

Participation Differences in Q&A Sites Across Countries: Opportunities for Cultural Adaptation

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ABSTRACT

While the success of online Question & Answer (Q&A) sites relies on user contributions, previous work has shown that the number of contributions varies between countries. What remains unknown is whether this is due to a few people contributing a lot, or whether highly represented countries have a higher percentage of users who are willing to contribute. In this paper, we investigate this question with the goal of identifying opportunities to equalize contributions between countries. Analyzing the data from StackOverflow and Superuser, two popular Q&A sites, we find that the percentage of contributing users significantly varies between 116 countries, and that these differences can be partly explained by a country's national culture and overall English proficiency. We discuss how specific design decisions on these sites, such as the competitive reward mechanism used to encourage contributions, could be changed to encourage currently passive people to contribute.

Author Keywords

Culture; Question & Answer Sites; Online Communities

ACM Classification Keywords

H.5.3 [Group and organizational interface]: Computer-supported cooperative work; Web-based interaction

INTRODUCTION

Question & Answer (Q&A) sites are expertise sharing communities in which groups interact to create a large body of questions and answers [2]. These online communities have in common that they rely on voluntary contributions: participants must be willing to post questions, and others must be willing to provide answers. An essential premise for well-functioning Question & Answer (Q&A) sites is therefore that users feel motivated and empowered to contribute content.

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The goal of this paper is to find out whether there are variations in the percentage of passive users between countries and to search for design opportunities to motivate contributions from around the world. We compare the participation data of users from 116 countries on StackOverflow and Superuser to analyze whether there are variations between countries in the percentage of users who contribute. Our results show that the percentage of users who contribute content indeed varies between countries: Depending on the country, between 29% and 55% of users on Superuser contribute either questions, answers, or are editing content, and between 50% and 83% do so on StackOverflow. This suggests that in some countries, a much larger fraction of the user population is passive than in others. For example, while the majority of users from China and Indonesia passively consumes content, a majority of users from United Kingdom, the Netherlands, or Germany contributes content.

To search for possible explanations for these differences, we built several regression models using measures of national culture, Internet usage, Gross National Income (GNI) per capita, and English proficiency as independent variables and several participation metrics (e.g., asking questions, providing answers) as the dependent variables. We found that English proficiency and national culture explain most of the variation between the percentage of contributors between countries: People who live in countries with an overall high English proficiency (but don't necessarily have English as their main language) and those from countries with individualist cultures (as opposed to collectivistic, more group-oriented cultures) are more likely to contribute than others.

Our work expands related work in the following ways:

- While previous work has shown that the number of contributions on StackOverflow varies between countries [32], we show that the percentage of users who contribute content also differs between countries. This provides a more in-depth understanding of contribution disparities. Our analyses indicate that there are more passive users in countries such as China and Brazil than in the United States and Germany, whose users are more likely to participate in answering and revising other users' posts.
- We show that the pattern found on StackOverflow holds in the Q&A community Superuser, suggesting that differ-

ences in contribution behaviors between countries are not restricted to a specific user group.

- Our results suggest that national culture (and in particular the extent to which people in a country are thought to be individualist versus collectivist) as well as a country’s English proficiency can significantly explain the variations between the percentage of users who contribute in different countries.
- We use our results to inform several design claims, suggesting how Q&A sites could be designed to encourage contributions from currently underrepresented countries.

RELATED WORK

Given the complexity of peer-production processes and the diversity of people who are involved in online Q&A sites, it is no surprise that users’ participation in these sites differs. For example, users have different motivations to contribute [27, 8], spend varying amounts of time contributing [27, 22], have diverse expertise [28], and have different preferences on what they would like to work on [3, 27]. Along similar lines, Furtado and colleagues [9] have shown that the sum of the contributions of non-power users can be as high (or higher) than their counter-part in Q&A sites.

In addition to these differences, people also come from various countries and different cultural backgrounds. Analyzing the StackOverflow community, Schenk et al. [32] found that most contributions were made by people from North America and Europe. Their results also show that the content created in countries from these continents accumulated six times more up-votes than the content contributed by the rest of the world.

Kayes et al. [18] have linked such differences in contribution behaviors to national culture. Their findings suggests that individualist countries such as the US and other Western nations, in which people are thought to define themselves as an individual and attribute success to themselves, tend to provide more answers than more collectivist, group-oriented countries such as China. Their findings confirm previous work that has shown that participation in online environments varies between countries, and that national culture can help to understand such differences [31, 12, 30].

