

USER REQUIREMENTS AND VISUALIZATIONS FOR A MULTI-FACET SEARCH TASK IN THE DOMAIN OF TRAVEL

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ABSTRACT

A search task in the domain of travel can be complex and is characterized by its wide variety of properties and many facets. Providing full insight in the available search products and their facets creates challenges for creating suitable interfaces and search applications. We did an explorative study into a travel search task and conducted the study in three phases: a first phase in which we gained insight in the domain of travel and its possibilities and challenges in interfaces; a second phase where we did a user study for identifying the user requirements for the search task; and a last phase where we translated these user requirements into several mock-ups and evaluated them by a think aloud walk-through method. In the first phase we set the scene for searching in travel by proposing an information search model in a travel perspective. The second phase of the study yielded the following list of requirements: users want to set prior properties, self compose their trip, start from multiple points, get insight in the facets and are interested in opinions of peers and background information. In the final phase of the study we confirmed these requirements and further explored the requirement of creating insight in the facets by creating several visualizations. We discovered that advanced visualizations can be difficult to understand, but can help the user in gaining insights in the search results and help finding the final items.

Index Terms— Complex search, User Requirements, Search Interfaces, Visualizations, Travel, City Trip

1. INTRODUCTION

In a search domain or search environment that is characterized by many dimensions and product facets, offering an interface or search application which gives users a full product overview and helps them select the preferred items in an efficient way is a real challenge. In this study we examine how we can support the user in fulfilling their search task. The goal of this study is to elicit the user requirements and possible visualizations for such environments. We select the domain of travel as an example of such a complex environment. The

outcome of this study provides insights in understanding the user requirements and possible visualizations in search fields which contain multi-facet search tasks. A search task where you are searching for multiple items containing many properties which depend and change from each other.

The domain of travel is one of the largest search domains on the internet, where an increasing number of consumers book travel trips online [1]. For example, if we look at the Netherlands we see that 7 out of 10 companies in the 2010 top10 e-commerce companies [2] are related to travel. The availability of travel information and products on the internet is very large, which makes the search task of finding and selecting the travel trip time-consuming [1]. Travel products are characterized by a wide variety of facets that change and depend on each other. Allowing users to search through all the facets, gain a complete insight in the available travel products and compare different travel facets is a challenge. We selected the search task of booking a city trip as representative for search tasks within the domain of travel. Based on our preliminary knowledge, and confirmed in this study, we define the city trip as a short-stay visit (1 to 6 nights) to a city where the stay is concentrated within the city and around tourist attractions. A city trip is characterized by its multi facets and usually consists of three main components: transport to the city, accommodation within the city and activities during the stay. A consumer can buy the city trip as a package, where an organisation pre-composes two or three components in a package, or the consumer can choose to compose the trip for him or her self. In this study we identified the user requirements for an interface for searching and composing a own city trip.

This study is conducted in three phases. In the first phase (section 3) we set the scene of travel by analysing current travel websites and interviewing experts in the field of online travel. Experts explain the design choices and concepts in the analysed websites. Furthermore, they provide insights in the domain of travel. In the next phase (section 4) we identified the user requirements by conducting a user study. A group of potential end-users, who could best explain the user require-

ments [3], were asked to fill out an online survey. In the last phase of the study (section 5) we evaluated these identified user requirements by creating several mock-ups. By a think aloud walk-through method we validate the proposed user requirements and explored one of the requirements in depth.

2. RELATED WORK

For this study we take travel as a representative domain for complex search environments. Bogdanovych et al. [4] describe the shortcomings of current online travel portals compared to traditional offline travel agents and a travel report by PhoCusWright [1] identifies that the process of booking a travel trip takes too much time. This indicates that searching in the domain of travel needs to be improved.

During this study we try to bring the travel domain in an information search perspective. Bieger et al. [5] proposed a model which describes the framework of the process of information searching in travel. In the search process they identify the search phase before the trip decision, the actual trip decision and the search phase after the trip decision. In this study we focus mainly on the process before the actual trip decision. This part of the process could be further divided in stages. Kuhlthau [6] describes a theoretical search model which describes 6 different stages in the process of searching information: initiation of the search process, selection procedure, exploration of search results, formulation for narrowing down, collection of result items and a final presentation of the results. In this study we bring these 6 stages in the context of travel and use this as a framework for later findings.

For this study we explore the field of advanced visualizations. Lee et al. [7] propose a multi-criteria decision interface for selecting a product, in which we want to explore the visualizations that create insights between the properties. Furthermore Mazza [8] gives an introduction to the field of information visualization, which we use together with other work [9, 10, 11] for inspiration in choosing and designing visualizations.

