This is a post-peer-review, pre-copyedit version of this article. The final authenticated version is available online at:
https://doi.org/10.1109/REW53955.2021.00057

Voice of the Users: A study of software feedback differences between Germany and China

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***Abstract*—App stores, product forums and social media form important channels for software users to communicate with developers and other users. Through their feedback users can share ways they want software to improve, get help and recommend their favourite applications. These online channels are popular around the world, yet, there has been limited research into how their use is impacted by cultural differences between software users from different countries.**

In this study, we investigate the differences in feedback behaviour and attitudes between software users in Germany and China. Through 1,376 user surveys, we show statistically significant differences in the feedback channels each country use, what motivates their feedback, the reasons they don't give feedback and potential new methods to encourage feedback. These differences are analysed through the lens of the Hofstede cultural model, looking in particular at the dimensions of individualism and power distance where Germany and China differ significantly. The findings in this paper give valuable insights on how each country uses online feedback channels and potential ways the channels can be adapted to better suit their distinct cultures.

I. Introduction

Online channels, such as app stores, forums and social media give software users the opportunity to communicate with developers as well as other users. Users often share ways software products can improve to better meet their needs. These online channels are also used to recommend software to other users, which can have a significant impact on downloads. These channels are popular with software users and producers of different cultures around the world. [1], [2], [3]

A user's culture has an impact on the way and style of how feedback is communicated [3], [4]. Depending on the disciplinary community it is applied to, culture has been defined in numerous ways [4]. Overall, these definitions agree that culture is shared, learned, and about groups [5]. Hofstede defines culture from a value perspective, stating that culture is *"a set of shared assumptions that result in a common frame of reference by members of a society or more simply as mental software"* [6].

However, to date there have been limited studies investigating ways online channels can be improved to better suit the different cultures they serve. Two recent studies investigated cultural differences in feedback between app stores in difference regions [3], [7]. Both of these studies identified significant differences in the feedback characteristics between app store regions. Fischer et al. analysed their findings through the lens of the Hofstede cultural model [8]. However, such studies have been limited to feedback on app stores and they have also not considered cultural differences in users' attitudes towards giving feedback.

In this study, we investigate the differences in feedback behaviour and attitudes between software users in Germany and China, for not only app stores, but forums and social media also. Following Fischer et al., our analysis is informed by the Hofstede cultural model, looking at the dimensions of individualism, power distance and uncertainty avoidance where Germany and China differ significantly. Like Fischer, we believe Hofstede is the best fit cultural model for this analysis as it focuses on cultural values that could effect user actions [9], and is the most widely used cultural model in software engineering research [10].

The work in this paper is based on a new analysis of survey data collected during our previous work on software feedback [1], [11]. A significant number of Chinese responses (423) were collected from Zhejiang University and German responses from Karlsruhe Institute of Technology (953), however, these groups were not compared in our previous work.

Our analysis in this paper is guided by the following high level research question:

RQ: *What are the differences in feedback attitudes and behaviour between software users from Germany and China?*

The contributions of this paper are insights into feedback differences between Germany and China, indicating ways online feedback elicitation can be customised to better suit these distinct cultures. Specifically, we show statistically significant differences in the feedback channels they use, what motivates their feedback, the reasons they don't give feedback, and potential new methods to encourage their feedback. Informed by these findings, we also discuss more broadly the cultural implications for analysing user feedback to extract requirements.

II. Related Work

A. User feedback in requirements engineering

User feedback on online channels, such as app stores, social media, or product forums are highly valuable for organisations as they contain requirements-relevant information [2], [12], [13]. Early studies on the fraction of user reviews that relate to software requirements found nearly a third of user reviews to be requirements-relevant [2]. Specifically, requirements engineers and developers can use feedback containing bug reports or feature requests to identify and address user needs and desires, to improve their software iteratively. Continuous product evolution based on implicit or explicit user feedback is a decisive factor for the development of innovative and successful

software, as in many applications, the competitor is only a click away [14], [15].

While one of the significant perks of app stores, forums, and social media as feedback channels is their easy accessibility both for users and requirements engineers, manually eliciting requirements from online feedback can be highly time-intensive [16]. Further, recent trends in the software landscape, such as combining multiple systems into larger ecosystems, can complicate RE [17]. Much recent research has investigated methods to automatically extract requirements in user feedback on app stores, Twitter, and product support forums [18], [12], [19], [20], [21], [22], [23], [24], [25], [26].

