# Discovering Activities in Your City Using Transitory Search

**Jeni Paay [1], Jesper Kjeldskov [1], Mikael B. Skov [1], Per M. Nielsen [1], and Jon Pearce [2]**
[1] Aalborg University, Denmark, Department of Computer Science / Centre for Socio+Interactive Design
[2] The University of Melbourne, Australia, Department of Computing and Information Systems
{jeni, jesper, dubois}@cs.aau.dk

## ABSTRACT
Discovering activities in the city around you can be difficult with traditional search engines unless you know what you are looking for. Searching for inspiration on things to do requires a more open-ended and explorative approach. We introduce transitory search as a dynamic way of uncovering information about activities in the city around you that allows the user to start from a vague idea of what they are interested in, and iteratively modify their search using slider continuums to discover best-fit results. We present the design of a smartphone app exemplifying the idea of transitory search and give results from a lab evaluation and a 4-week field deployment involving 15 people in two different cities. Our findings indicate that transitory search on a mobile device both supports discovering activities in the city and more interestingly helps users reflect on and shape their preferences in situ. We also found that ambiguous slider continuums work well as people happily form and refine individual interpretations of them.

### Author Keywords
Transitory search; Explorative Search; Event finding; Sliders.

### ACM Classification Keywords
H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces.

## INTRODUCTION
Think of a situation where you need to know a specific piece of information: the distance from work to home, the phone number of your favourite restaurant, or the opera that is playing at the opera house tonight. Chances are you would use a textbox and key-word search engine (like Google) to find this information. These search engines excel at looking up information based on a well-defined search query, so much so, that they have become the usual starting point whenever we need to find information about something. They work well, as long as you know exactly what you are looking for. The problem is that sometimes we are in situations where we only have a vague sense of this. In these situations, traditional search engines fall short. For example, if you are searching for inspiration about an activity or event that could be of interest to you *here* and *now*, then the kind of search that you need to make is open-ended and explorative [18]. Say you would like to do something that is not too physically active, preferably somewhere among other people, and close to the city centre. There might be many activities that would fit these criteria. But how do you find the one you would be most interested in? What you really need in this case is the ability to start with a vague idea, view and compare intermediate results and then reformulate preferences and criteria until you find an activity that sufficiently suits the situation. Searching for something to do can also include family and friends who need to collaborate in the search process, in these situations a simple search query does not support the coordination of group desires [20]. In response to these kinds of search scenarios that require much more diverse searching strategies, we have devised the *transitory* search approach to finding information within a large data set, while moving around in the city.

We have based the idea of *transitory* search on the concept of *transitory* information [3] – information that is temporary, transient and impermanent. In a similar way, transitory search provides responses that are provisional, fleeting, ephemeral, and as much starting points for further exploration as they are possible end results. With transitory search we thus imagine interacting with search engines in a very different way from the traditional query submission followed by a list of search results. We imagine interaction that is more dynamic and in real-time, where best-fit results "*bubble to the top*" in response to the user iteratively modifying search criteria to suit their current desires.

In this paper, we exemplify our notion of *transitory* search using a smartphone application designed to discover activities in the user's city. We present what we learned from two studies of the system in use: a lab evaluation and 4-week field deployment of a prototype system involving 15 people in two different cities. The contribution of this research is two-fold. Firstly, we concretize our idea of transitory search in the design of an app that takes advantage of cities as mobile environments. Secondly, we provide understanding on how people adopt and adapt transitory search approach using slider continuums on mobile devices for discovering activities in their city.


*MobileHCI '16,* September 06-09, 2016, Florence, Italy
 ISBN 978-1-4503-4408-1/16/09…$15.00
DOI: http://dx.doi.org/10.1145/2935334.2935378

## RELATED WORK

Our thinking about the mobile application of transitory search for discovering activities in a city, is inspired by research on recommender systems, mobile guides, and information systems using exploratory search.

### Recommender Systems and Mobile Guides

Recommender systems are widely used to provide people with suggestions about a wide range of things, for example, music, movies, books, clothing, etc. by presenting information believed to be particularly relevant for them based on their profile, history of interactions, searches, online purchases etc. [1, 7, 13]. However, it is known that these systems cannot effectively produce results unless they know the user's preferences, as discussed by Pearce et al. [11], and that users often construct their preferences only after a choice between several options is presented to them [7]. This not only presents a fundamental challenge for the design of such systems, but also illustrates the difficulty in starting a search from a single point of preference.

