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Redesigning Question & Answer Sites to Promote Culturally Diverse Adoption: What are participants' needs to exchange in StackExchange?

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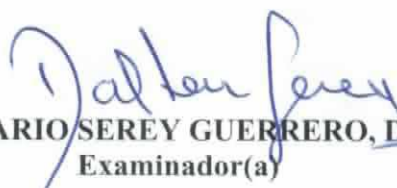
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"REDESIGNING QUESTION & ANSWER SITES TO PROMOTE CULTURALLY DIVERSE ADOPTION: WHAT ARE PARTICIPANTS' NEEDS TO EXCHANGE IN STACKEXCHANGE?"

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Resumo

Os sites de Perguntas e Respostas (Q&A) têm o objetivo de solucionar os problemas de seus participantes fornecendo ferramentas para que eles criem colaborativamente respostas para perguntas feitas, construindo assim um repositório de conhecimento pesquisável. Mais do que um repositório de informações, esses ambientes são comunidades de pessoas que interagem em torno do conhecimento criado. No entanto, como os colaboradores estão espalhados por todo o mundo, estes tendem a não compartilhar o mesmo contexto socioeconômico e cultural. Essas diferenças podem criar barreiras ou oportunidades de colaboração, e a falta de observação dessas diferenças pode resultar em comunidades menos diversificadas e produtivas. Esta pesquisa baseia-se na premissa de que ambientes online abertamente disponíveis podem ser projetados para apoiar igualmente o engajamento de comunidades culturalmente diversas e visa melhorar o conhecimento sobre como fazê-lo no caso de sites de Q&A.

Embora o sucesso dos ambientes de perguntas e respostas online dependa da participação dos usuários, a literatura mostra que o número de contribuições varia entre os países, além de estarem associados a valores culturais regionais. Nós seguimos estes resultados para examinar: (1) se tais diferenças se mantêm em dois sites populares não explorados previamente; (2) Se as diferenças na participação dos grupos nacionais também ocorrem porque alguns países têm uma porcentagem maior de usuários que estão dispostos a contribuir; e (3) Quais valores e perspectivas culturais sobre a colaboração podem orientar a concepção de sites de Q&A e outros ambientes interculturais de produção de conhecimento colaborativo mais inclusivos.

Para responder às nossas perguntas de pesquisa usamos uma abordagem de métodos mistos, começando por desenvolver uma exploração quantitativa da participação dos grupos nacionais e das explicações significativas para possíveis diferenças. Em seguida, mostramos como essas diferenças podem ser compreendidas através de um estudo qualitativo: uma comparação baseada nos valores humanos segundo a perspectiva dos projetistas do site e das preferências dos participantes de três países.

Nossa análise quantitativa confirmou resultados anteriores sobre a relação entre cultura nacional – mais especificamente o construto "Individualismo versus Coletivismo" – e diferenças em participação online. Nós encontramos, por exemplo, que os países com uma menor

porcentagem de participantes engajados em atividades de responder e comentar apresentam maior probabilidade de serem nações classificadas como coletivistas (geralmente aqueles fora da América do Norte e Europa Ocidental) ou de terem uma baixa proficiência em Inglês. Nós complementamos este resultado com uma análise de entrevistas a participantes de sites de pergunta e resposta provenientes de três países: China, Índia e Estados Unidos. Nossos resultados mostram que participantes Indianos e Chinese parecem buscar mais interação social que os Americanos – uma affordance que em geral não é suportada pelos sites estudados.

Esta pesquisa aborda os valores humanos inerentes às comunidades de Q&A online e as tensões existentes entre as diferentes partes interessadas que colaboram para criar artefatos de conhecimento de alta qualidade. Com base nisso discutimos como as decisões de design específicas desses sites, como o mecanismo de recompensa competitiva utilizado para incentivar as contribuições, poderiam ser alteradas para incentivar a contribuição de participantes atualmente passivos. Ao esclarecer as informações subjacentes à relação entre as teorias culturais e o engajamento online, esperamos contribuir para a criação de ambientes online com uma maior capacidade de mediar questões relacionadas a diferenças culturais.

Abstract

Question and Answer (Q&A) sites have the goal of solving participant's problems by providing tools for them to collaboratively create answers to posed questions and build a repository of searchable knowledge. More than a repository for information though, these environments are communities of people that interact around the created knowledge. However, because collaborators are spread around the world they tend not to share the same socioeconomic context nor the cultural background. Such differences can either create barriers or opportunities for collaboration, and a lack of observation of these differences might result in less diverse and productive communities. This research is grounded in the perspective that openly-available online environments can be designed to equally support the engagement of culturally diverse communities, and aims to improve the knowledge on how to do so in the case of Q&A sites.

While the success of online Question & Answer environments relies on user participation, previous work has shown that the number of contributions varies between countries and that they are also associated with regional cultural values. We follow this lead to examine: (1) If such differences hold for two not previously explored popular Q&A sites; (2) Whether differences in national groups participation also happen because certain countries have a higher percentage of users who are willing to contribute; and (3) What local cultural values and perspectives on collaboration can guide the design of more inclusive Q&A sites and other knowledge-based intercultural peer-production activities.

To answer our research questions we use a mixed-methods approach, starting by developing a quantitative exploration of national groups' participation and the significant explanations for its differences. We then show how these differences can be further understood through a qualitative study, a human values based comparison of the site designers' perspectives and the participants' preferences from three national groups.

Our quantitative analysis confirm previous results regarding the relation between national culture – more specifically the "Individualism versus Collectivism" construct – and differences in online participation. For instance, we find that the countries with a smaller percentage of participants who engage in answering or commenting to posts are more likely to be from countries that have been shown to be more collectivists (mostly the ones outside

North America and Western Europe) or have lower English proficiency indexes. We complement this result with an analysis of interviews with Question & Answer site users from three countries: China, India and United States. Our results show that Indian and Chinese participants seem to search for more social interactions than Americans – an affordance that is in general not supported by the studied sites.

This research surfaces the human values inherent to online Question & Answer communities and the existent tensions between different stakeholders collaborating to create high quality knowledge artifacts. Based on that 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. By clarifying the nuanced information underlying the relation between cultural theories and online engagement we hope to contribute to the design of more culturally-aware online environments.

Agradecimentos

Serei eternamente grato pelo suporte que recebi dos muitos amigos, familiares e instituições ao longo dos últimos cinco anos. Meus agradecimentos vão especialmente para:

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Chapter 1

Introduction

Question & Answer (Q&A) sites are knowledge sharing communities in which participants interact to create a large body of solutions to problems posted as questions to be answered by experts [Ackerman et al., 2013]. These peer-production communities have in common that they rely on voluntary contributions. Therefore, an essential premise for well-functioning collaborative efforts is that users feel motivated and empowered to contribute content – such as questions and answers in the specific case of Q&A sites.

Previous research show though that a large proportion of the participants in online environments do not actively participate in community activities [Nonnecke and Preece, 2000; Preece et al., 2004]. Moreover, differences in engagement were also demonstrated among members of different expertise levels [Bryant et al., 2005; Furtado et al., 2013], nationalities [Dong et al., 2012; Schenk and Lungu, 2013], and cultures [Quattrone et al., 2014; Kayes et al., 2015].

One specially interesting case of this problem occur when an online peer-production effort is successfully enough to cover struggles of specific participant groups. For example, while StackOverflow is regarded to be a very efficient site for solving problems of computer programmers [Mamykina et al., 2011], the literature also shows that participants from Western countries – such as the United States and Canada – dominate the production of content and, as a consequence, the reputation system [Schenk and Lungu, 2013]. Considering that different social groups will have their own preferences on how to collaborate [Li et al., 2014; Ardichvili et al., 2006; Yang et al., 2011b], such participation imbalances might create environments that are less accessible to some groups creating content biases in the long

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run [Tony et al., 2011]. It is also arguable that these knowledge sharing communities would produce richer content by combining a diverse set of viewpoints and intentions, variations that were found to happen among cultural groups working in Wikipedia's different language projects [Hara and Doney, 2015; Ribé and Laniado, 2016].

One possible explanation for differences in online participation could be a varying set of values related to the motivations to interact and collaborate using such complex online environments [Sellen et al., 2009]. While StackOverflow has been designed with certain values in mind – like 'productivity' and 'competition' [Mamykina et al., 2011] – these might not correspond to those of some of its users. For instance, the literature on cross-cultural studies have shown that a great deal of the population outside the Western and industrialized world emphasize values such as 'social order' and 'obedience', which are linked to *"restraining actions that might disrupt in-group solidarity of traditional order"*, building a social environment less supportive to 'intellectual autonomy' [Schwartz, 2006; Inglehart and Oyserman, 2004]. Moreover, another set of works has argued about the need to further considering cultural factors when designing interactive systems [Salgado et al., 2015].

The current work examines the problem of cross-cultural participation imbalances by asking: **What are the cultural characteristics of communities that do not fully engage in Question & Answer websites that can inform the redesign of such online environments aiming to better support non-active participants' collaboration needs?** To answer that, we search to identify incompatibilities in the values and cultural background that are carried by different groups of participants when using Q&A sites and contrasting these values with those that guided the design of the studied sites.

1.1 Methodology

We use a mixed-method approach to first explore participation behavior in two Q&A communities searching to identify contribution differences and find statistically significant culturally related explanations. Then we interview participants to understand the nuanced views and needs that explain why some groups engage less in the collaboration processes.

In the first exploratory study (see Chapter 3) we asked (1) whether there are variations in the percentage of passive users between countries and (2) what are the most relevant ex-

planations. To answer that we compare the participation data of users from 116 countries on two Q&A sites: the StackOverflow is focused on computer programming problems while the Superuser deals with general computer usage questions. We use this data to build linear regression models to test if socio-economic, linguistic and cultural factors can help understanding the found variations.

Because the found relations – between national characteristic and corresponding Q&A group behavior – involve theoretical concepts that are too broad, only general directions for design can be drawn from them. We decided that to meet our goal of better supporting underrepresented national communities in Q&A sites a detailed analysis of the found relations should be executed. Consequently, we designed and executed another study (see Chapter 4) where we investigate what possible needs from specific cultural groups are not supported by the design of the studied Q&A sites. We interviewed StackOverflow participants from three countries, and used a value-sensitive analysis [Friedman et al., 2013] to assess nuanced information on their preferences when using Q&A sites. Moreover, we contrast those values with the ones expressed by StackOverflow platform designers – identified via analysis of site's published material – searching to identify possible mismatches and opportunities for design.

1.2 Contributions

This thesis contributes to the current knowledge on designing online collaboration for multicultural groups in the following ways:

1. Showing that the behavioral variations among national communities in Q&A sites are not restricted to the amount of produced content, but also happen when considering the proportion of participants who are willing to contribute;

2. Confirming that the *Individualism versus Collectivism* cultural theory is also useful to study cross-cultural behavior in modern Q&A sites;

3. Testing competing explanations for cross-national participation variations and finding cases where national characteristics such as English Proficiency overcomes the *Individualism versus Collectivism* cultural dimension explanation power;

4. Showing how useful a value-sensitive analysis can be to unpack the relevant aspects of cultural dimensions linked to engagement problems;

5. Identifying Q&A site users' specific preferences and finding cultural tendencies that are not supported by the studied sites' affordances;

6. Defining design alternatives aiming for modern Q&A sites better supporting the engagement of underrepresented cultural groups.

1.2.1 Summary of Results

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 commenting or editing content, and between 50% and 83% do so on StackOverflow. We also 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 collectivist, more group-oriented cultures) are more likely to contribute than others.

When considering the qualitative analysis, all interviewees were conscious about the task-focused views built by design in the software and in the ideology of the StackOverflow community. At the same time, our results show that participants seem to fit differently to this perspective, and most interestingly those from India and China crave for more social contact and interactions than American participants when using not only StackOverflow, but other online environments used for question and answer practices.

We close this work by discussing these results in Chapter 5. There, we present design alternatives that aim to build collaborative environments that are more appropriate for collectivist communities. For instance, we propose that by reducing reputation information and providing more signals of group action in Q&A posts, collectivist participants' self-efficacy will increase hence they will be more prone to actively participate.

Chapter 2

Related work

By definition, computer-mediated communication and computer-supported cooperation tools create online social environments that promote identity expression, relationship establishment and eventually group work and community building [Herring, 1996; Grudin, 1994]. The study of such interactions generally searches for ways to minimize conflicts and to promote productive collaboration between individuals with diverse backgrounds. In this chapter we present concepts and related results that support the research presented in this thesis, which is focused on cross-cultural collaboration in Question & Answer (Q&A) sites.

2.1 Social Q&A sites

Question & Answer sites enable users to solve problems by collaboratively creating questions and answers. This central goal is typically facilitated leveraging additional mechanisms to identify content worthiness such as voting, content revision and user reputation. Well known examples of these sites are *Yahoo! Answers*[1] and *Quora.com* – two general purpose sites with categorized content, and *StackOverflow.com*, a well recognized site to finding software development resources.

In social Q&A sites the interaction around a posed problem (question) happens in a page – see Figure 2.1 – where participants can propose solutions (answers), vote up, vote down, comment, edit and flag posted content. Access to such functionalities are often based on the reputation gained via votes on personal contributions. Site users are generally directly

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[1] https://answers.yahoo.com/

associated to their actions and can access information about each other through links to their profiles.

Figure 2.1: A question's page taken from the Superuser.com site. It shows all the most commonly available functionalities in a Q&A site like answering, voting and commenting; and how users are associated to their contributions.

Theoretical perspective on Q&A environments. Gazan [2011] presents a comprehensive view of (Q&A) sites as socio-technical environments and argues that successful research or design efforts must take into account both the technical dimension and the related social factors such as usability, motivation to participate and communication norms. There is a duality of a site – as a set of tools; and a community – as a group of participants [Rosenbaum and Shachaf, 2010].

