Features for Mobile Feedback Tools: Applying the KANO Method

Melanie Stade[1,2], Norbert Seyff[2,3]

Cognitive Psychology and Cognitive Ergonomics, Berlin University of Technology (TUB)[1]
Centre for Requirements Engineering, University of Applied Sciences and Arts Northwestern Switzerland (FHNW)[2]
Requirements Engineering Research Group, University of Zurich (UZH)[3]

Abstract

Feedback tools support end-users in communicating needs and problems when using a software system. However, there are no research results available that discuss if the features provided by a feedback tool, such as screenshot annotation options, influence end-users' satisfaction with the feedback tool. In our study, we used the KANO method to explore the mobile feedback tool features that affect the end-users' satisfaction with the tool. We analyzed typical feedback features provided by two mobile feedback tools. Each tool was used by a selected number of end-users for a ten-day period. After that, we asked the end-users about their feature preferences and applied the KANO model to categorize the features. The results show that there are certain features that can influence end-users' opinion about the feedback tool. These research results can help with the design of future mobile feedback tools that optimally support end-users in providing feedback for software systems.

1   Introduction

User involvement is important for software development and evolution (Ko, Lee, Ferrari, Ip, & Tran, 2011) as it increases software companies' knowledge about real software usage and helps to provide improvement ideas (Maalej & Pagano, 2011). During the last few years, several research groups that investigated tool-supported gathering of end-user feedback have developed various tools to engage end-users in software evolution and requirements elicitation activities (Nakhimovsky, Miller, Dimopoulos, & Siliski, 2010; Hess, Wan, Ley, & Wulf, 2012; Wehrmaker, Gärtner, & Schneider, 2012; Seyff, Ollmann, & Bortenschlager, 2014). These tools allow end-users to communicate needs, opinions, usability issues, and feature requests as a speech act (i.e., written or spoken natural language) and a non-linguistic act (e.g., annotated screenshots) (Morales-Ramirez, Perini, & Guizzardi, 2015).

With a few exceptions (Seyff et al., 2014), these tools are not based on clearly defined requirements. Furthermore, instead of an in-depth evaluation, their success is usually evaluated by measuring how much feedback is collected by the tools. To the best of our knowledge, no study has explored what end-users expect from a feedback tool. In other words, the presence or absence of *specific features* for feedback tools impacts the (dis-)satisfaction of end-users with these tools has not been investigated yet. Therefore, a contribution in this area would be highly relevant for researchers and practitioners. We assume that the presence of satisfaction (or at least the absence of dissatisfaction) increases the probability that end-users accept the feedback tool as a feedback communication channel and do continuously send feedback. Moreover, following Bailom, Hinterhuber, Matzler, and Sauerwein (1996), the categorization of features has several advantages including deriving recommendations for development and evolution of (feedback) tools based on the requirement categorization. Thus, knowing features that could increase end-users' satisfaction with the feedback tool could help to better understand how end-users could be best involved in software development and evolution activities.

The aim of this research was: (i) to explore end-users' preferences regarding mobile feedback tool features by classifying them with the KANO model (Kano, Seraku, Takahashi, & Tsuji, 1984) and (ii) to investigate if these preferences differ based on end-user's experience with a specific feedback tool.

2   Method

2.1   KANO Method

We classified the features of feedback tools with the help of the *five user requirement categories provided by the KANO model* (Kano et al., 1984). Fulfilling a Must-be requirement (M), a feature that is implicitly assumed by customers (here, end-users of a feedback tool), would not improve customer satisfaction, but rather, its absence can negatively impact the satisfaction level for customers. In contrast, customer satisfaction increases proportionally to the extent of fulfilling a One-dimensional requirement (O) that is explicitly demanded by customers. Another significant impact on customer satisfaction has an Attractive requirement (A), because the absence of such a feature does not reduce customer satisfaction. However, its presence adds value to the product, while improving customer satisfaction. No impact on customer satisfaction or dissatisfaction has an Indifferent requirement (I) because (not) fulfilling this requirement will not make a difference to the customer. Furthermore, the presence of a Reverse requirement (R) would increase the customers' dissatisfaction level.

We used the *KANO method* and applied the four steps introduced by Bailom and colleagues (1996) for this feature classification by (1) identifying the features, (2) formulating the KANO questionnaire, which includes question pairs (functional and dysfunctional question parts), (3) conducting a survey, and (4) analyzing and interpreting the KANO questionnaire data.

