* in the form of approving evaluations; *feedback,* which gives reasons for approval; *constructive improvement suggestions;* detailed and pointed *questions;* and just *gossiping/socializing* with other members. After this alignment, the two coders analyzed another set of 200 randomly selected comment contributions and coded them independently according to the revised and updated coding scheme. Again, the meanings and appropriateness of the categories were renegotiated and any differences in coding discussed. Furthermore, the Cohen's kappa coefficient was calculated to test intercoder reliability [22]. Given a high intercoder reliability (percentage agreement: 92 percent), the remaining postings were coded by one of the two researchers only.

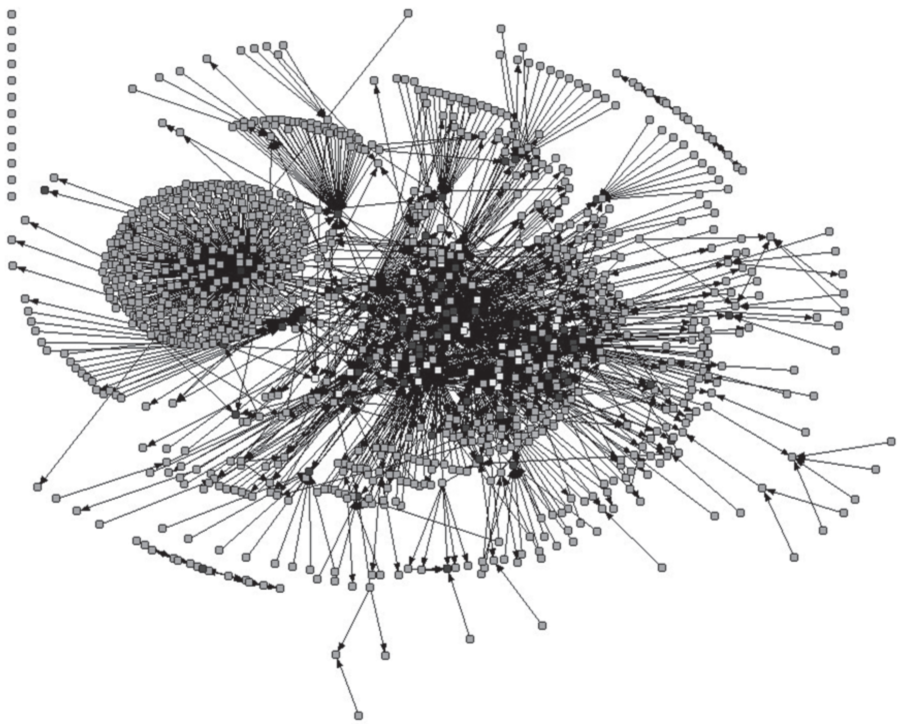

Figure 1. Innovation Contest Community Network

Analysis and Results

Descriptive Statistics and Analysis

In our analysis we relied on the number of contributed ideas and individual network measures capturing users' communication activities. In the contest community, computer-mediated communication took place by writing comments on the ideas of other community members. A relationship between two users was considered to be established as soon as one user commented on the design of another participant. The directionality of ties was preserved by distinguishing between the sources and the target of a relationship [35]. Based on this definition, only those who are involved by either sending or receiving at least one comment were included in our analysis. These considerations finally resulted in a total of 1,127 users who wrote a total of 2,936 comments. Figure 1 shows the network established among users through their commenting activities. It shows that communication is dense within smaller user groups in the core of the network, while many peripheral users engage only by commenting once without participating in further relationships. This indicates that users differ considerably in the way they interact and participate, supporting our assumption of the existence of different user types.

Table 2. Statistical Indicators of In- and Out-Degree Centrality and Number of Designs

Criteria	Mean	Median	Standard deviation	Variance	Skewness
In-degree centrality	2.91	0.00	32.81	1,076.47	31.46
Out-degree centrality	2.91	2.00	5.90	34.85	15.32
Number of submitted designs	2.34	0.00	7.64	182.61	162.00

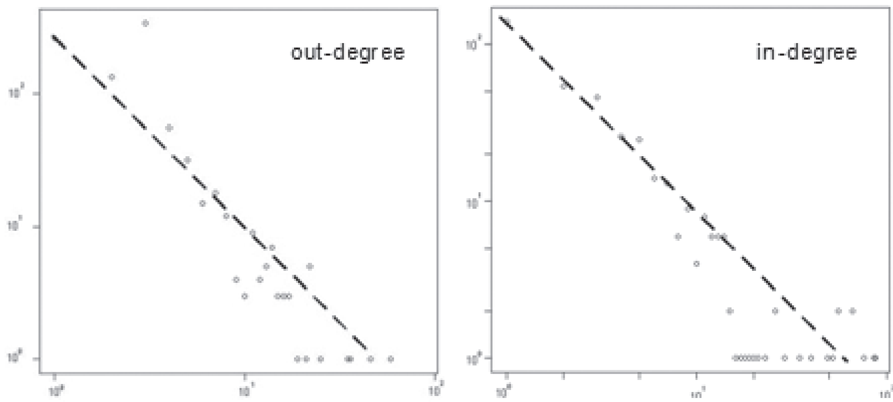

Figure 2. Out- and In-Degree Distribution (Log Values)

$p(k^O) \sim (k^O)^{-\tau}$ (out-degree), $p(k^I) \sim (k^I)^{-\tau}$ (in-degree), τ = constant component.

Descriptive statistics of the three individual node criteria—in-degree (number of incoming communicative relationships), out-degree (number of outgoing communicative relationships), and number of submitted ideas—displayed in Table 2 further reveal that an "average user" in the innovation-contest community posted/received approximately three comments and submitted two designs.

