Use and Even Recommend? Acceptance Modeling of a Smartphone Launcher App for Elderly Users

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Abstract. In this paper, we demonstrate how to utilize acceptance modeling in UX optimization via an adapted Technology Acceptance Model (TAM), which was applied in an industrial software development context. We evaluated a new Android launcher application that changes the user interface of smartphones to better match the needs of elderly users. Our findings show, that the factor "Usefulness" has the highest relevance and should be prioritized in both further product improvements and marketing processes. Furthermore, it is necessary to include the additional acceptance output variable "Intention to recommend" to determine successful communication strategies. We encourage researchers and practitioners to use context-specific technology acceptance models in software development processes to ensure adaption in the relevant target group.

Keywords: acceptance model, user study, smartphone, elderly users

1 Introduction

Emporia, an Austrian company which produces feature phones and smartphones for seniors, developed an elderly-friendly Android launcher application that changes the UI of common off-the-shelf smartphones in order to better match the special needs of elderly users, see Figure 1 (a) and (b). The Android launcher application was already in a late stage of the development process. However, previous market research by the company has shown that adoption of such a launcher typically happens via younger relatives who download and install the launcher on a smartphone (often an older model being reused), which is then handed over to the older family member. For the company, these younger relatives constituted a novel yet critical target group. Thus, it was necessary to obtain reliable information about how this group perceives and evaluates the product and as a consequence, how likely they would accept and adopt it. In this paper, we describe how we addressed this challenge by adapting Venkatesh's technology acceptance model (TAM) [6] and by utilizing it via a user study designed to obtain empirical data on acceptance-related factors related to the launcher application.

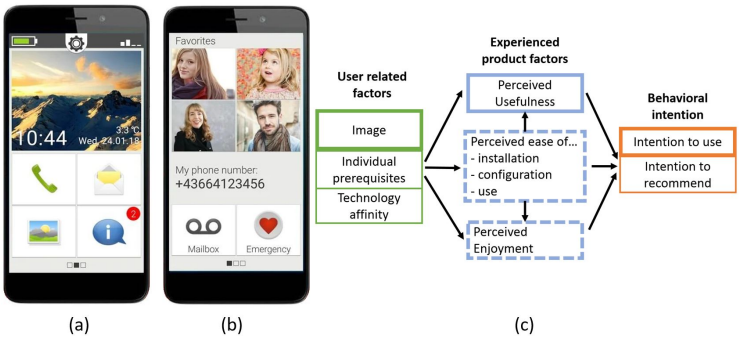

Fig. 1. (a) Home screen of the Android launcher. (b) Dial screen of the Android launcher. (c) Adapted TAM model for elderly-friendly smartphone applications. Bold borders indicate original TAM factors, whereas factors with thin borders were context specific and dashed ones were adapted ones.

TAMs were originally developed in the context of Information Systems with the purpose of quantitatively describing how different system and user related factors influence end-user adoption behavior, e.g. [4]. Although TAMs have the potential to provide substantial input in modern software development (cf. [1]), its practical application has been largely neglected so far. Similar to other end user studies (e.g. [1]), the underlying model needed to be adapted and extended to fulfill the requirements of the product and the target group. Hence, in our adapted TAM for elderly-friendly smartphone applications, we separated the original TAM factor *Behavioral intention* into *Behavioral intention to use* and *Behavioral intention to recommend* because recommendation to others (beyond mere usage) has become a critical factor in the context of acceptance and adoption in various contexts, e.g. [2]. We used the Net Promoter Score NPS [5] to determine this intention to recommend. For intention to use, we asked our study participants, if they would provide their older family members with a smartphone which has the launcher installed.

Whereas *Perceived usefulness* remained unchanged (e.g. whether the elderly family members would save time by using the launcher, and whether the software would support their daily life), we extended the original TAM factor *Perceived ease of use* with *Perceived ease of installation* and *Perceived ease of configuration*, since these are critical for applications like UI launchers (installation and configuration will be done by the younger relatives). Additionally, the younger relatives had to indicate how easy the daily usage would be for their older family members. We used the original TAM factor *Image* to determine the perceived social status of smartphones, i.e, younger relatives indicated if elderly people should use smartphones from a social point of view. Furthermore, we added the factors *Individual prerequisites* to determine if elderly users are able to interact with the UI from a physiological (i.e. cognitive, motoric and visual capabilities) point of view. A subset of the technology affinity questionnaire TA-EG [3]

was used to determine the affinity of the elderly family members regarding new technology products. Furthermore, we understand *Perceived enjoyment* as key factor for user satisfaction and acceptance. We asked the study participants if their older family members would enjoy the usage of the launcher. Figure 1 (c) displays our adapted acceptance model. Except NPS, all factors were covered by several items rated on 7-point Likert scales ranging from 1 *strongly disagree* to 7 *strongly agree*.