In our recent work we presented evidence that only a fraction of software users give online feedback [1], [11]. We showed that certain demographics are at risk of being underrepresented in feedback, raising questions about how representative online feedback is of the complete user base. This work also identified the top user motivations to give online feedback and how these motivations can vary between demographic groups. However, knowledge on how cultural differences impact feedback behaviour and attitudes remains sparse.

Some recent studies have investigated cultural differences in feedback between app stores in different regions, identifying significant differences in feedback characteristics such as length and content [3], [7]. This study builds on this work by investigating cultural differences not only in app stores, but also on forums and social media. Additionally, we investigate attitude differences (e.g. motivations) to online feedback between cultures, by directly surveying users, which is a previously unexplored area.

B. Culture-induced differences in feedback behaviour

In this study, we use Hofstede's well known cultural model [8] as a lens for analysing the differences between German and Chinese feedback behaviour. The possible threats to validity of applying the Hofstede model are discussed in section V. Hofstede surveyed employees of a large company active in 40 countries and discovered four dimensions (later increased to six) that can be used to explain cultural differences. On these six cultural dimensions, Germany and China differ significantly on three dimensions: power distance (C:80, G:35), individualism (C:20, G:67) and uncertainty avoidance (C:30, G:65) [3]. These are defined as:

- **Individualism/Collectivism:** The degree to which people's self-image is defined in terms of "I" or "We".
- **Power distance:** The degree to which the less powerful members of a society accept and expect that power is distributed unequally.
- **Uncertainty avoidance:** The degree to which the members of a society feel uncomfortable with uncertainty and ambiguity.

We focus on these dimensions (which are also the most commonly cited in information systems [9]) to explore differences in software feedback between Germany and China.

III. Methodology

The analysis in this study is conducted on data collected through user surveys from our previous work on software feedback [1], [11]. In this paper, we focus only on the survey responses collected from the Karlsruhe Institute of Technology in Germany, and Zhejiang University in China, discarding responses collected from other countries. We analyse and compare the responses from each institution to investigate cultural differences in feedback behaviour between German and Chinese feedback givers.

Comparing responses from Germany and China was selected for this study as they represented the two biggest groups surveyed in our previous work. Additionally, Germany and China have significant differences in the cultural dimensions described by Hofstede (see section I), allowing for the exploration into the impact of culture on reported feedback differences.

A. Survey Design

The user surveys were done in two rounds, both focusing on feedback in three online channels: app stores, product forums, and social media. The initial survey round was designed to investigate which demographics of software users give online feedback and their motivations for doing so. Analysis of the initial survey showed overall low feedback rates, with underrepresented demographic groups. This prompted a second follow up survey, with the goal of understanding why users often don't give feedback and how they could be better encouraged to in the future.

This paper analyses a subset of questions from both survey rounds, focusing on those most relevant to feedback differences between Germany and China (see RQ). Questions relevant to this study are described below and shown in table II. For clarity, the questions are described below without reference to the individual surveys. The survey each question appeared in is given in table II. A full copy of the first[1] and second[2] surveys can be found on Zenodo.

Survey question descriptions: The survey respondents were first asked if they had previously given written feedback to app stores, product forums or social media. Next, respondents who had given feedback were asked what their motivations were to write on each channel. A set of possible motivations were given and respondents asked to select all that applied to them. The answer options for the motivation to provide feedback were based on findings from recent research on each of the feedback channels [2], [12], [13].

Demographic questions were given to collect information on the participants age, gender, ethnicity, education, and employment. These questions and their associated answer choices were informed by traditional marketing demographic categories [31] as well as the New Zealand census (2018) [30].

