Fast Authoring For Mobile Gamebased City Tours
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Abstract

Tourists want to tell other people about their journeys and adventures. This is often done via social networks and digital photos. But what if one could tell other people about a great tour by sharing the tour itself with others than just photos or short messages? In this paper, we present an intuitive authoring tool for gamebased city tours and a rendering app for these tours on iOS. This way, complex tours can be authored and shared easily with others. These tours allow tourists to explore new interesting sites in an exciting way: Tourists are lead from station to station. On each station, something interesting happens: A short question has to be answered or interesting details in the surrounding is shown. This is very similar to geocaching, a worldwide GPS stash hunt. On each station, images and questions can be presented to the tourists. This leads to knowledge transfer: Tourists get to know new facts about the locations they are visiting. In our previous work, we showed that such tours can indeed transfer knowledge [1]. We evaluated the authoring tool to find out if it is possible to author complex touristic tours with it.

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1. Introduction

When tourists visit other cities, they want to tell other people what they experienced. This is often done via social networks. But what if one could tell other people about a great tour by sharing the tour itself with them? It would be possible to implement whole communities sharing touristic tours like it is done by the many different geocaching communities on the WWW and would add value to tourism by providing new opportunities in sharing experiences with others.

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In this paper, we present an authoring tool for game-based city tours and a rendering app for these tours on iOS. These tours allow tourists to explore new interesting sites in an exciting way: Tourists are lead around these sites through stations. On every station, they can experience images, texts and questions about what they actually see. This is very similar to geocaching. On each station, images and questions can be presented to the tourists. This paper aims to find out if it is possible to author complex touristic tours with this authoring tool.

2. Mobile City Tours on Smartphones

Nearly every tourist uses a smartphone when she or he explores new locations. They use smartphones to download information on their way, use maps with GPS positioning to navigate and they use it to communicate with their friends and families while being on their way. Tourism has completely changed because of smartphones: You don't have to plan everything in detail in advance of a journey because you are always online. Smartphones can also add great value in the exploration of new sites. There are many touristic apps for smartphones. Many are described in [8].

The worldwide stash hunt 'geocaching' became more and more popular in the last years. This is an outdoor sport where you have to find treasures at given GPS positions. People use their GPS devices or smartphones to search for geocaches. There is one specific type of geocache which is most interesting when exploring a new location: The so-called multicache. This type consists of stations at given locations which are connected to build a tour. On each station, geocachers have to solve one or more tasks, i.e. answer a question about the current location. These tasks are usually connected to the locations. One task could be to find an information board or to count something. The advantage is that people get to know information in a playful way about the locations where they are geocaching. This knowledge transfer is sufficient for tourism because touristic actions can only be motivated intrinsic (see [1]). There are other apps with stations to discover. One of them is described in [12]. Another app with stations at POIs can be found in [10]. Papers like [4] and [5] worked on the development and evaluation of game-based tours like the tours our authoring tool is able to produce. It was shown that there can be fun and even knowledge transfer via such apps.

The problem is that it is very complex to build such geocaches or apps with stations at POIs. Thus, it is still a task for experts. To build a geocaching tour and provide it to others, you have to find interesting locations in the target area, you have to look up interesting tasks and opportunities for the geocaching tour. In the next step, one has to connect these geographic points logically to a tour by bringing all stations in the desired order. For this complex step, there are no online or offline software tools so that it has to be done manually using pen and paper. After this, you have to implement the well-planned geocaching tour via web pages like geocaching.com. These web pages don't provide much comfort when building a geocaching trip. For example, one has to look up the GPS positions of specific places and to type them in manually to create a station. This is exactly where our authoring tool comes in. We aim to provide a tool which people can use to author complex tours similar to multicache tours with an intuitive GUI. In [11] it is pointed out how an individual tour planning for touristic tours can be done. Usually, tour planners don’t know the interests of tourists (see [11], p. 293). Our system aims to bring tour planners and tourists together by switching the role of tourists after a tour to tour planners.