In the special case of mobile recommender systems, limited screen space forms an additional challenge for presenting recommendations [7], and the abundance of recommended information in some areas, for example big cities, can make it difficult to get an overview [17]. Several mobile tourist guides, such as GUIDE [5] and COMPASS [17] have sought to overcome this problem by using personal details, pre-entered interests or goals, and location-awareness to recommend activities in close vicinity of the user. This has made them less prone to overloading users with information and better at providing well-matched recommendations. Other mobile guide systems, such as Magitti [4], Just-for-Us [8] and MTRS [6] add to this by looking at the user's activity, social context, past behaviours and history of socializing. They are valued for their ability to facilitate serendipitous discoveries of nearby activities, emphasizing the value of spontaneity over structured sightseeing.

### Exploratory Search Systems

In order to deal with information-seeking problem contexts that are *"open-ended, persistent, and multifaceted",* and processes of information-seeking that are *"opportunistic, iterative, and multitactical",* White and Roth [20] argue for a need for new exploratory approaches going beyond the query-response paradigm, and supporting exploration *"through symbiotic human–machine relationships that provide guidance in exploring unfamiliar information landscapes*". This is supported by Wilson et al. [22] who argue that *"as users' demands continue to grow and their needs evolve, opportunities are emerging for exploratory search strategies"*.

Within this area of exploratory search systems, Marchionini [9] argues that for search within large datasets, engaging with the investigation, discovery, and transformation of information are as much part of the search process as the finite outcomes. He identified strategies such as comparing, synthesizing, and evaluating that users might use to achieve their goals. As early as 1992 at CHI, Ahlberg et al. [2] demonstrated that "*dynamic querying*" had the potential to make it easier to find trends and exceptions in a database through direct manipulation of search query formulation. They compared searching using form-filling against slider widgets, in a non-mobile context, that gave immediate feedback through a changed graphical representation of the query result. This study found that in a non-mobile context sliders were more effective and more fun. In the context of searching for activities at a festival, Schaller et al. [15] confirmed that exploratory ways of searching were preferred by users. They compared the use of recommendations, genres, location, and text search, and found that unless people knew exactly what they were looking for, they preferred freely browsing through lists for inspiration rather than using the search function. Faceted Search [19] is an exploratory search technique that resonates with transitory search, in that it encourages users to explore a collection of information using multiple filters. Information elements can be accessed by their semantic properties, along multiple dimensions, which can be ordered in multiple ways thus creating a more complex expression to define the outcome. In this way, like transitory search, it offers a flexible search mechanism with multi-faceted results.

Recently, Pearce et al. [11] have developed a web based desktop system, *iFish*, for exploring large data sets using dynamic querying across multiple dimensions represented as continuums. Cases for applying the iFish system have included restaurants, libraries and curriculum, all as desktop applications. Through a number of experiments and qualitative user studies they have shown the value of dynamically adjusting continuum values using search-query sliders as opposed to drop-down menus or text-based search mechanisms, as well as higher user satisfaction for ill-defined searches [10, 11, 12].

## PROTOTYPE APPLICATION

To extend on the advantages of the slider approach to searching found in non-mobile contexts, we designed and implemented transitory search in a mobile prototype application, *"This Is My City"*, to help people find timely and/or new activities in their city. The prototype gives recommendations on activities that are nearby and happening today. Inspired by Ahlberg et al. [2], Williamson and Shneiderman [21] and Pearce et al. [10, 11, 12], confirming the ease of use of sliders for dynamic querying, the setting and modification of search criteria is done using a set of slider widgets, and search results change and update dynamically as sliders are moved. What is unique about this type of search is that continuums are not binary and criteria can be expressed by degrees rather than absolutes, supporting people doing open-ended searches [21]. The continuums are intentionally ambiguous and multi-faceted themselves to provoke inquiry and reflection when setting search criteria, and to open up for more playful and exploratory interactions with this system.