However, the high skewness of all three measures indicates user heterogeneity in contribution behavior. When analyzing the number of submitted designs per user, the median of zero highlights that a large portion of community members did not contribute by submitting a design but only through posting comments. The zero median of the in-degree also shows that a very large proportion of users did not receive any comments on their designs. The large standard deviation of in-degree compared to out-degree centrality indicates that some particular users elicit a lot of comments from many different members. The distributions of network measures resemble a power-law function, a property of a scale-free network, further proving heterogeneity in the way participants send and receive communication (see Figure 2).[3] In scale-free networks, the majority of nodes is only very poorly connected, while a minority of nodes is many times better connected than the average [2, 31].

User Typology

Descriptive analysis confirmed that it is not appropriate to use the average properties of our three criteria to describe the "typical prototype" user [77]. Therefore, based on previous research and our insights into the contest community, we combined in-degree centrality (number of incoming communicative relationships), out-degree centrality (number of outgoing communicative relationships), and number of submitted ideas to identify a typology of users. By using these particular criteria, we could capture a user's idea-contributing behavior and his or her involvement and prestige in communication relationships.

Cluster analysis was applied to identify a typology of participants based on this set of our identified three measures.[4] In our analysis, we combined hierarchical and nonhierarchical (*k*-means) clustering techniques [69, 81].[5] In a first step, we applied a hierarchical clustering procedure using the Ward's [96] minimum variance method, which is based on squared Euclidian distances. Compared to other algorithms, this method usually generates good results, and it allowed us to determine the number of clusters as well as the initial starting points for nonhierarchical clustering [71]. Both the Calinski and Harabasz [19] pseudo *F*-statistic as well as the Duda and Hart [32] pseudo T^2-values, identified as the best stopping rules in cluster analysis [70], supported a four- to-six-cluster solution. For each case, we performed a *k*-means, nonhierarchical cluster analysis on a cluster between four and six groups, in which participants are iteratively classified based on their distance to some initial starting points. We employed the centroids of our initial hierarchical group solutions as starting points in this iterative analysis. In addition to stopping rules, which help to determine the appropriate number of clusters, the robustness of cluster solutions needs to be assessed in order to assure the validity of the chosen solutions. In order to explore the robustness and stability of the four- to six-cluster solutions and to be able to compare them, we test the reliability of a group assignment within each solution. We did this stability test by sampling the group assignments. For each user, the most frequently occurring group assignment is taken as an estimate of the most common group assignment in the population. The user is assigned to a cluster group only if the probability of assignment in a particular group is more than half (at $\alpha = 0.05$) in the population of group assignments. While the four- and six-cluster solutions are characterized by a similar high level of stability (4: 89.68 percent; 6: 89.34 percent of valid cases), the five-cluster solution (5: 50 percent) is characterized by very low levels of stability. Based on the relationship found between cluster solutions, as well as the supporting literature, a six-cluster solution was finally found to be the most meaningful and interpretable. Sizes and means, as well as the six clusters identified by *k*-means cluster analysis, are provided in Table 3. An ANOVA was conducted to test the difference between user types on the three criteria. To estimate differences between the means in the in-degree and out-degree of the six identified user types, a one-way ANOVA was calculated using UCINET 6.0 [13].

The ANOVA procedure provides the regular estimations. However, due to the interdependence of network observations, permutation tests are applied to determine

Table 3. Cluster Analysis—Six-Cluster Solution

	Online contest community user type													
	Socializer		Idea generator		Master		Efficient contributor		Passive idea generator		Passive commentator			
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Total	*F*-value (*p*)
In-degree	2.71	3.33	8.44	6.17	58.45	20.82	8.04	6.14	0.90	1.32	0.11	0.60		935.34***
Out-degree	19.33	10.95	5.70	5.69	26.45	42.43	2.28	3.16	0.68	0.66	3.39	1.47		141.82***
Number of ideas	3.00	3.62	26.41	8.51	45.27	43.51	7.62	4.08	1.30	1.66	0.09	0.48		389.10***
Number of observations	24		27		11		95		440		529		1,126	
Percent of observations	2.1		2.4		1.0		8.4		39.0		46.9		100	

Notes: Number of permutations = 5,000. SD = standard deviation. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