Next, three multi-choice questions were asked, focused on reasons not to give online feedback, for each study channel. As this is a new area of software engineering research, there wasn't existing literature to draw on for

[1] https://zenodo.org/record/3674076#.XkxNFygzZPY
[2] https://zenodo.org/record/4320164#.X9beD9gzZ3g

TABLE I
RESPONDENT DEMOGRAPHICS

Demographic Type	Group	KIT (S1)	KIT (S2)	Zhejiang University
Gender	Men	356 (*66.8%*)	265 (*63.1%*)	182 (*43.0%*)
”	Women	172 (*32.2%*)	148 (*35.2%*)	232 (*54.8%*)
”	Other responses	5 (*1.0%*)	7 (*1.7%*)	9 (*2.2%*)
Age	Under 18 years	0 (*0.0%*)	0 (*0.0%*)	4 (*0.9%*)
”	18 - 24 years	358 (*67.2%*)	246 (*58.6%*)	332 (*78.5%*)
”	25 - 34 years	165 (*31.0%*)	168 (*40.0%*)	70 (*16.5%*)
”	Over 35 years	10 (*1.9%*)	6 (*1.4%*)	17 (*4.0%*)

TABLE II
ANALYSED SURVEY QUESTIONS*

Survey	Question	Answer Source
S1	How have you used ***this channel*** in the past? (*choose all that apply*) (*I haven't / Reading and viewing / Written posts*)	-
S1	What was your motivation(s) to write on ***this channel*** in the past? (*choose all that apply*) *(Show appreciation / Show dissatisfaction / Influence improvement / Recommend / Discourage others / Connect or socialise about software / No specific motivation / Other, please specify)*	[2], [12], [13]
S2	*Please rate your **agreement level** with the following statements:* In the past, when an app/software didn't meet my expectations, I've chosen not to write a review/post because, a) I wasn't aware I could influence app/software improvements by writing a review/post b) I thought it would take too long to get a resolution with a review/post c) I've found ***this channel*** confusing or hard to use d) I didn't think an app/software review/post would be seen by developers or lead to a resolution e) I would look for an existing answer online instead of writing a review/post f) I would look for an alternative app/software instead of writing a review/post g) I didn't think my review would influence other app/software users h) Other reason (please specify)	-
S2	*Please rate your **agreement level** with the following statements:* I would be more likely to post on app stores, forums or social media about software issues or requests in the future if, a) I would receive a small financial incentive b) I would receive in app rewards. E.g. game currency c) I could give feedback via audio d) I could give feedback via video e) I could give app feedback through a smart assistant (Alexa, Google Assistant) f) Other (please specify)	[27], [28], [29]
S1 & S2	Demographic Questions: - How old are you? - What is your gender? - What is your ethnicity? - What is your highest level of education completed? - What is your current employment status? - In which country do you primarily reside? (*S2 only*) ∗*Note: Answer options not shown here for space.*	[30]

**Note: The table shows questions from the first (S1) and second (S2) user surveys addressed in this paper. Questions outside the scope of this paper are not shown for space. The full surveys can be found on Zenodo via the links provided.*

answer options. The options for these questions were primarily sourced from discussions with respondents during the first survey and are given in table II.

A single multi-choice question was given focusing on new methods to encourage user feedback, across all study channels. This question gave five answers options, three new methods to give feedback and two reward types to incentivise feedback (see table II). The three new methods to give feedback (audio recording, smart assistant, video recording) were sourced from and inspired by Stade et al's work on smart home feedback [29]. The reward type incentives were taken from examples in industry (Mechanical Turk [28], digital items [32]). Finally, a question asking participants which country they primarily live in was given.

B. Ethics Approval

Both survey's had ethics approval from the University of Auckland's Human Participants Ethics Committee. Response data from the surveys could not be made publicly available as this is not permitted under the ethics committee's requirements.

C. Recruiting Participants

Convenience sampling was used in both surveys to recruit participants [33]. Convenience sampling was selected to engage a high number of participants in a reasonable time period. The possible sources of bias from our sampling methodology are discussed in section V.

As incentive for survey participation, we offered each participant a chance to join a raffle to win a $200/€120 cash prize. The surveys were primarily made available online through the Qualtics survey platform [34].

First survey round: The first survey was conducted in December 2019. German respondents were recruited from a pool of university participants using the hroot software [35]. The pool includes nearly 3500 participants who registered online to be invited to and participate in scientific studies, either on-site or online. This pool was mainly advertised at the Karlsruhe Institute of Technology, so the pool primarily contains students between the ages of 18 and 30. Through hroot, 2570 participants were invited. The survey was open to anyone 16 years or older.

