

ASSESSING USER PREFERENCES FOR MOBILE APPLICATIONS IN PUBLIC TRANSPORTATION: A PRE-STUDY USING A CONJOINT-BASED RESEARCH METHODOLOGY

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— Abstract —

Developing a successful mobile application requires the involvement of the user in the development process. Features and functionalities have to be carefully chosen to meet user expectations and preferences. This paper presents work in progress and proposes a conjoint-based approach for the assessment of user preferences regarding mobile applications in the context of public transportation. A pre-study was conducted based on a computer-aided online survey with two conjoint analysis variants: Choice-based conjoint (CBC) analysis and adaptive choice-based conjoint analysis (ACBC). The paper compares these two different conjoint methods and their implications for the study design and participation. As a result, some preliminary findings on relevant mobile app features and recommendations for the applicable conjoint analysis variant were derived.

Key Words: Mobile Media, Mobile Applications, Conjoint Analysis, CBC, ACBC, User Preferences, Public Transportation

JEL Classification: L82, L86, L91, L96, M31, O31

1. INTRODUCTION

In 2012 nearly 30 percent of the population in Germany owned a smartphone. About two-thirds of these smartphone owners accessed the Internet on their smartphones on a daily basis (Google,2012). One of the key factors of smartphones' success are mobile applications (apps) that can be used to personalize the devices to individual requirements. Since smartphone usage is nowadays deemed to be a highly personal and individual matter, mobile apps have to address the users' needs in order to be successful in the highly competitive mobile app market. Features and functionalities have to be carefully chosen to meet user expectations and preferences, i.e. to add value within a particular context of usage. Hence, developing a mobile app requires the involvement of the user in the development process at an early stage. Accordingly, the accurate assessment of user preferences for mobile applications is crucial to the success of a mobile app. In this context the research project "Success Factors of Mobile Application Design for Public Transportation (SMAT)" was initiated at the RheinMain University of Applied Sciences in Wiesbaden, Germany. The objective of this research project is to gain insights into user expectations and preferences for the development of mobile applications for public transportation.

The aim of this research paper is to develop an approach for the assessment of user preferences concerning these features. The objective of the pre-study is to obtain valid insights for the selection of an appropriate conjoint analysis approach. Following this introduction the paper begins with a discussion of the research background in section 2. The approach and the design of the pre-study are described in section 3. Key results on the study participation are presented in section 4 before the paper closes with the conclusions and implications for future work.

2. RESEARCH BACKGROUND

2.1. User Preferences and Expectations

Mobile apps can be used in public transportation in many ways, e.g. to schedule trips, get directions, buy tickets, or to inform oneself about real-time status and conditions of the public transportation network. However, the features and functionalities of such mobile apps can vary significantly between the public transportation systems and operators. This is because the set of available features is often defined on a technology-driven basis or determined by some prior key decisions on technologies or backend systems. In this context the SMAT project follows a

more technology-independent and marketing-oriented perspective to gain insights into customer preferences towards mobile apps for public transportation. Hereby the project follows an interdisciplinary approach based on a cooperation of the Media Management and Computer Science departments of the RheinMain University of Applied Sciences.

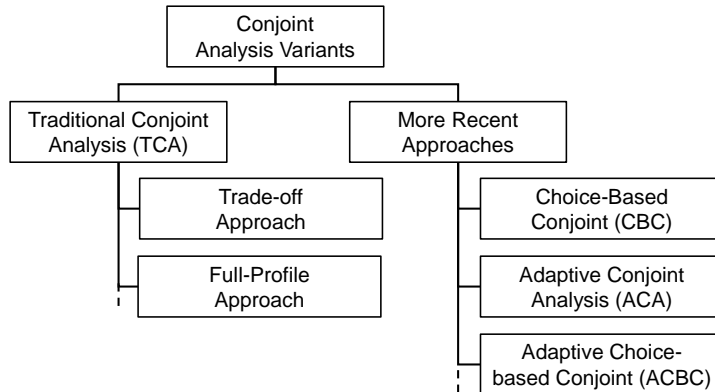
A user-centered design approach was chosen for the design and evaluation of the mobile application prototypes. Furthermore a prototyping platform was developed to simulate different backend systems and to allow a flexible configuration of mobile app features. This prototyping approach can be used to evaluate different mobile app design concepts and to obtain user feedback at an early stage. However, the approach requires an initial set of app features to be implemented as a prototype. It cannot be used to identify the relevant set of app features or to measure user preferences for individual app features. For this purpose, the method of the conjoint analysis and its variants are discussed in the following section.