This view resonates with Ackerman's [2013] literature review on computer-mediated

knowledge and expertise sharing, finding that the practices of this area evolved taking into account perspectives of community and social arrangements. For instance, Rosembaum and Schacaf [2010] present Q&A sites as online Communities of Practice (CoP)[2] where different roles and levels of participation are needed to fully support expertise sharing and collaborative knowledge creation. In their framework, two dimensions are used to understand the social Q&A effort: the **practices** that help members define their community – manifested through mutual engagement, negotiation of a joint enterprise, and shared repertoire; and the **identity** negotiation process – revealed by ways of (non)participation and models of belonging.

Altogether, these theoretical perspectives support that such online peer-production technologies are 'structural resources', meaning that they shape interactions but are also shaped by users' interpretation and appropriation processes. This view is specially important to the current work considering that our goal is fundamentally linked to how a design decision (i.e. technical structures) might promote different appropriation paths for participants with distinct cultural backgrounds.

State of the art of participation in Q&A sites.   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 socio-technical sites differs. For example, by analysing the contribution behavior at the *Naver Knowledge-iN* – the largest Q&A online community in South Korea – researchers have found that top answerers refer to varied motivates to contribute like altruism, learning, and competition [Nam et al., 2009].

The literature in this area further shows that participation in online Question & Answer sites also vary in terms of the time, periodicity and breadth of contributed knowledge. For instance, a study of the early moments of StackOverflow [Mamykina et al., 2011] shows that most users have very little activity and that the number of highly active contributors decays exponentially. In the case of the previously referenced study of Naver Knowledge-iN [Nam et al., 2009] it is also shown that intermittent participation is the norm even among the most active users. In another study using the StackOverflow data, Pal and colleagues [2012] have shown that distinguishing behavioral patterns happened even among the top most voted users

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[2]`https://en.wikipedia.org/wiki/Community_of_practice`

where, for example, some started with high loads of work that diminish with time while others build highly active profiles with time. Previous research has also shown that the range of knowledge that contributors share vary at the Yahoo! Answers site [Adamic et al., 2008], showing that many users contribute to quite a fill categories while there is a tendency for focused users having more accepted answers in technical categories.

These differences originated a strand of work related to Q&A sites user's typology [Adamic et al., 2008; Nam et al., 2009]. Part of these studies focus on understanding patterns of contribution behavior, grouping them in usage profiles and searching to understand their importance to sites' activities [Mamykina et al., 2011; Furtado et al., 2013]. Along these lines, Furtado and colleagues [2013] identified ten distinctive activity profiles by analysing five Q&A sites from the StackOverflow family. Moreover, this work presents a clear separation between experts (highly up-voted) and activists (highly active), and shows that the sum of the contributions of sporadic contributors can be as high (or higher) than the activists production.

Finally, another thread of research that only more recently started to be explored is how different cultural groups participate in the Q&A effort. For instance, Kayes and colleagues [2015] explore contribution imbalances at the Yahoo! Answers site and confirm some relations with cultural characteristics of national groups. Considering that our work search to contribute to these cross-culture area, in the following section we present a brief introduction to this topic.

2.2 Nationality, Culture and Online Engagement

Participation and collaboration in online environments are also shown to be uneven when considering both national communities [Pflug, 2011; Zhao et al., 2012; Barker and Ota, 2011] and cultural background [Hara et al., 2010; Setlock and Fussell, 2010] as the analysis level. For example, Q&A sites such as Yahoo! Answers and StackOverflow were shown to attract much less activities from Eastern countries when comparing to Western nations [Kayes et al., 2015; Schenk and Lungu, 2013]. This cross-cultural approach helps identifying behavioral tendencies of different groups that give insights into establishing opportunities to design more appropriate solutions for distinct cultural needs. For instance, cultural stud-

ies have documented Eastern-Western cultural differences highlighting component related to how social life is generally organized [Nisbett, 2010] – e.g. in few tight or many loose in-group bonds – which can inform the design of mediated social interaction.

Cultural dimensions. One prominent result from cross-culture research is the definition of *culture dimensions* [Matsumoto and Yoo, 2006]. Such cultural dimensions can be seen as a well documented set of differences between societies. They are attributed to culture and facilitate the interpretation of cultural variations. Some of the most known of these dimensions were defined by Hofstede [2010], Hall [1983], Levine [1999], Inglehart [2000] and Schwartz [2006].

In spite of criticism concerning the capacity of these dimensions in capturing culture dynamics or its focus on national groups [Ess and Sudweeks, 2005; Irani et al., 2010], these cultural frameworks are helpful to explain social variations in many contexts. They are also extensively used to assess online environments' culture-related behavioral tendencies and users' preferences, as exemplified by Gallagher and Savage [2013] survey on the online communities cross-cultural research literature.

In the following we present a perspective on cultural studies and a summary of the cultural dimensions that helped to define the theoretical frame used throughout the present work.

2.2.1   A frame for cross-cultural studies

In this work we define culture as *a shared set of basic assumptions and values that result in collective norms and attitudes* [Dahl, 2005]. Culture is then learned from a dynamic environment and manifests itself in social systems and institutions. Hence, human values and social norms play an essential role in our interactions with each other and result in specific procedures that are accepted in society. In fact, prior work suggests that social procedures are influenced by culture [Karahanna et al., 2006].

It is also accepted that 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, but that people living in the same country often adhere to a national culture to some degree [Dahl, 2005; Minkov and

Hofstede, 2012].

Considering all that, if social procedures are influenced by culture one can also assume that culture can partly explain differences in online contribution behavior between countries. That's how we approach the use of cultural dimension: as a framework to analyse behavioral differences among national communities. In the following we present the dimensions that were more closely examined and used by the present work.

In summary, we used two culture frameworks, each one drawn from a different research effort and based on highly dissociate datasets. Hofstede's work [2010] has been very popular in online behavior cross-cultural studies [Gallagher and Savage, 2013; Ess and Sudweeks, 2005], and has been related to differences in participation behavior in different online environments [Kayes et al., 2015; Reinecke et al., 2013; Quattrone et al., 2014; Garcia-Gavilanes et al., 2013]. We've additionally used Inglehart [2000] because it is arguably based on more representative and up-to-date data sample than Hofstede's work. Moreover, we focus on these theories because they have components that deal with a concept that is related to a fundamental requirement for Question & Answer sites to work properly: An individual's willingness to interact with a larger community [Inglehart and Oyserman, 2004].

Hofstede's cultural theory

Hofstede's initial cultural framework comprises four dimensions resulted from a quantitative study of IBM employees' values in the late 1960s. The theory has been tested and updated but the initial four dimension – which are used here – are still considered to be valid. At the present moment, more than 90 countries are considered and receive scores for six dimensions.

Power Distance   The Power Distance dimension informs us about inequalities in relationships: In countries with lower indexes in this dimension – like Austria and New Zealand, people will search for equalization in power distribution, generating a preference to a consultant way of decision making. In countries with higher indexes (e.g. Russia and Mexico), people will more easily accept hierarchical orders, what generally centers 'powerful' actions in the hands of fewer individuals. An interesting fact about this dimension is its high correlation with countries' wealth.

Individualism vs Collectivism   While Power Distance models power relations, this dimension captures social structures. In more individualistic societies (e.g. USA and Australia), people are expected to look after themselves and their immediate family; while in more collectivistic societies – like Guatemala and Indonesia, people organize themselves and owe loyalty to other (more than the family) and broader in-groups. A related characteristic to this dimension is that people from individualist countries are normally expected to be clear about their own opinions. It is also to some extent correlated with the previously presented dimension, what is weakened when national wealth is controlled.

Masculinity vs Femininity   This dimension is related with the degree of nurturing and the importance of consensus in a society. In more masculine countries – like Slovakia and Japan – the values of performance, assertiveness and material success are dominant; whereas in more feminine nations (e.g. Netherlands and Costa Rica) there is a higher importance of values such as modesty, cooperation and quality of life.

Uncertainty Avoidance   The basic issue captured by this dimension is how uncomfortable people are with uncertainty and ambiguity. If a country exhibits stronger uncertainty avoidance – like Portugal and Uruguay – its inhabitants tend to try to control future situations, e.g. by keeping rigid codes of behavior. In the opposite direction, countries with lower levels in this dimension (e.g. Singapore and Denmark) tend to be more open to unorthodox ideas.

Inglehart's cultural theory

Inglehart's theory is also based on a quantitative analysis of human values collected worldwide by the *World Value Survey*[3] project. This research created a cultural map that distributes nations in a bidimensional space composed by the *Traditional versus Secular-rational* dimension and the *Survival versus Self-expression* one [Inglehart and Baker, 2000]. While the first one indicates how strongly people from a society value religion and authority the second one reflects whether a society is more focused on materialism (e.g. maintaining order) or post-materialism (e.g. interpersonal trust and tolerance of outgroups).

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[3]`http://www.worldvaluessurvey.org`

Survival vs. Self-expression   Inglehart's self-expression concept is defined by four human values: equality – gender equality over patriarchy, liberty – sexual freedom over restrictions, autonomy – self-determination over obedience, and expression – voice over security [Welzel and Inglehart, 2010]. When considering Inglehart's cultural map, Western countries (e.g. English speakers and the Protestant Europe) are the ones with higher tendencies to self-expression values while South Asia and the Orthodox countries to survival values. This dimension was also demonstrated to be highly related with Hofstead's Individualism vs Collectivism dimension [Inglehart and Oyserman, 2004].

Finally, it is important to clarify that by using these quantitative dimension to assess cultural information we do not intend to characterize individual behaviors but to contrast group tendencies. We argue that this is comparable to using indexes for 'English Proficiency' and 'Internet Penetration' to assess possible difficulties when deploying English-only or heavily online-based systems in different regions of the globe.

2.2.2   Cultural differences in Online Participation

Cross-cultural studies have proved to be useful to examine how culture may be an influential factor to understand a broad spectrum of online life characteristics and to inform system design. For instance, Gallager [2013] present an extensive list of the studied aspects regarding cross-cultural participation in online communities: types of motivation to use systems; online vs offline relationships; ways to knowledge creation and sharing; and measurements of activity, behavior and communication. Another characteristic of online usage that was confirmed to be linked with cultural variation is the adoption of web page design and web marketing campaigns [Ess and Sudweeks, 2005].

Communication.   Considering communication practices in online communities multiple behavioral variations can be attributed to culture. Citizens from the USA were found to disclose more to coworkers than Chinese citizens, a difference that was related to the customary closeness of relationship between coworkers in these two countries [Zhao et al., 2012]. In the context of web forums, German participants were identified to disclose more than Indian users, while Indians tend to use more non-verbal symbols than Germans [Pflug, 2011]. Au-

thors propose that both these differences are related to the *Contextuality*[4] culture dimension defined by Hall [1983], which focuses on communication styles and defines high-contextual groups as those where, for a message to be understood by its members, less information has to be explicitly encoded because more is culturally shared.

The availability of large amounts of digital data related to social interactions has been used to make these cultural differences increasingly generalizable. For example, by considering user citations in tweet messages as a way of direct conversation, Garcia-Gavilanes et al. [2013] report that more collectivist countries – as defined by Hofstede's *Individualism versus Collectivism* dimension – are more social in Twitter. A related result shows that Asian participants choose communication tools that better support a 'social agenda' even in situations that were task focused [Setlock and Fussell, 2010].

In the context of Wikipedia another cross-cultural communication tendency was identified where a larger amount of courteous messages – in the Talk Pages – from Easterners are more common than from Westerners [Hara et al., 2010]. This difference was found to be partially explained by Hofstede's *Power Distance* dimension.

Social Interaction. On a second perspective, research has examined the relation between culture and how people tend to act socially. Similarly to what happens offline, it has been found that Eastern communities using the *RenRen.com* social network are more collectivist than those using its Western counterpart (i.e. Facebook) [Qiu et al., 2012]. Moreover, users tend to adapt their attitude when migrating from one site to the other, something that points to the influence of social context and environment design on action definition. In another research comparing social networking usage, caucasian American young women were found to be more prone to public expressions when using Facebook photos while Japanese young women are much more likely to communicate closeness when using the *Mixi.jp* diaries [Barker and Ota, 2011].

Conflict and disagreement have been analyzed in Wikipedia, pointing to a higher incidence of those in Western communities [Hara et al., 2010]. Considering scheduling events in *Doodle.com*, Hofstede's *Individualism* dimension contributes to explain participants' attitudes towards facilitating agreement: Participants from individualist countries tend to re-

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[4]https://en.wikipedia.org/wiki/High-_and_low-context_cultures

spond later to polls – probably trying not to compromise their agenda – while those from collectivist nations made themselves more available [Reinecke et al., 2013].

Engagement. Cultural frameworks have also been shown to contribute to understand users' engagement and participation in online communities. In the context of tagging activities Americans were found to apply more tags than their Chinese counterparts; and that the former used more factual and analytical tags, while the later more holistic ones [Dong et al., 2012].

In the context of micro-blogging, a higher *Pace of Life*[5] [Levine and Norenzayan, 1999] has been related to a higher temporal predictability of tweeting activities [Garcia-Gavilanes et al., 2013]. When considering the *OpenStreetMap* project, Hofstede's *Power Distance* was found to be negatively correlated to the size of national groups – controlled for Internet population; as well as to the average number of contributions per user [Quattrone et al., 2014]. This last dimension was also found to explain the expectation of Wikipedia deletion actions [Pfeil et al., 2006]; while adding and clarifying information in wiki pages were found to be positively correlated with Hofstede's *Masculinity* dimension and negatively correlated with the *Individualism* concept.

In one of the few studies relating social Q&A behavior to culture, Yang et al [2011a] used a survey to compare how differently people from four countries use their social networks in Q&A situations. They found that the national culture explains some behaviors better than other control variables (e.g. age and gender). For example, the authors report that Asian individuals are more likely to use their social networks to Q&A activities and that they take more social considerations in the process. This and other findings were related with culture dimensions such as Hofstede's *Individualism* and Hall's *Contextuality*.