DIFFERENCES IN CONTRIBUTION BEHAVIOR BETWEEN COUNTRIES

To evaluate potential differences between the percentage of users who contribute to Q&A communities, we leverage activity log data from two Q&A communities, StackOverflow and Superuser. Both are English-only sites, and at the moment of writing, they are the two largest communities in terms of traffic on the StackExchange platform¹ with hundreds of thousands of both registered users and visitors per day. The main functionality made available by these sites include asking and answering questions. Additionally, in order to increase content quality, users can vote up, vote down, comment, edit and flag posted content. Users can also access information about each other through links to their profiles.

¹<http://stackexchange.com/sites>

	StackOverflow	Superuser
Age	5.5y	5.7y
Users (10 ³)	3080	312
Countries	223	177
Localized Users	16%	34%
Questions posted	18%	41%
Answers	68%	59%
Comments	60%	60%
Editions	66%	69%

Table 1. Descriptive statistics for StackOverflow and Superuser. Percentages are based on users that identified their location.

The data used in this research covers the period between July 2008 to April 2014 for StackOverflow, and July 2009 to February 2015 for Superuser².

Users’ nationality was determined based on an optional field in their profile named *location*. For verification purposes, the information in non-empty fields was mapped to a country via a geocoding service.³ The same procedure was used in [32], and although our study uses a different geocoding service, we found comparable proportions of localized users and their contribution to StackOverflow. Some descriptive statistics on the two Q&A communities are presented in Table 1.

We excluded countries with less than 80 users for which the estimate of the percentage of contributors showed large confidence intervals. The final StackOverflow dataset contains 116 countries, and the Superuser dataset has a subset of 70 of these countries.

Distribution of the Number of User Contributions

To analyze whether users contribute equally or whether there is a small number of users that contribute most, we calculated the Gini coefficient, which measures statistical dispersion and serves as a measure of inequality. A Gini coefficient of 0 shows that all values are the same (i.e., perfect equality), while a Gini coefficient of 1 suggests that the data is extremely unequal.

Our results show a Gini coefficient of .91 for StackOverflow and .93 for Superuser, suggesting that the number of contributions per user varies widely on both sites. Moreover, we found considerable variation in the distributions of the number of contributions in each country, with Gini coefficients ranging between .75 and .98.

While our results confirm previous work in that most contributions come from a small number of contributors, we are interested in finding out whether the percentage of passive users (i.e., those who have never contributed content) varies between countries. This is important because it might surface patterns that can inform the design for more inclusive Q&A sites. In the following, we will therefore focus on the percentage of contributors independent of the number of contributions these users have made.

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

³<https://developers.google.com/maps/documentation/geocoding/>

Does the percentage of contributors vary between countries?

To analyze how many percent of users contribute content, we first counted any user that has posed questions, answered questions, or commented or edited others' content. We then calculated the percentage of all users within a particular country who have contributed at least once. We found strong differences between countries: On Superuser, the percentage of contributors varies between 29% and 55%. On StackOverflow, the variation is even larger with 50% to 83% of contributors. While these percentages are fairly large, note that this includes only users who provided their location information—which we previously showed are users who produce the majority of the content (see Table 1). Figure 1 shows an overview of how the percentage of contributors varies between countries. In the following, we discuss this result with a conservative analysis, based on the lowest estimated values in the 95% confidence interval.

The first aspect that stands out is that—independently of their country—users are less likely to contribute to the Superuser site than to StackOverflow (median 44% in Superuser and 63% in StackOverflow). This suggests that the two communities function differently, and thus provide different contexts to test for differences between countries. Despite this difference, we find a common trend on both sites: (i) Western countries, such as the UK, Germany, or the Netherlands, tend to have higher percentages of contributing users, and (ii) Eastern and African countries tend to be among those with the lowest percentages, meaning they have a higher proportion of passive users.

This result complements the findings of Schenk et al. [32], who found that the number of votes received by posts from Western countries is much higher than the ones from other parts of the world – which is a way to compare the contribution of participants from different regions in the world. Our data adds to their results with a more nuanced picture, considering other types of contributions, and showing that several European countries have a higher percentage of contributors than the US and Canada. In addition, our findings show that South American countries also tend to have a higher percentage of contributing users than Asian countries.

WHAT ARE POSSIBLE EXPLANATIONS FOR THE DIFFERENCES IN THE PERCENTAGE OF CONTRIBUTORS?

After noting a sizable variation in the percentage of contributors in different countries, we evaluate which national factors could explain these differences by comparing the results of different multiple regression models. Each model uses a subset of the following socioeconomic, language, and national culture metrics.

