

The Success of Question Answering Communities: How Diversity Influences Ad Hoc Groups

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1. MOTIVATION

Question and answer (Q&A) web sites have become increasingly popular in recent years. These communities are social media platforms that enable users around the world to easily share their knowledge with each other. Q&A sites are based in part on the wisdom of crowds [Surowiecki 2005], i.e., everyone involved in the community can contribute something, and through collaborative production they create a comprehensive knowledge repository [Fichman 2011]. Harper et al. [Harper et al. 2008] describe how these sites presented high-quality answers compared with the professionally-staffed library reference services. Understanding the dynamics in the Q&A websites can play an important role in developing better Q&A platforms for general use, and for use within organizations. Moreover, since the groups of individuals who participate in these forums are brought together on an ad hoc basis, they also provide insight into how ad hoc teams perform in general, and can provide insights into the role of different factors in the performance of these teams.

The purpose of this study is to explore the performance of a popular network of multiple Q&A communities and understand if the success of these communities can be related to the diversity of the community members.

1.1 Previous work

Past work has shown that diversity can affect group performance. There is evidence for performance-increasing effects of diversity because it can improve creativity and innovation through the group members' greater variety of perspectives [Roberge and van Dick 2010]. More precisely, some theoretical approaches propose that heterogeneous groups are more likely to possess a broader range of task-relevant knowledge, skills, abilities and viewpoints that are distinct and non-redundant compared to those of individuals in homogeneous groups [De Dreu and West 2001]. For instance, Hong and Page [Hong and Page 2004] show that complex problems can often be better addressed by a diverse team of competent individuals than by a team composed of the best individual problem-solvers, due to the diverse perspectives that improve the collective understanding and collective problem solving. The research of Page [Page 2008] summarized in detail the evidence that diversity (especially intellectual diversity) produces much better, faster problem-solving.

2. STACK EXCHANGE

In this work, we will use the Q&A site Stack Exchange as the focus of our study. Stack Exchange¹ (SE) is a network of more than 130 question answering communities that are created and run by experts and enthusiasts on a variety of topics. Users post questions and each question can receive zero, one, or multiple answers from multiple users. The asker can mark one answer as accepted answer, but

¹<http://stackexchange.com>

accepting an answer does not mean it is the best answer, it just means that it worked for the person who asked. Users can vote up or down the answers, whether they are accepted or not, based on their perception of the quality of the answer.

2.1 Data used

The data used in our studies consist of all user-contributed SE content since 2009 until September 14th 2014². We have randomly chosen 50 boards from SE to analyze, considering both technical and non-technical topics. Ultimately, the dataset used contains more than 5 million users. The board with the highest number of subscribed users is: StackOverflow, with more than 3,400,000 of users. The other boards have on average approximately 37,000 subscribed users. Across all boards, there is an average of 55% *inactive users*, i.e., users who signed up but never posted any question, answer or comment. We considered almost 26 million posts between questions and answers in this study. The ratio of answers to questions was on average 2.02 with a standard deviation of 0.64. The mean percentage of unanswered questions was 7% with a standard deviation of 7%.

3. SUCCESS AND DIVERSITY MEASURES

As explained in the previous Section, accepting an answer does not indicate that answer is perfect, it just means that it worked for the person who asked. In this dataset, 70% of the accepted answers were also the first answer posted. Inside the communities, the votes of the users raise the answers as the best answers for the different questions even when they are not the accepted answers. The judgments of the users inside a community can be considered reliable with a pretty high level of confidence [Bougoussa et al. 2008]. For these reasons, in our study, we relied on the crowd judgment of the best answers as the answer with the highest score for each question. So, considering all the answered question q , and $Score_{a,q}$ as the score of the answer a posted to answer the question q , the average of the $Max(Score_{a,q})$ is this value used to measure the success of a board. In future work, we will explore other definitions of success within these boards.

Diversity can also have different definitions according to the context. First of all, diversity needs a multitude of entities, where the diversity can be a variation on same of their attributes [Page 2010]. Among a group of users who interact inside an online community, there are many attributes which can vary. In this study, we chose to measure diversity as the variance of the users' tenure inside the community. We calculated this tenure as the difference between the date of the last access and the subscription date of the user. Thus, our diversity measure is the variation of the tenure of the active users (the users who provide at least one answer, question or comment). We will use those two measures to explore: (1) can the interaction between novice and experts (intended as users with more experience inside the community) be correlated with the success of a Q&A board? (2) is this relationship valid across different topics?