For obtaining and evaluating the user requirements we are interested in user centred approaches in interface research [12] and in particular thinking aloud methods [13, 14]. Van Someren et al. [15] describes a think aloud method for practical modelling cognitive processes which help in understanding user requirements. Nielsen et al. [16] describe a mathematical model for finding usability problems in computer interfaces. A study by Matzler et al. [17] shows that the efficiency and effectiveness of a travel website has a strong influence on customer satisfaction.

3. CHARACTERISTICS OF THE DOMAIN OF TRAVEL

For identifying the possibilities and challenges in travel interfaces we first set the scene of travel. For understanding

the domain of travel we performed two types of orientating studies: first, an analysis of current travel websites and, second, interviewing experts for obtaining a deeper insight and understanding of the domain. These first findings were used to bring the domain of travel in an information search perspective (section 3.3) by using the Kuhlthau [6] information search model as a framework.

3.1. Setup

The website analysis was an explorative study to get a vision on how current websites are designed, what search strategies they offer and what properties and filters are available. In addition, this study indicates what visualizations are used for exploring the different facets of the items. Furthermore, the website analysis provided input for interviewing the experts. For this study we looked at the following websites: Expedia, Bing Travel, eBookers, Booking.com, Kayak, Skyscanner, KLM, Transavia, Sunweb, Correndon, Boekjezo.nl and DeJongIntra.

The semi-structured expert interviews took place with experts from several disciplines in the travel domain. These interviews helped us obtaining an understanding of how travel websites work and what the experts' motivations are for choosing several design elements and concepts. Furthermore, the experts helped us in discovering the shortcomings and challenges in the travel search domain and gaining valuable practical knowledge from an expert point of view. Two product managers, one marketing manager and an interaction manager were interviewed by phone and face to face.

3.2. Findings

The analysed websites offer different travel products. Where some websites offer only air-plane tickets, others specialize in hotel bookings, some do both and some offer only travel packages. The websites all offered the user a search interface for searching through the products. Looking at the properties that were used we indicate the prominent properties in searching a city trip: the destination (city), travel dates and the number of persons. After these properties were set and the first results were shown, users could always set other properties. For example a wide range of analysed properties such as flying time, airport of departure, airline companies and tens of less prominent properties such as the availability of swimming pools, entertainment or room service.

The analysed websites used a wide range of visualizations for gaining insight in the results, such as tables, graphs, calendars and maps. The tables were used for showing dimensions of information in several ways. For example, KLM used a table to show the lowest flight price by comparing the arriving and leaving dates, where Bing Travel for example, used a table to show the lowest flight price by comparing the flying times on a given day and used several graphs (figure 1)

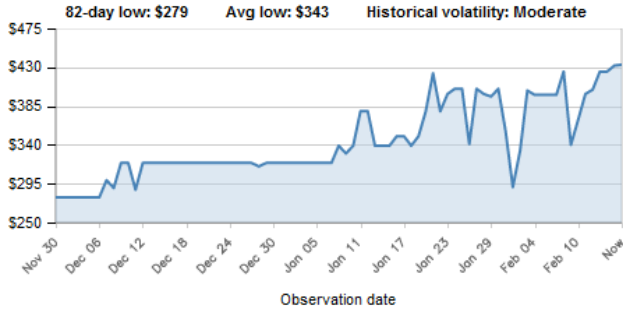


Fig. 1. Graph used by Bing Travel to show the ticket price over time.



Fig. 2. Calendar used by Transavia to show the ticket-prices per day. This visualization is often used by travel websites.

for showing the lowest price over time. Often used by travel websites was the visualization of a calendar (figure 2), which is used to show the prices per day. Notable was that in sorting items most websites used the price property. If they did not, the price was a prominent part of the website.

Taking this first observations into account, we interviewed several experts. Based on these interviews we see that, at least according to our experts, travel websites do not focus on providing complete information, but prefer to design the website from a commercial perspective. The search results were, by default, sorted on business rules, but users have the availability to sort on other properties. The experts did not really think about more advanced visualizations, which according to them, are difficult to understand for the mainstream user. But the experts admit that advanced search interfaces become convenient for the general consumer. The consumer is demanding more transparency in the search results and available items. Though, the experts think that general users prefer to buy a travel package instead of composing a trip by themselves.