Step 1: We compared several feedback tools in literature that allow end-users to provide feedback for an application on a mobile device. Table 1 compares the main similarities and differences in the features supported by these feedback tools. Guided by this feature list, we used and configured two applications as feedback tools and manipulated the features supported (see Section 2.2.1).

Step 2: For each of the features identified (see Table 1), we formulated a pair of questions to enquire about the participants' opinion (functional/dysfunctional) on a feature in the feedback tool (Berger et al., 1993). The opinions of the participants to the mandatory questions are shown in Table 2.

Step 3: Two groups of end-users answered the KANO questionnaire: One group of end-users used a feedback tool supporting a minimum set of features, while the other group used a feedback tool supporting a maximum set of features (see Section 2.2).

Step 4: Based on the questionnaire, we identified the fitting KANO category for each participant and feature. We then calculated the satisfaction coefficients (see Section 3) for further interpretation.

2.2   Study Design, Participants and Data Collection

For ten days, 30 students or employees (19 females, aged 20–30 years) used a feedback tool (between-subjects factor) to provide feedback to the Facebook Android App (www.facebook.com), including the documentation of usability issues, problems occurred, or ideas for improvement. The feedback was documented in German because all the participants were German native speakers. The participants were required to have a regularly used Facebook account for at least one year. After a short online tutorial, which included their task description, the participants installed and configured the feedback tool on their private Android smartphones (and other devices, see Section 2.2.1). Before participating in the study, participants neither had experience in providing feedback nor used the applications we selected as feedback tools (see Section 2.2.1).

After ten days, the participants completed an online questionnaire and participated in a short telephonic interview. For each of the ten feedback tool features (see Table 1), the participants answered the functional and dysfunctional part of the KANO questionnaire. Furthermore, the participants answered questions about their behavior and experience while participating in the study, such as how soon they provided feedback; those results are not part of this paper. All the participants received a small token of appreciation (15 Euros) for their participation in the study.

In this study, the experience with one of the two feedback tools is an independent variable while the responses in the KANO questionnaire are dependent variables.

2.2.1 Evernote and MovisensXS as Feedback Tools

After investigating the different feedback tools, we identified a list of features provided by the feedback tools (see Table 1). However, we also noted that none of the existing dedicated feedback tools under analysis supported all the features available and allowed for configuration.

Analyzing the features provided by the feedback tools, we also learned that there are general-purpose tools that provide similar features. In particular, we identified the *Evernote Android App* (www.evernote.com) as a general-purpose tool that provides all features necessary for successful feedback communication. Evernote is designed for capturing and editing digital personal notes in so-called notebooks. In the study, the test leader shared one notebook with each participant. The note pages of the notebook included a feedback form and were automatically synchronized with the test leader's account and other participants' different devices (i.e., PC mandatory, tablet optional). The second application we used as a feedback tool was the *MovisensXS Android App* (https://xs.movisens.com/). MovisensXS is a research tool for ambulatory assessment and can be used to capture participants' experiences via digital questionnaires. For our study, we designed a questionnaire using MovisensXS, which is similar to the feedback form used in Evernote. The flexible configuration option of the MovisensXS App (which is not provided by the feedback tools under analysis) allowed us to configure the MovisensXS App in such a way that minimum features for feedback were available for the participants. Thus, the MovisensXS App was a kind of counterpart to the full-fledged Evernote App. Therefore, we used and compared two different feedback tools in our study. However, this would not have been possible if we had used the feedback tools under analysis.

Features and code	(a) Tools in literature				(b) Study tools	
	Nakhimovsky et al. 2010)	Hess et al. (2012)	Wehrmaker et al. (2012)	Seyff et al. (2014)	Evernote (n = 14)	MovisensXS (n = 16)
Free text input (F1)	X	X	X	X	X	X
Audio recording (F2)	X	X	X	X	X	X
Image upload (e.g., screenshot) (F3)	X	X	X	X	X	X
Image annotation: highlighting (F4)				X	X	
Image annotation: blacken (F5)				X	X	
Upload of >1 image (F6)		X	X		X	
Categorization of feedback (e.g., title, tag) (F7)	X	X			X	
Continue on other devices (F8)		X			X	
Number of feedback sent visible (F9)	X			X	X	
Content of feedback sent visible (F10)	X			X	X	

Table 1: Features supported ("X") in (a) feedback tools in literature and (b) feedback tools configured for the study.