4. SELECTED RESULTS

We used the Pearson coefficient to explore if Q&A communities with high variance in terms of tenure of their users provide on average answers with highest score, i.e., is diversity related to success? Considering the 50 boards analyzed as a single group, the Pearson coefficient was 0.01. It means that the answer of our first question is "No": there is no correlation between users' tenure and board success. At this point we considered separately the boards according to the topic addressed. In particular, we divided the boards according to whether the board addresses (a) non-technical topics (e.g., Cooking, English Language Learners, and Anime & Manga), or (b) technical topics (e.g., Programming, Server

²<https://archive.org/details/stackexchange>

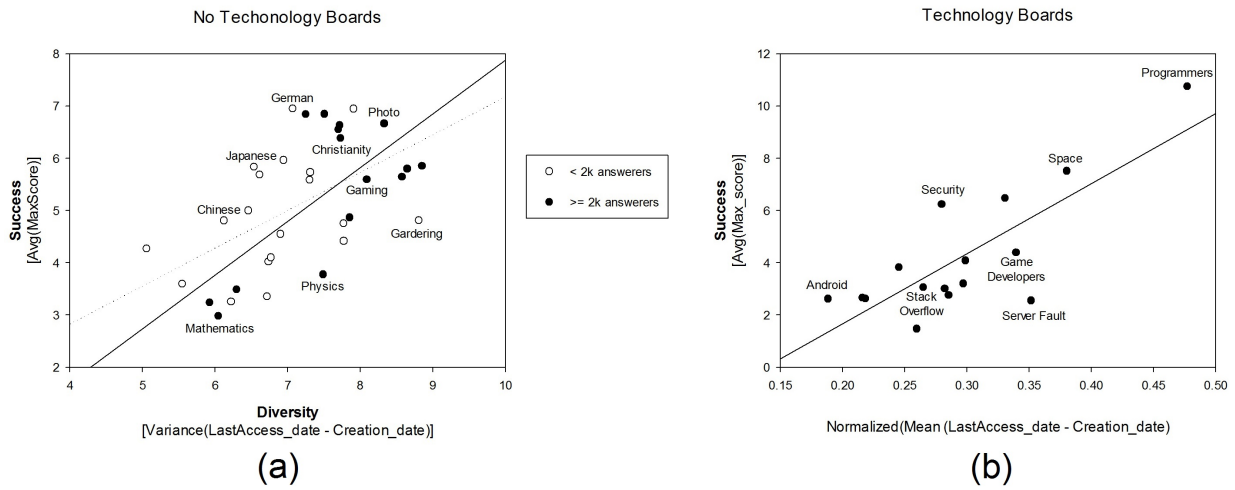


Fig. 1. Success and diversity in non-technical and technical boards

Faults, and more specifics Android and Ubuntu). When considering only the non-technical boards, the Pearson coefficient was equal to 0.55, and when considering the boards with more than two thousands answerers (the more active boards) the Pearson coefficient increased to 0.67. Figure 1 (a) shows this correlation. The coefficient of correlation for the technical boards reveals a negative correlation between success and diversity. In fact, the Pearson coefficient was equal to -0.50. That means that within technical boards, the greater the diversity of the users' tenure, the lower the success. Considering this, we calculated the normalized mean tenure of the users in the technical boards. That is the mean of the difference between the last access date and creation date, normalized considering the creation date of the board. Figure 1 (b) shows the relatively high correlation between the success and the normalized mean tenure of the users active in the technical communities, indicating that the having experienced users is the most important factor in the success of technical boards.

5. DISCUSSION

The growing success of the Q&A communities depends principally on the will of the users to answer questions. In this study, we analyzed the users and the posts of 50 different active communities belonging to the Stack Exchange network. In particular, we focused on the correlation between success and diversity within these communities. We have measured the success as the mean of the highest score of the answers of each question posted, and the diversity as the variance of the tenure of the user inside the community. The results presented show how the effect of diversity on success within Q&A communities depends on the nature of the topic. This means that in general, non-technical topics, diversity in users' tenure increases the ability of the community to obtain better answers. On the other hand, in technical boards, expertise prevails over diversity, so it is more important to maintain an expert community to ensure success within these communities. This leads us to the hypothesis that within non-technical ad-hoc groups, a mix of old and new individuals can improve the success of the group, while within technical topics, a high level of expertise will result in the best success of the group.

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