In the beginning of the study we made the assumption that city trips were a simplified form of a travel trip, the experts

Table 1. Information Search Process in Travel

Stage in ISP (Kuhlthau)	Characteristic for Travel
1. Initiation	Formulating the initial idea of making a trip
2. Selection	Pre-selecting prior properties of the trip
3. Exploration	Browsing the results and getting insight
4. Formulation	Create focus and narrowing down by choosing and selecting soft criteria
5. Collection	Final collection of interesting items and choosing the final product
6. Presentation	Checking the selected trip and process of booking

explained that city trips are in fact quite complex products because of the many facets available. They agree with the earlier proposed definition of a city trip (see Introduction).

3.3. Travel Search-model

Based on the first findings we model the scenario of searching and composing a city trip as an information search process. This will enable us later to generalize our findings and results to a wider perspective and to other domains. We instantiate the information search process model of Kuhlthau [6] with the characteristics of a travel search task. This results in Table 1, where we describe the 6 stages of the information search process from a travel perspective.

At the "Initiation" stage the user has the initial idea of making a trip. How is the user coming up with the idea of making this trip, what will the user's destination be, does the user have any dates in mind and who is going with the user. In the stage of "Selection" the user starts searching for the travel trip and then defines the earlier prior properties of the trip, which the user already knows. The stage of "Exploration" is characteristic for browsing the obtained results and trying to understand what travel-options are available. Based on that observation, the user reaches the "Formulation" stage in which the user narrows down the focus and selects soft properties to process in finding more preferred items. Soft properties are the properties which the user defines during the search process, still could change and which are in most cases not critical in the final decision of the trip. In the "Collection" stage the user collects the most interesting items, compares them and finally chooses one option. In case of a city trip, which consists of multiple product items, the sequence of the stages "Selection", "Exploration" and "Collection" repeats for every single item. In the final stage of "Presentation" the user checks all the collected items and chooses to enter the

Table 2. User study demography: 32 respondents

Age:	16-76 years old (M=28.8, SD=14.0)
Gender:	18 male, 10 female, 4 unknown
Highest Education ¹ :	11 University, 7 HBO, 2 MBO, 3 VWO, 2 HAVO, 2 VMBO, 1 Primary School, 4 unknown
Computer Knowledge:	11 very good, 11 good, 5 reasonable, 1 moderate
Ever made city trip:	29 did, 3 never did

booking process. This model is used in upcoming sections to position the user requirements.

4. INTERFACE USER REQUIREMENTS

In order to identify the user requirements for an interface supporting the task of searching and composing a city trip, we performed a user study.

4.1. Setup user study

For getting a full understanding of the user search task from a user perspective, we chose for a user study to identify the user requirements. Users who in general fulfil this travel search task and could help us best in identifying the user requirements [3]. We chose for the setup of an online user survey to get a wide range of responses in a relative short amount of time.

For the user survey, we created a list of questions on several topics. The topics were: the respondents' history of making city trips, their last city trip, the process of choosing the last trip, the process of choosing a city trip in general, composing a city trip in general, experience with travel websites, their preferences in travel interfaces and some demographic background. For reaching respondents that were likely to have experiences with travelling and city trips, we placed our survey in several online travel communities and later spread the survey within a group of people in our personal network. The participation requests resulted in a total of 32 responses. In Table 2 we give an overview of the demographics of the respondents.

4.2. User Requirements

In this subsection we describe the user requirements which are based on the findings of our user study. For every requirement we start with the findings from the study, which results in the user requirement itself and we bring each requirement

¹Education system in The Netherlands.

in a wider perspective by generalizing and referring to the information search process as described in Table 1.

4.2.1. Selecting prior properties

96% of the respondents said they know beforehand who their travelling companion will be and 64% knew which city they want to visit. When the users start looking at travel websites, 79% said they start by first selecting a city or destination. Asking about their last city trip, only 7% came up with the idea of making this trip with the help of the internet. This indicates that in the process of selecting a destination, users use other sources rather than searching on the web. 93% of respondents were sure about the date of their last trip when they started searching.

Users know some of the properties before starting the search process. Giving the ability to set these properties in front would probably increase the effectiveness of the process. In the context of the city trip we identify the following prior properties: the city of destination, the number of travellers and a range of travel dates.

For bringing this user requirement in a wider perspective, we place this requirement in the stage of Selection (2) in the information process model (Table 1). In the Selection stage, the user preselects the properties he or she knows beforehand and which most likely will not change during the search process. Giving users the opportunity to set prior properties in the stage of Selection and remember these in later stages would increase the efficiency of the search process.