Second survey round: The second survey was undertaken in November 2020 and was also hosted on Qualtrics. Once again, participants were contacted through the hroot software pool, recruited from the Karlsruhe Institute of Technology. About 1300 participants were invited through hroot for the second survey.

Furthermore, we recruited new participants for the second survey through Zhejiang University, China. The survey was advertised in Zhejiang University's online student forums (CC98 and Duoduo Xiaoyou.), with respondents being given the chance to win one of several ¥200 prizes, as substitute to the $200 prize offered in Germany. For the Zhejiang University distribution, the second survey was translated from English to Mandarin by a paid contractor, and was then reviewed by the third author (a native Mandarin speaker), before distribution. The translated survey has been made available on Zenodo[2]

D. Survey Participants

The survey participants are primarily divided into German and Chinese groups for the analysis in this paper.

German participants: The German response's were collected in two rounds (surveys 1 & 2), through KIT. In the first round, 533 responses were collected to the original survey (S1). In the second round, 420 new responses were collected, introducing the extension questions (S2). As the responses were anonymous and were invited from a larger overall pool, the overlap in respondents between the two rounds is unknown. A break down of the demographics for the KIT respondents in each round are shown in table I.

For survey two, a question was added asking respondents in which country they primarily reside (Q25). From 420 round two respondents, 94.5% were from Germany, 3.6% didn't give an answer and 1.9% were from another central European country. Country information isn't available from round one KIT respondents, which is discussed in the threats to validity (section V).

Chinese participants: 423 Chinese responses were collected in one round from Zhejiang University (China), combining the survey one and two questions. A breakdown of their demographic information is shown in table I. All Zhejiang University respondents said they primarily reside in China.

Age and education: The survey respondents in this paper were engaged through two universities and as such their age and education level are not representative of the general population of software users in each country. Both the KIT and Zhejiang University respondents are primarily between 18 and 34 years old (see table I) and of higher education level than the general population. This limitation is further discussed in the threat to validity (section V).

E. Survey Analysis

In the results, presented in section IV, the ratio of respondents in each user group (China, Germany) that reported a particular behaviour is given, e.g. giving feedback on a particular channel or having a certain motivation. Chi-squared tests, which evaluate differences in proportion between two groups [36], were used to assess if differences reported between Chinese and German respondents were statistically significant.

Statistical significance (Chi-squared) was calculated for Likert scales answers by considering *strongly agree* and *agree* as a single agreement value. Likewise, *strongly disagree* and *disagree* were combined as a single disagreement value, with neutral values not used in the calculation.

IV. Results

Feedback channels used: *Respondents from Germany and China reported significant differences in their feedback rates, on app stores and social media (Table III).* On app stores, Chinese respondents reported to give feedback more often than German respondents (C:24.53%, G:18.20%).

On social media Chinese respondents reported to give feedback at a significantly higher rate than German respondents (C:22.73%, G:4.97%). Finally, on forums, the feedback rates between German and Chinese respondents wasn't found to be significant.

TABLE III
User Feedback with Country

	Germany	China	*Chi2 (p)*
App Store (%)	18.20	24.53	5.42 (*)
Forums (%)	12.01	8.02	2.03
Social Media (%)	5.07	22.73	63.82 (***)

*** $p<0.001$, ** $p<0.01$, * $p\leq0.05$

Motivation to give feedback: *Differences in the motivations to give online feedback were reported between respondents from China and Germany, across all three study channels.* Motivations rates between respondents from each country are shown in Table IV. On all three channels, respondents from Germany were significantly more motivated to influence an improvement in software. On social media this difference was the largest with 70.37% of German feedback givers compared to just 31.11% of Chinese feedback givers citing this motivation.

On all channels, Chinese feedback givers were more likely to be motivated to recommend software to others. However, this difference was only statistically significant on social media, with 45.93% of Chinese feedback givers and just 18.52% of German feedback givers citing the motivation. Also across all three channels, Chinese respondents were more likely to be motivated to express their dissatisfaction with software and to discourage other users from downloading it. However, these differences were only statistically significant on product forums, where 41.18%

of Chinese feedback givers were motivated to show dissatisfaction and 23.53% to discourage others, compared to just 17.19% and 6.25% of Germans respectively.