(a) (b) (c)

**Figure 1: Transitory search interface on a smartphone application: a) Main screen with image tile search results; b) pop-up window details on selected activity; c) close up of sliders (overlaying main screen) for modifying search criteria.**

To inspire design, a field visit was conducted in the city of Melbourne during a cultural festival, with five participants (3 females, 2 males, all in their twenties). They were allowed to use whatever sources they wished, including staff at a nearby visitor centre, their smart phones, the festival brochure, etc. Each participant was asked to find an event in the festival they would like to attend, and to think aloud during the process. Using observation and contextual inquiry, video and audio data was collected and analysed using open coding. From 119 unique codes, 8 categories were identified: proximity to here, trustworthy advice, value for money, event desirability, visual impression, before and after, what's on now, changeable preferences.

The prototype consists of three elements: 1) a main screen for search results, 2) a screen with details on a selected activity or event, and 3) an overlay with four sliders for manipulating the search. The main screen presents results in a 2-column scrollable grid of image tiles with titles and best matches placed towards the top of the screen (Figure 1a). Tapping on an image creates a full screen pop-up window with detailed information on that activity (Figure 1b). Activating the transitory search function, by tapping on a blue side bar, opens a semi-transparent overlay over the results screen showing four slider labels and a grey/blue proportionate indicator of their current setting (Figure 1c). Touching a white label makes the grey/blue slider pop-out to fill the width of the screen. This slider can then be re-set, modifying the "weighting" across that search continuum. For example, as shown in figure 1c), the small grey slider handle is being used to set the continuum toward the fun end, rather than the serious end of the continuum).

When a slider is moved, the search result image tiles are reordered accordingly. This happens immediately and is animated to create a fluid user experience where one can literally see activities "rise to the top" in response to their interaction. Robertson et al. [14] with their *Polyarch* browser have shown that using animation to support users through transitions in an interface helps them in their exploration. All activities are still accessible through scrolling, but the 6 best-fit results are visible on the screen.

To calculate the best-fit results in response to the four active sliders, all events and activities in the system are tagged accordingly with a relative weight on these 8 continuums expressed as a number between 0-100. In the experimental prototype this relative weighting was determined by the research team, based on descriptions provided by the cities official tourism web-sites. Best-fit results are calculated using an algorithm that finds the difference between the current setting of an active slider and the tagged value, then ranking the dataset by the lowest cumulative score across all active sliders. The best-fit activities then dynamically rise to the top of the presented listing of all events, with the top 6 visible without scrolling.

The prototype currently operates with 8 possible search criteria continuums with a maximum of 4 sliders active and visible at a time. Each can be swapped for another, or simply be deactivated. This allows the user to select which criteria are most relevant in a given situation but also forces a deliberate reduction of complexity in the search.

These criteria continuums were chosen using analysis of outcomes from two activities. In addition to the data from the first field visit, we conducted a design workshop with four participants (2 females, 2 males, all in their twenties) for the specific task of designing the sliders. Participants were given several tasks searching the Melbourne Festival brochure to identify events of interest. They then shared their reasoning behind these choices, and what made these events interesting. They were also given an early design paper prototype of the system, and asked to discuss ideas for slider labels and cooperatively construct continuums on

a whiteboard. Videos from this workshop session were analysed in combination with the initial field visit videos to create a list of 24 paired slider labels and 52 event-based descriptors. These were then grouped using affinity diagramming to produce 8 distinct slider continuums.

For the prototype we used these 8 continuums:

| | | |
|---|---|---|
| Public | <======> | Intimate |
| Fun | <======> | Serious |
| Active | <======> | Passive |
| Suburbs | <======> | City Centre |
| Fast | <======> | Slow |
| Loud | <======> | Quiet |
| Traditional | <======> | Contemporary |
| Big | <======> | Small |

## USE STUDY

We conducted a use study in two parts, one in the lab and one in the field, to investigate how people understand, experience, and use transitory search for discovering activities in the city around them. The study took place in Melbourne, Australia and Aalborg, Denmark.

The first part of the study was a lab-based evaluation in Melbourne. The purpose of this was to get a basic understanding of how people make sense of the transitory search approach, and how they experience the prototype interaction design for exploring possible activities in their city. For this purpose we populated the system with real data about 80 upcoming events in the Melbourne Festival sourced from their web site. We then gave the system to 5 test subjects (2 male, 3 female, all in their twenties), with a brief introduction, and asked them to carry out a number of tasks with it. First, each participant was asked to find a comedy event of his or her own liking. Secondly they were asked to find an event appropriate as an outing to share with their work colleagues. Lastly, they had to find an event they would like to go to themselves during the festival.