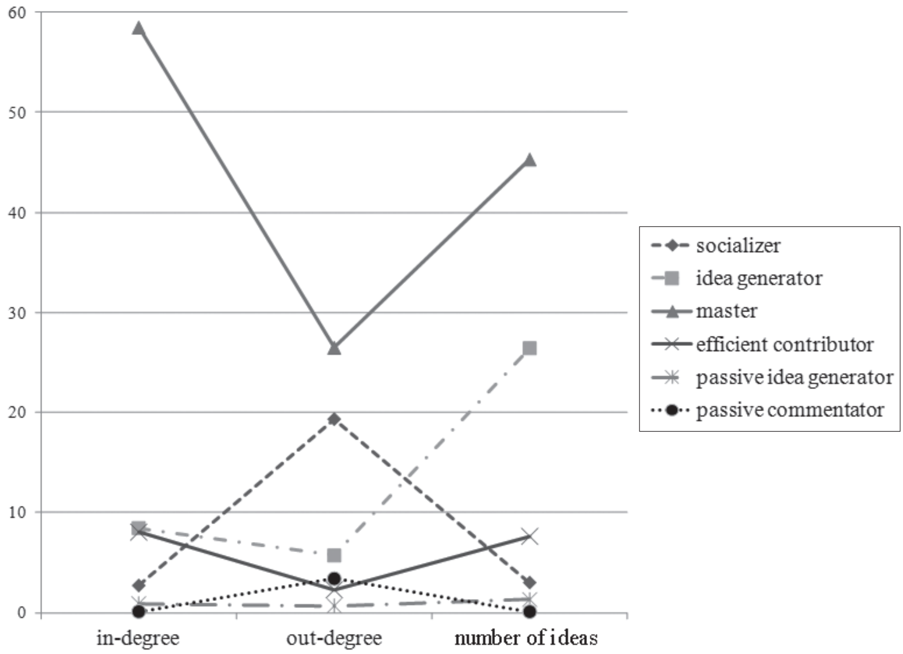

Figure 3. User Type Identified Through Cluster Analysis

the significance of mean differences [49]. The results support the distinctive clusters, as our three criteria—out-degree centrality, in-degree centrality, and the numbers of submitted ideas—differ significantly across the identified clusters. Distinctive profile peaks in each cluster can be seen in Figure 3. These peaks were also referred to when labeling our clusters as the six participant types: socializer, idea generator, master, efficient contributor, passive idea generator, and passive commentator. To point out the differences among the user types and their associated interaction patterns and behavior, we also visualize the egocentric networks of the user types [98].

Socializer. This type of participant (2.13 percent) very actively engages in the communication and interaction activities, shown by a very high level of comments written in regard to the designs of others. Figure 4 shows the egocentric network associated with *socializers.* A *socializer* is characterized by a high number of outgoing relationships, indicating that those users are actively engaged in commenting. *Socializers* focus their contribution on participating by communicating and interacting with other members. The very low number of ideas submitted by the *socializers* further indicates that this user type does not contribute to the contest community with his or her design ideas but rather with his or her interaction behavior.

Idea generator. This user type (2.40 percent) is characterized by the very large number of submitted designs. Figure 5 represents the egocentric network of an *idea generator.* It highlights that a large number of uploaded designs does not automatically lead to high attention and curiosity from other members, as shown by the relatively low number of in-going relationships. Hence, it can be assumed that their ideas, despite their vast number, do not have the potential to make people curious, initiate discussion, or