This work is based on the work of Stier et. al. who presented in [1] a system for game-based knowledge transfer consisting of a game-based city tour on iPhones. In this work, the system could add value to the touristic experience. It consisted of many stations leading through the german city Ratisbon. On each station, the users had to answer questions or play mini games. The evaluation results showed that the system was well accepted by the tourists. It was fun to play and it could be shown that there is indeed knowledge transfer. This paper shows how these tours can be generated by an authoring tool. In [2], Ternier et. al described an authoring tool for Augmented Reality apps. This toolkit provides all opportunities to build serious games for hostage taking scenarios, but focusses not on building easily a geographic based tour with stations. There is an authoring component and a renderer for smartphones. In [3], different mobile apps with stations were implanted and
evaluated. Especially interesting in [3] is the Florence case, a game similar to the city tours our authoring tool can provide. Furthermore, this case had explorative learning content just as our tours do.

Even if there is plenty of related work, there is no authoring tool to author gamebased touristic city tours. We present an approach filling this gap. With our authoring tool, city tours can be produced very fast which leads to new scientific and economic opportunities.

3. Authoring Tool

A tour consists of some parts which can be built with our authoring tool: Stations and connections between stations. A tour consists of stations which are to be visited by the tourists. The way between stations is called a connection. Being the core of our authoring system, these parts hold the semantics of a tour and thus are mapped directly to our intern data structures. When authoring a tour, these parts have to be built by the author. First, we take a closer look to the GUI and workflow of the authoring tool. After this, we introduce the details of authoring a tour.

3.1. GUI and workflow

The GUI consists of two main parts: The map window and the story window. The map window provides a geographic overview of the stations of the tour and their connections. The story view allows to view the context of the tour's story. The order of the stations can be recognized as well as the details of all stations such as their names, the number of images and questions and the radius of the station.

In the map window, a station is a point with GPS coordinates, a radius, a type and a name. In the story window, the logic of the Story Stations is presented. There are two opportunities to plan a tour. On the one hand, one can plan the tour on the map by just clicking on the map. A menu will open where you can choose...
which kind of station is to be added. On the other hand, you can build the story graph in the story window. Here you can click to add stations. If you click two stations consecutively, these two stations will be connected.

In the story window, one can add questions to stations. These questions can refer to something being at the given station. For example, a question could be to find a year on a statue. Each question can have as many answers as it is desired by the author. Images can be used to explain more about locations or add an opportunity for tasks to be solved on a given station: An image can be presented and tourists could be asked to find information which has been removed from the image or to find something shown on the image to get some needed information for the questions of this stations.

The main workflow begins with an idea for a game based tour. The author can begin to place stations all over the map or to implement the story of the tour and author the geographic data later. Both ways are good: If an author wants to implement a story driven tour, she or he can do this by authoring the story in the story window. If the author wants to implement a location driven tour, she or he can begin in the map window. This way, it is possible to implement tours with any complexity.

3.2. Stations

A station that isn't specified any further is a 'Geo Station'. These can only be built in the map window because a Station in the story window is more specific when building it. A station generated on the map has nothing more than just its GPS position leading to the necessity of this basic station type.

The most important type is the 'Story Station'. Tourists have to solve each Story Station in order to accomplish the tour.

Furthermore, there are 'Trigger Stations’. These stations trigger the next stations but don't have any content. Authors can use them to enforce tourists to use a specific route to reach the next station. For example, a Trigger
Station could be used in a switchback to ensure that tourists aren't able to walk straight through. Trigger stations are shown in the iOS renderer as next station so that tourists have to pass them.

'Annotation Stations’ don't connect with other stations but allow authors to annotate interesting sites. On the iOS renderer, tourists are able to turn the smartphone in landscape mode. The smartphone will switch into camera mode and present annotations via augmented reality.

Geo Stations, Story Stations and Trigger Stations can be connected in any combination.