Socioeconomic and language metrics

Three socioeconomic and language metrics are considered in our *Baseline model*:

1. GNI per capita: As more economical resources are available to the population, we can expect more access to technology, and in turn, a higher engagement in Q&A sites

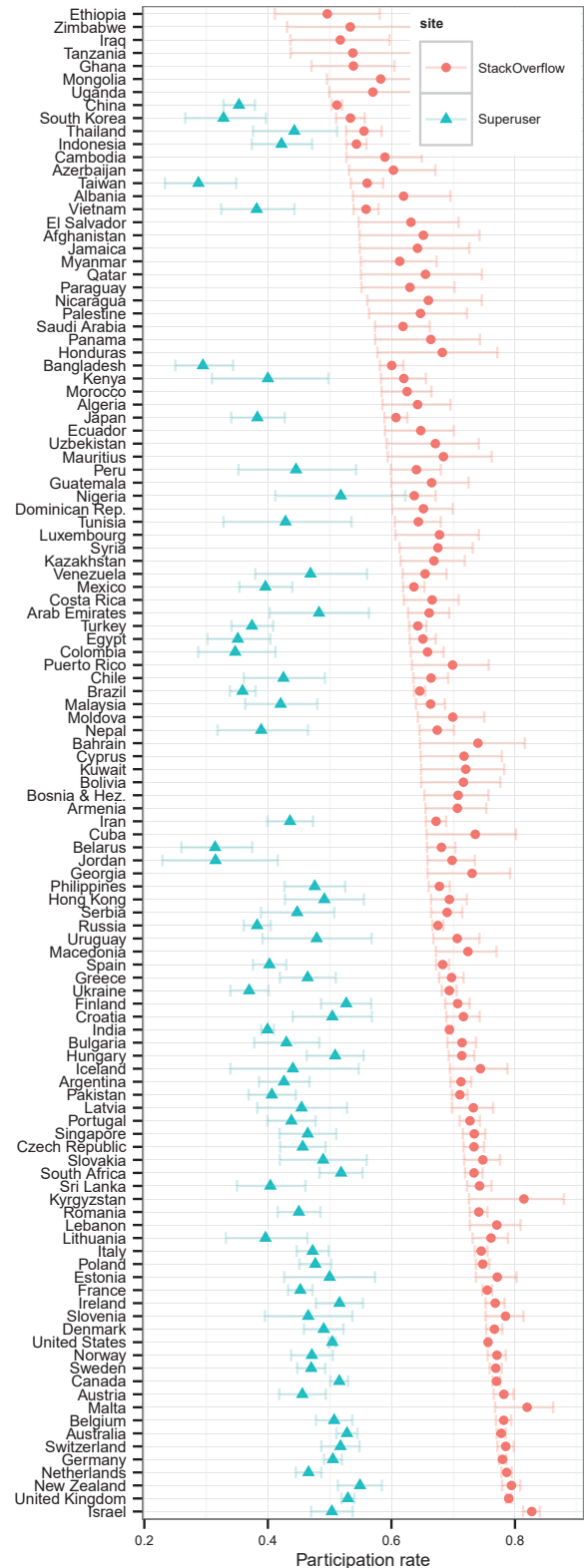


Figure 1. Percentage of contributors per country. Error bars represent confidence intervals of 95%. Data is ordered by the lowest estimated value of StackOverflow's rates.

which deal with questions around technology usage. The source for the data we use is the 2011 World Bank report [34];

2. Internet penetration: given that the participation in online environments requires access to Internet, the percentage of contributors should increase with a country's Internet penetration rate. This data also comes from the 2011 World Bank report [34];
3. English Proficiency Index (EPI): Because StackOverflow and Superuser are written in English, the percentage of contributors per country may be influenced by the population's ability to express themselves in that language. The English Proficiency Index is a measure of such capability published in the 2014 Education First's report [7]. The original EPI data provides a proficiency indicator for a number of non-native speaking countries. We supplement this data by adding information on eight nations that both (i) have English as an official language and (ii) have more than 90% of English-speaking population [33]: Australia, Canada, Ireland, Jamaica, Malta, New Zealand, UK and USA. The percentage of speakers was transformed to the EPI scale for these countries.

Cultural metrics:

Values and norms play an essential role in our interactions with each other and result in specific social procedures that are accepted in society. In fact, prior work suggests that social procedures are influenced by culture [17], *a shared set of basic assumptions and values that result in collective norms and attitudes* [6]. A cultural group sharing such set of basic assumptions and values can comprise societies within a country (e.g., people speaking the same language), or subgroups of people between different countries. In other words, it is generally agreed that not all people living in the same country share the same culture [26], but that people living in the same country often adhere to a national culture to some degree [6].