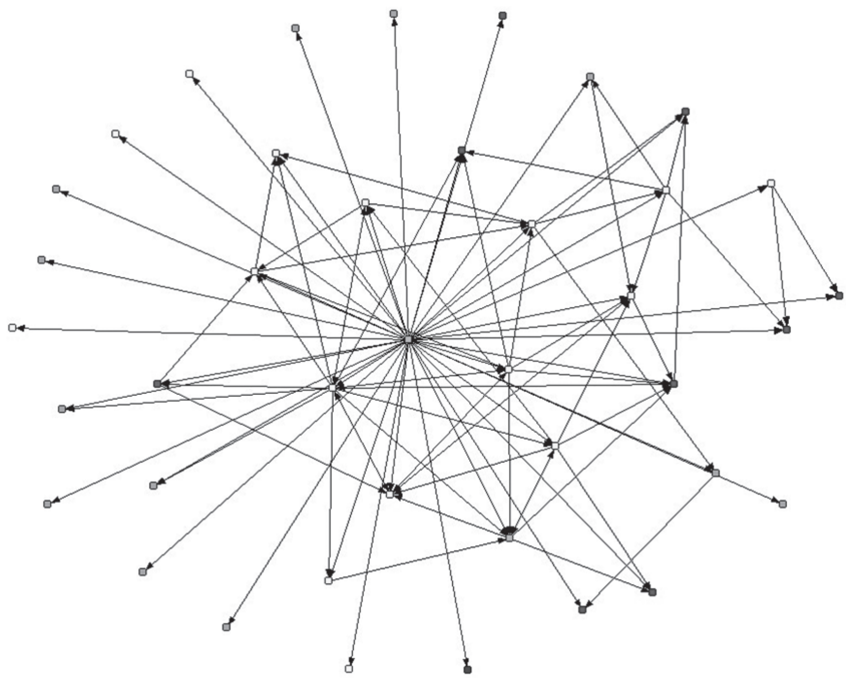

Figure 4. Socializer (ID 2191), 6 Designs, In-Degree 0, Out-Degree 46

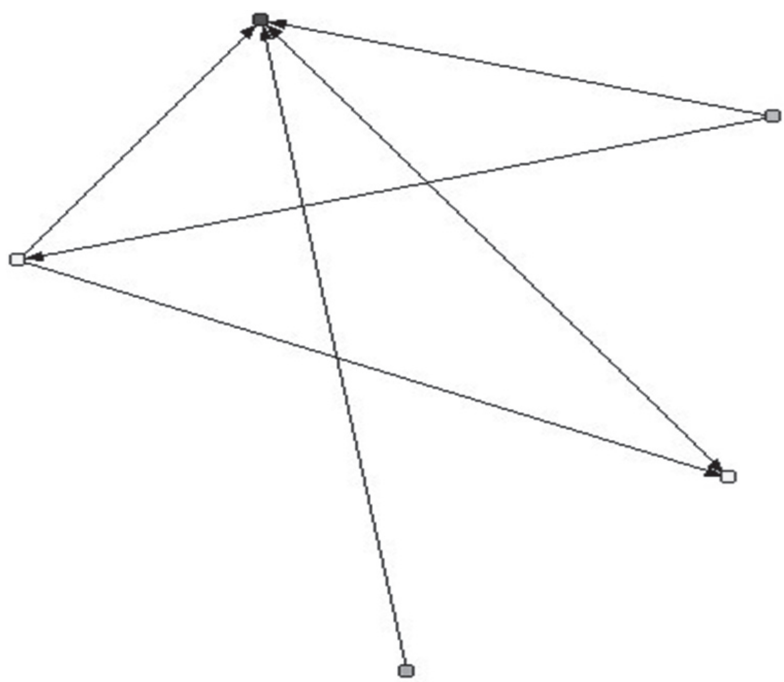

Figure 5. Idea Generator (ID 2245), 21 Designs, In-Degree 6, Out-Degree 3

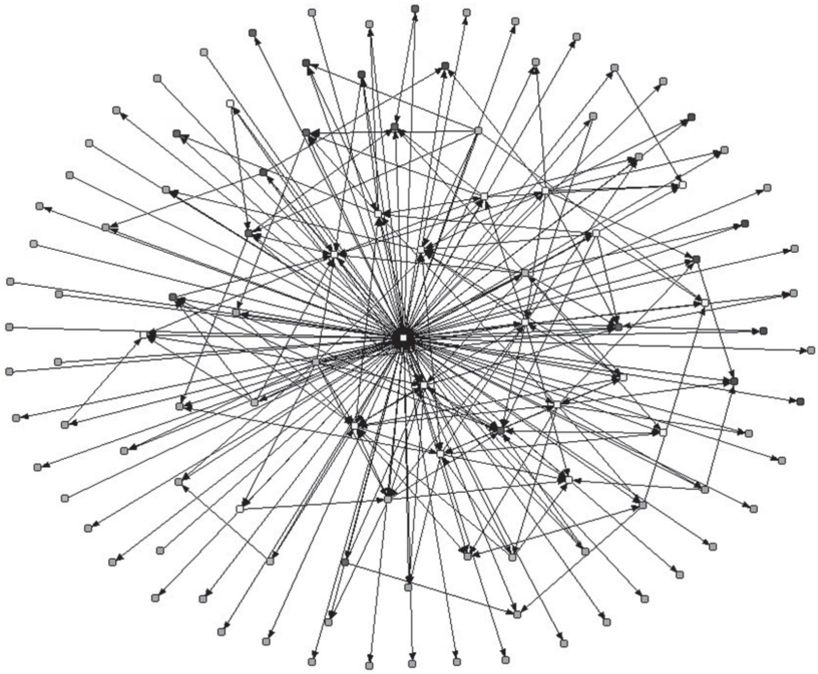

Figure 6. Master (ID 1921), 34 Designs, In-Degree 76, Out-Degree 149

spread the word about them. Furthermore, *idea generators* do not actively participate in communication or facilitate information exchange or social relationships, which can be seen from their few, if any, outgoing relationships.

Master. This user type (1 percent) comprises only a very small part of the contest community, as indicated by the very small cluster size. However, this type of user contributes at an above-average rate on every one of the three criteria. *Masters* very actively engage in communication and interaction behavior within the network; however, unlike the *socializer,* this user type also provides a high volume of ideas, promising new breakthrough designs. In contrast to the idea generator, these ideas attract a high level of attention among members. The high level of awareness among the other members generated by a *master* is indicated by the numerous inward connections in Figure 6, which shows the egocentric network of a master. Furthermore, this ego is characterized by a high number of outgoing connections. As *masters* provide a high quantity of content, with a high degree of attraction, they represent a valuable user type that should be captured and encouraged to engage in the community.

Efficient contributor. This user type (8.4 percent) is not characterized by a significant peak on the investigated variables. Compared to the previously described user types, the participants falling into this cluster seem to resemble the characteristics of an *idea generator,* although on a more moderate level. Again, the focus on contribution of an *efficient contributor* lies with idea-generating activities rather than with active-commenting behavior. However, compared to *idea generators* and in relation to the

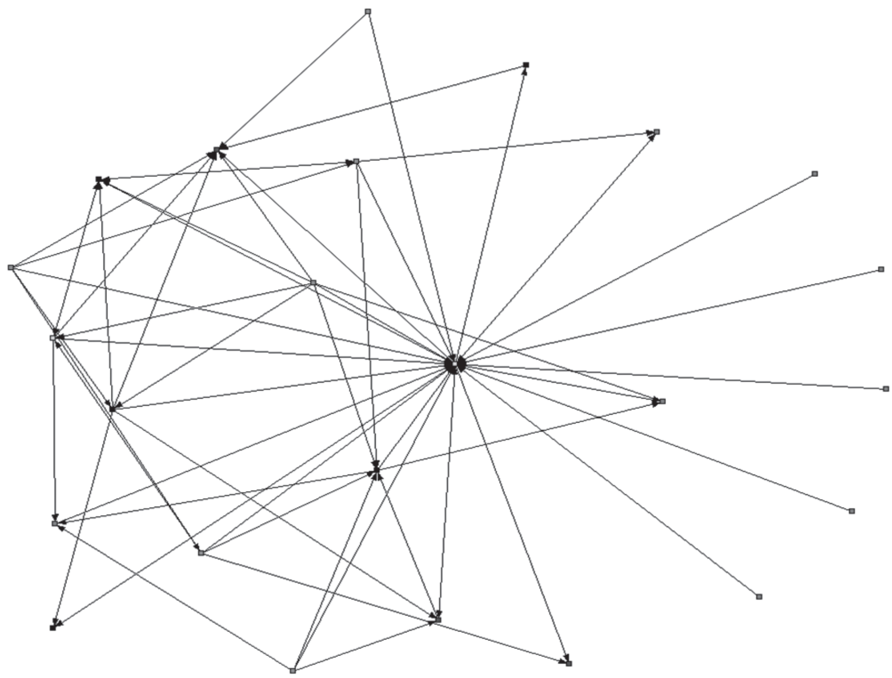

Figure 7. Efficient Contributor (ID 401), 3 Designs, In-Degree 26, Out-Degree 11

number of submitted ideas, the *efficient contributor* is able to attract attention among contest community members more "efficiently." Hence, with fewer submitted ideas, this user type is able to attract the same level of attention as the *idea generator* with a very high number of submitted designs. Figure 7 shows the ego-network of a general user characterized by few outgoing, but a moderate level of incoming, relationships.