The second part of the study was a 4-week field deployment in Aalborg, with field observations using think aloud at the beginning of the trial period and contextual interviews at the end of it. The purpose of this part of the study was to deepen our insight into the experience, and use of transitory searching in real world settings and to see how people's impression of the system changed after having used it for a few weeks.

For this we populated the system with real data about 282 upcoming activities sourced from the local tourist office. We then recruited 10 participants (7 males, 3 females, all in their twenties) and asked them to use the system as much as they liked over the duration of the trial. The participants were all asked to reflect on, and take notes about, their use and experiences of the system during the deployment. After 2 weeks of use a reminder was sent to prompt them to continue using the system. The pre-deployment field observations were done to gain insight into user's responses to and use of the prototype. Participants were asked to think aloud while using the system for the first time to search for activities in their city that they would like to do that day. The post-deployment contextual interviews were done to follow-up on the participants' experience of using the system over time and for their own purposes, and to find out if and how their impressions of the system changed from their initial use of it. The interviews were conducted in the city to prompt their recollection of their own situations of use. In both parts of the study we deliberately did not provide our interpretations of the search criteria continuums, as we wanted to see how user's interpreted and operationalised the sliders and their labels. Unfortunately, we did not log use of the system during the 4-week period, as our initial interest was focussed on how people perceived the search mechanism as supporting their discovery of activities, but in retrospect this would have given us insight into how use patterns affected their responses.

The 20 field observations and contextual interviews each lasted around 30 mins, and were all recorded on video and audio. These were then selectively transcribed (to remove noise from the transcript) and coded using open coding. These codes were then grouped, categorised and themed for the purpose of understanding people's responses to and appropriation of the transitory search mechanism. We wanted participants to use the system in their own way, as our interest lies in providing a search mechanism that can show regular denizens new aspects of their own city, or simply surprise them with timely and desirable recommendations, rather than a one-visit tourist guide.

## FINDINGS AND DISCUSSION

Through our data analysis, we identified three main themes that gave us insight into how people used transitory searching to discover activities in the city. These included using the system to shape their preferences on what they would like to do that day, happily making their own interpretations of ambiguous continuums, and using transitory search to satisfactorily discover something to do while out and about.

### Shaping Vague Preferences

An interesting finding about people's response to transitory search when finding leisure activities in a city was how they used the application for articulating and shaping their preferences, as one said, *"I like this idea of sliders when I don't know what I am looking for"*. The types of activity people want to engage in at any time is influenced by many factors, for example who they are with, what mood they are in, how tired or energetic they feel, the weather, etc. As one participant said, *"I think I am looking for something that is not too much like a family thing and I am looking for something that has to be a bit active, and where people can talk together"*. But rather than being clearly defined based on this, we found that people's preferences were indeed quite vague, imprecise, open for negotiation, and open for being impulsive. For example, *"I'll take something where I can get a bit inspired. That could be good"* or *"It's Friday*

*afternoon, I just want to get my mind off Uni or work and I just want to chill"*.

Interestingly though, we found that the adjustable criteria of transitory searching appeared to match this lack of precision, and that the process of transitory searching helped not only in discovering desirable activities happening in the city but also actually helped people to shape their preferences about what they felt like doing today. As one participant said at the beginning of a search, *"You don't know what you are after"*. During the search, another said, *"It gives me more clarity as to how I can prioritize and find specific things",* and in terms of setting sliders, *"That would mean that…even a small move [of a slider] can actually mean a lot for my mood"*.

This led to search interactions of a "double-loop" rather than "single-loop" nature where the outcome was not only the specific activities themselves, but also the gradual development of more clearly shaped preferences. As one user said, *"I like that it gets more precise. I prefer that I have few choices, so I don't have to consider too many. So it is great that I can eliminate some of them so I don't have to relate to them too much"*.

This finding resonates with Donald Schön's concept of "reflection-in-action" [16] describing decision making as a reflective conversation with the situation. Introducing this perspective to information search explicitly brings to focus the iterative and reflective nature of exploring a space of possibilities when what we are looking for is not defined up front, and the need to explicitly support this in our search mechanisms. Transitory search is an example of how this can be done for discovering activities in the city on a mobile app.