If social procedures are influenced by culture, one could assume that culture can partly explain differences in online contribution behavior between countries.

To evaluate this assumption, we additionally included two cultural dimensions in our models. We focus on these two dimensions because they both describe a concept that we assume is related to contribution behavior: An individual's willingness to interact with a larger community.

1. Individualism vs. Collectivism (developed by Hofstede [14]): Hofstede's individualism concept is one of five dimensions that resulted from a quantitative study at IBM in 74 countries, and assigns a score to each country. Predominantly individualist societies – such as the US and Western Europe – emphasize the individual, meaning that people are more likely to see themselves as independent of others. In contrast, people in collectivist societies, such as China and large parts of Africa and Latin America, define themselves as part of a group. His work also indicate that people from collectivist countries generally search for

tighter in-group collaboration, high-contextualized communication and even others' approval before contributing to group work [14].

2. Survival vs. Self-expression (developed by Inglehart [16]): Inglehart developed a similar (and highly correlated) dimension, *Survival vs. Self-expression*, which describes the extent to which people give priority to survival needs over subjective well-being. Inglehart has linked this concept to how people tend to make autonomous decisions [15]. While Hofstede's Individualism dimension has been previously shown to relate to participation behavior [18, 31, 30, 12], we additionally use Inglehart's dimension because it is based on a more representative sample than Hofstede's and it is frequently updated to reflect changes in national cultures over time.

To evaluate the suitability of these dimensions to explain differences in the percentage of contributors, our analyses use two models: *Model 1* uses the *Individualism vs Collectivism* dimension [14] and *Model 2* the *Survival vs Self-expression* dimension [16]. Both models are built by adding the cultural dimension to the previously presented Baseline model. This procedure allows us to control for other national characteristics, such as socio-economic and language factors, as suggested by Gallagher and Savage [10].

Analysis

As active participation in Q&A communities can happen in different ways, we subdivided our analysis into four distinct contribution types: asking questions, providing answers, and commenting on and editing other users' posts.

To enable comparisons between the models, we consider only the countries for which data for all explanatory variables is available ($n = 51$ for StackOverflow and $n = 45$ for Superuser). Since the models employ at most four independent variables at a time, a Linear Regression Power Analysis [5] shows that these samples are sufficient to find large effects ($f^2 = .35$) with a relatively high power of $\beta = .85$ and $p < .05$. In practice, this means that our models might fail to detect 'smaller effects' (i.e. relations between variables in models with lower R^2).

Overall Results

Table 2 presents the results from three linear regression models. An analysis of this data shows that the baseline model explains a large portion of the variation between countries – i.e. $R^2 \in [.49; .69]$ in StackOverflow and $R^2 \in [.32; .58]$ in Superuser. Moreover, English proficiency is the strongest predictor in most models. The Individualism index (Model 1) improves the explanatory power of the Baseline model in the majority of the cases, and more consistently in the StackOverflow data. We found the opposite regarding the Self-expression index (Model 2), which slightly improved the baseline model in only one case.

Posing questions

Our analysis shows that a country's English proficiency is the only predictive variable that is significantly correlated with the proportion of users from a country that ask questions in all

three models for both StackOverflow and Superuser. When applying model 1 to the StackOverflow data, we found that Individualism shares part of the explanatory power, but an F-test shows that the improvement over the baseline model is only marginally significant ($F = 3.04$, $p = .09$). Note that this result might not be representative of realistic question-asking behavior given that the participants included in our analysis produced less than half of the questions in StackOverflow and Superuser (see Table 1).

However, we did find that the percentage of people asking questions varies between countries. For instance, our data shows that the six countries in StackOverflow that have the lowest percentage of people who ask questions are all Asian countries. Five of them are also among the fifteen countries with the lowest percentage of people who ask questions on Superuser: China, South Korea, Thailand, Vietnam and Japan.

Providing answers

Our data shows a consistent pattern in both Q&A sites, where the Individualism index in Model 1 significantly improves the Baseline model. Moreover, this factor is the most powerful in explaining the percentage of people answering questions on both sites.

Figure 2 shows that predominantly individualist countries, such as the United States, Australia, or the United Kingdom, as well as those countries with high English proficiency (e.g., the Netherlands) have higher percentages of users who provide answers. In fact, the 25 countries whose users are most likely to provide answers are almost exclusively European and Anglo-Saxon countries.