3.3. Connections

A connection connects two stations logically. The author can change the route of a connection by grabbing it with the mouse in and dragging it to another location. The geographic data for the routes are computed and provided by the Google Maps API. If an author wants tourists to pass a specific spot, she or he can add one or more Trigger Stations. The iOS renderer will present a proposition of a route which the tourists can take.

3.4. Implementation

The authoring tool is implemented in C++ using Qt for the story window and logic of the authoring tool and JavaScript using Google Maps for the map window and the interaction with it. Fig. 3 shows the components of the whole system. The main parts of the authoring process, the story and map window, are implemented as components. The map view uses the Google Maps API to render a map in a web context using JavaScript. The authoring tool exports .xml data which is used by the iOS renderer. All data between JavaScript and C++ are serialized by JSON.

One of our biggest problems was that there is no possibility that JavaScript communicates with C++. Thus, we implemented a timer which calls a JavaScript method several times per second. All changes like the creation of new stations, connections between stations or selections are pushed into dynamic arrays. The JavaScript method called by C++ serializes all these arrays and sends them back to the C++ part via JSON. The C++-part of the authoring tool deserializes the data and interprets them.

If there is any interaction in C++, they are serialized to JSON objects and sent to JavaScript where they can be interpreted.

![Fig. 3. The components of the whole system. The authoring tool consists of the story and map window and exports .xml data which can be used by the iOS renderer.](image)
3.5. Data export

The data exported by our authoring tool consists of an XML-scheme. The Google maps routes are stored as a plain google maps key so that the renderer can use them by sending this key to the Google Maps API and recomputing the route. This way, the most actual data from Google Maps is used. If there would be a change in some geographical details, the tours would be rendered properly on the iOS renderer. The two main parts of each tour, stations and connections, are exported as tags and filled with their details. Thus, we map the tour’s main logic directly into our data structures. This leads to better readable data structures and an excellent extensibility.

Fig. 4. The XML schema we use for the export of a generated tour. The most important parts, stations and connections, are exported as tags and filled up with their details.

Fig. 5. Left: The renderer app rendering one of the tours implemented by our test persons. Right: A user using our app with the augmented view activated.
4. Mobile Renderer for iOS

The iRendARAR (iOS app) starts with a tour selection screen where the user can see all former authored and uploaded tours. Choosing one of them the app downloads a zip containing all media files and tour data.

The tour automatically switches to the map overview which is showing all stations where the user can start her trip. On the map, the route to the next station is shown as a blue polygon like in google maps. This is the route authored by the user of the authoring tool. It is not necessary for tourists to follow this tour strictly - it is only needed that one reaches the next station. Thus, the author can decide which way she recommends to the tourists using the mobile renderer. If it is necessary that tourists take a specific route, the author has to implement this by using Trigger Stations.

When entering the radius of a station it gets activated and could show information of the current locations, media files or an interactive dialog where the user can earn points for answering a question. New stations get visible and she can choose her own individual route until the goal is reached. Visited stations become marked as visited and are put into a list named ‘visited locations’. They can be tapped to get the information of these stations and to see the images but it isn't possible to redo the questions.

If the user of the app raises the smartphone, an augmented reality view will be activated. This view shows all Annotation Stations of a tour augmented into the camera's video stream.

5. Evaluation

We evaluated the authoring tool with 17 test persons to find out if the tool is sufficient to plan and implement gamebased city tours. We presented a 2 sided sheet with information how the tool works to each of the test persons to ensure that each test person has the same information at the beginning. After that, we gave our test persons the task to plan a city tour in the german city ‘Koblenz’. There were some points the test persons had to implement in their tours: They should stay in the near of the ‘German Corner’, a famous german attraction in Koblenz where the rivers ‘Mosel’ and ‘Rhine’ converge. They had the explicit opportunity to use the internet to get images and information about attractions as well as a list of attractions in the area. This way, we made sure that all test persons had the same chances to implement an attractive city tour. All questions
could be left unanswered. The test persons could answer all question with 'completely agreed', 'agreed', 'undecided', 'disagreed' and 'completely disagreed'.