Reasons users don't give online feedback: Respondents were asked to rate their agreement, on a five point Likert Scale, with seven predefined reasons that they didn't give feedback in the past, when faced with software issues (Table II). *Respondents from China and Germany reported significant differences in their motivation to give software feedback, across all three channels (Table V).*

Chinese respondents were significantly more likely than German respondents to prefer finding an existing answer over giving app store feedback (C: 81.6%, G:72.9%). However, this was reversed for product forums where German respondents reported being more likely to find an existing answer instead (G:89.1%, C:68.1%). Chinese respondents reported to be significantly more likely to not give app store and social media feedback because they felt a solution to their problem would take too long.

Chinese respondents reported significantly more than German respondents to not be aware that their feedback could influence an improvement in the software, across all three study channels. Significantly more German respondents found product forums confusing or hard to use, whereas, Chinese respondents were more likely (than Germans) to find app stores and social media confusing or hard to use.

Methods to encourage online feedback: Respondents were asked to rate their agreement, on a five point Likert Scale, with five predefined potential new methods to encourage their feedback (Table II). *Significantly more Chinese than German respondents reported that each of the suggested incentive methods would increase their probability of giving software feedback* (table VI).

German and Chinese respondents agreed that a small financial incentive was the top potential method for encouraging their feedback, with in-app rewards the second most promising. However, Chinese respondents were significantly more likely than German respondents to endorsed both a financial incentive (C:86.9%, G:77.6%) and in-app rewards (C:70.2%, 61.0%).

The difference between groups was even larger when accessing the potential of the three suggested alternative feedback methods. Chinese respondents were more than twice as likely to endorse giving feedback through a smart assistant (C:37.4%, G:15.0%), through an audio channel (C:24.0%, G:11.4%) and through a video channel (C:16.0%, G:6.9%).

V. Threats to validity

Convenience sampling, used to elicit all survey participants, is a non-probabilistic sampling method and a possible source of bias [33]. The target population of the study's are users of software and mobile applications. German participants were engaged through the Karlsruhe Institute of Technology survey pool, with Chinese participants engaged through Zhejiang University's online student forums. Therefore, in both groups only a subset of the target population had the opportunity to participate. Respondents in both groups were predominantly between the ages of 18 and 34, with many having some form of higher education. The two groups do vary with respect to their gender split, with the German respondents having a higher proportion of men than the Chinese respondents. Additionally, KIT is a technical university, while Zhejiang is a general university. As such, there may be some non-homogeneity in the technical savviness of the two groups. Finally, all respondents who completed the survey were self-selected, and their feedback habits may not generalise to all software users.

To mitigate these sources of bias, we collected data from a large number of software users, 423 Chinese respondents, and 533 then 420 responses (two rounds) from German participants. With, the age and education level distributions being similar between the compared groups. However, we cannot claim that our results generalise outside of our sample. Future studies can replicate the survey's (available on Zenodo) to validate our findings.

One additional threat to validity is the possibility of round one KIT survey respondents, analysed (and presented) as German, being from countries other than Germany. This is possible as country data wasn't collected in the first KIT survey round. However, it's likely both rounds of KIT residents are predominately German. Both rounds were drawn from the same pool of approximately 3500 KIT students and Karlsruhe (Germany) citizens. The round two KIT respondents were asked their country of residents and were overwhelming from Germany (94.5%) or other central European countries (1.9%). It's likely round one respondents follow a similar country distribution. Supporting this, respondents from both KIT rounds reported very similar distributions in gender, age, ethnicity (predominately European) and education level.

Finally, viewing cultural differences through the Hofstede model is a possible threat to validity. Despite being widely used, the Hofstede model has been criticised for being outdated [37], as well as having a western perspective [38] and being focused on companies [39]. While there may be some validity to these points, Hofstede's model remains popular and the cultural dimensions it measures have been shown to be stable over time [40]. Additionally, in this study we don't focus on the exact scores proposed by the model, but generally on the three dimensions where Germany and China vary significantly. Therefore, our analysis should be resilient to minor changes in the dimensional scores over time. Future work could investigate user feedback with the aid of alternative models to see if the impact of culture continues to appear significant.