4.2.2. Self composing

On the basis of 93% of the respondents has the need to plan a trip by themselves. Asking the respondents about their last city trip 76% of the last made city trips were self-composed, compared with 17% that were bought as a travel-package. The respondents say they like to have the feeling of self control, e.g. choosing the most comfortable accommodation in the city. The respondents also feel they get a better price by self composing, rather than choosing a pre-composed travel-package.

In the interviews with experts in the earlier study we concluded that most users are not interested in composing their own travel trips and prefer the choice of buying a travel package. This user study indicates the opposite. An interface or application where users can compose the products would satisfy their needs better than offering only packages.

In an environment with products containing multiple items, users would like to have control over choosing and collecting the items. This, of course, brings great challenges in creating applications and interfaces for satisfying this requirement. By composing multiple items the user will repeat the cycle of the stages of Exploration (3) and Formulation (4) for each item. In the stage of Collection (5) the user will collect

the items and put together, which will be presented in the last stage of Presenting (6). In a work flow of composing several items, the user needs to be able to go through the stages for every single type of item.

4.2.3. *Multiple starting points*

In the user questionnaire we wanted to know with which of the three components of a city trip the user would start. We found that users have different starting points in selecting these components. To the question with which element users would start to search for a city trip, 39% responded they would start with transport, 32% with accommodation and 29% with an activity.

This indicated that when creating a search application or interface for composing a city trip, a user needs the opportunity to start the search process at three starting points: the transport, the accommodation or the activities.

We place this requirement in the information search model (Table 1) in the stage of Exploration (3). In this stage the user starts exploring the available information from several starting points and follows her/his own search strategy. In an environment with several types of products with a range of facets, which depends on each other, you need to give users the opportunity for exploring the following stages in their own direction and order. As described in the requirement of Self Composing, for every single item the stages of Exploration (3) and Formulation (4) will be repeated till the stage of Collection (5).

4.2.4. *Insight several facets*

In the user study, 79% of respondents has the need to compare several travel items on their different features. As mentioned earlier, the number of available features is large and the preferred features differ per user. Nevertheless, we can indicate some of the features which are popular for most users. Although users tend to fix their date of travel before starting to search, 64% of the respondents expressed a desire to see other travel options from other dates than the selected date selection. Experts also confirm that their visitors browse through date options than the first selected date. Apparently, users are interested in other options even though they already had an idea about what date they want to travel on. We can link this need for browsing through the date dimension with the high need of the price property. In the user study 59% of respondents base their choice of transport to a city on the price. 44% of the respondents base their choice for accommodation on the price. When asking the respondents about the pros and cons of current travel websites, a considerable number of respondents mentioned their need for transparency of the prices. 86% of the respondents has the need to sort results by price. 79% want to select the city trip search results based on their budget. We conclude that the search process of a city trip is

price-driven and users have a higher need to get an instant insight in what prices are available, compared to other features.

The task of searching and composing a travel trip can be very complex. A travel trip has a wide variety of properties and users have the need to browse and compare these properties. Users want to compare the price over time, which differs for every product. Price is one of the most important properties. The challenge is to visualize these dimensions in a way that users understand them and help them to gain more insight in the results and help them fulfil their search task.

We place this user requirement in the information search model in three stages: the stage of Exploration (3), the stage of Formulation (4) and the stage of Collection (5). In all these stages the user wants an insight in the items and the their facets, but on several levels. In the stage of Exploration (3) the user starts browsing and wants a glance of the available items. At this point some important properties and relationships need to be clear for choices in further stages. In the stage of Formulation (4) the user decide to create focus and narrows down by selecting more filter properties and criteria. The user can be helped in making a choice by giving insight between the properties. In the stage of Collection (5) the user choose a final option, where in the process of choosing this final option creating insight in the different properties of preferable items could help.

4.2.5. *Opinions of peers*

According to the user study results, 43% of the respondents replied they came up with the idea of making their last city trip by friends, family or colleagues. This indicates that a large group of users trust peers for making decisions about a city trip rather than consulting experts. Not only known peers, friends, family and colleagues, are important in this search and decision process. Unknown peers, for example in the form of user ratings, are also important for the user. 32% of respondents is interested in online opinions about the city they visit, 39% of respondents is interested in online opinions about the travel company and 83% of the respondents is interested in online opinions of the accommodation. We asked users about sorting the results on the number of stars, usually given by expert organizations for star classification, and sorting the results on user ratings. 38% of respondents were interested in sorting the results on the number of stars and 54% of respondents were interested in sorting on the user ratings. This suggest that users are more interested in opinions of peers than opinions of experts.