2.3 Final remarks

Based on all the literature presented in this chapter, the present work develops a cross-culture study that examines two major hypotheses: (1) When using largely international collabora-

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[5]Levine defined the concept of pace of life by timing societal characteristics such as walking speed in large cities from 31 countries. Overall, he found that the pace of life was faster in Japan and in countries from Western Europe and slower in economically undeveloped countries.

tive environments, groups with distinct cultural background will engage differently in modern Question & Answer sites and will demonstrate different preferences and needs to actively participate; and (2) When building these Q&A environments, designers push some Western culture values to site affordances creating participation barriers for populations who do not share those values. We evaluate these hypotheses by first analysing the relations between cultural theories and national communities engagement tendencies in two modern Question & Answer sites (presented in Chapter 3). We then use these results as a guiding frame to study a more nuanced picture of participants' values through a set of interviews with Stack-Overflow.com users from three countries (presented in Chapter 4).

Chapter 3

Explaining cross-national participation differences in online Q&A

In the previous chapter we presented literature results on cultural studies and online participation that pointed us to the need to further develop the understanding of why there are engagement and contribution differences among national groups. In this chapter then, we present a research effort that both confirms that national communities engage differently in two not previously evaluated Q&A sites and find out what are the best candidate explanations to understand and address these disimilarities.

In a preliminary step (Section 3.1), we evaluate correlations between different national group behaviors and Hofstede's first four cultural dimensions (which were detailed in Section 2.2.1). This was useful to (1) finding out that the studied linear correlations have high statistical power – necessary to define sample sizes in future work; and (2) confirming that Hofstede's *Individualism versus Collectivism* cultural dimension is the strongest candidate to explain Q&A behavioral variations.

In a second step (see Section 3.2), we refine our hypotheses to focus on a new facet of the cross-cultural participation differences in Q&A environments: Differently from previous research, instead of studying the amount of contribution per national group we examine if the percentage of active participants from a nation also varies. This allow us to extend the understanding of cross-cultural participation with a focus on national communities' engagement or 'willingness to participate'. Then, in Section 3.3, we present a novel way – based on multivariate regressions – to test what are the possible explanations for variations in en-

gagement among countries and more specifically, if the hypothesized cultural link hold when contrasted with socio-economical and linguistic factors.

The analyzed data. In this research 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 platform [1] with hundreds of thousands of both registered users and visitors per day.

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[2]. The same procedure was used in [Schenk and Lungu, 2013], and although our study uses a different geocoding service, we found comparable proportions of localized users and their contribution to StackOverflow. Moreover, we searched to control for errors in this localization process by removing countries with smaller number of participants from our samples. Figure 3.1 presents a visualization of how StackOverflow geolocalized participants are distributed around the world.

3.1 Contribution behavior in a Q&A site

To examine if the previously reported cross-cultural differences in online participation holds to the StackExchange Q&A environment, we follow the literature practices and hypothesize and test correlations between culture dimensions and expected behavior in the studied environment. To do so, in this section we map the theoretical background on cross-culture studies – more specifically the one involving Hofstede's work – to hypotheses that take into account the specific affordances of the studied Question & Answer site.

To test these hypotheses we use the Superuser.com site as a study case and report on the first three and a half years of this community activities. In Table 3.1 we present information about the localized participants and their production relative to the total number of registered users.

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[1] http://stackexchange.com/sites
[2] https://developers.google.com/maps/documentation/geocoding/
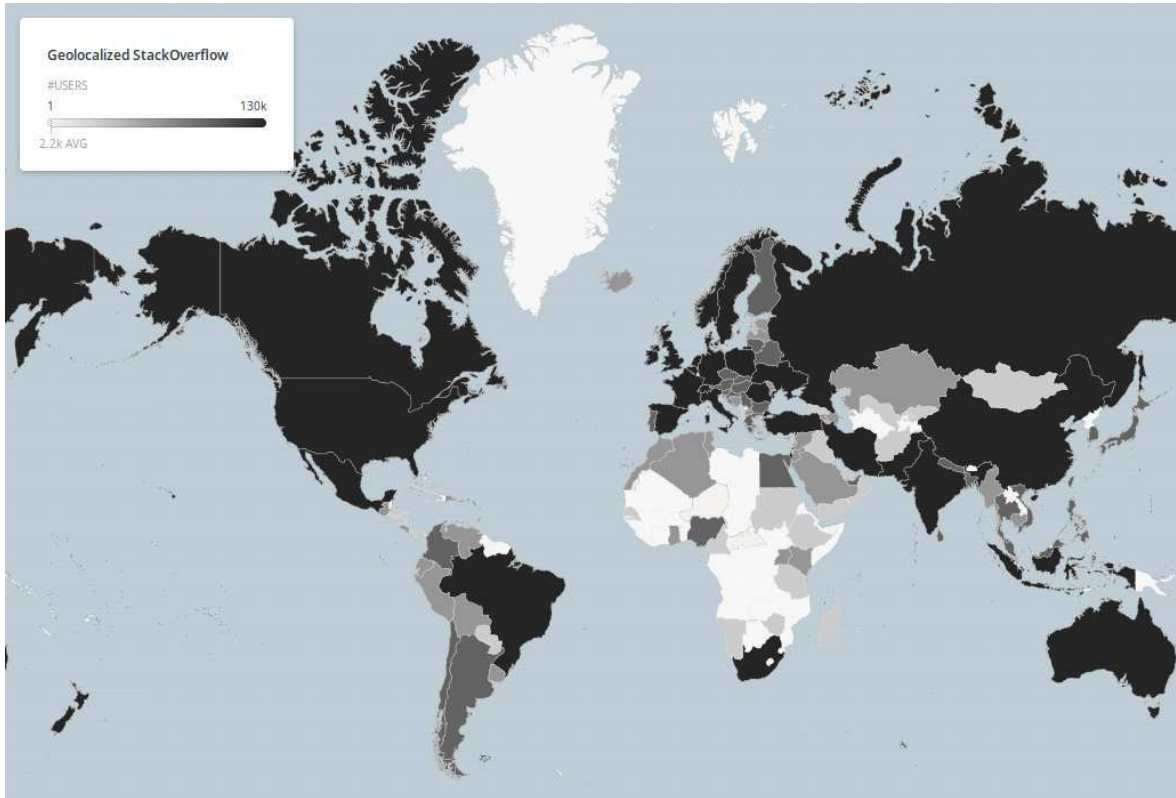
Figure 3.1: Number of StackOverflow participants around the world in April 2014. Only participants who defined a location in their profile were considered in the process of geolocation. An interactive version of this map is available in the following URL: `https://goo.gl/btFXhV`

3.1.1 Hypotheses

Besides posting questions and answers, several Q&A sites also allow for collaborative editing of posted content. In StackExchange sites' design, any participant can propose revisions to posts authored by others. If the participant already has a certain reputation the change is directly applied, while in the case of 'novice' users, proposed revisions are first peer-reviewed by more reputable participants. All post's changes are recorded and revisions are associated to their proponents.

From a social standpoint, revising other users' contributions can be interpreted as an impositive action. Considering the already presented association of the *Power Distance* cultural dimension and the amount of people in a society that are prone to take directions by themselves, the following hypothesis is proposed:

Table 3.1: Description of the Superuser.com data referring to its first 42 months of activity. The percentages refer to the fraction of users that had their geo-location identified.

#Users	%Localized	%Questions	%Answers	%Comments	%Editions
153000	19%	47%	63%	64%	45%

Hypothesis 1: The percentage of editors of third-part posts, among users of a country, is negatively correlated with the Power Distance index of that country.

A second and non-exclusive interpretation of others' content revision is as an opinative action. Considering that Hofstede's work defined the relation between the *Individualism versus Collectivism* cultural dimension and easiness of expressing one's opinion, we hypothesize the following relation:

Hypothesis 2: The percentage of editors of third-part posts, among users of a country, is positively correlated with Individualism's level of the country.

Commenting is a Q&A functionallity designed to be used for pointing out errors, lack of information, or more generally, proposing new directions to posted questions and answers. Similar to the previous construct, we consider that the action of commenting, in other users' posts, can be related with the same cultural assumptions as editing third-part post. The main difference is that when using commenting one would be proposing changes in a more conversational manner, while directly editing posts' text would be a more impositive action.

To model the commenting on others' posts construct we discard comments on a post made by its author because these are assumed to be chiefly related to answering others or complementing one's own ideas. Framing third-part post commenting this way leads us to the following two hypotheses:

Hypothesis 3: The percentage of third-part posts commenters in a country is negatively correlated with its Power Distance index.

Hypothesis 4: The percentage of third-part posts commenters in a country is positively correlated with Individualism levels.

Besides looking at the proportion of the users who comment on third-part posts, it is also plausible to test how much of the activity from a user is devoted to commenting. Defined like that, the *commenting rate* would model how much of their energy contributors from a country invest in caring about content quality and guiding other – maybe less experienced – community members. This view depicts a comment as a more social and caring action in contrast to more technical – and cold – interactions of voting, asking and answering.

Considering this perspective, we hypothesize a relation between commenting rates to Hofstede's third culture dimension: *Masculinity vs. Femininity*. This hypothesis predicts that users from more feminine countries will have a higher proportion of comments (C) compared with the number of produced questions (Q) and answers (A). Considering a user's commenting activity as $C/(Q + A)$, our hypothesis is:

Hypothesis 5: The geometric mean[3] of user's commenting activity by country is negatively correlated with masculinity levels.

Participation in Q&A sites can be exercised by questioning, answering, commenting, editing content, but can also be exercised by simple observation or content search. Contrasting the initiative of action with the possibility of observation, we propose a relation with Hofstede's fourth culture dimension: *Uncertainty Avoidance*. This is based on the view that actions in an open community lead to losing control over ideas and at the same time create an opportunity for social interaction, uncertain feedback, and criticism. This leads to the following hypothesis:

Hypothesis 6: The geometric mean of the number of questions/answers created by users from a country is negatively correlated with the uncertainty avoidance level of that country.

As previously discussed, action in a public space can be related to the Power Distance levels in a country. This happens because if people are not used to take decisions in their daily interactions – as they await that from people higher in the hierarchy – it is also expected

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[3]The geometric mean is a better average measure than the arithmetic one when considering values that differ in numeric range. Because the distribution of participation in online environments tend to follow a long tail distribution, we use the geometric mean to minimize the impact of 'super-contributors' on the measured average.

that they participate less as active members of the community. Given that, we believe that the number of questions produced by a group might be related to this concept, direction us to formulate the following hypothesis:

Hypothesis 7: The geometric mean of the number of questions created by users from a country is negatively correlated with the Power Distance level of that country.

Finally, the Individualism concept may also be helpful to explain the total contribution of national groups. While we hypothesize that the total number of questions is related solely to the amount of people in a society that is 'generally prone to act' (i.e. Power Distance); in the case of producing answers we argue that more than 'natural inclination' is needed. In the case of answering questions, people have to be more 'used to express their ideas publicly' – an idea that is captured by the Individualism dimension. Considering that, our last hypothesis is:

Hypothesis 8: The geometric mean of the number of answers created by users from a country is positively correlated with the Individualism level of that country.

3.1.2 How well does national behavior correlate with cultural dimensions?

To test the presented hypotheses we use Spearman's correlation coefficient, which results we present in Table 3.2. When evaluating the hypothesized correlations we have also varied an additional parameter named g: This parameter is a threshold for the minimum number of nationals of a country among identified site's participants that must exist for us to consider the country in our analysis. This practice was used because we understand that to observe national culture tendencies one must have a large enough sample to dilute behavioral variations among individuals inside a group. Considering we don't know how large is large enough to analyse each of our hypotheses, we then varie g and considerer correlation indexes consistency as an indication of effect strength and correlation confidence.

From Table 3.2 one can see that the measured effects involving the relation between culture and online cross-national behavior can be as high as .76 for the amount of answers

Table 3.2: Hypotheses testing on SuperUser data: significant Spearman's correlation coefficient found for different minimal sizes of national communities(g).

Hypothesis	$g > 500$ ($n = 20$)	$g > 300$ ($n = 29$)	$g > 200$ ($n = 37$)	$g > 100$ ($n = 51$)
H1: Editors x Power Distance (-)	$-.44^*$	$-.50^{**}$	$-.48^{**}$	$-.39^{**}$
H2: Editors x Individualism (+)	$.70^{***}$	$.56^{***}$	$.55^{***}$	$.49^{***}$
H3: Commenters x Power Distance (-)	$-.72^{***}$	$-.63^{***}$	$-.60^{***}$	$-.53^{***}$
H4: Commenters x Individualism (+)	$.61^{**}$	$.58^{***}$	$.58^{***}$	$.62^{***}$
H5: Commenting x Masculinity (-)	$-.59^{**}$	$-.47^{**}$		
H6-Q: Questions x Uncertainty avoidance (-)			$-.39^{**}$	$-.34^{**}$
H6-A: Answers x Uncertainty avoidance (-)			$-.32^*$	
H7: Questions x Power Distance (-)	$-.61^{**}$	$-.42^*$	$-.37^*$	
H8: Answers x Individualism (+)	$.76^{***}$	$.58^{***}$	$.51^{***}$	$.46^{***}$

$^{***}p < 0.001, ^{**}p < 0.01, ^*p < 0.05$

produced by the 20 largest national communities in Superuser, and as low as .32 when testing the relation again of answering with the *Uncertainty Avoidance* dimension. An intersting fact is that, although not all hypotheses was consistently supported by the data, every single significant result agrees with the proposed correlation direction. This might mean, specially for the case of $H6$, that the studied effects regarding the *Uncertainty Avoidance* cultural dimension are too small to be studied with groups composed by $n \leq 500$. In the case of $H5$, it seems that the studied relation between commenting and Hofstede's masculinity concept could be studied with groups larger than $n > 300$.