2.2. Conjoint-based Research Methodology

Conjoint analysis is a very popular research tool to analyze consumer trade-offs and customer preference structures in marketing research and for the development of new products and services (Green et al.,2001: 4). Products are considered as bundles of different features on which the customer decides or is forced to make trade-offs in real-world purchasing decisions. This means that in a conjoint analysis the respondents have to *consider* several features *jointly* (Schaupp and Bélanger,2005: 100f.). These overall decisions are subsequently decomposed using statistical methods. The derived part-worth utilities can be used to conduct advanced market simulations and to predict the customers' preferences for different product alternatives. Conjoint studies have been used in a wide range of different branches, e.g. in marketing, transportation, health and cross-cultural differences (Nikou et al.,2012: 26). They have also been successfully applied to measure user preferences for mobile services and applications (Bauer et al.,2007; Eckjans et al.,2011) or combined with prototyping approaches for this field of application (Kohne et al.,2005). Since its first appearance in the mid-sixties, the conjoint analysis research method has vastly evolved. As shown in figure 1 its variants can be differentiated into *traditional* and *more recent approaches*. Traditional conjoint analysis (TCA) can be applied using trade-off and full-profile approaches. The significance of TCA is declining in the field of market research due to its severe limitations on the number of features and levels that can be included, its lack of support of "non-choices", as well as other methodical and statistical problems (Green and Srinivasan,1990: 8f.). Among the more recent conjoint variants

choice-based conjoint analysis (CBC) and adaptive conjoint analysis (ACA) are popular approaches.

Figure-1: Overview of Conjoint Analysis Variants



In CBC analysis the respondents have to choose the most attractive product alternative from a choice set (full-profiles) which simulates fictitious purchase decisions (Jaeger et al.,2000: 1218). The respondents can choose a concept alternative or refuse the choice by deciding on a “none” option. Only an excerpt of possible combinations of choices can be presented to a single respondent to avoid mental overload. Therefore the choice sets are typically distributed among all survey respondents and analyzed at an aggregated level. For this reason no individual utility values can be calculated and larger sample sizes are required compared to TCA approaches (Sawtooth 2008: 2). ACA is a computer-based approach that adapts the survey design to the respective respondents by focusing on the features that have been identified to be the most relevant to the respondent. The ACA approach allows higher numbers of features and levels but abstracts more from the natural purchase decision compared to CBC (Bauer et al.,2006: 146).

The adaptive choice-based conjoint analysis (ACBC) is another more recent conjoint variant that leverages some advantages of CBC and ACA. This approach mimics a purchase decision very realistically, as does the CBC approach, but adapts the survey design to the individual respondent as does the ACA variant. It encourages the respondents to be more engaged in the interview compared to conventional CBC studies and works with smaller sample sizes (Giessmann and Stanoevska-Slabeva,2013: 1036). The ACBC starts with a first step where the respondents use a “Build Your Own” (BYO) configurator to select feature levels that represent their preferred product. Concept alternatives similar to this BYO

concept (“near neighbors”) are then presented to the respondents to construct a “configuration set” of relevant product configurations and to determine feature levels that are completely unacceptable (“unacceptable”) or an absolute requirement (“must haves”). Based on this information choice tasks similar to the CBC approach are used to identify the preferred concept within the configuration set. The results can be used for part-worth estimation at an individual level and allow the inclusion of more features and feature levels than the CBC approach.

The aforementioned conjoint approaches are characterized by varying strengths and limitations. CBC and ACBC variants have been identified as suitable approaches for the study at hand. Both approaches realistically mimic choice behavior and provide the ability to deal with feature interactions. The latter is important because features of mobile applications for public transportation often rely on each other or cannot be assessed independently (e.g. searching for a connection and getting directions). However, a final decision between CBC and ACBC could not be made based on these general characteristics. The ACBC approach seemed to be rather adequate, but its more extensive survey design (compared to CBC) might have a negative impact on the participation (e.g. completion rate). This is the reason why a pre-study has been conducted.

3. APPROACH AND STUDY DESIGN

The objective of our research was to identify a preferred concept of mobile app features that can be used as an initial configuration for the development of a mobile app prototype. Against this background, the study was carried out as follows: (1) Market analysis and expert interviews for the identification of relevant mobile app features. (2) Use case definition and selection of features to be included in the conjoint analysis. (3) Pre-study based on CBC and ACBC focusing on the selection of an appropriate conjoint analysis approach. The discussion of the empirical findings of the conjoint analysis is not included in the scope of this paper.