For selecting components of the city trip, users are interested in opinions of peers. This could be opinions of peers in the social environment or peers they do not know. When choosing a city, more people base their selection on peer suggestions rather than consulting experts. When choosing accommodation, users have a need for online user ratings, rather than expert ratings.

Opinions of peers are important in the selection and decision process of the end-user. In the stage of Exploration (3) the availability of peer opinions could help in pre-selecting a range of items. In the stage of Formulation (4) and Collection (5) the opinions of peers could help in choosing more specific properties and choosing the final option.

4.2.6. Background information

From the user study 82% of the respondents uses the internet to see what a city has to offer, 82% of the respondents are interested in viewing photo's of the accommodation and, furthermore, mentioned they are interested in seeing more background information.

A city trip has a large availability of detailed background information. It offers photo's of the accommodation, current and upcoming events, knowledge about the city and information about tourist attractions.

Background information could be helpful in the decision making process of an item. In the information search model (table ??) we place this requirement in the stage of Collection (5) where users choose the final option. Giving more specific background information helps the user in the decision. In the stage of Presentation (6) background-information could further help in the process of booking or the after booking period. [5].

5. MOCK-UP DESIGN, VISUALIZATIONS AND EVALUATIONS

In the final phase of our study we designed several mock-ups wherein we used the user requirements and concepts as earlier described. We evaluate the user requirements we identified in the user study. Secondly, we explored in more depth one individual requirement of creating insight in the several facets for the user. In this section we describe the setup of this phase of the study, we describe the design rationale and motivations and finally we discuss the findings of this phase.

5.1. Design rationale

We based our design rationale for the mock-ups mainly on the user requirements. For the requirement of giving insight we designed several visualizations. We describe for each user requirement how we satisfied these in the mock-ups. In this paper we included 2 of the 7 designed mock-ups (figure 3 and figure 4), which give an overview of all designed elements. The mock-ups follow a work-flow of composing a city trip, by first selecting the prior properties, the travel dates, two transport options and finally selecting a desired accommodation.

Prior properties In all mock-up screens we set up primary selection search fields (figure 3-B and 4-B) for the identified prior properties: destination, number of persons and travel dates. In the first screen and first step of the

process we were interested if the test persons would use them. In the scenario we used the prior properties and showed items based on these properties. In all screens the properties could be changed, to see if test persons were interested in changing them.

Self composing The requirement of self composing is prominently present in the mock-ups screens. We introduced the concept of a shopping cart [18] (figure 3-A and 4-B) which the test person could use to compose the three different components. The shopping cart is available on every single screen and is filled during the process. We were interested to see if the test person would use this concept and whether it helped the test person in fulfilling the search task.

Multiple starting points Users have different needs in starting their search task. In the mock-ups we translated this by prominently showing the three products of a city trip (figure 3-C and 4-C). We gave the test persons the chance to chose one of the concepts to start with. Giving the test person this choice we were interested if the users chose different strategies.

Insight several facets For gaining insight in the several facets of the products we proposed several visualizations. In the mock-ups we chose for 4 different visualizations for showing the facets by several dimensions. In the stage of selecting the transport, we used a price table (figure 3-D) for showing the minimal transport price based on departure and return date. In the stage of selecting an accommodation we used three different visualizations. First of all we used a scatter-plot (figure 4-D) for showing accommodation in the scale of price and user rating. The second visualization in this stage was a map (figure 4-E), showing the accommodations in the geographic space. The last visualization was a graph (figure 4-G) for every single accommodation, showing the room prices on a time scale.

Opinions of peers In the user study we identified the importance of opinions of peers in the process of searching a city trip. We processed this in the mock-ups by introducing a user-rating for every single accommodation (figure 4-G). Besides that we added the number of stars for the accommodations to see if the users were really more interested in opinions of peers. The results could be sorted on user rating and on number of stars. As default we chose for the sorting on user rating, which also correspond with the user ratings in the scatter plot visualization showing the user rating in relation to the price.

Background information To see if users were interested in background information we added several links which would link to background information (figure 4-G).

5.2. Evaluation setup

For evaluating the user requirements we chose to setup several mock-ups (figure 3 and figure 4), which represented the user requirements. The mock-ups show in general the design and functionality but do not actually work. With a mock-up we can visualize the proposed user requirements to a user to see how he or she would interact. With the help of several test persons we walked step by step through the mock-ups, for which we used a walk-through think aloud method [12, 15]. A total of 5 test persons participated in this study, which according to Nielsen et al. [16] is enough for getting the main usability issues and matched the scale of our project.