About half of the 30 participants used Evernote (n = 14) to document their feedback while the rest used MovisensXS (n = 16). In total, the participants provided 286 feedback entries (108

entries in the Evernote group). To start the feedback documentation, each participant opened an empty note page (Evernote) or started a new questionnaire (MovisensXS). Both tools supported free text input (F1), audio recording (F2), and uploading of images (F3) to document a feedback; these three features are also available in the analyzed feedback tools (see Table 1). While MovisensXS supports only these three features, Evernote supports all the features available: The Evernote group could edit one or more screenshots uploaded (F4, F5, F6), categorize their feedback (F7), continue their feedback on other devices (F8), and get an overview of the sent feedback (F9, F10).

3   Analysis

First, for each participant and feature, a classification was obtained by applying the classification table (see Table 2) that identifies the KANO categories based on the answer pairs (i.e., functional and dysfunctional part, see Section 2.1) of the KANO questionnaire. Note that no feature was classified as a Reverse requirement (R) (presence would increase dissatisfaction) or Questionable requirement (Q). The latter would indicate that the data about this feature must be excluded from further analysis because customers experienced difficulties in understanding the pairwise questions in the KANO questionnaire.

Answer categories		Dysfunctional				
		(1)	(2)	(3)	(4)	(5)
Functional	I like it (1)	Q	A	A	A	O
	It must be that way (2)	R	I	I	I	M
	I am neutral (3)	R	I	I	I	M
	I can live with it (4)	R	I	I	I	M
	I dislike it (5)	R	R	R	R	Q
Must-be requirement (**M**), One-dimensional requirement (**O**), Attractive requirement (**A**), Indifferent requirement (**I**), Reverse requirement (**R**), Questionable requirement (**Q**)						

Table 2: KANO evaluation table (Bailom et al., 1996).

Second, the *Customer satisfaction (CS)* coefficient (Berger et al., 1993) was calculated for each feature based on the KANO category frequency in the experimental groups. The *CS+ coefficient* is calculated as CS+ = (A+O) / (A+O+I+M), and it indicates the extent to which *satisfaction increases* when a requirement is fulfilled. Thus, CS+ values closer to zero reflect a small increase in satisfaction. The *CS- coefficient* is calculated as CS- = (O+M) / ((-1) * (A+O+I+M)), and indicates the extent to which *dissatisfaction increases* if a requirement is not fulfilled. CS- values closer to zero indicate a minor increase in dissatisfaction.

In the KANO diagram (see Figure 1), the CS+ coefficients are plotted against the CS- coefficients, resulting in four quadrants representing the four KANO categories (Berger et al., 1993). Thus, in the KANO diagram each feature is classified as Must-be (M), One-dimensional (O),

Attractive (A), or Indifferent (I) requirement based on its CS+ and CS- scores. Note that this categorization was separately done for each feedback tool group.
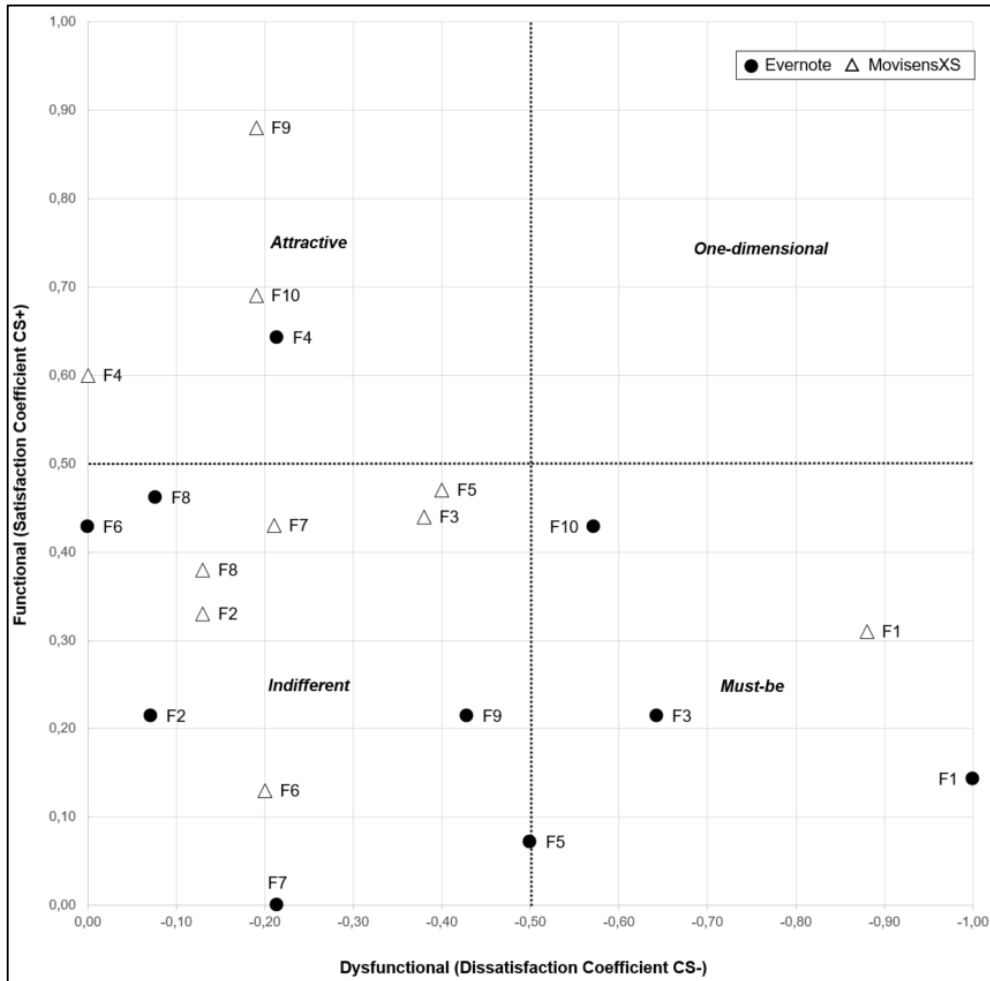