VI. Discussion

In this section, we first discuss our findings in relation to cultural differences between Germany and China. Following this, we consider the implications of cultural impact on software feedback from a requirements engineering perspective.

Cultural influences: Following Fischer et al.'s [3] work on cultural differences in app store feedback, we analyse the differences between German and Chinese feedback behaviour through the lens of the Hofstede cultural model. On the six cultural dimensions outlined by Hofstede (see section II), Germany and China differ significantly on

TABLE IV
MOTIVATIONS TO GIVE FEEDBACK WITH COUNTRY

	App Store (%)			Product Forums (%)			Social Media (%)		
Motivation	Chinese	German	*Chi2* (*p*)	Chinese	German	*Chi2* (*p*)	Chinese	German	*Chi2* (*p*)
Show appreciation	55.77	67.01	2.22	55.88	28.13	6.15 (*)	66.67	55.56	0.78
Show dissatisfaction	54.81	42.27	2.68	41.18	17.19	5.52 (*)	66.67	51.85	1.55
Influence improvement	40.38	64.95	11.17 (*)	29.41	56.25	5.39 (*)	31.11	70.37	13.15 (***)
Recommend	31.73	25.77	0.60	35.29	20.31	1.89	45.93	18.52	5.88 (*)
Discourage	22.12	14.43	1.49	23.53	6.25	4.66 (*)	22.96	11.11	1.26
Get help	20.19	9.09	4.87 (*)	55.88	70.91	0.07	22.22	31.82	0.03
Connect/socialise	4.81	1.03	1.34	17.65	21.88	0.05	26.67	37.04	0.74

*** $p<0.001$, ** $p<0.01$, * $p\leq0.05$

TABLE V
REASONS NOT TO GIVE FEEDBACK, AGREEMENT LEVEL BY COUNTRY

	App Store			Product Forums			Social Media		
	Germany (%)	China (%)	*Chi2* (*p*)	Germany (%)	China (%)	*Chi2* (*p*)	Germany (%)	China (%)	*Chi2* (*p*)
Alternative app	82.7	73.5	2.67	58.4	62.8	2.28	67.5	72.1	0.25
Existing answer	72.9	81.6	15.08 (***)	89.1	68.1	14.26 (***)	83.1	75.2	1.68
Too long	72.7	84.6	16.09 (***)	66.3	64.4	0.44	46.6	73.3	80.25 (***)
No resolution	51.1	47.5	0.31	41.6	37.2	0.02	56.1	51.1	0.82
Not aware	30.6	67.6	150.69 (***)	33.7	47.6	17.53 (***)	50.1	60.0	13.75 (***)
Won't influence	28.0	30.3	0.02	26.6	26.2	0.01	37.5	39.2	0.04
Confusing	6.2	35.5	165.48 (***)	30.9	19.9	5.87 (*)	7.8	19.1	41.11 (***)

*** $p<0.001$, ** $p<0.01$, * $p\leq0.05$

TABLE VI
METHODS TO ENCOURAGE FEEDBACK (AGREEMENT LEVEL)

	Germany	China	*Chi2* (*p*)
Financial incentive	77.6	86.9	16.39 (***)
In-app rewards	61.0	70.2	19.57 (***)
Smart assistant	15.0	37.4	80.58 (***)
Audio feedback	11.4	24.0	38.61 (***)
Video feedback	6.9	16.0	24.70 (***)

*** $p<0.001$, ** $p<0.01$, * $p\leq0.05$

three dimensions: power distance (C:80, G:35), individualism (C:20, G:67) and uncertainty avoidance (C:30, G:65).

Chinese respondents reported being more motivated to recommend and to discourage other's from using software products through their feedback. This may be a reflection of China's more collectivist culture (low individualism), where people are integrated into strong, cohesive in-groups, forming opinions collectively [8]. Germans conversely reported being less motivated to recommend or discourage others, which could be an indication of their more individualistic culture.

German feedback givers reported being more motivated to influence improvement in software through their feedback, across all channels. Chinese respondents, being from a high power distance culture, may feel less willing to question the design decisions of software producers. Germans, however, are a low power distance culture and appear to have less inhibitions about influencing software decisions. Chinese respondents more often reported not to give feedback because they were not aware they could influence software improvements. This is in line with not being motivated to influence software improvements, and could also be an indication of a perceived power distance between software users and producers.