At the beginning of the evaluation we gave the test persons a short introduction into the think aloud method and what we expected from the test persons. We also gave the test person the earlier proposed definition of the city trip (see Introduction) to clarify the concept. We divided the mock-ups and the test-scenario in three stages. A first stage of prior selection, a second stage of searching and selecting the transport and the third stage of searching and selecting the accommodation. In the first stage we started by giving no scenario or task information to the user and studied what the test person would do. Later on we started by setting a scenario and several tasks to see how the test person would pass the several stages in fulfilling the tasks. Further steps in the mock-ups were designed and filled in with information relevant for this scenario to help the test person in approaching the mock-ups as a real working application. During the study the test persons followed the following scenario:

Together with your partner you want to make a city trip to Barcelona. You are planning to go around the weekend of Saturday 12th and Sunday 13th of February. For a maximum of 2 nights.

For the evaluation we developed a list of questions and several tasks corresponding to the scenario. For every mock-up, task and element we noted the test-persons' thoughts, actions and asked questions afterwards. During all steps we were most interested in what the test persons noticed, how they approached the elements, concepts and visualizations and if the test persons thought it was useful and if the test persons were missing something.

5.3. Evaluation findings

Prior properties We started by not proposing our scenario where the user started with setting the destination and number of persons. Two people decided to not start with a date at that point, to get a first overview. After reading the scenario everyone set the prior properties including the date to go further in the process. All users rated it as useful and were not missing any other prop-

erties. We conclude that users have the need to set the prior properties.

Self composing All participants identified the shopping cart and immediately understood the concept of adding the items of a city trip step by step. Asking the users afterwards, they all liked this self composing concept and found it useful.

Multiple starting points During the evaluation we saw that different participants want to start at different points in the search process. Two participants wanted to begin with the transport, two participants with accommodation and one person with the activity. Each had their own motivations.

Insight several facets Starting with the price table (figure 3-D) for finding the lowest price for transport, all participants took some time to fully understand the table. After understanding the information, they selected a date and saw the travel options for that date showing up. The participants were optimistic about its use, even though 4 of them were slightly disappointed that only the minimum price was shown in the table. During the questions 3 participants suggested to add more information or dimensions in the table. For example a colour-scale for showing the price scale to directly identify the cheaper options or adding the accommodation price.

In the stage of selecting accommodation, all participants first identified the scatter plot (figure 4-D), which they did not really understand at first. It took quite some time for all users to understand the context, but when they understood it they used the scatter plot quite intensively. They all selected the same accommodation (accommodation #4 in figure 4) which had a good price and user rating ratio. The participants continued by comparing the accommodation with the items showed in the map.

The map (figure 4-E) was quickly recognized and understood by all participants. They liked to see the items in a geographic space and compared it with the results from the scatter plot. All the participants started looking for the interesting items from the scatter plot in the map to decide which accommodation was best. Although for most participants the tourist information was missing to determine what place in the city was best. They did not request any additional accommodation information in the map.

The last visualization, the price graph in the time scale (figure 4-G), wasn't used by the participants. They did not really understand the visualization that was shown. After explaining the visualization they were still not interested in the graph and the information that was shown.

All test persons liked the use of the visualizations. It took some time before the test persons understood the price table and scatter plot, but used them successfully to fulfil the search task. In the stage of picking the accommodation, the items in the scatter plot were compared with the items in the map, which took some time for all participants. Nevertheless, none of the users scrolled down the page to view the items one by one, which indicates that the visualizations seem to be successful for searching and picking items.

Opinions of peers In selecting accommodation all participants were interested in the same item (accommodation #4 in figure 4). This item had a relative low number of stars, but a high user rating. The participants were more interested in the opinions of peers rather than the expert star rating. In particular, participants cared less about its low number of stars because of the favorable price. Nevertheless, the participants were interested in and asked about the total number ratings given.

Background information The participants were interested in the background information. Before making a final decision the test persons were all interested in seeing background information.

6. CONCLUSIONS

We conducted a study into the user requirements for a multi-facet search application in the domain of travel. In the preliminary study we set the scene for travel and gained an insight in the domain. The domain of travel is really complex and the task of searching a city trip seems to not that easy. We placed the characteristics of searching and selecting a travel trip in an information search framework. In the user study we questioned 32 persons, from which we identified a list of user requirements. The final phase of our study was the evaluation of the user requirements and proposing visualizations for the requirement of offering insight. By walking through the pages and elements we confirmed the user requirements and explored the possibilities in offering visualizations.