Figure 1: KANO diagram with satisfaction and dissatisfaction coefficients for the ten features (F1–F10), grouped by the two feedback tools used in the study.

4   Results

Analyzing the overall results, none of the ten features is identified as a One-dimensional requirement. Moreover, five features in the Evernote tool group and six features in the MovisensXS feedback tool group were classified as Indifferent requirements, indicating that the presence or absence of these features will not make any difference to the end-users. Three

features were categorized as Attractive requirements, while four features were Must-be requirements, suggesting that some features have the potential to increase the end-users' satisfaction with the feedback tool; however, some features are viewed as essential for end-users (Must-be requirement). Interestingly, in the MovisensXS group, three features were identified as Attractive requirements while only one feature was a Must-be requirement. In the Evernote group, more Must-be than Attractive requirements were identified.

Looking at the feedback tool features *in detail*, the two groups differ in some feature categorizations. The features "Free text input (F1)" and "Audio recording (F2)" available in both feedback tools were identified as Must-be and Indifferent requirements, respectively, in both the groups. However, the feature "Image upload (F3)", as the third of the three features available in both the groups, was identified as a Must-be requirement in the Evernote group, whereas the MovisensXS group categorized this feature as an Indifferent requirement. Regarding the image annotation features, which were only available in the Evernote group, the feature "Highlighting (F4)" was categorized in both groups as an Attractive requirement. However, the "Blacken (F5)" feature was identified as a Must-be requirement in the Evernote group and as an Indifferent requirement with a tendency to being an Attractive requirement in the MovisensXS group. Nonetheless, both groups had similar CS+ values for F4 and similar CS- values for F5. The upload of more than one image (F6) had higher CS+ values in the Evernote group compared to the MovisensXS group, but it was classified in both groups as an Indifferent requirement. The feature "Categorization of feedback (F7)" that was used in the Evernote group was classified as an Indifferent requirement with similar CS- values in both groups, whereas the MovisensXS group had very high CS+ values with the tendency to become an Attractive requirement. In both groups, the feature about continuing a feedback on other devices (F8) was categorized as an Indifferent requirement with a tendency to become an Attractive requirement. In the MovisensXS group, where the participants could neither see the number (F9) nor the content of feedback forms sent (F10), both features were categorized as Attractive requirements. In the Evernote group that used these features during the study, the feature number of feedback visible (F9) was identified as an Indifferent requirement and only the feature "Content of feedback sent visible (F10)" was an Attractive requirement.

5   Discussion

5.1   Interpretation of the Results

In applying the KANO method on features for feedback tools, the study identified end-users' preferences regarding tool attributes. The study also identified differences in end-users' feature preferences based on the experience with a specific feedback tool.