Significantly more Chinese respondents reported finding app stores and social media confusing or hard to use. This may partly be a consequence of cultural differences between western producers of app platforms and Chinese users. The Apple and Google play stores were given as examples in the survey. Several Chinese phone companies, such as Huawei, do provide their own app stores. However, we didn't ask survey participants to differentiate between different app stores, and therefore don't know if the usability issues reported by the Chinese users are specific to the western app stores or app stores in general.

Chinese respondents reported giving feedback through social media significantly more than Germans (C:22.7%, G:5.1%). This could be a reflection of different social media platforms being used. In Germany, Facebook and Twitter are popular, whereas in China, QQ, WeChat and Weibo are the most widely used platforms. One difference between western social media and Weibo, for example, is that it is common for Weibo users not to use their real name and instead use a nickname [41]. In our previous work [11], survey respondents told us they would be more likely to give feedback if they were able to do it anonymously. Using nicknames on some social media may give Chinese software users a sense of anonymity and therefore encourage their feedback.

Implications and future work: Germany and China differ culturally in several key dimensions, as described by the Hofstede model. Software users in each country reported significant differences in their behaviour and attitudes to online feedback. One implication of these differences is that different cultures may need a targeted approach when trying to elicit and improve the quality of their feedback. Improving feedback elicitation from users of different backgrounds will, in turn, produce requirements that better represent a software products complete user base.

Collectivist cultures (like China) could be more motivated to share their opinions on software with other

users (encourage/discourage), therefore feedback channel features that support this behaviour may encourage engagement. Additionally, Chinese respondents reported being significantly more motivated by possible incentives for their feedback, as well as new methods to give feedback (audio, video). This illustrates that these approaches may be well suited to certain countries (and cultures), but alternative encouragement may be needed elsewhere.

Low power distance, high uncertainty avoidance cultures (like Germany), may be more motivated to influence improvement in software. Therefore, their engagement could be encouraged by showing the impact of their feedback on software improvement. One approach would be to clearly show a track-record of implemented features and repaired bugs from user feedback. Additionally, a quick response to feedback givers showing their improvement suggestions are being considered may also be encouraging [11]. The ability to give anonymous feedback could also facilitate feedback that wouldn't have been given otherwise.

Chinese respondents reported not being aware they could influence software improvements and not being motivated to do so. This may be effecting the quality of feedback they are giving, if they aren't suggesting ways to improve the software. If this is a result of China's high power distance, it's likely countries with similar cultural characteristics will also face this issue. Future work could investigate if Chinese software users, and other high power distance countries, are in fact giving less improvement suggestions and if so, investigate new approaches to elicit this type of feedback.

Looking forward, while CrowdRE tends to take a high level view, seeing the crowd in aggregate, we have investigated a more fine grain approach. In this and our previous work ([1], [11]) we have shown evidence that feedback habits and attitudes vary significantly between countries (and cultures), genders and age groups. We believe that understanding the demographics within the crowd is an important step to more inclusive and ethical CrowdRE. Future work should endeavour to understand additional demographic and minority groups within the crowd and could also be extended to include intersectionality between groups.

VII. Conclusion

App stores, forums and social media are important channels for software users to share ways they want software to improve, get help or recommend their favourite applications. These online channels are popular in many different countries, however, there has been limited work looking at how cultural differences effect their use.

In this paper, we investigate how the use of online feedback channels and attitudes towards them vary between software users in Germany and China. Through 1,376 user surveys we show distinct differences between each country. Chinese respondents told us they were more likely (than Germans) to recommend or discourage other users from applications. Whereas, German respondents were significantly more motivated to influence improvements through their feedback. Chinese respondents reported using social media to give feedback significantly more than Germans, which is likely a result of the different social media platforms used in each country. Finally, Chinese respondents more frequently endorsed the potential use of incentives to encourage their feedback, as well as possible new methods to give feedback (audio, video, smart assistant).

We discuss the findings in the context of the cultural dimensions described in the Hofstede model. In particular, we discuss how differences in individualism and power distance between German and Chinese societies may be reflected in their reported use of online channels. Through these insights we suggest ways to adapt online channels to better suit the needs of each country.

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