Passive users. Passive users are made up of two types of users: *passive commentators* (47 percent) and *passive idea generators* (39 percent). Together, these two *passive user* types make up for the majority of participants in the contest community (86 percent). When looking at their contributions, the *passives* do not actively participate in the innovation-contest community through a high number of comments or designs, or through providing highly attractive designs that capture considerable community attention. While *passive commentators* provide very few comments, *passive idea generators* merely submit one idea on average without any other kind of contribution.

Comparing Quality and Kind of Contribution Across User Types

We also studied how the identified user types differ in terms of the quality and content of their contributions. In the second analysis step, we therefore compared the quality of submitted ideas as evaluated by the community itself across the six types of participants. We also analyzed whether the content of comments provided by the user types is differently distributed across comment-content categories.

Quality of ideas. ANOVA revealed that the quality of submitted ideas significantly differs across the six types. As shown in Table 4, *masters* received the highest community evaluations among all user types, followed by the *efficient contributor.* The *master* is found to be the user type who submits ideas with the highest potential as evaluated by the community. This result supports the fact that the *master*—despite his or her low number within the community—is a very critical and important type of participant. Nevertheless, the *efficient contributor* also seems to be an important contributor in the sense that this user type seems to be able to generate and submit a few ideas that are highly valued by the community. Although the *idea generator* submitted a very high number of designs, this user type just could not receive the same evaluation from the other community members as the efficient contributor. As expected, both types of *passive users* achieve the lowest community evaluation among all user types.

Content of comments. As described above, comments were assigned to one of the final six categories representing distinctive forms and elaboration of comment contributions: *critique, support/motivation, feedback giving reasons for approval, constructive improvement suggestions, detailed and pointed questions,* and *gossiping/socializing with other members.* From the initial 2,936 comments, 254 could not be assigned to any of the categories, as they just included meaningless combinations of letters and symbols. From the remaining 2,682 comments, the content of 54 comments could be assigned to two categories, while six could be assigned to three different content categories at the same time. In these cases, the comment was counted twice or three times for the individual user, once in each respective category. This resulted in a final number of 2,748 content categorizations in total. The distribution analysis of comments in Table 5 was subsequently based on this total of 2,748 categorizations in order to take into account the hybrid nature of the longer comments.

The majority of submitted comments fell into the categories of *support and motivation* and *feedback* (which includes detailed reasons for approval). A smaller proportion of comments concern *critique, socializing, constructive suggestions* for improvement, and *specific questions.* Table 5 shows the distribution of comments across the different categories by identified user type. Pearson and likelihood chi-square tests reveal that the six user types differ significantly in the types of content they contribute.

Due to the large number of comments submitted by *socializers,* this user type is a facilitator of communication within the community and primarily engages in building communicative relationships with other community members. The *socializer* contributes a large absolute number of comments within each content category. Through this very active engagement in commenting on designs, this user type facilitates the assessment, enhancement, and development of the posted ideas. It is interesting to see that, compared to all other user types, the *socializer* shows the largest proportion of comments that have focus on social aspects alone, rather than on ideas. Based on these findings, it can be assumed that socializing, gossiping, chatting, building relationships, and gaining friendships with other community members are indeed of higher particular importance to *socializers* than to other users, as shown by the following comments:

> when can I see a photo from the dot-designer?—i love your lovely dots. (User 1944)

Table 4. Community Evaluation Among Six User Types

	Online contest community user type													
	Socializer		Idea generator		Master		Efficient contributor		Passive idea generator		Passive commentator			
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Total	*F*-value
Community evaluation	1.92	1.01	2.81	0.49	3.57	0.70	2.87	0.55	1.28	1.09	0.09	0.42		281.46***
Number of observations	24		27		11		95		440		529		1,126	
Percent of observations	2.1		2.4		1.0		8.4		39.0		46.9		100	

Notes: 1 = lowest score; 5 = best score. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 5. Distribution of Qualitative Comments Across Content Categories per User Type

Content category	Online contest community user type					
	Socializer (percent)	Idea generator (percent)	Master (percent)	Efficient contributor (percent)	Passive idea generator (percent)	Passive commentator (percent)
Critiques	3.91	1.63	0.00	2.19	1.54	1.12
Support/motivation	68.46	72.36	84.65	59.56	73.85	78.08
Feedback	16.38	20.33	12.60	29.51	21.54	15.80
Constructive suggestion	2.93	0.00	0.79	5.46	1.15	0.86
Asking questions	2.44	4.88	0.39	2.19	0.77	0.39
Social relationships/gossiping	5.87	0.81	1.57	1.09	1.15	3.75
Total	100	100	100	100	100	100
Pearson $\chi^2 = 145.70^{***}$						
Likelihood ratio $\chi^2 = 130.03^{***}$						

> all the best. (User 2109)

> hey man, how are you? nice to see someone familiar here . . . hehe . . . yeah its been a while since the watch contest. . . . and i thought i should give it a try here also . . . nice design btw ;). (User 2434)

Idea generators are mainly driven by generating and submitting ideas, without engaging in interaction and communication behavior. Accordingly, the comments of *idea generators* do not show engagement in socializing tasks or attempt to build social relationships with others. In addition, this user type does not support other members with constructive and helpful suggestions through his or her own comments. If *idea generators* engage in commenting at all, they show a larger proportion of asking design-specific questions than the other identified types:

> Great piece looks like a [Fabergé] style, clever locket idea, but couldnt see hinge mechanism. Is it a slide across or does it have a lip to help it stay closed? (User 2840)

> Nice piece, but what are the materials? is it an enameled metal or a type of plastic? (User 840)

Through these questions *idea generators* seem to be trying to understand certain designs and gain information, ideas, and knowledge, which can then be used and applied for generating a high number of ideas.