We conducted a laboratory user study to provide participants with hands on experience with the close-to-final prototype. The goal of the user study was to evaluate our acceptance model and to derive specific recommendations for software development marketing strategies for our industrial partner. Overall, 25 participants (f=14, m=11), all taking care of elderly relatives, took part in our study, with age between 33 and 59 years and a mean age of 47. Study participants were asked to download, install and configure the Android Launcher including the granting of several android permissions, setting up WhatsApp, creating family contacts with photos and setting up the weather app. Then, the participants had to fulfill typical smartphone tasks, e.g., dialing, making a photo and sending it via WhatsApp, etc. All steps were evaluated via questionnaires accompanied by open questions to gather qualitative data about the investigated factors.

2 Findings

Table 1 displays the mean and SD values of all factors, Cronbach's alpha values (0.7-0.98) indicate a high internal consistency of the different items. The high mean values of the factors indicate, that the expectations of the target group regarding an easy to use and useful Android launcher for elderly relatives were fulfilled. The calculated NPS is 38%, which is comparable to the NPS of Apple in Austria with 39%[3].

Table 2 shows which factors are most relevant for *Behavioral intention to use/recommend* by depicting correlations (level of significance:*=p<0.05, *=p<0.01,***=p<0.001). The factor *Perceived usefulness* has the highest correlation for both *Intention to use*(r=0.84, p<.001) and *Intention to recommend*(r=0.84, p<.001), i.e., for further product optimizations we advised our industrial partner to focus on this aspect and to communicate, e.g., how using the launcher saves time (for both elderly users and their younger relatives) and how the launcher enables older user to interact with the smartphone. Furthermore, our participants provided some ideas how to increase the usefulness of the launcher, e.g., by providing the possibility to set alerts for individual intakes of pills. Surprisingly, *Perceived ease of use* has rather low impact on *Behavioral intention to use* (r=0.49, p<.05) and on *Behavioral intention to recommend* (r=0.45, p<.05). However, the ratings themselves show that the launcher is easy to use. Although *Perceived ease of installation* was evaluated very positively,

[3] http://www.marktmeinungmensch.at/studien/der-net-promoter-score-nps-von-smartphone-marken-i/, last access: 14.04.2021

it doesn't exert significant impact on *Behavioral intention to use* or *Behavioral intention to recommend*. Some participants mentioned, that launcher installation is performed only once in the application life-cycle, which resulted in higher tolerance towards irritations like granting several Android permissions.

The average ratings about the *Image* of smartphones, that smartphones are perceived as becoming relevant for this user group from a social perspective. The ratings about the *Technology affinity* of elderly relatives is rather widespread (Inter Quantile Range=3.83), e.g., this user group is diverse regarding the readiness to explore new technologies. The high ratings about the *Individual prerequisites* show, that - according to the younger relatives - the elderly target group has all necessary capabilities to handle a smartphone with the installed launcher.

	Mean	SD
Techn. affinity	3.51	1.94
Prerequirements	6.07	0.84
Status	4.15	1.39
Easiness of ...		
... installation	5.95	0.92
... configuration	5.81	1.21
... usage	5.81	0.89
Usefulness	5.97	1.08
Enjoyment	5.06	1.25
Intention to use	5.88	1.49

Table 1. Acceptance factor results

Factors targeting intention to use
1. usefulness (r=.84***)
2. easy config (r=.52**)
3. easy usage (r=.49*)
4. enjoyment (r=.44*)

Factors targeting intention to recommend
1. usefulness (r=.69***)
2. enjoyment (r=.61**)
3. easy config (r=.52**)
4. easy usage (r=.45*)

Table 2. Relevance of factors

3 Conclusion

In this paper, we discussed the integration of acceptance modelling in an industrial software development context. We demonstrated how practitioners benefit from context-specific acceptance models in both software development and marketing processes. Our findings show, that conducting an acceptance user study in a late stage of a software product development process provides valuable input for marketing strategies and defines a clear prioritization for final product improvements, e.g., in our case *Easiness of installation* seems to have only a minor impact on intention to use. Therefore, the industrial partner was advised to focus on improving the usefulness of the software and not putting res sources into enhancing the installation process.

Especially for software products that are bought online in app stores, online recommendations and Word-of-Mouth-Marketing are highly relevant for commercial success. Hence, it is crucial to understand the motivation and attitudes of potential customers. In our use case, *Behavioral intention to recommend* and *Behavioral intention to use* need to be considered separately. For example, *Perceived enjoyment* is more important for *Behavioral intention to recommend* than for *Behavioral intention to use*.

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