3.1. Market Analysis and Expert Interviews

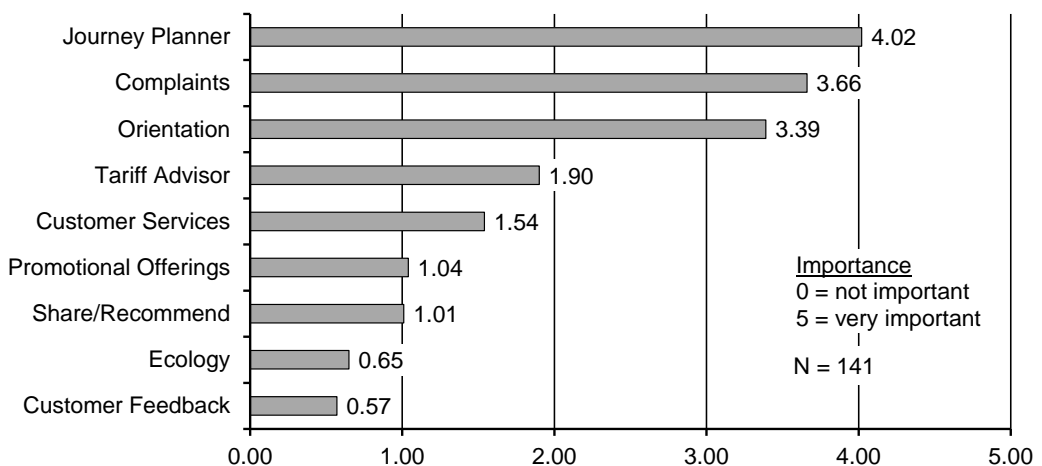
The market analysis was carried out in June 2012 among the public transportation networks in the ten largest cities in Germany as well as the public transportation networks of the capital cities of the G-20 member states. More than half (54 percent) of the public transportation networks in the scope of the study already offered a mobile app. iOS (79 percent) and Android (58 percent) were the most supported smartphone platforms. As a result of the market analysis, a variety of inno-

vative mobile app features was identified. The SMAT project focuses on local public transportation networks (LPTN) with specific technical and financial limitations. For this reason an expert workshop was conducted with representatives of a LPTN. As a result a preliminary set of ten relevant app features was identified: journey planner, tariff advisor, ticket purchase, complaints, customer feedback, ecology, promotional offerings, share/recommend, orientation, and customer services.

3.2. Use Case and Feature Selection

As a next step, a subset of features had to be selected and arranged for the conjoint analysis. For this purpose, the interaction between user and mobile app feature as well as its area of application were described in usage scenarios and use cases. Based on this information short feature descriptions were prepared to measure user preferences and feature importance using a compositional, self-explicated approach. The corresponding survey was conducted among 141 students of the RheinMain University of Applied Sciences in November 2012. The student sample may bias the results but seems to be adequate for the pre-study because students are frequent and regular users of the LPTN included in the scope of the study. The ticket purchase feature had to be excluded from the survey because the enrollment fees of the students already include a ticket for the LPTN. The results revealed preferences of the respondents towards a narrow set of app features including journey planner (4.02), complaints (3.66), and orientation (3.39) as shown in figure 2.

Figure-2: Features and Self-Explicated Feature Importance



However, within the ongoing studies it became obvious that the feature set for the forthcoming conjoint analysis had to be reconfigured to (1) be presented in written form, (2) better comply with the methodological limitations of conjoint analysis, and (3) sufficiently integrate the perspective and requirements of the LPTN. Considering these aspects and the results of the aforementioned survey, the subset of features presented in table 1 was determined for the conjoint-based pre-study.