The distribution of comments submitted by *masters* has to be interpreted with caution, as the number of individual users within this special category is very low. If *masters* contribute comments, they seem to engage more in supporting and motivating the other identified types.

Compared to the comment content of other user types, the *efficient contributor* is the one who provides the largest amount of feedback, giving reasons and descriptions of what they like about a certain design and why a design might be appealing to them:

> Very nice composition and choice of colors! (User 2010)

> simple, modern, and one can design a secret song into it to make it more personal. (User 2610)

> I like the idea of using the hair like a part of your jewel. very nice job. (User 2611)

Furthermore, the efficient contributors are the ones who provide more constructive feedback and specific suggestions for further idea development than the other types, allowing the contest community members to benefit from a joint idea and development process:

> very very interesting . . . the idea that your design allows multiple combinations for each user taste (maybe you can add a wider range of passion colors). (User 401)

> modern, minimalist and fashion. the overall idea is very nice but as you can see those gems cant just stand like that in the air and trying to get them attached in a correct manner will probably change the overall aspect. (User 401)

> I really like this piece of jewelry i think you should have added some more gems to the pendant. (User 2278)

Finally, in their few comments, passives are also mostly engaged in giving approval to other community members, thereby enhancing the assessment of designs and future trends. However, passive users do not engage intensively in giving constructive suggestions for enhancement or in building social connections with other community members.

Discussion

Theoretical Implications

In this exploratory study, we investigated whether and how hybrid structures (building on the competition and cooperation of community members) found in online innovation contests lead to innovations by studying users' roles, behaviors, and contributions. Little research exists on the combination of cooperative and competitive structures in general [36, 45] and within innovation communities in particular. Those studies that do tackle this issue yield inconclusive findings (for a review, see [16]). While theory would suggest that hybrid structures are a weaker and more unstable version of strong cooperative or strong competitive structures [30, 45] as they lead to different cooperative or competitive behaviors that can be functional or dysfunctional in an innovation community, practice shows that most innovation contests are designed as hybrid structures [1, 16]. To understand why and how these hybrid structures work, we analyzed the heterogeneous roles participants take on in innovation-contest communities.

Numerous studies [6, 25, 89, 103] have analyzed social structures and user roles in Internet communities and found that a small, densely knitted core of highly active users and a large periphery of passive users seem to compose the typical, general social structure. Hence, the question arises as to whether communities with hybrid structures lead to different social structures. The typology identified in this study consists of six user roles: *master, idea generator, efficient contributor, socializer, passive commentator,* and *passive idea generator,* which differ in their contribution and communication behaviors as well as in the content and quality of submissions (see Table 6). Some of the identified user types show similarities with previously identified member types in the context of open-source software development or communities of consumptions. As reported in previous studies, our study also found a high percentage of *passive users,* such as *lurkers, tourists,* or *peripheral users,* not actively contributing or communicating [42, 60, 74, 75, 89, 103]. Hence, it can be assumed that this kind of rather inactive user type can be commonly found in online communities across different contexts.

Table 6. Summary: User Type Characteristics and Implications

Type	Share (percent)	Number of ideas	Outgoing comments	Incoming comments	Quality of ideas	Content of comments[a]	Managerial implications
Master	1.0	Very high	Very high	Very high	Very high	Mainly providing support and motivation	Provide functionalities and incentive structure that encourage masters to share more of their knowledge and to contribute more constructive feedback and improvement suggestions
Socializer	2.1	Low	Very high	Low	Low	Largest proportion of comments with focus on social aspects: socializing, gossiping, chatting, building relationships, and gaining friendships	Integrate special community functionalities, e.g., chats, blogs, and forums in contest platform Provide special incentives for the most active or the most supportive behavior
Idea generator	2.4	Very high	Low	Low	High	Largest proportion of specific questions—collecting information on design characteristics	Do not explicitly incentivize a large number of ideas—higher costs of handling and evaluating these ideas Avoid “idea spam,” e.g., combining idea submission with a brief written description or assessment of the submitted ideas

Efficient contributor	8.4	Low	Low	Moderate[b]	High	Largest proportion of constructive feedback giving reasons and descriptions and specific suggestions for improvement	Provide functionalities and incentive structure which encourage and enable improvement suggestions Allow joint development of ideas or the further development of others' ideas
Passive idea generator	39	Low	Very low	Very low	Very low	Mainly providing support and motivation	Encourage passives to spend more time on the platform even though they are not active Enable easy browsing through submitted ideas or comments Provide linking functionalities Provide suggestions for ideas which might be interesting based on past views
Passive commentator	46.9	Very low	Low	Very low	Very low	Mainly providing support and motivation	

[a] Share compared to the other types. [b] In relation to the number of submitted ideas.

This finding suggests that the social structure, characterized by a densely connected core of users and a loosely attached, less active periphery [26, 27], previously found in open-source or open-content communities [7, 28, 95], is a general characteristic of Internet communities that are built on voluntary participation without a central hierarchical authority [67], where users freely decide on how much time to devote to which task and with whom they interact [27]. Hence, we propose that the basic social structure of online communities is also found in online communities with hybrid structures such as innovation-contest communities.