As shown by Williamson and Shneiderman [21] people have no difficulties using sliders effectively. Because it allowed them to express their preferences by degrees, for example *"sort of fun, but sort of serious",* simply by moving a slider, even by a little, they were able to quickly reassess their priorities with respect to the immediately updating results and how they felt about them. What we can add to this knowledge is that the unclear component in the problem of activity searching was not users' understanding of the search mechanism, but rather the difficulties they experienced in trying to clearly define up front exactly what they were looking for. In response to this, transitory search gave them the opportunity to reflectively explore their feelings and preferences as an integrated part of the search.

Current tourism recommender systems based on people's pre-entered personal profile and interests [5, 18] are limited in their ability to match their results to the changing moods, situations and other preferences that people have when they are out in the city looking for something to do. Even systems using people's social context and past behaviours to make recommendations [4, 6, 8] only go part way to predicting what people might actually feel like doing today. We found that a transitory search mechanism allowed people to reflect on what they wanted to do *here* and *now*, and shape these vague preferences into an activity choice.

**Interpreting Ambiguous Continuums**

Our second finding is about how people worked with the set of search criteria continuums provided. Users reported that working with continuums to search gave a very different experience to selecting discrete items, for example, categories on a pull-down menu, a check list of interests, or precise word searches using form filling. In designing the continuums, we deliberately played on this difference to provoke a discovery experience for users, by including some continuums where the end points were not necessarily the antithesis of each other. For example, "Fun <=> Serious" was perceived by participants as having a different meaning to "Fun <=> not Fun" or "Serious <=> not Serious". This made people reflect on their search criteria with respect to the results shown, leading them to form their own individual interpretations of the meanings associated with each continuum. When talking about setting a slider to the middle, one said, *"Something that is a bit of both. You are kind of saying it doesn't matter if it is intimate or public"*. Another participant adjusting the active-passive slider decided, *"I think I put this one too far up. I don't think I feel like participating"*.

As discussed earlier, each activity in the system was tagged with respect to the 8 continuums. In the early field trials with the system we were concerned that participants were misunderstanding "our" meanings for the continuums. This was especially the case when the words used on a slider were related to feelings or experiences, such as "fun", "intimate", or "passive", in which case we worried they would be too ambiguous. However, after several field studies we realized, as we watched participants explore and discover activities they liked, that this did not matter at all. In the context of searching for interesting leisure activities, there is no "correct" answer - only search results that serve to inspire, remind, entice and surprise. As one user said, *"If I never get the criteria right, I'll still use it to see what's going on right now"*. Another participant said, *"Yeah, I didn't think about a dining experience, but now that I see it come up, I think that it could be a really nice way to get to know each other"*.

When we held contextual interviews after 4 weeks of use, we found that people had devised their own meanings for continuums, evolved through their use of the system over time, which sufficiently supported them in using the app to search for things that they wanted to do. They found they could set sliders, review results, readjust sliders, reflect on the new results, and make their own meanings for the continuums. These meanings did not need to correspond exactly with the way activities were classified in the system; it just had to be good enough to support their own search in a way that they were satisfied with the outcomes. Another reason this is interesting is that people's

preferences are based on values that are difficult to define, making it difficult to design the perfect set of continuums. Additionally, activities available in a place change over time, sometimes quite rapidly, so in a sense the activities themselves are transitory. This makes the challenge of assigning "correct" continuum values to a changing range of activities an impossible task. Therefore, people's flexibility and adaptability in making sense of the world around them [8] becomes an essential consideration in designing transitory search systems.

### Discovering Activities

All participants were positive about transitory search as a useful way to search for activities to do while mobile in the city. As one user said, *"So it's only showing what is available today…Oh cool! I'll definitely use that one",* and *"It came up with some good results"*. The system also supported serendipitous discovery of activities, *"there's, like, a lot of things, [in the results list] you realise there is so much happening"*.

The concept of search criteria continuums, implemented as sliders and overlaid on images of the search results, was easily understood and gave users quick access to pertinent information on their smartphones using the app. As one user said about the use of the sliders, *"I think they are much more helpful than what I am used to with apps. They are exactly what I am asking for when I am looking for an event"*.