The user requirements for searching and composing a travel trip we identified and confirmed are: setting prior properties, self composing a trip, starting at multiple points, getting insight in several facets, interest in opinions of peers and the availability of background information. Users are interested in advanced visualizations for fulfilling a search task in a multi-facet search environment. The visualizations give the end user insights in the several facets and help in picking an item, but can be difficult to understand and demand some effort from the end user.

This paper identifies a number of user requirements for an interface in searching and composing a city trip. The intention of our user study was to get a good representation of the

average traveller population and to clarify user requirements in general. We have to remark that in the user study we only had 32 respondents, which is not really representative for a larger population. Our questioned group consisted of mainly higher educated around 28 years old with good knowledge of computers.

The evaluation study was really an explorative qualitative study where we had a total of 5 test-persons, who already participated in the user study and were higher-educated. This forms a biased group, especially in using advanced interfaces, visualizations and statistical information. The outcome of our study is therefore useful for this group, but should be tested with other users.

7. FUTUREWORK

As future work this study could be reproduced for a larger population to confirm the user requirements for a larger general group. A second search task in addition to the task of composing a city trip would reveal more about the domain of travel. As for future research it would be interesting to further explore the visualization of information, in particular what direction these help users for fulfilling the task.

Another finding of our study was the interest in opinions of peers. In future studies we could explore the social interaction in the information search process. A direction of collaborative searching, where users can search, browse and select items and share them with other users.

8. ACKNOWLEDGEMENTS

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Stedentrip Zoeker

Uw samengestelde Stedentrip

Barcelona
2 personen
19 mrt 2011 – 21 mrt 2011 (2 nachten)

Vervoer:

Heen:
Transavia TR1019
Vertrek 08:10 Schiphol
Aankomst 10:15 Barcelona € 45

Terug:
EasyJet EZ2198
Vertrek 09:30 Barcelona
Aankomst 11:25 Schiphol € 30

Accommodatie:

Nog niets toegevoegd

Activiteiten:

Nog niets toegevoegd

Totaal € 75

[Boeken](#)

Bestemming
Barcelona

Aantal personen
2

Datum
van 19 mrt 2011 t/m 21 mrt 2011 (2 nachten)

[Zoeken](#)

Overzicht **Vervoer** Accommodatie Activiteiten

Vervoer

Vervoer voor 2 personen van Amsterdam (AMS) naar Barcelona (BCN)

Prijs v.a.	Retour Do 17 mrt	Retour Vr 18 mrt	Retour Za 19 mrt	Retour Zo 20 mrt	Retour Ma 21 mrt	Retour Di 22 mrt	Retour Wo 23 mrt
Heen Di 15 mrt	€ 90 (2 nachten)	€ 120 (3 nachten)	€ 100 (4 nachten)	€ 90 (5 nachten)	€ 120 (6 nachten)	€ 80 (7 nachten)	€ 115 (8 nachten)
Heen Wo 16 mrt	€ 100 (1 nacht)	€ 80 (2 nachten)	€ 100 (3 nachten)	€ 70 (4 nachten)	€ 80 (5 nachten)	€ 50 (6 nachten)	€ 40 (7 nachten)
Heen Do 17 mrt	€ 140 (0 nachten)	€ 150 (1 nacht)	€ 90 (2 nachten)	€ 100 (3 nachten)	€ 90 (4 nachten)	€ 40 (5 nachten)	€ 130 (6 nachten)
Heen Vr 18 mrt	-	€ 150 (0 nachten)	€ 100 (1 nacht)	€ 120 (2 nachten)	€ 90 (3 nachten)	€ 120 (4 nachten)	€ 95 (5 nachten)
Heen Za 19 mrt	-	-	€ 90 (0 nachten)	€ 110 (1 nacht)	€ 60 (2 nachten)	€ 50 (3 nachten)	€ 40 (4 nachten)
Heen Zo 20 mrt	-	-	-	€ 70 (0 nachten)	€ 75 (1 nacht)	€ 80 (2 nachten)	€ 70 (3 nachten)
Heen Ma 21 mrt	-	-	-	-	€ 100 (0 nachten)	€ 180 (1 nacht)	€ 180 (2 nachten)

Heenreis (za 19 maart)