A second important question regards the effectiveness of hybrid structures: Does competition or cooperation within these innovation communities lead to better ideas? Or, in other words: Are the best ideas submitted by individuals that do not interact with others or by individuals that heavily engage in communication (giving and receiving comments)? Our exploratory study provides relatively clear answers. In contrast to previous studies, we analyzed not only participants' contribution activities, such as the frequency and type, but also their involvement and the effect of their submitted designs on communication and interaction with others—the attention they draw from other participants. This allowed us to identify the special group of *masters. Masters* can be related somehow to the *insiders,* as identified by Kozinets [60], as they engage in design activity as well as active commenting and interacting. In addition, *masters* can be regarded as especially valuable contributors, since many community members start voting for and discussing the ideas contributed. *Efficient contributors* are able to gain a high level of attention relative to the number of their submitted ideas. Through the high number of votes and ongoing comments, these attention-grabbing users receive valuable feedback and suggestions from other network members, which lead to the potential for further enhancement of the posted idea. The combination of the network measures and the contribution frequency and type also allowed us to identify participants such as *idea generators* or *socializers* that concentrate on one specific activity. *Idea generators,* for example, seem to be engaged solely in the generation of multiple ideas. The literature suggests that a high number of ideas increase the probability of finding an appropriate solution [76] or provide high potential for innovative ideas in an idea contest [44, 72]. Furthermore, a stream of literature suggests that with every submitted design, more is learned about idea generation and design processes, and this learning and accumulated knowledge can be used in every future idea generation [9]. However, idea generators are not able to attract a lot of attention with their designs, whereas the generation of a higher number of ideas, simultaneously, leads to a higher cost of handling these ideas.

Socializers represent a combination of the *posters/discussants/debaters/chatters* [42, 74, 75, 91] and the *minglers* found by Kozinets [60]. Our identification criteria combined with content analysis revealed that *socializers* mainly heavily engage in commenting and are involved in social activities. It is interesting that this socially engaged user type can also be found in a contest setting, where competition could be assumed to rule the behavior of participants. In addition to "specialized" user types, our study has identified participants such as *masters* who are interested in various activities. While our study reveals similarities between *idea generators, socializers, masters,* and Kozinets's [60] classification of *minglers, devotees,* and *insiders,* it also sheds light on the different specific contributions underlying these behaviors that support us in finding ways to mobilize individuals and make use of developer heterogeneity in innovation-contest communities.

To summarize, the most effective users (in terms of quantity and quality of ideas) are those who also strongly interact with others (masters, see Table 6). They receive many comments on their ideas and they give a great deal of feedback, and thus they benefit from the hybrid structure of the innovation contest. Idea generators (high number of ideas and high-quality ideas) also benefit from Web 2.0 functionalities to support interaction, as they claim the largest portion of specific questions asked, collecting information on design characteristics. Efficient contributors (low number but high quality of ideas) also make use of the communication tools, giving constructive feedback and suggestions for improvement. The passive users (very low in idea contributions) are the largest user type, contributing very few ideas but providing support and motivation to other users. Hence, our empirical study clearly shows that hybrid structures are an effective form of Internet-based innovation communities. It seems that innovation contests strongly benefit from interaction, information exchange, mutual support and motivation, community building, and cooperation [54, 102]. Our findings also support von Krogh and von Hippel's argument [93] that various member roles are important in order to create high-quality outputs. For example, while *masters* and *efficient contributors* may be needed to obtain high-quality designs, *socializers* may help to create a lively community and provide a certain amount of interactions that make it interesting for others to engage in the community. Thus, we propose that in Internet-based innovation communities, hybrid structures are viable and effective forms that foster innovation by building on competition and cooperation at the same time.

Managerial Implications

Implications for appropriate incentive structures, rewards, and the encouragement for users who are actively contributing to support the needs and health of the community are summarized in Table 6. Companies can devise and align their actions accordingly with an appropriate management approach for innovation-contest communities. Further implications are given for platform design and functionalities. Our findings indicate that, for example, *idea generators* may be more interested and engaged in creating ideas and designs while *socializers* may be more attracted by and engaged in the community itself and the community functionalities that the platform offers. To support this valuable behavior, additional differentiated incentives could be offered not only for the best ideas but also for the most active or the most supportive behavior. An addition, recognition or small gifts may be appropriate for the most active *socializers.* Needless to say, it is important to align the offered incentives with the desired behaviors in order to avoid crowding-out effects and free-riding.

Through their active feedback, approval or disapproval, and suggestions, *socializers* activate knowledge transfer, sharing of information, and experiences within the community and therefore also contribute in pooling, refining, and disseminating ideas and new product developments. These processes are the key prerequisites for establishing collaboration in the creative innovation process and enhancing the individual's ideas through joint interactions. They enable the innovation-contest community to be more than a contest where users can simply submit their ideas. Their engagement nurtures a lively community where like-minded people interact and collaborate online through the use of social software applications. These findings offer important practical implications for the technical design of innovation-contest communities. Only the inclusion of special community functionalities and software applications on Web platforms allow *socializers* to engage in communication and interaction, which allow information and knowledge sharing and enhance organizational learning, resulting in collaborative, more successful, and creative innovation.