The visualization reveals a similar pattern for StackOverflow and Superuser. Users from South Korea, Indonesia, and China for example – countries that rank low on the individualism dimension – are among the ones with the lowest proportion of users who provided answers on StackOverflow (all in the 30 – 35% range). In contrast, this proportion is twice as high in Western countries such as Australia and the United States in the case of StackOverflow (around 60%).

Commenting on posts

Our models significantly explain the variations in the percentage of users who comment on posts between countries ($R^2=0.7$ for StackOverflow, $R^2=0.6$ for Superuser). English proficiency is again the most powerful explanatory variable, while Individualism helps to significantly improve the Baseline model in both cases.

When ranking the countries by the percentages of users providing comments, we see the same pattern as before: Most countries with low percentages of users who provide comments are in Asia, Africa, and Latin America. It is interesting to note that the five major emerging economies, Brazil, Russia, India, China, and South Africa, are all in the mid-to-low part of the ranking.

Editing content

For StackOverflow, English proficiency, Internet penetration, and Individualism significantly explain the variations in the

percentage of users who edit other's contributions. For Superuser, neither of those factors significantly explain the variation, and only the GNI per capita contributed to the model fit. Internet penetration and GNI per capita are sometimes seen as directly related to access to technology. Seeing that editing content is a less visible activity than posing and answering questions, we could expect that only more "tech-savvy" countries will engage in this task, such as countries with a higher GNI per capita and widespread Internet access.

Our results also show a strong difference between the model fit for the StackOverflow and the Superuser data ($R^2 = 0.7$ and $R^2 = 0.3$, respectively). The low R^2 of the Superuser models might be due to the small difference in the percentage of editors between countries (a variation of only 6% in the country with proportionally more editors to .7% in the country with the smaller proportion). We believe that the effects in this data might be too small to be studied by the used regression models and sample size.

On the other hand, in the StackOverflow models for editing others' content, Individualism replaces English proficiency as the most significant explanatory variable. The produced Model 1 for this case is also the most accurate among all studied models, explaining 74% of the variation between countries.

DISCUSSION

When discussing contributions in online sites, researchers have mostly assumed uniform behaviors across an increasingly global participant population (a broad compilation of such discussions can be found in [20]). However, several cross-cultural studies present a compelling argument that this assumption does not hold for many online environments and studied behaviors [10, 12, 31]. Our findings showed that this is also the case for answering, commenting and editing on StackOverflow and Superuser: The percentage of users who contribute strongly differs between countries. This suggests that users from some countries might feel less empowered or willing to contribute, and are more likely to passively read the content.

Our results, for example, show that the proportion of users from a country who answered questions in StackOverflow can be as high as 60% in Germany and as low as 32% in Indonesia. We also found large differences in the percentage of users who comment and edit others' posts (e.g., 33% of commenters in UK versus 16% in China for Superuser), which is similar to the findings of previous studies [18, 32].

These variations cannot solely be explained by a country's economic viability. Instead, our results show that these variations can be best explained with the help of a country's English proficiency and national culture, or more specifically, by the Individualism dimension.

The language barrier detected by our analysis is an already recognized problem given the recurrent effort to translate and localize web sites. The StackOverflow community recently decided to start new sites in languages such as Portuguese, Russian, Spanish and Japanese. This decision will certainly facilitate the engagement of participants with a lower English

Percentage of users who ask questions						
	StackOverflow			Super User		
	Baseline	Model 1	Model 2	Baseline	Model 1	Model 2
Intercept	-.00 (.10)	.00 (.10)	.00 (.10)	-.00 (.12)	-.00 (.12)	-.00 (.12)
GNI	.00 (.15)	-.07 (.15)	-.11 (.18)	-.19 (.18)	-.25 (.18)	-.05 (.22)
Internet	.17 (.16)	.13 (.16)	.21 (.16)	.02 (.18)	-.04 (.18)	-.02 (.18)
English	.59 (.14)***	.43 (.17)*	.55 (.15)***	.73 (.16)***	.56 (.19)**	.78 (.17)***
Individualism		.30 (.17)•			.32 (.20)	
Self-expression			.16 (.15)			-.19 (.18)
Adj. R ²	.49	.51	.49	.37	.39	.37
F statistic	16.99***	3.04•	1.08	9.68***	2.50	1.07