Prijs	Vertrek	Aankomst	Maatschappij	Kenmerk
<input type="radio"/> €40	Schiphol 06:15	Barcelona 08:20	Transavia	TR1019
<input checked="" type="radio"/> €45	Schiphol 08:10	Barcelona 10:15	Transavia	TR1020
<input type="radio"/> €60	Schiphol 15:30	Barcelona 17:25	Vueling	VL2029
<input type="radio"/> €120	Schiphol 10:00	Barcelona 12:00	KLM	KL801
<input type="radio"/> €105	Schiphol 17:30	Barcelona 19:25	KLM	KL802

Terugreis (ma 21 maart)

Prijs	Vertrek	Aankomst	Maatschappij	Kenmerk
<input type="radio"/> €20	Barcelona 08:30	Schiphol 10:20	Transavia	TR1018
<input checked="" type="radio"/> €30	Barcelona 09:30	Schiphol 11:25	EasyJet	EZ2198
<input type="radio"/> €35	Barcelona 12:00	Schiphol 14:00	Vueling	VL2028
<input type="radio"/> €60	Barcelona 15:30	Schiphol 17:25	Vueling	VL2029
<input type="radio"/> €120	Barcelona 10:00	Schiphol 12:00	KLM	KL801
<input type="radio"/> €105	Barcelona 17:30	Schiphol 19:25	KLM	KL802

Totaal prijs: €75

[Direct boeken](#)
[Toevoegen aan stedentrip](#)

Fig. 3. Mock-up screen Transport. (A) Composing a city trip by the concept of a shopping cart, (B) The prior properties the user set first, (C) Several tabs with the three modules of a city trip, the user starts with an overview and in this screen transport is selected, (D) Table visualizations with the prices by departure and leaving dates, (E) Travel options appear when choosing date options.

Stedentrip Zoeker

Uw samengestelde Stedentrip

Barcelona
2 personen
19 mrt 2011 – 21mrt 2011 (2 nachten)

Vervoer:

Heen:
Transavia TR1019
Vertrek 08:10 Schiphol
Aankomst 10:15 Barcelona € 45

Terug:
EasyJet EZ2198
Vertrek 09:30 Barcelona
Aankomst 11:25 Schiphol € 30

Accommodatie:

Hotel: Catalunya
2 persoonskamer € 149

Activiteiten:

Nog niets toegevoegd

Totaal € 224

Bestel de samengestelde producten

Bestemming
Barcelona

Aantal personen
2

Datum
van 19 mrt 2011 t/m 21 mrt 2011 (2 nachten)

Overzicht **Vervoer** Accommodatie Activiteiten

Accommodatie

Accommodatie voor 2 personen in Barcelona
Aankomst zaterdag 19 maart en vertrek maandag 21 maart (2 nachten)

Inzicht hotels

Kaart

Resultaat accommodatie

Sorteer de resultaten op: [prijs](#), [gebruikers beoordeling](#), [aantal sterren](#)

1	 Hotel Palace GL ★★★★★ Hotel Palace GL is een elegant, luxe hotel dat de beste traditionele en moderne faciliteiten	Fantastisch, 9.1 Prijsverloop
	Deluxe Double Room € 360 voor 2 nachten Tweepersoonskamer Deluxe € 570 voor 2 nachten	
2	 Eurostars Grand Marina Hotel GL ★★★★★ Dit designhotel kijkt uit over de haven van Barcelona, aan de overkant van La Rambla	Erg goed, 8.5 Prijsverloop
	2-persoons standaard kamer € 277 voor 2 nachten 2-persoons romantische kamer € 415 voor 2 nachten	
3	 Just Style ★★★ Hotel Just Style heeft een gunstige locatie achter station Sants	Erg goed, 8.4 Prijsverloop
	Loft Suite (1-2 adults) € 246 voor 2 nachten Loft Suite (3 adults) € 280 voor 2 nachten	
4	 Catalunya ★★ Catalunya ligt net buiten La Rambla, op 50 meter afstand van de Plaça Catalunya	Erg goed, 8.4 Prijsverloop
	2-persoons kamer € 149 voor 2 nachten 3-persoons kamer € 253 voor 2 nachten	

Fig. 4. Mock-up screen Accommodation. (A) The shopping cart, filled in after choosing the products, (B) The prior properties which stay the same, (C) The accommodation tab is now selected, (D) Scatterplot showing the hotels in relation with user rating and price, (E) A map showing the hotels in a geographic space, (F) List of accommodations for the given city, which the user can sort on price, number of stars and in this mock-up on user rating, (G) A single accommodation showing the name of the hotel, number of stars, the user rating, a photo, two rooms with prices and a graph showing the price of the rooms on a time-scale.