Finally, *passive users* who are consistently found in online communities across different contextual backgrounds may also be useful in innovation-contest communities, since they may help to reach the critical mass necessary to distribute information about the contest or be considered as fans. Other participants may be impressed by the large number of users visiting their ideas or profiles. However, if only a very low number of the other user types are active in the community and little content is provided, a high number of *passive users* can become a problem, as no one wants to be part of or return to a silent community where nothing is happening [80]. Passive users may also use the innovation-contest community to virtually learn and get excited about new potential products in advance, which can facilitate dissemination of breakthrough ideas in the real world. They may spread the news of the existence of the design contest and its community and help to acquire new members.

To our knowledge, considering the effect of one's contribution on others is a quite unique, but nevertheless useful, approach in the field of innovation-contest communities [12]. It treats others' interest as a proxy for the quality of submitted contributions, which allows for the identification of users with promising designs and ideas. Furthermore, these findings can offer important insights for providing a solution to the difficult task of identifying the most promising contributions from an enormous number of submissions. This is especially interesting for innovation-contest communities, as the social context of a peer community facilitates a process of collaborative filtering and a selection of promising ideas [9, 92]. Hence, the frequency of interaction and the number of contributions should not be regarded as the only indicators to identify the important members within innovation-contest communities. Rather, key-player identification should be evaluated by the effect that users evoke, considering that the attention allows companies to leverage the "wisdom of the crowd" of the innovation-contest community [53]. A high level of attention may also serve as an indicator for market attractiveness. It may offer a first verification of preferences and indicate how much attention and interest a new design might raise among potential customers [24, 100].

Limitations and Further Research

Certainly, this study bears some limitations and raises questions calling for further research. As this study was exploratory in nature, the question of generalizability arises. However, we are confident that the results of our study can be generalized to innovation-contest communities with hybrid structures for two reasons. First, we found the same basic social structure (e.g., dense, active core and large, passive periphery, heterogeneity regarding quality and quantity of contributions) as in other online communities described in our literature review. Hence, we believe that these basic social structures are stable across contexts. Second, the Swarovski jewelry design contest is quite representative for many other innovation-contest communities with hybrid structures [1, 16]. Nevertheless, while the basic social structure does not vary across different types of communities, specific behavioral patterns, size of the user clusters, and so forth might be influenced by the specific context of a community (e.g., duration, incentives, and topic). Therefore, the generalizability of identified user types and its sensitivity to contextual factors still needs to be tested. For further confirmation and elaboration of the findings, additional innovation-contest communities with differing tasks (e.g., problem-broadcasting, solution-oriented contests, or creative-idea-generation contests), branches, or inductors need to be investigated. Furthermore, research should investigate how the activity and contribution data of participants could be used for evaluation purposes and the identification of the most promising designs. The social bias of one's network position on the evaluation of the designs within the community might be especially interesting.

Further exploration of different user types' underlying motives and personalities may be worthwhile in order to find appropriate strategies for the mobilization of user types [9]. In addition, longitudinal studies on user types might clarify whether users evolve and switch among user types over time, which would allow for the creation of strategies to transform users from one type to another (e.g., *passive* to *socializers*). Furthermore, besides several motives, the more precise notion of procedural utility [39, 40] and its impact on behavioral patterns might be of further interest (e.g., the impact on participants' intention to purchase, their willingness to pay, or their inclination to enact positive word-of-mouth marketing).

Finally, while the goal of this study was not to explain the evolution and dynamics of structures, we are aware that different social processes may make similar predictions about network structures. Hence, different clusters observed in the innovation contest community might emerge from endogenous (e.g., self-organizing) structural effects, through node-level effects (e.g., homophily) or other multilevel factors. The opportunity to detect and explain the influences of these factors on cluster generation provides very interesting avenues for future research. In order to be able to investigate which of the alternatives might lead to a certain structure, future studies could, for example, evaluate the differences in predictions through statistical modeling such as the p^* approach [23]. We hope that our study thereby inspires other researchers to further explore the emerging topic of innovation-contest communities and gain a better understanding of the patterns and dynamics of these innovative ecosystems of heterogeneous member types.

Conclusion

Hybrid structures (competition and cooperation) are a common form of online innovation contests. In this study we investigated the social structure of such innovation communities to understand whether and how these structures lead to more and better innovations. We found that, similar to other online communities, innovation contests with hybrid structures are characterized by a dense, active core and a large, passive periphery. Based on our literature review and our own empirical study, we conclude that this social structure of online communities is stable across contexts. Furthermore, we found that hybrid structures in innovation contests are beneficial to the quantity and quality of ideas. They are an effective form of Internet-based collaboration, and these contests benefit from the interaction among their participants, their information exchange, their mutual support, community building, and cooperation. While the findings of our study lead to a number of managerial implications regarding community management in such contests, they also reveal interesting and promising questions for further research such as: How do hybrid communities evolve over time and how do user roles change? How do context-specific factors (e.g., duration, topic, incentives) influence behavioral patterns and outcomes? Such questions can be answered with approaches such as experimental designs or statistical modeling.

Notes

1. In this context the term "user" does not refer to "consumer" or the use of a certain product. Rather, it concerns users of a contest platform and therefore refers to community members.
2. As one of the authors has a long-term working relationship with Swarovski, Swarovski allowed us to analyze this contest and granted us access to all the data. It also provided us with a better understanding of the general empirical setting. However, the author was not directly involved in this project, nor did the author actively manage the community, influence any member behavior, or engage in the design evaluation process.
3. The exponent τ in our network is 1.5 for out-degree as well as for in-degree distribution. An exponent value of less than 2 is a distinctive characteristic of a heterogeneous network structure.
4. As all criteria were measured on the same scale, no standardization was required.
5. Before conducting our analysis, an extreme outlier was detected and dropped from the analysis. One user displayed an in-degree of 1,079, indicating an extraordinary attention level generated by his designs, which resulted in a single-user cluster.

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