Our data also present a case that is consistent with the literature: Hofstede's *Individualism vs. Collectivism* is the cultural dimension with the most consistent and strong correlations. Although the *Power Distance* dimension also present strong results in $H1$ (proportion of editors) and $H3$ (proportion of commenters), we prefered to focus the rest of our study diving into the nuanced aspects of the individualism and collectivism concepts and search for ways in which they might influence design decision in Q&A sites.

This initial exploration also guided the next steps of our analyses by confirming that larger national groups are preferable when searching for cultural effects, and by showing that

linear relations are plausible enough – as can be better seen in Figure 3.2 – to be considered in more complex statistical analysis used in the following sections.
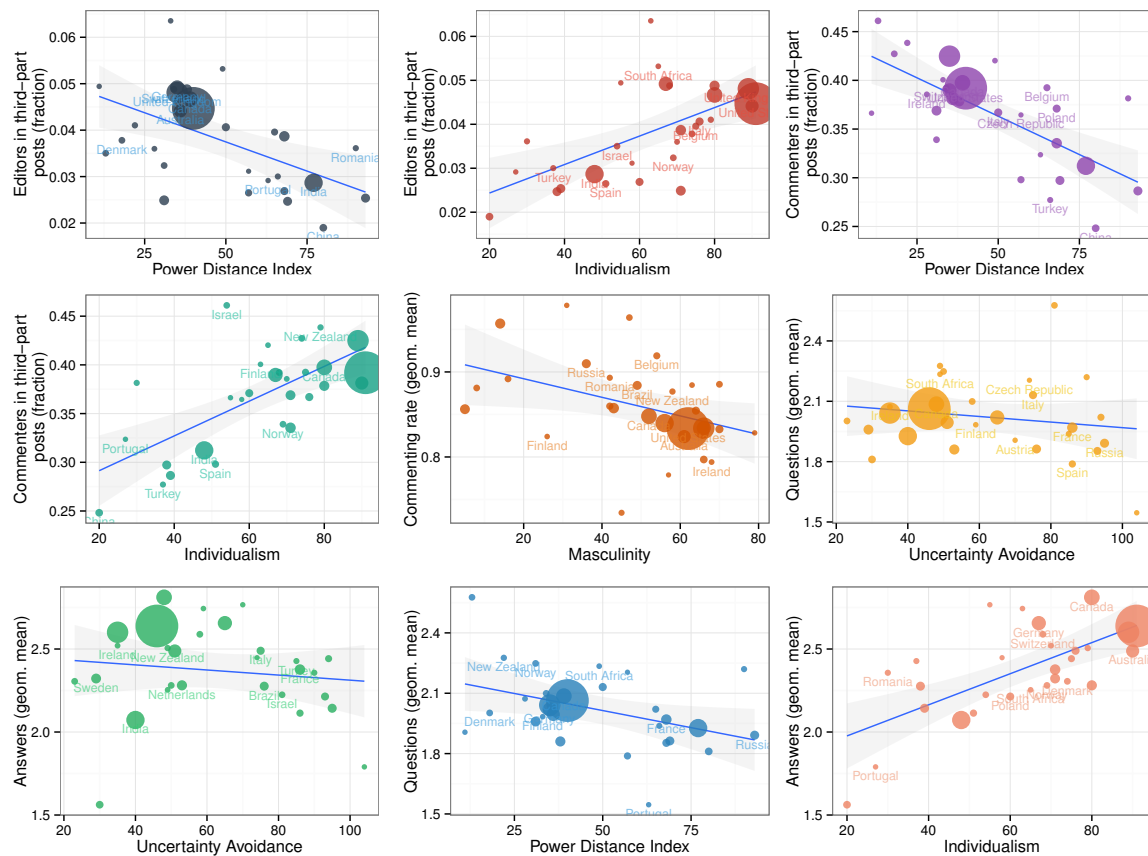
Figure 3.2: Scatterplots relating the considered cultural dimensions and the behavioral constructs as hypothesized in our exploratory cross-cultural study of the Superuser Q&A site. Each circle stands for an identified national group. The size of the circle encodes the number of users in that national group – all plots are for groups with more than 300 participants (i.e. $g > 300$). In each plot, the line represents a linear regression of the two variables.

3.2 Differences in engagement across national groups

After exploring the cross-cultural relations in the previous section, we opted to focus on the construct called 'percentage of contributors': The proportion of participants from a group that contributed regardless of the number of times. As previously presented, we use that as a proxy to national community engagement or 'willingness to participate' in Q&A activities.

Table 3.3: Descriptive statistics for the used data from StackOverflow and Superuser, including its size and the contribution of users that had their location identified.

	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%

Moreover, we are interested in finding out whether the percentage of passive users (i.e., those who have never contributed content) varies between countries because it might surface patterns that can inform the design for more inclusive Q&A sites.

By doing so, we extend the understanding of how differently national communities participate in online Q&A efforts, mainly because previous work focus on the amount of actions which can be biased by highly active contributors. We also add up to our previous step by using data from two sites aiming to verify results' consistency.

3.2.1 The analyzed data

To execute this research step we enhance the dataset compared to the previous one. Here, the data covers roughly the first five and a half years of activities of two sites: The period between July 2008 to April 2014 for StackOverflow and July 2009 to February 2015 for Superuser [4]. Some descriptive statistics on the two Q&A communities are presented in Table 3.3.

Contribution inequality. To analyze whether users contribute equally or whether there is a small number of users that contribute most of the content, we calculate the Gini coefficient, which measures statistical dispersion and serves as a measure of inequality. A Gini coeffi-

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[4]https://archive.org/details/stackexchange

cient 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 these results confirm previous work in that most contributions come from a small number of contributors [Wilkinson, 2008] and present a richer picture of the studied sites, in the following we will focus on the percentage of contributors construct.

Outlier removal. Before proceeding with our analysis, we evaluate how the studied construct varies among the national communities aiming to exclude anomalies. Considering the sum of the four types of studied contributions (i.e. asking and answering questions, and commenting or editing in others' posts) the median value for the percentage of contributors is .47 and .68 for Superuser and StackOverflow respectively. Most communities are in a balanced distribution around the median, with the interquartile range of .15 for both sites. Examining countries that have extreme values in this distribution shows that all of them come from countries with less than 80 users in our sample. A complementary examination of this sample size ($n < 80$) demonstrate that estimating proportions with such a small value produce a 95% confidence interval that is too imprecise to be valuable to differentiate national participation. We therefore opt to study only national groups for which there are 80 or more users in our sample. The final StackOverflow sample contains 116 countries, and the Superuser one has a subset of that with 70 countries.

3.2.2 Does the percentage of contributors vary between countries?

To answer if the percentage of contributors vary among the national communities in our sample we complement the previous outlier analysis by analysing the proportion of users that posed questions, answered questions, or commented or edited others' content in communities with more than 80 participants. This analysis present strong differences between countries: At Superuser, the percentage of contributors varies between 29% and 55% while at 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 in-

formation – which we previously showed, are users who produce the majority of the content (see Table 3.3). Figure 3.3 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 and Lungu [2013], 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 how valuable are the contribution from different regions of the world. Our data adds to their results 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.

3.3 Explanations for the differences in the percentage of contributors

After noting a sizable variation in the percentage of contributors in different countries, we search to understand if there are national factors that can explain these differences. To answer this research question we compare the results of different multiple regression models. By doing so, we are able to test competing explanations as these statistical models calculate each explanatory factor effect while controlling for the other variables in the model. Moreover, considering that previous results – including ours – propose a *culture explanation* for such cross-national behavioral differences – more strongly by using the individualism concept –
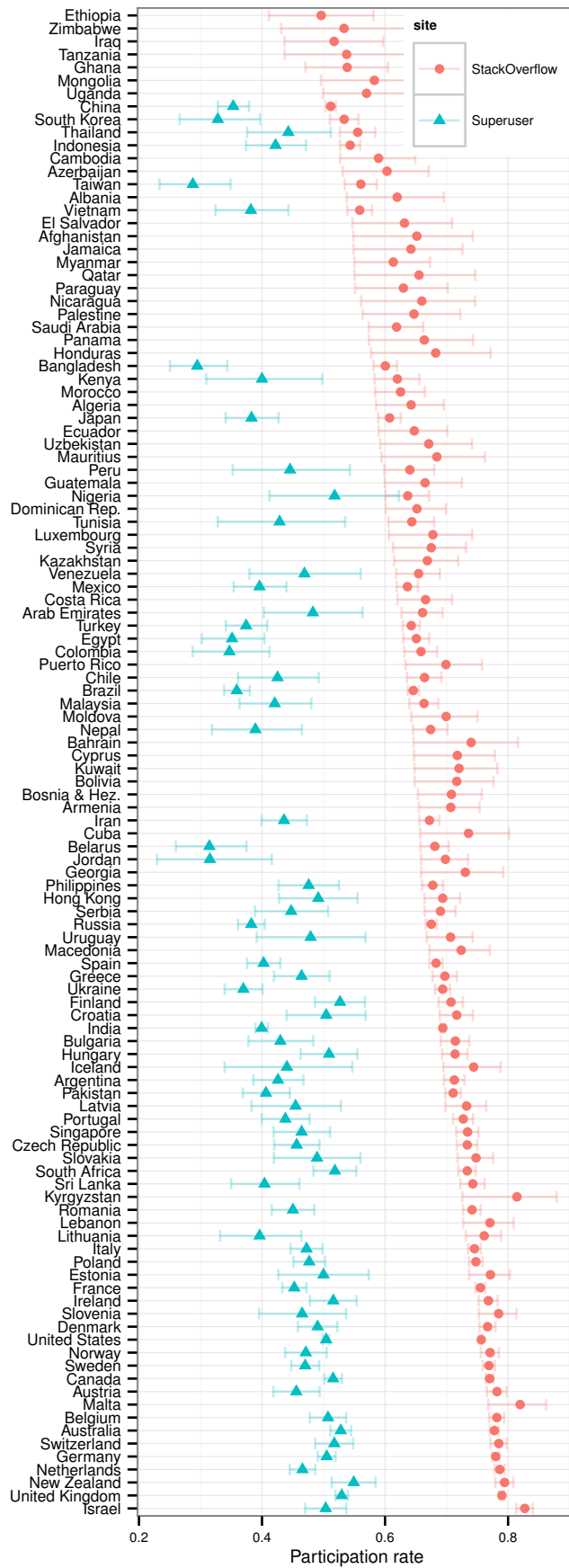
Figure 3.3: Percentage of contributors per country. Error bars represent confidence intervals of 95%. Data is ordered by the lowest estimated value of StackOverflow's rates.

we opted to create separate models to test if the cultural explanation holds when contrasted with other important national characteristics.

Each of our regression models use a subset of the following socioeconomic, linguistic, and cultural metrics [5]:

The Baseline Model. Three factor were included in our baseline model: two socioeconomic and one related to language.

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

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 [2011];

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 [2014]. 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 [Wikipedia, 2015]: Australia, Canada, Ireland, Jamaica, Malta, New Zealand, UK and USA. The percentage of speakers was transformed to the EPI scale for these countries.

The Cultural Model. Moreover, we consider two cultural dimensions to assess information on national groups cultural tendencies to participate in online Q&A environments: *Individualism vs. Collectivism* and *Survival vs. Self-expression*.

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[5]The compiled dataset created for this research is available at `https://goo.gl/vD3uas`

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 [Hofstede et al., 2010] – because we already identified it as a strong factor to study online behavior variations among nations – and **Model 2** the *Survival vs Self-expression* dimension [Inglehart and Oyserman, 2004] – because it was identified as a more up-to-date construct related to Hofstede's second cultural dimension. 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 as suggested by Gallagher and Savage [2013].

As active participation in Q&A communities can happen in different ways, each one been passive of design interventions, we subdivided our analysis into four distinct contribution types: asking questions, providing answers, and commenting on and editing other contributors' 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 [Cohen, 1988] 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 with small regression coefficients). Considering though the results of our correlation analysis – see Section 3.1 – we assume that the effects we're dealing with are fairly large to proceed with this analysis.

3.3.1   What factors explain cross-national differences?

In summary, our results show that the baseline model explains a large portion of the variation between countries in StackOverflow (– i.e. $R^2 \in [.49; .69]$ for the 95% CI) and in Superuser ($R^2 \in [.32; .58]$, 95% CI) – please refer to the Appendix A containing the results from all tested linear regression models. In addition, the English proficiency factor 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 these results 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 3.3).

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 3.4 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.

This visualization also reveals a similar pattern for StackOverflow and Superuser. Users from South Korea, Indonesia, and China for example – countries that rank low on the Individualism versus Collectivism dimension – are among the ones with the lowest proportion of users who provide 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%).
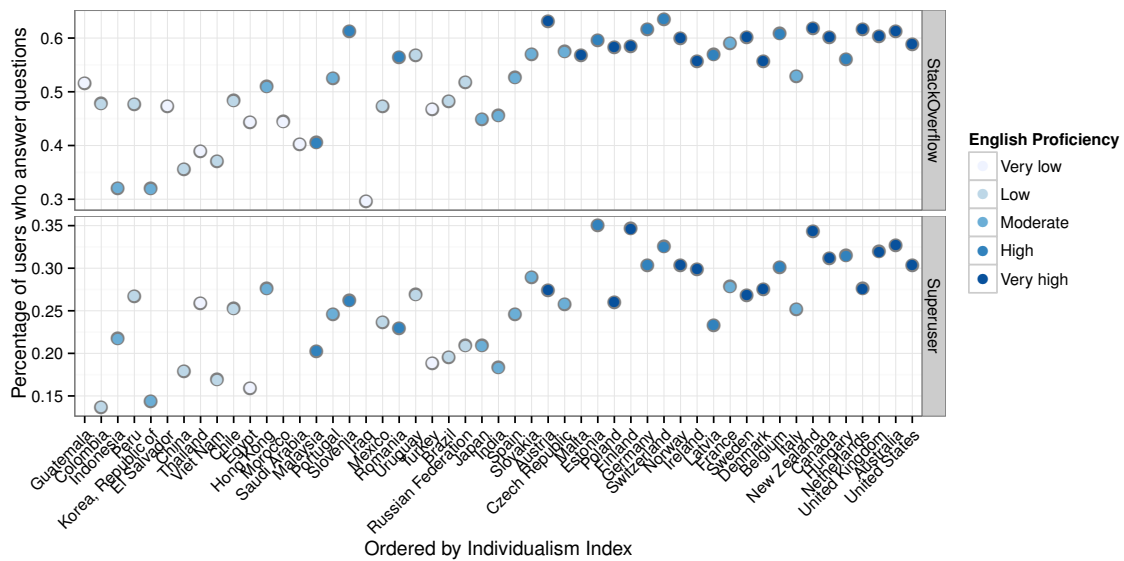
Figure 3.4: The relation between the percentage of users who answered questions in national communities and a country's individualism and English proficiency indexes. This data is presented for StackOverflow (top) and for Superuser (bottom).