Compound searches on mobile phones is challenging to say the least, with small screens limiting the ability to compare options across multiple windows. It can be both frustrating and time consuming if a user needs to check lists or fill forms, then look at a list of results, and if they do not find what they are looking for, return to the criteria screen to reset values to get another results list. It requires a series of trial and error searches, working back and forth between criteria setting and viewing results. As one user complained, *"on some websites you have to change your settings and change all kinds of things to change what comes up – this is easy, it it's all right there"*. With our instantiation of transitory searching, participants were able to work effectively on a small screen, re-adjusting their search criteria with results immediately visible and dynamically changing in response to slider settings. They could also scroll through the full list of activities if they wanted to. They were able to understand this, saying *"It is the same results, it's just the position of them…so the one's that fit my criteria are at the top, and the ones that don't fit as good are further down"*. Another said, *"If I use the app again, I will know it works, and I don't have to scroll all the way to the bottom [of the search result list]"*.

In designing transitory search for mobile contexts specifically, we found that the use of images representing resulting activities, with brief titles, helped users to quickly get an overview and "feel" for their best-fit options. Images that represented the ambiance or experience of an activity, rather than, for example, just the exterior view of the building in which they were held, were even more helpful to participants in making decisions about which available activities appealed most.

## CONCLUSION

We have investigated the use of transitory search in a mobile app for uncovering information about activities in the city around you. Unlike traditional search engines our approach is not based on the assumption that the user knows what they are looking for but to facilitate search that is open-ended and explorative. The contribution of this work is a concretization of transitory search for mobile devices and empirical findings about the experience and use of this approach to searching for activities in the city.

In light of the work by Wilson et al. [22] who point to future search interfaces that facilitate *"exploring information spaces that Google's elegant keyword search cannot do",* we have observed that our instantiation of transitory search provides a worthwhile addition to exploratory search approaches on mobile devices. Using our application, we give users the opportunity to discover new, surprising and relevant activities within their city. Our dynamic query results presented as tiled images and use of compact slider widgets with ambiguous continuums make an important contribution to understanding how people like to search for activities while mobile in their own city. We have presented three main findings. Firstly, we found that transitory search not only discovered activities happening in the city but also helped shape people's vague preferences about what they felt like doing. Secondly, we found that ambiguous search continuums work well for transitory searching because people happily form and refine their interpretations of these as part of the exploration of available activities and their own preferences. Thirdly, we found that transitory search on mobile devices gives a fun experience for young adults discovering activities while out and about in the city,

In order to identify future opportunities for the transitory search approach in the design of mobile city guides and recommender systems, we plan to followed up this research with a longitudinal study, involving a greater number and diversity of participants and with collection of additional data, for example, logging of interactions and responses in place, to better understand it's use in context.

## REFERENCES


1. Gediminas Adomavicius and Alexander Tuzhilin. 2005. Toward the next generation of recommender systems: a survey of the state-of-the-art and possible extensions. IEEE Transactions On Knowledge And Data Engineering, 17, 6 (June 2005), 734-749. http://doi.acm.org/10.1109/TKDE.2005.99
2. Christopher Ahlberg, Christopher Williamson, and Ben Shneiderman. 1992. Dynamic queries for information exploration: an implementation and evaluation. In Proceedings of the SIGCHI Conference on Human

Factors in Computing Systems (CHI '92), 619-626. http://doi.acm.org/10.1145/142750.143054