Percentage of users who provide answers						
	StackOverflow			Super User		
	Baseline	Model 1	Model 2	Baseline	Model 1	Model 2
Intercept	.00 (.09)	.00 (.09)	.00 (.09)	-.00 (.11)	-.00 (.10)	.00 (.11)
GNI	.14 (.14)	.05 (.14)	-.03 (.17)	.23 (.17)	.15 (.16)	.20 (.20)
Internet	.24 (.15)	.19 (.15)	.29 (.15)•	.05 (.16)	-.02 (.16)	.06 (.17)
English	.46 (.14)**	.27 (.15)•	.39 (.14)**	.51 (.15)**	.29 (.17)•	.50 (.15)**
Individualism		.37 (.16)*			.41 (.18)*	
Self-expression			.25 (.14)•			.04 (.17)
Adj. R ²	.54	.58	.56	.48	.53	.46
F statistic	20.84***	5.22*	3.05•	14.38***	5.25*	0.67

Percentage of users who comment on others' posts						
	StackOverflow			Super User		
	Baseline	Model 1	Model 2	Baseline	Model 1	Model 2
Intercept	-.00 (.08)	-.00 (.07)	-.00 (.08)	-.00 (.10)	-.00 (.09)	-.00 (.10)
GNI	.11 (.12)	.03 (.12)	.07 (.14)	.08 (.15)	.01 (.15)	.09 (.18)
Internet	.30 (.13)*	.25 (.12)*	.31 (.13)*	.12 (.15)	.06 (.14)	.11 (.15)
English	.52 (.11)***	.36 (.13)**	.51 (.12)***	.65 (.13)***	.47 (.15)**	.65 (.14)***
Individualism		.32 (.13)*			.33 (.16)•	
Self-expression			.06 (.12)			-.02 (.153)
Adj. R ²	.69	.72	.69	.58	.61	.57
F statistic	38.16***	6.11*	0.26	21.09***	4.1•	0.01

Percentage of users who edit others' content						
	StackOverflow			Super User		
	Baseline	Model 1	Model 2	Baseline	Model 1	Model 2
Intercept	.00 (.08)	.00 (.07)	.00 (.08)	.00 (.12)	.00 (.12)	.00 (.12)
GNI	.19 (.12)	.07 (.11)	.12 (.15)	.44 (.19)*	.40 (.20)*	.46 (.23)•
Internet	.28 (.13)*	.20 (.12)•	.30 (.13)*	-.12 (.19)	-.15 (.19)	-.13 (.19)
English	.45 (.12)***	.19 (.12)	.42 (.12)**	.33 (.17)•	.24 (.20)	.33 (.18)•
Individualism		.51 (.13)***			.16 (.21)	
Self-expression			.10 (.12)			-.04 (.19)
Adjusted R ²	.66	.74	.66	.32	.31	.30
F statistic	33.01***	16.25***	0.68	7.75***	0.53	0.04

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, • $p < 0.1$

Table 2. The results of our regression models. Each model reports on the standardized regression coefficients, its standard error in brackets, and the p-value of its t-statistic. The F-statistic shows the one-way ANOVA test result for each Baseline model. For Model 1 and Model 2, the F-statistic tests whether the models significantly improve upon the previous model.