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). The English proficiency is again the most powerful explanatory variable, while the Individualism index helps to significantly improve the Baseline model in both sites.

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.

3.4   Final remarks

Our main finding in this chapter is that participants from 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). Although this result is aligned with the literature on online cross-cultural behavior [Gallagher and Savage, 2013; Schenk and Lungu, 2013], this is arguably contrary to the assumption that a national culture that is geared towards communal life (i.e. Hofstede's collectivist ones) would lead to more contributions to a common pool resource – as it was detected in the case of Wikipedia[Pfeil et al., 2006].

One explanation for that happening in Q&A sites might be related to the designed affordances' of such online environments. For instance, while Hofstede argues that the strong interpersonal ties in collectivist societies might lead to cautiousness when participating in group activities aiming to avoid social disruption, the usage of voting systems and explicit individual association with contributions seem to be incompatible with this cultural characteristic. Another reason might be that Internet users from collectivist countries might be more likely to use their online social networks instead of Q&A sites to solve questions online, as suggested by Yang et al. [Yang et al., 2011a].

Given that, we believe that there are possibilities to use these results to adapt the design

of online Q&A sites in order to encourage more engagement from currently passive people. In order to better inform such adaptations, in the next chapter we present a study that further investigates how differently national communities appropriate of StackOverflow affordances.

Chapter 4

Assessing cross-national preferences to inform design

> "There can be no doubt that individual persons have the freedom to depart from the values they share with other members of their group, but this in no way vitiates the well-documented claim that values, as Barth (1993, p. 44) has carefully pointed out, when viewed within the social contexts of actors, 'valorize emotion, orient choice, and propel action in very significant ways'." – Patterson [2014]

In this thesis we search to better understand why national communities engage differently in Question & Answer sites aiming to inform the design of online peer-production environments that better support participation across cultures. In the previous chapter we identified – through a quantitative analysis – the existent link between engagement differences and the Individualism vs. Collectivism cultural theory. In this chapter we use a qualitative approach to unpack these correlation results into more clear usage perspectives.

This study is inspired and share the premises of interactional theories, where human beings acting as individuals or in groups shape technology, and in turn, these tools shape human experience and society [Friedman and Kahn, 2003; Gazan, 2011]. Following from that, we also understand that human values both shape technology design and development, and can be embedded in technology. That is, technology is not value-neutral.

Accordingly, one possible explanation for the found differences in the engagement of national groups in social Q&A sites activities could be a varying set of values related to

the motivations to interact and collaborate in such large online communities. To examine this hypothesis we interviewed participants of StackOverflow from three countries and used a value-sensitive analysis to assess nuanced information on their Q&A sites' perspectives and needs. Moreover, we contrast those values with the ones expressed by StackOverflow's platform designers searching to identify possible mismatches and opportunities for design.

In summary, the results of this investigation highlights that the performance-oriented design options made by the StackOverflow platform emphasizes productivity based on reputation and competition – a view also identified by Mamykina et al. [2011] – a worldview that might be less suitable for collectivist societies. Moreover, our cross-cultural analysis presents an unprecedentedly nuanced view of participation practices in Q&A sites, showing for example that users from India and China tend to value social contact as part of their information seeking processes, a practice that is not well supported – and even discouraged – by the StackOverflow platform.

4.1   Methodology

The value-sensitive analysis used in this work is inspired by Friedman's work, that introduced to Human Computer Interaction (HCI) an approach to consider human values in technology design [Friedman, 1996]. In this approach a *human value* is defined simply as what is important or desirable by a person in a way that guides their actions and decisions. Called *Value Sensitive Design* (VSD), Friedman's methodology builds on the concepts of Participatory Design to create an iterative tripartite framework [Friedman et al., 2013]:

- **Conceptual investigation:** Involves an identification of involved stakeholders, implicated values and trade-off among competing values in the design. The current study was strongly inspired by this, influencing the attention to the perspectives of Q&A site designers and the diverse roles of participants.

- **Empirical investigation:** Complements the conceptual investigation by bringing the human context in which the technical artifact is situated. One example is to evaluate the success of a particular design – which is in line with the current research project. In this chapter we implement an empirical investigation searching to identify stakeholders'

priorities and what is the importance of such needs for Q&A engagement.

- **Technical investigation:** Focus on the technology itself, either by studying how exist-
  ing technological properties support or hinds human needs, or by proactively design-
  ing systems that support values identified in the conceptual analysis. We discuss such
  questions mainly in the next chapter when we propose alternatives to the current Q&A
  design.

At the same time we have considered these VSD guidelines, we also were attentive to sug-
gested evolutions to this framework by Borning and Muller [2012] whom called for a more
flexible and less universal definition on the considered values.

Interview procedures.   By design this research does not intend to characterize "the na-
tional culture" for each country individually. Our intent is to compare the perspectives of
three groups of Q&A site users while controlling for their nationality. We have chosen
China, India and United States as cultural groups because they are among the largest com-
munities in our quantitative analysis samples, they are fairly distinct in the *Individualism
vs. Collectivism* dimension, and they were more convenient to recruit at the moment of data
collection.

Our intent To amplify the possibility of detecting differences in perspectives based on culture, we've
executed the interviews in presential focus groups composed by individuals with same na-
tionality. To prevent the perspectives of one participant from guiding the conversation, each
section of our interview started with one general question for which participants were asked
to answer individually using sticky notes. These notes were then presented to the group by
aloud explanation and fixing them over posters – see Figure 4.1. The setup of the room with
posters containing three main site pages – the home page containing lists of questions; a
question page containing interactions to solve a problem; and a user's profile page contain-
ing the list of contributions and other personal data – was used to help with the retrieving
process of information and stories about participants' site practices.

Our protocol was designed to reflect concepts that are part of the *Individualism versus
Collectivism* cultural theory, and has four parts: contextualization on Q&A sites, perspectives
on participants and interactions, perspectives on goals and performance, and a final design
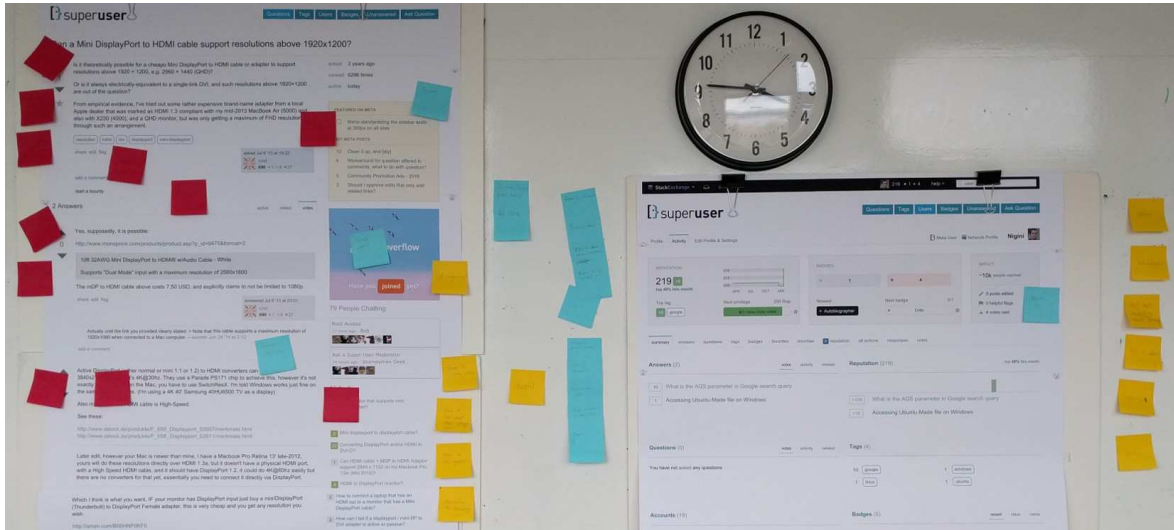
Figure 4.1: Posters and sticky notes used as part of the focus group setup.

activity – please refer to Appendix B to see details. Only the data collected in the three first parts were used for the present analysis.

Recruitment. The recruitment was based on public calls in email lists and physical spaces at the University of Washington[1], mainly at the Department of Computer Science and Engineering and at the Information School (only two participants came from different areas: Biology and Biomedical Informatics). All candidates had to be affiliated to this institution as graduate or undergraduate students searching to control for other variables such as education level and age range. The recruitment call emphasized that candidates should have used the Q&A site StackOverflow before, and that experiences with other online Q&A environments were welcomed. They were asked to fill up an online form to help identifying their fit to the study and a presential meeting was scheduled as soon as enough suitable candidates from a given nationality were identified. All participants were compensated with US\$20$ (Twenty US dollars).

We aimed to execute two focus groups with three participants of each studied nationality but two participants failed to be present at the scheduled time. Table 4.1 presents a list of our interviewees. An initial focus group composed by one participant from each nationality

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[1]This research project was designed and executed while the author of this thesis was visiting the Department of Computer Science and Engineering of the University of Washington as part of his doctoral research program. Therefore, it was also revised and approved by that institution's Human Subject Division.

Table 4.1: List of the focused groups' participants. The participant identification used in the text carries a letter that identifies their nationality: (A) for United States of America, (C) for China and (I) for India.

Participant	Focus Group	Nationality	Gender
P1-A	1	American	M
P2-A	1	Korean-American	F
P3-A	1	American	M
P4-A	2	American	F
P5-A	2	American	M
P6-I	3	Indian	M
P7-I	3	Indian	M
P8-I	3	Indian	M
P9-C	4	Chinese	M
P10-C	4	Chinese	F
P11-C	4	Chinese	M
P12-I	5	Indian	F
P13-I	5	Indian	M
P14-I	5	Indian	M
P15-C	6	Chinese	F
P16-C	6	Chinese	M

was also used as a pilot for the interview protocol and its data was not used in the following analysis, except to inspire an initial set of codes.

Data collection & analysis   All focus groups were carried out by the author of this thesis, sometimes accompanied by a note taker. The conversation took around 90 minutes each and were audio recorded. The audio was fully transcribed, anonymized and coded based on three major categories: (1) roles and identity, (2) site experience, and (3) human values – a summary of the used codes can be found in Appendix C.

To build our codes we have used Miles and Huberman's perspective [Gläser and Laudel, 2013; Miles and Huberman, 1994], where both theory and data are considered as valuable

sources of codes. An iterative process executed by the author of this thesis and a research assistant started by coding the first two interviews separately and then revising each other's work to decide what codes should be used. The resulting codes were continuously applied to other transcriptions and revised by the two researchers. After the dictionary reached consistency all previously coded transcriptions were revised to use the final version.

The analysis was guided by the following questions:

- Why people do and do not participate?

- What type of social interaction is – if ever – needed?

- What values are involved in participants' positions?

For each question, several searches in our data were made using the relevant codes. Recurrent ideas were aggregated into themes that are presented in our results.

Moreover, searching to contrast the findings on participants' values, we also analyzed two sets of public materials about the site and its goals: the StackOverflow tutorial for new users and the platform's blog posts discussing design considerations. In this case, the same researchers who developed the previously described analysis read and coded the material using only the codes related to human values. Again, the result of this process was discussed aiming for a consensus and the codes were searched to answer the question: "What values are cultivated by the site designers?" In the following we present the results from both analysis.

4.2 Values embedded in the StackOverflow design

Our investigation surfaced a number of values implicit in the design of the StackOverflow Q&A site, including quality, control, reputation, competition, self-improvement and productivity. These values appear throughout the StackOverflow company blog and its official site, beginning with the introductory tour[2], which welcomes newcomers with the banner *"Ask Questions, Get Answers, No Distractions"*, and proclaims itself as a site for professional and enthusiast programmers. The tours' language throughout maintains this emphasis on professionalism and no-frills content, declaring that it's not a discussion forum: There's no

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[2]`http://stackoverflow.com/tour`

chit-chat. The tour also continuously emphasizes the rules of contribution through which the StackOverflow designers and community managers maintain control over the quality of the site content. For example, the site instructs newcomers that, *"not all questions work well in our format"*. It also asks participants to avoid questions that are primarily opinion-based, or that are likely to generate discussion rather than answers. The tour also features a prominent section explaining how to earn reputation points, and what those points allow users to do.

Values such as competition and reputation surface even through playful promotional events such as the Winter Bash, in which users complete specific challenges in order to win silly hats for their avatars. At the conclusion of the event, the StackOverflow community managers compile a leaderboard where they award and recognize individual users for completing certain challenges[3].

StackOverflow's blog also emphasizes and encourages the value of self-improvement, with posts such as 'How to be Awesome'[4], which provide helpful tips on how to begin and advance in a professional career in computer programming.

This initial investigation seems to align the StackOverflow family with a more individualist worldview that emphasizes standing out and even competing against others – a result that is aligned with a previous analysis by Mamykina and colleagues [2011]. Even the Chat tool[5] that would be regarded as a more open-ended 'social' environment is presented as a less structured place to have professional conversations on site's topics, highlighting the value of productivity.

With that we aimed to create a baseline view of StackOverflow designers' values. This will help to understand the different perspectives that participants with various cultural backgrounds might express.