3. Paul Ayres and Amina Youssef. 2008. Investigating the influence of transitory information and motivation during instructional animations. In Proceedings of the 8th international conference on International conference for the learning sciences - Volume 1 (ICLS'08), Vol. 1. International Society of the Learning Sciences, 68-75.
4. Victoria Bellotti, Bo Begole, Ed H. Chi, Nicolas Ducheneaut, Ji Fang, Ellen Isaacs, Tracy King, Mark W. Newman, Kurt Partridge, Bob Price, Paul Rasmussen, Michael Roberts, Diane J. Schiano, and Alan Walendowski. 2008. Activity-based serendipitous recommendations with the Magitti mobile leisure guide. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '08), 1157-1166. http://doi.acm.org/10.1145/1357054.1357237
5. Keith Cheverst, Nigel Davies, Keith Mitchell, Adrian Friday, and Christos Efstratiou. 2000. Developing a context-aware electronic tourist guide: some issues and experiences. In Proceedings of the SIGCHI conference on Human Factors in Computing Systems (CHI '00), 17-24. http://doi.acm.org/10.1145/332040.332047
6. Damianos Gavalas and Michael Kenteris. 2011. A web-based pervasive recommendation system for mobile tourist guides. Personal Ubiquitous Comput. 15, 7 (October 2011), 759-770. http://dx.doi.org/10.1007/s00779-011-0389-x
7. Damianos Gavalas, Charalampos Konstantopoulos, Konstantinos Mastakas and Grammati Pantziou. Mobile recommender systems in tourism. Journal of Network and Computer Applications, 39 (March 2014), 319-333. http://dx.doi.org/10.1016/j.jnca.2013.04.006
8. Jesper Kjeldskov and Jeni Paay. 2005. Just-for-us: a context-aware mobile information system facilitating sociality. In Proceedings of MobileHCI '05, 23-30. http://doi.acm.org/10.1145/1085777.1085782
9. Gary Marchionini. 2006. Exploratory search: from finding to understanding. Commun. ACM 49, 4 (April 2006), 41-46. http://doi.acm.org/10.1145/1121949.1121979
10. Jon Pearce and Shanton Chang. 2014. Exploration without keywords: the bookfish case. In Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures: the Future of Design (OzCHI '14), 176-179. http://doi.acm.org/10.1145/2686612.2686639
11. Jon Pearce, Shanton Chang, Gregor Kennedy, R. B. W. Ely, and Mary Ainley. 2012. Search and explore: more than one way to find what you want. In Proceedings of the 24th Australian Computer-Human Interaction Conference (OzCHI '12), 469-478. http://doi.acm.org/10.1145/2414536.2414608
12. Jon Pearce and Sofia Pardo. 2008. To search or to explore - that is the question: a study in mindful engagement. In Proceedings of the 20th Australasian Conference on Computer-Human Interaction: Designing for Habitus and Habitat (OZCHI '08), 251-254. http://doi.acm.org/10.1145/1517744.1517763
13. Francesco Ricci, Lior Rokach and Bracha Shapira. 2011. Recommender Systems Handbook. Springer.
14. George Robertson, Kim Cameron, Mary Czerwinski, and Daniel Robbins. 2002. Polyarchy visualization: visualizing multiple intersecting hierarchies. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '02). ACM, New York, NY, USA, 423-430. http://dx.doi.org/10.1145/503376.503452
15. Richard Schaller, Morgan Harvey, and David Elsweiler. 2012. Entertainment on the go: finding things to do and see while visiting distributed events. In Proceedings of the 4th Information Interaction in Context Symposium (IIIX '12), 90-99. http://doi.acm.org/10.1145/2362724.2362743
16. Donald Schön. 1983. The Reflective Practitioner. How Professionals Think in Action. Basic Books
17. Mark van Setten, Stanislav Pokraev, and Johan Koolwaaij. 2004. Context-Aware Recommendations in the Mobile Tourist Application COMPASS. In Proceedings of the Third International Conference on Adaptive Hypermedia and Adaptive Web-Based Systems (AH '04), 235-244. http://dx.doi.org/10.1007/978-3-540-27780-4_27
18. Ben Shneiderman. 2011. Social discovery in an information abundant world: Designing to create capacity and seek solutions. Information Services & Use, 31, 1 (2011), 3-13. http://dx.doi.org/10.3233/ISU-2011-0628
19. D. Tunkelang. 2009. Faceted Search. Morgan & Claypool.
20. Ryen. White and Resa Roth. 2009. Exploratory Search: Beyond the Query-Response Paradigm. Morgan & Claypool.
21. Christopher Williamson and Ben Shneiderman. 1992. The dynamic HomeFinder: evaluating dynamic queries in a real-estate information exploration system. In Proceedings of SIGIR '92, 338-346. http://doi.acm.org/10.1145/133160.133216
22. Max Wilson, Bill Kules, m c schraefel, and Ben Shneiderman. 2010. From Keyword Search to Exploration: Designing Future Search Interfaces for the Web. Found. Trends Web Sci. 2, 1 (January 2010), 1-97. http://dx.doi.org/10.1561/1800000003