Interestingly, the *most frequent KANO category* was the Indifferent requirement category. However, which feature was categorized as an Indifferent requirement varied among the two groups. A possible explanation for the results is that some features were identified as Indifferent requirements in the MovisensXS group, but not in the Evernote group because the MovisensXS participants did not have a first-hand experience with these features; therefore, they

could not anticipate the advantages (or disadvantages) of these features. Moreover, in the MovisensXS group, which could use only a minimum set of features, more features were identified as Attractive requirements, whereas the Evernote group, which could use a maximum set of features, identified more Must-be requirements. Providing features to end-users that they already known (here, Evernote group) might avoid dissatisfaction for end-users and providing new features (here, MovisensXS) might increase the chance of higher satisfaction with the feedback tool.

Surprisingly, the presence or absence of an *audio recording feature* will not make any difference to the end-users' satisfaction, whereas free text input was identified in both groups as a Must-be requirement. Because audio can be viewed as a superior format for a feedback documentation in a mobile context, future work should investigate obstacles for end-users to use an audio recording feature.

Seeing own feedback already sent was identified in both groups as an Attractive requirement, while it seems that seeing the feedback content could impact the satisfaction more than just seeing the feedback number, as indicated by the Evernote group, which experienced both features and identified the latter as an Indifferent requirement.

Overall, it seems to be a *cumbersome process to increase end-user satisfaction* using a feedback tool. The first explanation is that the feature list presented to the end-users did not include future features that might increase satisfaction. Second, it is questionable if we can even increase satisfaction with a feedback tool because giving feedback is usually just a side-task for the end-user.

5.2   Study Limitations and Recommendations for Future Work

The first limitation is the *requirements list* for the KANO questionnaire. In this study, the creation of the requirements list was not driven by an end-user survey, but by the literature analysis, which resulted in extracting features that are (not) supported in mobile feedback tools available. Thus, the list of features might not be complete. However, in the post-interview, participants did not mention any missing features. Beyond the list creation, the list of features in the questionnaire was very detailed. High-level (non-functional) requirements such as "easy to use" or "nice design" were not asked and are potential candidates for further research. Thus, future research work should validate and, if needed, extend the current requirements list.

Second, the *applications used as feedback tools* were not originally developed and designed as feedback tools. However, in literature, it is shown that existing tools can be adapted as feedback tools (Lichtner, Kounkou, Dotan, Kooken, & Maiden, 2009). Moreover, all participants used the tools for the first time, so they were not aware of the intended function (e.g., using Evernote for private notes management) and were able to document the feedback. Therefore, we conclude that the study participants perceived and accepted the applications as feedback tools.

The third issue is about the *sample characteristics*. We applied the KANO method to a small and relatively young sample that experienced the process of feedback documentation during the study for the first time. Our study should be expanded by including end-users who are

experienced in providing feedback with several tools or channels (e.g., email, contact form). In general, we had wished to involve more heterogeneous participants and assume that a larger sample would allow for a clearer categorization of features, even for sub-groups of end-users (e.g., based on their preferences, computer experience).

Finally, the *generalizability* of this study must be discussed. The study is limited to the investigation of mobile standalone feedback tools used by end-users to provide feedback for a consumer App. Feedback tools—built-in or standalone—for non-mobile devices could request for other features. We highly recommend extending our study to a real usage context and investigating if end-users' feature preferences change under specific conditions such as working environment and desktop application.

5.3   Conclusion

This study demonstrated the application of the KANO method as a fruitful approach for investigating feedback tools. Feature preferences for mobile feedback tools were identified, whereas end-users' experiences with a concrete feedback tool influenced the impact of the presence or absence of a feature on their (dis)satisfaction level. This study goes beyond the usual evaluation of feedback tools based only on the volume of feedback sent while satisfaction levels and the needs of end-users are neglected.

The key outcomes are that none of the ten mobile feedback tool features were identified as a One-dimensional requirement and that the most frequent KANO category was the Indifferent requirement category. Overall, it seems that only a few features have the potential to increase end-users' satisfaction with a mobile feedback tool, while the absence of most features will not increase dissatisfaction. Nevertheless, before researchers or practitioners decide on features for their feedback tool, needs of the feedback receiver should be elicited (Bettenburg et al., 2008). Therefore, we see potential in an adaptive feedback gathering approach (Almaliki, Ncube, & Ali, 2015): A flexible feedback tool that can be easily tailored and configured by researchers and practitioners for the end-users' needs would foster user involvement research.

Acknowledgment

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