4.3 Values of online Question & Answer users

By examining our participants' views and practices when using Q&A sites we could identify the following topics as the most relevant discussion points: the perspectives on participation and contribution; the different goals and mindsets; the role of social interaction; and the

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[3]`http://winterbash2015.stackexchange.com/leaderboard`
[4]`https://blog.stackoverflow.com/2015/09/how-to-beawesome/`
[5]`http://chat.stackoverflow.com`

conceptualization of belonging.

4.3.1 Participation and (non-)contribution

When describing their usage of StackOverflow, all of our participants identified themselves as 'problem solvers' – ie. searching for an answer to a specific problem. This role is also linked to how they search and access content on Q&A sites. The majority of the participants mostly use external search engines, mainly Google, to find solutions to their problems. Because of this, participants generally don't experience other pages of the site outside of specific threads of question and answers related to their searches.

Moreover, in comparison with answering questions, the majority of our participants seem to view other ways of contributing – like asking questions, commenting, editing and voting – as having an auxiliary role to the site.

Similarities among participants. Across all three cultural groups, participants used a lack of expertise or lack of confidence as two of the most important factors discouraging them from contributing answers to StackOverflow threads.

> "Much more in StackOverflow, I feel like I'm part of the group of dumb people who do not know the answers for the problems." [P13-I]

> "A lot of stuff I'm asking [meaning searching] are novice level. But what I've seen I don't feel like I can contribute at all." [P1-A]

> "I feel a little shy, I feel my skill level is not up to the mark of someone who answer." [P6-I]

However, differences arose in the way participants expressed their lack of contribution.

Differences between the groups. Participants from different countries expressed varying amounts of emotion around not answering questions in StackOverflow. While participants in the American groups simply described their lack of participation, several Indian participants expressed a sense of guilt or shame for not answering questions. Interestingly, our Chinese participants seemed entirely disengaged from participating in StackOverflow.

For example, when [P1-A] stated that he felt he couldn't contribute to StackOverflow, the participant did not express regret, and stated that the ability to answer is built with time. From the same group, participant [P3-A] had no problem in describing himself as a *"lurker"*, someone who comes to the site only for *"browsing and using resources"*. He recognized himself as part of the group of *bad users* of Q&A sites by *"not responding someone who asks question where you know the answer to"* but did not mention wanting to change his behavior.

In contrast, a similar discussion in the Indian groups created more emotionally charged discourse.

> "I feel that users like me should not be parasitic like in only consuming. I'd say it is more about, how a person attributes how helpful they are, how inclined to help other people they are." [P8-I]

> "I created a profile just to upvote and downvote. I'm getting these resources online and for free, the least I can do is tell people what was helpful for me and was not helpful." [P13-I]

> "If you're busy and choose not to answer that, you're not a good user of Stack-Overflow." [P14-I]

Our data doesn't show a clear tendency in this case for the Chinese participants who seem to be more disconnected from StackOverflow:

> "We don't even have an account in these websites!" [The other two participants agree!] "So we're not very active in commenting or posting our questions. We just use this to go through the answers and find the best answer." [P9-C]

This Chinese disconnection seem to be related to a very different perspective of engagement with online platforms expressed in two topics. The first one is related to how they value 'curiosity' and the need for better ways to explore content, which we discuss in the next section. The second one is their expectation of more 'social interaction' discussed after that.

4.3.2 Users' goals and mindsets

While most participants from all three cultural groups stated finding specific information as their primary goal in using online Q&A sites, further discussion surfaced other reasons participants had for visiting these sites.

Differences for Chinese participants. While the majority of American and Indian participants stated their focus on trying to answer specific questions, the Chinese participants expressed exploring topics or having fun as a major goal in using online Q&A sites.

> "First, [I use Q&A sites for] searching for accurate and correct answers. Second one is interesting to read and relax – I think this is not the case here [pointing to the StackOverflow posters in the room]. Third one is socialize with those who have similar interests. Last one is keep in touch with old friends by commenting every so often [. . .]" [P16-C]

> "Yes. I think I have a switch in my head. When I see such a comment I switch into fun mode. But when I see a serious comment I will switch into that mode." [P15-C]

Another Chinese participant – [P9-C] – explained that, while using Quora.com he follows some specific topics and professors to see new content related to those subjects: *"In Quora I'll follow some professors. They will answer academic problems which I care about. I follow the topic 'PhD Application' and it was pretty good(...)".* Other participant from the same group reminds that following topics is an action presented very early in the process of being a Quora user:

> "When you setup your account you choose topics you're interested." [P10-C]

When asked why they don't do the same at StackOverflow [P9-C] says that it is *"Because if you follow a topic like Java (...) you don't need to go through all the questions about Java, you just need to know 'how to do a hash in Java'."*

When participants from China compare StackOverflow's perspectives of fun with other platforms they are categorical in saying: *"No fun mode."* says [P15-C]; and complements

this view by citing one more site that gives a better experience in that regard: *"Also in Zhihu [a Chinese Q&A site similar to Quora] the top answers are both informative and fun."*

In summary, Chinese participants generally expressed that *enjoyment* – as much as usefulness – in the process of finding information, as an important motivating factor in using online Q&A sites. There is also the idea of following *interesting* topics that doesn't seem to match the current tagging system of StackOverflow.

American and Indian participants.   It is, though, not the case that only the Chinese interviewees expect some fun in using online Q&A sites. However, when discussing these sites our American and Indian participants focused on how humor or enjoyment affects their ability to find and understand useful information:

> "[It's great when answers are] funny because it shows they're actually into answering and makes it easier to read." [P2-A]

> "This is something that a couple of times I had good moments: People have written funny answers. A little bit of sense of humor." [P6-I]

One Indian participant actually expressed the use of humor on Q&A sites as a potential detractor to him achieving his goal:

> "It would be [a problem] in a site such as StackOverflow for me because I appreciate humor but not at the expense of my time." [P14-I]

Americans and fun in competing.   American participants, much more so than Chinese or Indian participants, expressed competition as being part of their enjoyment of or motivation to contribute to online Q&A sites:

> "Entertainment and light-hearted competition: because I enjoy answering questions and it's entertaining for me and when I'm working on one I feel like, a little bit of competition (. . .) to have the right answer first." [P4-A]

> "[To feel part of the group] I would have to derive enjoyment out of answering those questions and getting those karmic points but I'm wrapped up in my work." [P3-A]

Although our interviewees from India and China also state they like receiving votes and thanks, they seem to more strongly present reasons to participate such as being helpful to others rather than competing against others. This finding can be linked to *individualist* and *collectivists* values and motivations to collaborate. In the following section we present another topic that is also directly related to this cultural theory, which is the role of social interactions in people's lives.

4.3.3 The role of social interactions

When evaluating the ways our participants experience the site, we confirm that the sites' content is the major focus of interest in Q&A environments. But all this content must be produced by people through interactions that are mediated by sites' functionalities and communities' rules. The question we examine in this section is what is the role of social interaction – which we expect to be different for the three interviewed national groups – in the participation of Q&A sites.

Similarities. One of the most important values raised by all groups was 'politeness'. The majority of participants stated that contributors should be level-headed and calm:

> "productive arguments, not flaming or putting someone down." [P7-I]

Many participants cited being mean and judgmental as characteristics of bad users of these sites, and some describe how experiences in the site might go wrong:

> "It kind of depends on how the interactions go. [If someone say:] 'Why would you ask stupid questions?'; then I'd go: 'OK, [goodbye…]'." [P5-A]

> "A dream user is someone who respects the fact that there are users that are novices, and gives them a proper answer instead of making fun of them or trolling them." [P7-I]

Another aspect discussed by all interviewed groups was regarding the ability to recognize individuals by their expertise, and how recognizing or even following can help them as a productive practice:

"Also I know that there are 15 to 20 people who I actually followed as being experts, so I can always browse through the answer and say 'ok, these particular answer is from this chap who I know as an expert', so I'd probably stick to his answer, and not even look to the others!" [P8-I] – About Q&A group at Facebook.

"The first step for me is always content. But if I find some specific person I'm interested in, I will follow them." [P15-C]

Differences. Sometimes the difference of how interactions are acceptable is very nuanced – for example in the situation where two female participants comment on receiving a 'thank you' in a comment on their answers. The following two quotations show how the American interviewee (first quote) seem to care less about been thanked than the Indian participant:

"I don't feel like I need or want to be thanked, but sometimes someone will say 'thank you' and someone else will say 'don't say thank you'. I think that this is like: 'whatever'." [P4-A]

"There was one person who, I think one month after I posted the solution, that needed the solution. So he posted saying thanks. [. . .] It's good, such interactions make the site more useful." [P12-I]

Most interestingly, another interviewee from the same group commented on the previous quote, making it clear the social importance of more personal interaction:

"I feel that this type of interactions are definitely good, because as the person who is giving the answers, like you said you feel good and you're more inclined to go out and do it again." [P13-I]

However, the most relevant finding in our data is how differently participants from India and China expect to experience social interactions in comparison with the American interviewees. In summary, Indian and Chinese participants present much more interest in knowing the people behind the content and sometimes trying to directly contact site users, both to further discuss the content in the site or maybe making new friends.

> "[The ideal user is] someone who is willing to chat: I tried to contact a couple
> of people and ask them for their email and stuff, but people are not willing to do
> that." [P6-I]

> "I mean, some people are very nice people and they answer some interesting
> questions. And I want more detailed answers from him or I have some related
> questions to ask him. So I'll try to message him once we become friends!"
> [P9-C]

No American participants expressed similar interest in cultivating direct interactions with other users of online Q&A sites.

The Chinese Social Agenda. What are the consequences of having a socially focused group using environments that were designed for task focused activities with little social openness? Invariably this was the major point of discussion among our Chinese participants. As presented below, they tend to differ in Q&A sites' appropriation processes, mainly regarding adapting behavior when moving between environments inside and outside their Chinese social circles.

> "Originally it [Zhihu] was only designed for getting an answer for some question
> but then people turned it to have more conversations." [P15-C]

> "[. . .] in Quora I feel like kind of restricted, because it is in United States. In
> China we can like – if you don't like him – you can quarrel with him and post
> your thoughts. [. . .] In Chinese Quora you can express your mood!" [P9-C]

Commenting on that, [P11-C] says: *"The exchange. There are more exchanges!"*; and [P10-C] complements: *"I think it's Chinese culture to quarrel with each other all the time."* She concludes the conversation with two very profound consideration: the first one is about 'having to fit' in other social environments and a second one on the implication of communication in foreign language:

> "If you're posting something in these websites, you need to fit to this kind of
> project. I don't say we don't mean it, but we can say in the Chinese Quora. But
> in the US, even if we mean it we can't say it." [P10-C]

"And as I was saying, language is very big barrier: in Chinese we criticize people in a pretty humorous way. But in English is pretty hard for us to do it. When you're reading this post you can understand the idea in these words, but you can't read the emotion. It is really difficult!" [P10-C]

This last comment shows that language impose two levels of barrier: The technical one, somewhat easier to bridge by understanding the functional meaning of words; and the socio-cultural gap related to using the language to read and express emotions. That's a very interesting result considering that our quantitative study presented in Section 3.3 shows that language and culture share the explanation of participation differences.

4.3.4 Sense of belonging & community

When directly inquired in the last part of the interview if they felt like part of a community when participating in Q&A sites, independent of roles and nationality, the general answer was that it is not the case. The interesting thing though is why does that happen, with answers varying from a more individualist perspective to more social ones.

"I feel more like an individual, considering my circumstances: If I had started by asking questions maybe I would feel more a part of it." [P5-A]

The point presented by the previous quotation is based on a very common perspective among our interviewees that necessarily associates contribution to the concept of community. But from the perspective of the few interviewees that are also contributors it seems that this is still not enough: Even though [P4-A] is a recurrent contributor to a specific topic in StackOverflow, she does not recognize them as her community because *"[. . .] I don't talk with them enough [. . .]"*. This same justification appeared in all three interviewed national groups, clarifying that another important component for defining a community is still maintaining relations with the people behind the content available in these sites:

"I think the problem is that we don't know each other in the Q&A sites, we only know his answers." [P16-C]

"I have an example, that on Facebook there is an interest group [. . .] and I feel like part of a community partly because every member of this community reacts like a real person towards me." [P15-C]

The other, less common perspective on community affinity, is the one that relates the sense of belonging with similar opinions and knowledge needs:

"If I have a question and search for it and the question comes up there is a sense that someone had this question before: part of community because of a shared experience but not part in ability to answer – you build that up." [P1-A]

"[. . .] sometimes you view their answers, and you totally agree. This types of moments you feel like a community!" [P10-C]

In summary, the only ones who had some feeling of been part of StackOverflow community were two non-contributors (an American and an Indian male participants) who related with other's needs and answers. Although the general opinion among non-contributors was that they had to contribute content before been part of the Q&A community, the two contributors in our data (an American and an Indian female participants) felt that they need to have further contact with people before calling it a community. This socialization need was also common among other participants, more clearly among Chinese and Indian interviewees but less with Americans ones.

Therefore, when discussing community belonging, three major levels were presented: common needs, contributions, and socialization. The differences with this conceptualization among the interviewed groups somewhat reinforces the previous findings in this thesis regarding how American participants' tend to act more strongly in line with individualist values, while nations like India and China present deviations from that tendency. This chapter's main contribution then, was to show how these individualist and collectivist participant values are expressed in an online Q&A environment and how these sites' design reinforces incompatibilities with some cultural groups needs. In the next chapter we discuss these results in detail and analyse their impact in the design of modern Question & Answer sites.

Chapter 5

Implications for Design

In this work we've presented two studies aiming to assess information on why groups of participants from different countries tend to engage differently with Question & Answer sites. The first one is a quantitative exploration that searches for distinguishing national characteristics that significantly explain participation differences. In the second one we use a qualitative method to further understand how these national characteristics are linked with designers' and participants' values. Now we turn to discussing these results' implications for the design of online collaboration for multi-cultural communities.