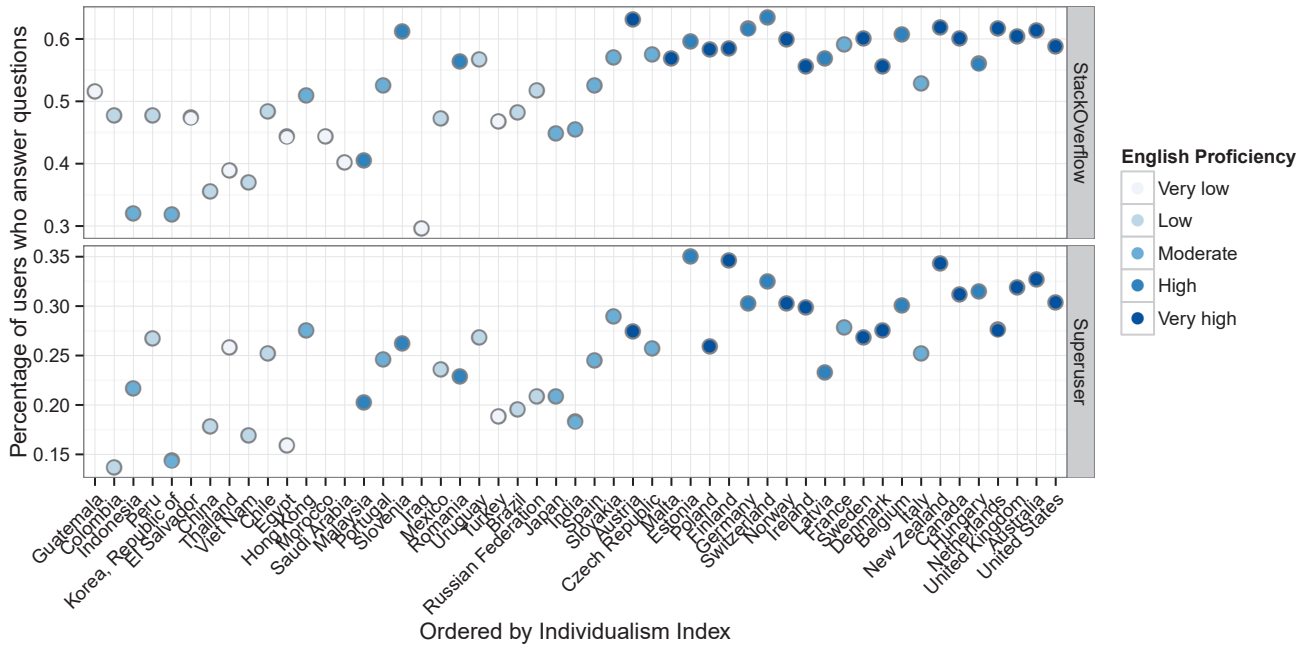


Figure 2. Percentage of users who answered questions on StackOverflow (top) and on Superuser (bottom).

proficiency. However, there are also ways to lower the barriers for multilingual collaboration: Gao and colleagues [11], for example, present results on how creating awareness of translation usage by non-native English speakers can help to solve interpretation problems.

As our results showed, a country’s English proficiency does not seem to be the only factor that stands in the way of contributions. Another strong predictor is national culture.

Our findings show that users from predominantly individualist countries (such as many European and Anglo-Saxon countries) are more likely to contribute to the content on StackOverflow and Superuser than users from collectivist countries (such as many Latin American or Asian countries). This is contrary to a possible assumption that a national culture that is geared towards communal life would lead to more contributions. One reason might be that Internet users from collectivist countries are more likely to use their online social networks instead of Q&A sites to pose questions, as suggested by Yang et al. [35].

Given these results, we believe that there are possibilities to adapt the design of online Q&A sites in order to encourage more engagement from currently passive people. We will discuss possible implications for design (i.e., design claims) in the next section.

DESIGN IMPLICATIONS

Our data indicates that users from individualist countries are more likely to contribute content. For instance, the 25 countries with higher percentages of users who have contributed by providing answers are almost exclusively European and Anglo-Saxon countries. One possible reason for this is that

people in individualist cultures are usually thought to have a larger desire to be unique when compared to their collectivist counterparts [1]. They are also expected to have strong opinions [14], and have been found to be more confident in their own decisions [23].

In contrast, the 25 countries whose users are least likely to provide answers are all situated in East Asia, Africa, the Middle East, or Latin America. Previous studies have shown that people in these societies reported having a higher preference for collective decision-making and less confidence in their own decision-making ability [23]. This could result in people being more reluctant to contribute answers, and “impose” their knowledge on others in these fairly large online communities.

Our finding is similar to the results from Kayes et al. [18] who analyzed data from Yahoo! Answers. They found that participants from individualist countries on average provide more answers. One contrasting result is presented by Pfeil and colleagues [29], who investigated the relationship between Individualism and the number of information additions to Wikipedia pages. Their analysis revealed a negative correlation between the two factors, which they interpreted as a result of the collaborative setting in Wikipedia. One explanation for these diverging results could be that Wikipedia and online Q&A sites vary in their motivation/reward mechanism: while Wikipedia encourages users to collaboratively edit content, StackOverflow and Superuser are set up to have different answers to questions competing with each other. Hence, the reward for contributions on Wikipedia is less visible and only in the longer term expressed by a rising status in the community. In contrast, StackOverflow and Superuser reward individual contributions with competition-focused score and

badge systems. This, in combination with the potential loss in one's reputation score, could be discouraging to people from collectivist countries.

Design Claim 1:

Rewarding individual contributions through competitive mechanisms, such as upvoting answers on Q&A sites, encourages more contributions from individualists than from collectivists.

Collectivist societies are described as being organized in tighter in-groups [14], where a stronger need for a shared context and even social bonds is a requirement for collaboration [4, 21]. This rationale goes in line with Yang and colleagues [35], who found that Internet users from highly collectivist countries, such as China and India, place more importance on their social ties and social capital when answering questions in online networks than users from the US and the UK.