At first, we gathered some general information about our test persons. The average age of all test persons was 24.17 years. We asked them how they use social networks to report about touristic tours. 100% stated that they put photos online after tours while 11% stated that the write reports and 44% checked in via geo-check-in services like foursquare. 93.33% recommend interesting places to their families and friends after a tour. Thus, the need to show others the explored sites is very high. 100% recommend interesting places by telling other people, 6% write reports, 25% communicate using social networks, 88% use digital photos, 13% use printed photos and 19% give their printed tour guides to other people. 0% used the recommendation of geocaches to tell other people about interesting touristic sites.

Because one of our main goals is to enhance tourist’s opportunities to report about touristic tours, we asked them if they found the opportunities of the used social media sufficient to report of their tours. 63.63% stated that they were while 36.36% stated that they weren't.

29% of the test persons already did geocaching while 71% never did it. Thus, our group of test persons was a good mixture of those who did geocaching and those who didn't. 33.33% of those who did geocaching stated that they use geocaching explicitly to find new, interesting sites while 66.66% didn't.

70% stated that geocaching is sufficient to show other humans new interesting sites while 30% stated that it isn't. This shows that the concept of tours with stations fits the touristic scenario well.

The knowledge about the city 'Koblenz' where the tours should take place was well distributed: 6% had very high knowledge about the city, while 35% estimated their knowledge as high. 41% had average knowledge while 18% low knowledge. None of the participants knew nothing about the city.

Most people know much about the usage of smartphone today. 35% had very high experience with smartphones, 29% high and 24% average while only 12% had low experience with smartphones. None of the test persons had no experience with smartphones.

80% used their smartphones while being on touristic explorations and only 20% didn't. This shows that smartphones are used very often in tourism. Services like Google Now, Google+, Facebook, Google Maps and other map tools were used very often. All of those who used smartphones in tourism stated that they find them very useful. 93.75% stated that tours on a smartphone would be useful while only one test person stated they weren't. Only one test persons already had experienced a city tour on the smartphone. This again shows the need of city tours on smartphones. On the other hand, 93.75% stated that they had already done a guided city tour. Thus, city tours are perceived well in tourism but the opportunities of smartphones aren't used enough while it is wanted by tourists to use them. Furthermore, 56.25% stated that they would prefer to do city tours with their smartphones instead of a guide (43.75%).

5.1. Evaluation of the authoring tool

5.1.1. Effectivity and efficiency

This category aimed to find out if it is possible to implement a city tour with the authoring tool. Our first question was if it was possible to plan a mobile city tour successfully with the tool. 68.75% stated that this was completely the case while 18.75% stated that it was the case. Thus, 87.5% of the test persons stated that the authoring tool made it possible to plan a mobile city tour.

After this, we asked the test persons if it was possible to implement everything the test persons wanted fast. 59% agreed or agreed completely that they could implement everything fast, 12% were undecided and 30% answered that it was not possible to implement everything fast (6% disagreed completely, 24% disagreed).

64% stated that all needed features were in the authoring tool, 29% were undecided and 6% stated that not all needed features were in the authoring tool.
We asked if the test persons could imagine to integrate the authoring tool into social networks. 29% completely agreed, 35% agreed, 24% were neutral and only 12% disagreed (nobody disagreed completely). 47% agreed completely that the authoring tool is sufficient to show interesting places to others, while 29% agreed to this statement. 12% were undecided and another 12% disagreed (nobody disagreed completely).

The question if the system added value, the 12% of the participants completely agreed, 41% agreed, 29% were undecided and 18% disagreed (nobody disagreed completely).

53% would use the system to explore new places by themselves, 30% wouldn't (with 18% undecided). Most test persons imagined how other people would play their route: 29% agreed completely, 35% agreed while only 6% disagreed completely. This shows that the authoring tool is able to assist authors in their imagination of a tour they are currently implementing.