This chapter is divided in two main parts: In the first one (see Section 5.1) we define a set of design guidelines based on how our results can be interpreted in light of research on Human-Computer Interaction and related area. The second part (see Section 5.2) we use these guidelines as a framework to define design claims aiming to promote culturally diverse engagement in Q&A sites. It is important to note though that these design suggestions are not meant to be final solutions but informed alternatives that have to be tested in specific environments and communities.

5.1 Defining design guidelines

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 [Kraut and Resnick, 2012]). However, a trend of works started defending the opportunities of include human culture and values when designing interac-

tive systems to overcome collaboration barriers and to push human-computer interaction frontiers [Sellen et al., 2009; Salgado et al., 2015]. Furthermore, several cross-cultural studies present a compelling argument that the assumption of uniform behavior does not hold for many online environments and studied behaviors [Gallagher and Savage, 2013; Garcia-Gavilanes et al., 2013; Reinecke et al., 2013]. Our findings show that this is also the case for answering, commenting and editing on StackOverflow and Superuser Q&A sites. We also show how participants from China, India, and United States value different affordances when they consider engaging with these sites.

Our results from Chapter 3 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 [Kayes et al., 2015; Schenk and Lungu, 2013]. Moreover, our results show that these variations cannot be explained solely by a country's economic wealth or Internet access – as one might expect considering the relation between these indexes with the population access to online technology. Instead, our results show that the found engagement variations in Q&A sites can be best explained with the help of a country's English proficiency and national culture – more specifically Hofstede's *Individualism versus Collectivism* dimension. This suggests that users from some countries might feel less empowered or willing to contribute, and are more likely to passively read the content.

5.1.1 Self-efficacy and online participation

Complementing these findings, the results from Chapter 4 demonstrate that interviewees highly value those who contribute to the site, although in their majority they are unable to contribute because of a perceived lack of expertise or a lack of self-confidence. A lack of self-confidence was also found to be an important factor for 'lurking' in online discussion boards [Nonnecke et al., 2004]. The theory of self-efficacy [Bandura, 1995] helps to interpret such results by posing that *a person who believes in being able to cause an event can be more active and motivated to make it happen* [Schwarzer et al., 1997]. Even more relevant to the present work is that, according to Bandura, self-efficacy is shaped through maturation and socialization experiences, hence a culturally dependent process.

Indeed, an interaction between self-efficacy and cultural traits was shown to moderate the effect of training in task performance [Earley, 1994]. More specifically, individualists performed best when exposed to training focused at individual information, while collectivists accomplished better results when trained with a focus on group information. In practice, Earley's experiment shows that the appropriate cultural prompt can make participants improve their perceived self-efficacy and performance on a task.

This relation between cultural prompts and self-efficacy supports one useful interpretation of our results: Participants with a collectivist cultural background will feel more able to act when in contact with an online environment that is designed with more collectivist-focused prompts. Considering that we already identified that the evaluated sites' design are more individualist-focused we propose the following design guideline:

> **Design Guideline 1:** Providing more collectivist cues to Q&A sites' interfaces – like groups membership – will increase the self-efficacy of participants with collectivist cultural background and in consequence their motivations to actively participate in the site.

5.1.2 Attachment types

Our qualitative analysis also presents a rich take of Q&A environments from the views of StackOverflow participants from three countries: China, India and United States. In summary, all interviewees were conscious about the task-focused perspective built by design in the software and in the ideology of this community. The results show that interviewees seem to fit differently to this perspective. Participants from India and China tend to crave for more social contact and interactions – presenting a case for a mix between sociability and productivity goals. American participants seem to better adapt to the productivity-only focus when using online environments for question and answer practices.

A theoretical lens that enables an expressive analysis of this adaptation is the group attachment theory [Hogg and Turner, 1985]. Social psychology holds that attachment in groups arises in two ways:

- identity based: focused on group goals and character, and can be enhanced by presenting people as members and downplaying their personal attributes.

- bond based: focused on interpersonal relations, and can be enhanced by giving people an opportunity to develop relationships, for example by highlighting interpersonal similarities.

Classically, Q&A sites and other user-content generated systems like Wikipedia tend to focus on identity-based attachment, whereas most discussion forums that allow off-topic conversation also promote bond-based attachment. One could argue that while features like Wikipedia's Personal TalkPages or StackOverflow's Chat rooms have the potential to promote bond-based attachment, the way they are now designed and presented falls short of this. Instead, these spaces tend to promote their usage only by already engaged participants. For instance, only site contributors who casted a certain amount of votes can use the chat rooms provided by StackOverflow. Moreover, this functionality should only be used to discuss 'more or less the same site topics' in a 'professional and respectful' way [1]; diminishing its potential as an environment for the development of bond-based attachment.

From our data we can understand that the StackOverflow creators present a site with two major identities: you should be a 'programmer' to use the site, and contributions should come from 'experts'. Considering our interviewees, the only participants who felt part of the community – regardless of nationality – were the ones that could identify themselves as programmers who had the same problems as other site participants. Interestingly, the only participant who was a contributor to StackOverflow – and another one who contributed to other alike technical site – expressed the need for better knowing their peers before considering themselves as part of a community (an idea very much aligned with the bond-based group attachment).

All considered, it seems that both forms of attachment could be further developed in the design of StackExchange Q&A platform. For the identity-based case one could: (1) better explore tags as a definition of communities – instead of using them just as a content navigation tool – knowing that the technology one uses (which is the case of tags inside the StackOverflow and Superuser sites) is a prominent way of creating communities; and (2) using the different ways of contribution in a Q&A site to define in-groups – ie. askers, answerers, editors, etc. For example, in a study of a movie lovers community [Ren et al.,

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[1]http://chat.stackoverflow.com/faq

2012] – The Movie Lens website[2] – 'identity-based' prompts were artificially generated by creating animal-named teams where users were included and had the constant experience of comparison among themselves and competition between teams. When compared to a 'bond-based' interface – where individual participants' information were highlighted more than group information – the 'identity-based' design was more successful to make users to visit the site. Culturally speaking though, this result reinforces the current biases in design choices from a Western/Individualist world perspective: By evaluating the zipcodes of users from the MovieLens site[3] we identified that 99% are United States residents.

Our data present evidence that participants do recognize other contributors mainly to associate them as an 'expert' or a reference in some topic or context. Moreover, when asked if they felt as part of a group or community using Q&A sites, some of our participants referred to feel as part of either the group of 'dumb' people who don't know the answers or the group of 'lurkers' who don't feel like actively participating. Indeed, this seems to be the most prominent idea of (non-)attachment among our interviewees: A Q&A user is either a contributor – or even better an expert – or a consumer of information, which are both forms of identity-based attachment related to the purpose of a Q&A site. Nevertheless, when processes of recognizing other participants lead someone to pursue social contact (i.e. bond-based attachment) – as our interviewees from India and China – either the environment or its usage rules and norms stop them doing so. Considering that, we propose another design guideline to promote the engagement of participants with a more collectivist cultural background:

> **Design Guideline 2:** Using bond-based attachment cues in Q&A design will increase the participation of more collectivist groups based on its members' tendencies of searching for social contact.

5.1.3 Sociability and competition

When discussing the design of online communities taking into consideration intrinsic motivations, Kraut and Resnik [2012] (see Section 2.4) examine among others the use of 'social contact' and 'competition'. They proposed one design claim that is directly related to

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[2] https://movielens.org/
[3] http://files.grouplens.org/datasets/movielens/ml-1m-README.txt

our analysis of Q&A participants' needs: *"Combining contribution with social contact with other contributors cause members to contribute more." (Design claim 2.16).* Based on our data, this seems indeed to be a natural way to support communities with collectivist cultural background.

However, a previous research identified that 'conversational' questions had much lower quality and archival value than 'informational' question [Harper et al., 2009]. This means that problems formulated as factual questions tended to be much more helpful to the community in the long run – a result that perhaps inspired the design decisions of StackOverflow where 'discussion' based posts are not welcomed. On the other hand, this same work concludes that specific design decisions should still be able to take advantage of 'social users' – who are responsible for driving traffic numbers – at the same time that 'informational users' generate searchable content. The authors suggest that Q&A sites could develop reward and searching mechanisms that adjust to informational or conversational needs.

Interestingly enough, before being created, the StackOverflow chat environment was thought by Jeff Atwood[4] – one of StackExchange's co-founders – as a separate social space in light of Oldenburg's third place [Oldenburg, 1999]. Although this environment is now available, none of our interviewees have tried it, and only one knew about it. Furthermore, based on their participation experiences, we can also argue that this chat environment does not fulfil our interviewees' social contact needs mainly because it is only available for already engaged participants – i.e. one has to be a contributor and have a certain reputation (based on votes) before been allowed to access it. Another model to provide social contact in a knowledge-based community is the User (Talk) Pages[5] implemented by Wikipedia. This is a mix of profile and message wall where other users might get in contact by writing entries in this page. The need for such an ability to directly contact their peers in Q&A sites was clearly stated by some of our participants from India and China. But because such social needs might conflict with the current task-focused design, we propose a third and final design guideline for supporting multicultural collaboration in online communities:

> **Design Guideline 3:** Creating a separate environment or an adaptive interface
> that provides social functionalities for opting participants can help providing

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[4]https://stackoverflow.blog/2010/04/29/do-trilogy-sites-need-a-third-place/
[5]https://en.wikipedia.org/wiki/Wikipedia:User_pages

social contact without compromising more task-focused activities.

Based on our data, both design claims might be re-written using a culturally-based tendency, showing that collectivist communities are those that has less interest in comparative performance feedback and would prefer a less game-like focused atmosphere.

Considering the discussion put forward in this section, we argue that there are opportunities to adapt the design of online Q&A sites in order to encourage more engagement from currently passive users. In the next section we complement the previously presented design guidelines with design alternatives for three ways of participation in Q&A sites – i.e. answering a question, commenting and revising posts; the ones more clearly identified as having different engagement levels among individualist and collectivist communities.

5.2 Designing Q&A sites that equally support cross-national engagement

After discussing our results in light of a larger set of theories and results, now we turn to using this discussion as a background to present more specific design alternatives focusing back on the specific Q&A sites' cross-cultural results presented in this work. These design alternatives aim to improve the investigated sites' affordances regarding their ability to engage a larger community from collectivist societies. To do so, we use the 'design claim' approach as defined by Kraut and Resnick [2012]: *"Design claims follow a positivist scientific paradigm, seeking to state general claims – that under certain observable conditions certain outcomes can be expected."* In our case, the general desired outcome will be improving the likability of active participation by users with collectivist cultural backgrounds, while the observable conditions are the alternative ways to build Q&A site affordances to users with different cultural backgrounds (e.g. directly associating users with their contribution or presenting them as a group creating solutions for a problem). One important regard about a design claim is that by implementing it, one might affect other design decisions – for example, by focusing a design to favor collectivist values it might be the case that the individualist ones will be weakened. Although final decisions should only be made by run-

ning usability tests, one specific model that we believe can work for the following claims is the adaptable user interface, where more than one design concept (e.g. individual or group orientation) can be delivered for different countries, groups of users, or individuals.

5.2.1   Content contribution

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 [Aaker and Maheswaran, 1997]. They are also expected to have strong opinions [Hofstede et al., 2010], and have been found to be more confident in their own decisions [Mann et al., 1998]. 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 [Mann et al., 1998]. This could result in people being more reluctant to contribute answers, and "impose" their knowledge on others in these fairly large and competitive online communities. Moreover, in an online environment where every contribution is clearly associated to its contributor, it might inhibit participation from individuals that expect to work as part of a group. This Japanese proverb illustrate this view perfectly: *The nail that sticks up gets hammered down.* – both expressing an expectancy for conformity and a push for all 'nails' to work in the same way to support the structure.

> **Design Claim 1:** Dimming the link between contribution and contributor in a
> Q&A page will diminish the barriers for collectivist participants to act.

Our findings are similar to the results from Kayes et al. [Kayes et al., 2015] 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 [2006], who investigated the relationship between the Individualism concept 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 – helping people to save their face – and only in the long term expressed by a rising status in the community. In contrast, StackOverflow and Superuser reward participants for each contribution in a more individualist and reward-based approach by using both score and badge systems. This, in combination with the potential loss in one's reputation could be discouraging to people from collectivist countries.

> **Design Claim 2:** Reducing the prevalence of performance-based reputation info
> in question and answer posts will encourage more contributions from collectivist
> participants.

Moreover, collectivist societies are described as being organized in tighter in-groups [Hofstede et al., 2010], where a stronger need for a shared context and even social bonds is a requirement for collaboration [Ardichvili et al., 2006; Li et al., 2014]. This rationale goes in line with Yang and colleagues [2011a], 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 metaphors: Who are the participants? What is the group's contribution history? How well is this group doing in relation to others?

Encouraging contributions by highlighting in-group clues has been suggested in the context of the design of web-based user interfaces to motivate participation [Marcus and Gould, 2000], and when proposing a "Team Performance" design strategy to motivate collectivist gamers [Khaled et al., 2009]. 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 a group and that their contribution is valuable [Kraut

and Resnick, 2012] (see design claim 33 in Chapter 2).

> **Design Claim 3:** Emphasizing the relation between contributions and group
> identities – like the team of contributors in a Q&A page or in the set of pages
> around a tag – will improve collectivist participants' willingness to act.

5.2.2   Content revision

We found that the proportion of contributors who comment or edit in others' posts is higher in individualist than in collectivist countries (in the case of edits, this was only true for Stack-Overflow). One explanation for the correlation with the Individualism concept 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 [Aaker and Maheswaran, 1997]. Similarly, Hofstede stated that for collectivist groups, "relationship prevails over task" [6]. In line with this, Hara et al. [2010] found that Wikipedia editors from more individualist countries produce a higher number of conflicts on Wikipedia's talk pages than those from collectivist countries.

> **Design Claim 4:** Providing mechanisms for negotiating content revision that are
> not public or that are more individualized will reduce the barrier for collectivist
> participants to edit or comment in others' posts.