Consequently, we believe that there is an opportunity for Q&A sites to further encourage answer contributions in collectivist countries by facilitating users' perception of in-group contributions. For example, Q&A sites in general categorize their content into topics, which can also be used as a group metaphor: Who are the participants? What is the group's contribution history? How well is this group doing in relation to the site overall? Encouraging contributions by highlighting in-group clues has been suggested in the context of the design of Web user interfaces to motivate participation [24], and when proposing a "Team Performance" design strategy to motivate collectivist gamers [19]. Some support for this can also be found in previous design claims which emphasize that controlling the size of (sub-)communities is an important factor to improve users' sense of being part of something and that their contribution is valuable [20]⁴.

Design Claim 2:

Providing mechanisms for being aware of social ties and in-group participation can improve the engagement of users from collectivist cultures.

Content revision

In this study we found that the proportion of contributors by post commenting and editing is higher in individualist than in collectivist countries – in the case of edits, this is only true for StackOverflow. One explanation for the correlation with Individualism could be that content revisions might be interpreted differently depending on cultural norms. Collectivists might be more reluctant to openly comment on or edit others' content because these actions could be seen as a critique to others. This interpretation is supported by the general belief that preserving harmony is seen as more important in collectivist than in individualist countries [1]. Similarly, Hofstede stated that for collectivist groups, "relationship prevails over task"⁵. In line with this, Hara et al. [13] found that Wikipedia editors from more individualist countries produce a higher number of conflicts on Wikipedia's talk pages than those from collectivist countries.

⁴See Design-claim 33 in Chapter 2

⁵See Table 4.4 at [14]

Design Claim 3:

Revising or questioning others' content — e.g. by directly editing or commenting — is seen as more appropriate by users from individualist countries than by those from collectivist countries.

This observation suggests that offering more pronounced guidance to participants with collectivist backgrounds might help increase the number of comments. For example, the Q&A sites may present revising content as an expected task, and ask for it in specific situations, such as while a user is searching for and reading content. Phrasing a contribution's guidance as being uniquely important to one's group can also support this goal, as stated in [20] (see Design-claim 34 in Chapter 2). It is also likely that different messages will have different results for individuals with different cultural backgrounds. Finally, seeing that collectivists tend to be more comfortable in the presence of other in-group members, one could create a mentoring program where more experienced participants could be engaged in monitoring site access and provide direct support for new users with collectivist backgrounds (a similar idea was presented in [19]).

Design Claim 4:

Providing more pronounced guidance, focused on presenting content revision as part of an in-group necessity, will better motivate users from collectivist cultures to edit and comment on others' posts.

In summary, our results suggest that StackOverflow and Superuser are less successful in encouraging contributions from collectivist users than from individualists. Comparing this finding to results from the analyses of other online environments suggests that smaller communities and less competitive reward mechanisms might be more suitable design decisions for collectivist users.

More generally, this work demonstrates the need for designing for a diverse audience. This effort requires research in HCI and related fields, to further investigate where and when "Western" behaviors and values cannot be generalized.

LIMITATIONS AND FUTURE WORK

Perhaps the most important limitation of this work is that we investigated two primarily technically-oriented Q&A sites. Any conclusions on behavioral variations between countries are therefore biased by the population studied: users of StackOverflow and Superuser are Internet users (and thus, most likely younger and more educated than average), English speaking, and are interested in learning about computers and programming. Hence, they represent a subculture within their country, and the behaviors that we observed might not be generalizable to a broader national culture. Future work should compare our results to analyses of other Q&A sites focused on varying topics.

Future work should also investigate the reasons for these behavioral differences between countries with the help of other methodological approaches, such as interviews and unpacking studies [25]. In addition, it is necessary to follow up our

findings with design experiments that test our claims, and to investigate whether alternative design decisions might indeed increase the likelihood of contributions from participants with collectivist backgrounds.

CONCLUSION

This paper provided empirical evidence that the proportion of users registered on Q&A sites who engage in activities such as answering questions and revising posts varies between countries. Using the data from StackOverflow and Superuser, we showed that these differences in the percentage of users who contribute can be partially explained by national culture: Users from individualist countries, such as Germany, Switzerland, or Israel, are more likely to contribute answers, comments, and edit content, than users from collectivist countries such as China, Brazil and India. These results suggest that StackOverflow and Superuser are less successful in encouraging contributions from collectivist users than from individualist ones. Comparing this result and the design of StackOverflow and Superuser with other systems' design and studies, we proposed several design claims that suggest how future online Q&A sites could be designed to encourage more contributions. Both in this specific case and more generally, we hope that these behavioral differences are taken into account when designing collaborative platforms for global audiences.

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