Table-1: Features and Levels of the Conjoint Analysis

Features	Level Values
Journey Planner	text input / favorite based / location based
Ticket Purchase	none (ticket machine) / by tariff zone / by distance or route
Coverage	local / regional / trans-regional
Real-Time Services	complaints / delays / notifiers
Promotional Offerings	ad-free / generic ads / location-based ads
Customer Services	advisory (tariffs) / orientation / support / loyalty (rewards)

3.3. Pre-Study Design

Both conjoint analysis approaches were constructed and applied using Sawtooth Software’s SSI WEB Suite. SSI Web is a software platform to create and conduct standard interviews as well as conjoint analysis. Both survey procedures contained sections on (a) socio-demographics of the respondents, (b) smartphone and public transportation usage, (c) a training section explaining features and levels, (d) the actual conjoint section with the CBC/ACBC survey, and (e) a survey feedback. The prefix (a-c) and the survey feedback (e) contained the same questions for both survey alternatives. The survey was designed taking the specific design variables of the CBC and ACBC SSI WEB modules into consideration. Table 2 summarizes the relevant CBC and ACBC design settings.

Table-2: Design Settings of the Conjoint Analysis

Design Settings	CBC	ACBC
Features and Levels	6 features (5 features with 3 levels and 1 feature with 4 levels)	6 features (5 features with 3 levels and 1 feature with 4 levels)
Stimuli and Choice Tasks	<ul style="list-style-type: none"> ▪ 972 stimuli ▪ pairwise choice sets ▪ 12 choice tasks per person (including a "non-option") 	<ul style="list-style-type: none"> ▪ “Build Your Own” section ▪ 7 screening tasks with 3 unacceptable and 2 must-haves ▪ 8 choice tasks (including 3 choice sets)

4. RESULTS OF THE PRE-STUDY

The pre-study was conducted as an online survey based on the SSI WEB Suite in November 2012. In order to ensure that both approaches were equally frequented, a software switch was implemented to alternately route participants towards the CBC or ACBC variants of the survey. In total 61 respondents participated (CBC: 31, ACBC: 30) of which 41 fully answered the questionnaire. As mentioned above, the results of the study are not meant to be representative or statistically valid due to the composition (mainly students) and small size of the samples. Therefore the results emphasize (1) duration, (2) incompleteness rate, and (3) qualitative feedback regarding the two CBC and ACBC variants.

ACBC comprises different sections (BYO, screening, choice tasks), which leads to a higher number of screens presented to the study participants and a higher duration as shown in table 3. The number of incomplete surveys is also higher for the ACBC variant but this is not related to the conjoint part of the survey as most of the participants aborted the questionnaire in the preceding (prefix) sections.

Table-3: Key Figures of Study Participation

	Number of Screens	Average Duration (Minutes)	Number of Participants	Incompletion Rate	Drop-outs	
					Prefix	Conjoint
CBC	46	10:47	31	24%	8	0
ACBC	55	12:10	30	38%	11	1
Total	–	–	61	31%	19	1

Neither the differences in the average study duration nor the aborts within the conjoint sections justify the rejection of one approach. However, the results of the qualitative feedback questions presented in table 3 give some evidence that the ACBC survey requires higher levels of involvement and patience from the respondents compared to the CBC approach. Twenty-two percent of the respondents of the ACBC variant stated that they were willing to answer the questions thoroughly, but lost their tempers at the end of the survey (in the conjoint section). But these findings are somewhat contrary to the results of question (3) in table 4 where more respondents of the CBC variant stated that they had only answered the first part of the interview thoroughly. In summary, the results on study participation give no clear indication about a favorable study design. Both conjoint variants produce a workable study design from the perspective of study participation.

Table-4: Results of the Survey Feedback Questions

Questions	CBC	ACBC
(1) I have read and answered all questions thoroughly	52%	50%
(2) Apart from a few questions I have answered the interview thoroughly	31%	22%
(3) I only answered the first part of the interview thoroughly	13%	6%
(4) I was just curious and answered the questions by chance	0%	0%
(5) I was willing to answer thoroughly, but lost my temper at the end	4%	22%

5. CONCLUSION

This paper presents ongoing work on the assessment of user preferences for a mobile application in public transportation. A conjoint-based approach was proposed to assess user preferences by focusing on the CBC and ACBC variants. Based on the findings of the pre-study, both variants yielded workable study designs and are applicable to the research problem at hand. Future work will need to optimize the study design. The sections preceding the conjoint section have to be shortened to increase the completion rate. Considering the strengths and limitations of both methods, the ACBC approach seems to be more promising. In general the ACBC variant requires smaller sample sizes, allows for more engaging interviews, surveys qualitatively higher data and offers broader interpretation opportunities. This is also supported by the fact that the apprehended negative impact of the ACBC approach on the respondents' engagement towards the survey, i.e. a lower completion rate (in the conjoint section), was not confirmed.

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