Another way to deal with the content revision versus group harmony issue is by providing more pronounced guidance to participants with a collectivist background. As previously stated, not only collectivist individuals tend to prefer harmony to raising up alone, they are also expected to contribute as needed by the group. Aligned with that, another design claim by Kraut and Resnick [2012] (see design claim 34 in Chapter 2) support that phrasing a contribution guidance as uniquely important to one's group will motivate contributions. It is also likely that different messages will have different results for individuals with different cultural backgrounds.

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[6]See Table 4.4 at [Hofstede et al., 2010]

Design Claim 5: Presenting revising content as a needed and expected task by one's group will motivate users from collectivist cultures to edit and comment on others' posts.

Finally, considering that collectivists tend to be more comfortable in the presence of other known in-group members, one way to create such a contact is via a mentoring program. One way to implement that would be to alert volunteer mentors about the presence of newcomers in pages related to common interests or nationality. Mentors could engage in friendly conversations aiming to provide a sense of social contact and to direct new users into their quest to search for information and community.

Design Claim 6: Assigning mentors to collectivist newcomers will enhance their chance to develop group bonds and as a result, will improve their willingness to act.

Final remarks. In this chapter we discussed the results of two cross-cultural studies aiming to define design alternatives to balance participation across countries in Question & Answer sites. First we defined design guidelines based on links between our results and social and psychology theories, then we defined design claims to support participation of collectivist groups. Our major next step is to test these design suggestions to find out which ones are appropriate in a real setting. In the next chapter we further discuss our future work and the limitations of these results.

Chapter 6

Conclusions

In this thesis we investigated the following research question: **What are the cultural characteristics of communities that do not fully engage in Question & Answer (Q&A) websites that can inform the redesign of such online environments aiming to better support non-active participants' collaboration needs?** Our results suggest that the two Q&A sites studied – StackOverflow and Superuser – are less successful in encouraging contributions from collectivist participants than from individualist users. By interpreting these results through the lens of social and psychological theories, we proposed that these engagement differences among different national groups can be mitigated by redesigning such Q&A environments. The redesigns we propose are guided by results from cross-cultural studies, particularly involving the self-efficacy and group attachment concepts.

Our work also confirmed the link between cultural factors and online behavior in Q&A sites, a result found to be true for many other online environments such as social networking websites and online knowledge sharing environments, and "offline" sites such as multinational businesses and organizations. While we did find that Hofstede's *Individualism versus Collectivism* cultural dimension helps to understand contribution tendencies among national groups in StackOverflow and Superuser, we also found cases where strong correlations were weakened when other factors were considered – mainly a country's English proficiency. This result encourage cross-cultural researchers to be aware of competing explanations for commonly hypothesized relations between culture and online behavior.

We used these quantitative results to inform an interview-based study aiming to further understand the views and values of groups of Q&A sites' users from three different national-

ities. With this mixed-methods approach, we captured nuanced views of differences in open knowledge creation processes, mainly regarding preferences of participant groups with distinct cultural backgrounds. It can also capture divergent values expressed in the site's design (more individualist) and by some participants (more collectivist).

By comparing our findings to results from cross-cultural studies involving other online environments, we suggest concrete design claims to increase active participation of collectivist individuals. For instance, we propose that making room for social contact and collaboration within smaller communities and a less competitive environment are more suitable design decisions to promote engagement among collectivist users in the examined Q&A sites. These design considerations can likely also promote more engagement from collectivist individuals on other peer-production knowledge-based collaboration sites such as Wikipedia.

In sum, this work examined the cross-cultural participation imbalances in online collaboration platforms found on Q&A sites. Our results demonstrate the need for awareness of cultural diversity among participants, and reinforces the need for investigating ways to design online collaboration platforms that take into account usage requirements beyond the Western-individualist mindset. We recommend that globally available systems adopt culturally aware and adaptive designs, in which participants with different values and preferences can be equally supported to decide when and how to contribute to the community.

6.1 Limitations & 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 studied population: users of StackOverflow and Superuser are Internet users (and thus, more likely to be 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 population. Future work should compare our results to analyses of other Q&A sites that focus on other, varying topics.

Moreover, even though we have no intention to characterize general national behavior and preferences, we understand that our qualitative analysis can be improved by increasing

the interviewed population in size and diversity. For instance, by varying the social background of the recruitment pool (e.g. other universities or multinational companies), we can enrich knowledge on preferences and values that should be taken into account when redesigning Q&A sites. Increasing the confidence in such results can also be reached by designing and applying a questionnaire that focuses on the identified relationship between concepts, such as collectivism and the desire for bond-based attachment.

It is also important to keep searching for other cultural behavioral differences and investigating reasons for them. While we have found regression models and focus groups to be an effective pair of methods to deal with this task, investigating the usability of other methodological approaches – such as unpackaging studies [Matsumoto and Yoo, 2006], questionnaires, and content analysis – might prove to be helpful in getting more accurate and faster views from site participants.

In future work, we intend to follow up on our findings with design experiments that test our claims, and investigate whether alternative design decisions might indeed increase the likelihood of contributions from participants with collectivist backgrounds. Another way to improve the creation and testing of design recommendations is by involving participants in the design process by using Participatory Design techniques [Muller, 2003].

Finally, we intend to extend the research on designing online collaboration for specific cultural groups by studying societies that are rarely considered in cross-cultural studies, such as those from Latin America and Africa [Gallagher and Savage, 2013]. Considering our own nationalities, investigating Brazilian communities' specific needs and preferences is a natural choice. A promising opportunity exists when one considers that the first non-English speaking Q&A site from the StackExchange platform was the Portuguese version of StackOverflow[1], a site that was heavily based on the requests of the community of Brazilian programmers.

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[1]`http://pt.stackoverflow.com/`

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Appendix A

Results of Regression Models

Table A.1: Results of Chapter 3 regression models used to test what national characteristics better explain community engagement differences in Q&A sites. Each model reports on the standardized regression coefficients, its standard error in brackets, and the p-value of the t-statistic. The F-statistic either shows (1) the one-way ANOVA test result for the Baseline model (composed by GNI per capita, Internet penetration and English proficiency as predictors); and for Model 1 (Baseline + Individualism) and Model 2 (Baseline + Self-expression) the F-statistic testing whether the cultural model significantly improve upon the Baseline one.

| | **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)$^\bullet$			.32 (.20)	
Self-expression			.16 (.15)			$-.19$ (.18)
Adj. R^2	.49	.51	.49	.37	.39	.37
F statistic	16.99***	3.04$^\bullet$	1.08	9.68***	2.50	1.07

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $^\bullet p < 0.1$

	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)$^{\bullet}$	.05 (.16)	−.02 (.16)	.06 (.17)
English	.46 (.14)**	.27 (.15)$^{\bullet}$	.39 (.14)**	.51 (.15)**	.29 (.17)$^{\bullet}$	.50 (.15)**
Individualism		.37 (.16)*			.41 (.18)*	
Self-expression			.25 (.14)$^{\bullet}$			.04 (.17)
Adj. R^2	.54	.58	.56	.48	.53	.46
F statistic	20.84***	5.22*	3.05$^{\bullet}$	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)$^{\bullet}$	
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$^{\bullet}$	0.01

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\bullet}p < 0.1$

	StackOverflow			Super User		
	Percentage of users who edit others' content					
	Baseline	Model 1	Model 2	Baseline	Model 1	Model 2
Intercept	.00 (.08)	.00 (.07)	.00 (.08)	.00 (.12)	.00 (.12)	.00 (.12)
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

$^{***}p < 0.001, ^{**}p < 0.01, ^{*}p < 0.05, ^{•}p < 0.1$

Appendix B

Interview Protocol

B.1   National prompt

- (Should take around 5 minutes)

- Would you say that you use more sites and online resources that are from your national community or from outside your national community?

- Can you cite and describe the site from your national community that you use the most?

B.2   Site & Content

GENERAL QUESTION: What is a Q&A site for you? (POST-ITS)

- (Should take around 15 minutes)

- When do you use a Q&A site instead of an online/offline contact/colleague?

- Does the way you use a Q&A site change depending on the topic you're focusing on? (For example: From work to fun or from programming to photography)? If so, how?

- What was the most interesting (unusual) usage you've made (or seen) of a Q&A site? (Describe your experience.) (For example: "saved" in a deadline, helped someone with school work, interesting comment or debate, etc.) How did you use the site? Was the content helpful?

B.3   Community, interactions & identity

GENERAL QUESTION: Describe the dream/nightmare Q&A site user! (POST-ITS)

- (Should take around 15 minutes)

- Have you ever interacted with (dream/nightmare) users inside the site? [YES? How did it go? What do you check about others before interacting?] [NO? Would you say that you only interact with content?]

- When using/participating in a Q&A site, do you feel you are there mostly as an individual or as part of a group? Why?

B.4   Goals & Performance

- (Should take around 10 minutes)

- What are your goals when using Q&A sites? How do you know that you have achieved your goals?

- Which aspects of the site do you think are most important to achieving your goals?

- Which aspects of the site do you think are least important to achieving your goals?

- How does the VOTING system help you to achieve your goals? In what situations have you voted? Have you ever received votes? Why?

- What about COMMENTS? In what situation have you used them? Have you ever 'answered' to a comment?

B.5   Design Activity

This is a GROUP TASK, and you should use paper and pen to answer. We're going to keep the final result, but don't worry much about organization.

- (Should take around 30-45 minutes)

- Brainstorm topics you would like to use a Q&A site to explore – preferably different than those you already use today – and write down at least five. (3 minutes)

- Then, as a group, choose one. (30 seconds)

- Brainstorm questions you might have related to that topic and write down as many as possible. (3 minutes)

- Then, as a group, choose one. (1 minutes)

- Imagine you are in your home country and you need to use technology to find an answer to your question. You could use an existing technology, or some imagined future technology (BUT no Q&A sites are available). Individually, sketch out five possible solutions to your problem. Your sketches might involve people, content, interface, processes, anything. (5 minutes)

- Then, as a group, choose one solution to your problem.

- Now sketch two short stories (Use as many details as possible – make the situation come alive!) In the first story, describe an ideal scenario in using this technology to solve your problem. (5 minutes)

- In the second scenario, describe a nightmare scenario that might happen when using this technology to solve your problem. (5 minutes)

- Now, present your stories! (5 minutes)

Appendix C

Dictionary of codes

Table C.1: List of codes used to analyse the interviews executed as part of the study described in Chapter 4.

Concept	Definition
Roles(#Identity)	Users' perceptions of themselves and others, including their roles when using the site.
Independent	Definitions related to "I", autonomy, self-relevant goals, ego-other distinction
Interdependent	Definitions related to "We", harmony, social goals (successfully developing social roles), ingroup-outgroup distinction
Expert	Someone who is seen as an expert in a field.
Contributor (Asker, Answerer, Commenter, Editor, Voter)	Someone who is seen by their contribution, being that a question, answer, comment, or any other action to improve site's content or interactions.
Moderator	Someone who take administrative actions like closing or deleting questions.
Learner	Someone who is just consulting the site at any moment, without intention to contribute.
Problem solver	A type of #learner, focused on solving a specific problem.

Explorer	A type of #learner: someone who is seen as a curious, navigating and searching to explore a theme, and not necessarily to solve a specific problem
Outsider	A type of #learner: someone who "is not part of" the site. (Sometimes called negatively as a "lurker").
Newbie	Someone who is seen as inexperienced in a topic or community.
Site experience (#Community)	Users' perceptions/experiences on interactions and group participation.
People	Used when participants experience the site through or by citing other participants.
Contact	Used when participants describe their experience in the site through the need – or lack of – direct contacting or interaction with other individuals!
Content	Used when participants describe their experience in the site by using content.
Interaction	Mentions to experiences around discussions and other types of interactions around content.
Site Features	Used when participants describe their experience by using site features.
Praxis	Description of (expected) practices of a site, group or community.
Engagement	Description of repetitive experiences that signals engagement to the site, group or community.
Contribution	Used when participants experience the site through contributions like answering or asking questions.
Categories (Tags)	Description of activities around categories or tags in the site (like following or searching using it).
Affinity	Used when participants describe a feeling of affinity with content or other users.

Validation	Used when participants describe a feeling of self-validation when experience any aspect of the site, group or community.
Voting	Statements on voting systems.
Feedback	When people use voting as a feedback system – like informing others about content usefulness.
Competition	When people use voting as a competing system.
Reputation	When people use voting to build and assess others' reputation.
Values	Statements where participants express what is important for them and others while using the site. (Complementary, what is unimportant or problematic.)
Helpfulness	Intention or need for things to be of help.
Productivity	Expression of the need to be productive (mainly in personal work).
Efficiency	Expression of the need for things to be fast.
Quality	Expression of the need for retrieved content to have high quality.
Adequacy	Need for content/interactions to be "to the point".
Specificity	Answers should provided specific details rather than broad and generic information.
Diversity	The importance of content and ideas diversity.
Organization	Need for content or site functionalities to be well organized.
Anonymity	Need for or concerns about anonymity.
Knowledge	Urge to learn and/or find needed content.
Belonging	Need for a sense of being part of a group.
Trust	The importance of content and people to be trustworthy.
Ease of use	Need for the site to be easy to use.
Rules	The importance of rules to control or guide how people should use the site.

Enjoyment	Expression of joy or need to have fun.
Competition	Opinions on competing behavior.
Non judgment	Need for users to be non judgemental.
Openness	Need for users to be open to share and accept others' contributions.
Sociability	Need for connection with others.
Politeness	Need for users to be polite.
Receptiveness	Urge for participants – more importantly newbies – to be well received.
Reputation	Comments on the importance – or lack of – reputation or rankings.
Curiosity	Opinions on curious behavior.
Social openness	Opinions on sharing more than content, like express feelings, opinions and mood.
Encouragement	Need for users to be encourage others.
Participation	Need for users to participate in site's activities.