Finally, we asked the participant if they were happy with the results. 82% were happy (of which 29% agreed completely and 53% agreed), 6% were undecided and 12% disagreed (nobody disagreed completely).

These results show that it is possible to implement a city tour with the authoring tool. Most test persons found it effective and were happy with their own results.

5.1.2. Usability

This category evaluated the usability of the authoring tool. Our first question was if the needed time to implement a tour was sufficient. 29% agreed completely, 47% agreed, 12% have been undecided, 6% disagreed and another 6% strongly disagreed. Thus, 76% of the participants had the feeling that the time needed to implement a tour was sufficient. After this, we asked if the authoring tool was a handicap while implementing a tour. Most users denied this: 29% strongly disagreed, 35% disagreed, 29% were undecided and only 6% agreed. Nobody agreed strongly.

18% agreed completely that the authoring tool was precise, 41% agreed while 29% were undecided and 12% disagreed (nobody disagreed strongly). 76% of the participants had the feeling that they had control over the authoring tool (29% agreed completely, 47% agreed), 12% were undecided and also 12% disagreed.

We were also interested if all features could be found directly. 18% agreed completely, 29% agreed, 29% were undecided and 24% disagreed (nobody disagreed completely). The interaction between the map and story view was perceived good: 24% agreed completely, 53% agreed while 6% were undecided, 12% disagreed and 6% strongly disagreed. The menus could be understood well: 35% strongly agreed, 29% agreed, 18% disagreed and another 18% disagreed.

5.1.3. Fun

Because tourism is an activity done in the spare time, it is important that such systems are also fun because they wouldn't be used if they weren't. Thus, we were interested if the usage of the authoring tool was fun. 24% agreed completely, 59% agreed and 6% voted each for undecided, disagreed and completely disagreed. When we asked the test persons if they have fun to show new places to their friends using the authoring tool, 18% completely agreed. Another 24% agreed, 29% were undecided and 12% disagreed. Furthermore, 18% completely disagreed. Most users would like to share the implemented tours with their friends: 18% strongly agreed, 29% agreed, 35% were neutral, 6% disagreed and 12% disagreed strongly.

Our last question in this category how hard it was to implement a tour with our specifications. Most people found it easy: 18% voted for very easy, 59% voted for easy, 18% for medium and only 6% for hard. Nobody voted for very hard.

The results in this category show that the authoring tool is fun and easy to use.
5.1.4. Attractivity

The design of the authoring tool should be evaluated by this category. Most test users found the GUI design attractive: 71% stated it was attractive or very attractive. 12% were undecided, another 12% stated it was not attractive. 6% found the tool very unattractive.

65% found the overall design appealing. 29% were undecided and 6% found it very unappealing. This means that our prototype’s design was liked by our test persons.

6. Conclusion and future work

We implemented an authoring tool for gamebased city tours that are very similar to geocaches. Test users with no knowledge in advance were able to implement tours with our tool within under 90 minutes. Overall, we showed that the authoring tool was effective, easy and fun to use and attractive. The usability was good. The evaluation pointed out that there should be some advantages in the design and usability. For example, the difference between story and map view was not always completely clear.

Thus, our goal to enable the implementation of complex touristic tours for everybody was achieved even if there could be some improvements in the design or the usability.

The tool exports the data via XML. We presented an XML scheme for the data export that maps the tour’s logic directly into the data structures. This allows a good understanding of the exported data and enables easy changes. Furthermore, the usage of this easy data export allows new renderers or applications to use these data.

We implemented a renderer for these data to proof that our concept of data exchange works good and to enable future scientific work with these touristic tours. This renderer allows the dynamic tours to be rendered and enables tourists to use the authored tours.

This whole work shows that it is possible to implement systems that add value to touristic experiences. The results can be used to implement different touristic tours and to find out which one work best. Furthermore, an online community to exchange such tours could be implemented to add the social component. Alternatively, the existing system could be integrated into social networks. This allows a completely new view on the usage of social networks: Not only media are exchanged but complete experiences.

References