'Guess A Who, Why, Where, When?': The Visualization of Context Data to Aid the Authoring and Orchestration of a Mobile Pervasive Game

Michael Wright[1], Alan Chamberlain[1], Chris Greenhalgh[1], Steve Benford[1], Nick Tandavanitj[2], Amanda Oldroyd[3], and Jon Sutton[3]

[1] Mixed Reality Laboratory, Department of Computer Science, University of Nottingham, Nottingham, UK
{maw,azc,cmg,sdb}@cs.nott.ac.uk
[2] Blast Theory, Portslade, Brighton, UK
nick@blasttheory.co.uk
[3] BT Research, Adastral Park, Ipswich, UK
amanda.oldroyd@bt.com

Abstract. As part of the mobile pervasive game, Professor Tanda's 'Guess A Where' [1] there was a need to allocate pre-authored content for the game on a daily basis to provide an enjoyable and engaging experience. To aid this allocation of content we collected and visualized context information about each player during the course of the game. The aim of these visualizations was to provide a method through which an author/orchestrator could retrospectively view a player's current total and daily context data gathered by the game. Observations made about this data could then be used to, not only allocate appropriate content but, to tailor the content to a specific player. This paper presents the data that was gathered and the visualizations created to achieve this process.

1 Introduction

Professor Tanda's 'Guess A Where?' is a pervasive mobile phone-based game in which a character, Professor Tanda, asks players questions about their day to day activities and life to establish their environmental footprint. Feedback during the game is given via hints and tips from Prof Tanda about ways to reduce the player's environmental footprint, entertain and save the player money. The game is designed to be light hearted and humorous to encourage players to interact with the system and present information in a non-patronising, yet educational way.

During the course of the game context data relating to the player is collected from both server-side and client-side systems. This data is then used to create new game sessions for the player. Game sessions are allocated based on an authors interpretation of a players current game experience. This includes the game sessions played/not played, places played, times played etc. Therefore, to allow authors to gain this insight into the game we have designed and implemented a set of visualizations that present both statistical data views (i.e. lists of content played and logical next content to be allocated) and the players game experience so far based on data collected about the context of the player.

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Fig. 1. The Prof Tanda game is played on the players mobile phone – the interface to which we can see in this figure. Prof Tanda calls the player at least once per day to ask them questions to establish their environmental footprint.

Timeline visualizations are used to present the context data to the authors, which they can inspect and annotate. The context data collected ranges from location data to game sessions played to context information gathered by the questions posed by Prof Tanda. We visualize all of this information so that patterns can be discovered and content can be allocated in such a way that the game becomes more tailored to the players' game experience.

In the remainder of this paper we shall describe the data collected about a players' context during the course of the game and the visualizations that we implemented to allow authors to gain an insight into a players game experience. We shall conclude with a discussion about the benefits and draw backs of these visualizations and our intended future development of visualization systems, such as the one described in this paper.

2 Motivation and Related Work

The Prof. Tanda visualizations allow the game orchestrators to gain insight into certain aspects relating to the context of the player. The context information gathered is spatial (i.e. cell-id location), interactions with the game (e.g. when Prof calls the player, when the player responds etc.) and facts about the player from the questions posed by Prof Tanda. Previous systems developed by the MRL (Mixed Reality Lab) have gathered and visualized this type of context information. For example, in the pervasive game Hitchers [2] location-based information, tagged by a player was collected and visualized. Location tagging contains context information about a player's location (e.g. a location could be labeled cafe or train station), about the task they are performing (task-based) (e.g. playing cards at a cafe or in a meeting), and interestingly about the emotional state of the player (e.g. feeling lonely, mad or relaxed). By examining the emotional content of the game we may be able to look at the engagement that the player has with a system and also gather more 'personal' data that gives an insight into player behavior.

In order to analyse the data gathered from the Hitchers pervasive game, the data was visualized as a connected node graph whose nodes represent a unique cell-id and

the arcs the transitions between these unique cells. The advantage in using this type of visualization is that we are able to explore the collected data and gain insight into the different locations. Thus, we can see how players relate to a given location. This information can then be used in extended versions of the game where content can be placed at locations of interest which can be discovered by not only by viewing the traffic through that cell but also by inspecting the location labels for interesting places relevant to the content or context?.

Another example where the MRL has visualized context information for a pervasive game is Day of the Figurines [4]. During the first trials of the game at the Laban Centre, London, dedicated mobile phones were used that could run cell-id logging software. This software recorded sequences of cell-ids encountered by the player, which could be uploaded back to a central server. This data was then combined with the data recorded about a player's interactions within the game to produce visualizations thereby allowing us to explore patterns of game play. Furthermore, this information was used to explore the potential of using context information to tailor game play, based on the contextual information gathered by the logging software.

These visualizations aim to allow explorations of context information to support game play. From the Hitchers visualizations we were able to explore how players relate to their environment and how this information could then be used to create new content within the game. The Day of the Figurines' visualizations allowed us to explore patterns of play and focused on the delivery of content. Using these patterns of context and awareness is a common feature of context aware systems where users are presented with content based on there current context.

For example, the Cyberguide [5] presents users with information about their current location based on context information gathered about the user. Location information is one metric that is used but other metrics, including a past locations history, are used to tailor the city tour guide to that particular user.

Similarly, CATIS [6] (Context Aware Tourist Information System) gathers information about a users location, time of day, speed, direction of travel, device type and personal preferences to deliver tourist information.

In these applications the analysis of context is performed by a system which then decides what content is to be displayed. In Prof Tanda we are taking the reverse approach i.e. we present context information to an author and allow them to interpret the data (with the aid of visualizations and other statistical data) which they can then use to deliver the content to the player. This approach has the advantage of the content being more tailored or 'fine-tuned' for that particular player. For example, if we find that a player often plays the game at home we can then deliver content for times that they are at home and that relate to their home situation. Similarly, we can stop the game interrupting the player during times that they do not wish to play the game.

Conversely, we can use the data to stimulate play during times that the player does not often play e.g. during lunch breaks. The advantage here is to guide players in such a way that game play does not become predictable and stale. By introducing game sessions that are outside the players established patterns of play and by utilising the gathered context information, we can introduce interesting game sessions.

Of course there are disadvantages to this human dependant reactivity of the system with the main disadvantage that of limiting the number of players that can participate in the game. This is because of the large amount of time spent analysing the data to determine suitable content. However, a hybrid approach such as allowing the game mechanics to place some content and authors to place more detailed content could be one solution to this problem. Indeed, Hitchers would allow for this hybrid approach as content could be placed by a system that looks for common location labels (e.g. train station or cafe) and authors could create more interesting content based on more obscure location labels such as “queuing for a ticket to a gig”.

3 Data Collected

As part of the Prof Tanda pervasive game we collect data about,

- Cell id – e.g. where a session took place or where the user has traveled
- Time – e.g. the time the player played a session or a cell-id was entered
- Contact the system – e.g. when a player requests a game session or a new game session is triggered
- Game sessions played and facts established

Importantly, each game session can be triggered by either a timer, player request or a cell-id. These triggers allow authors to establish the context and play patterns for a particular player. For example, if the player requests a session then we know that at that time and at that place they were able to play the game. By reviewing the context establishing questions, such as, "Are you at work or at home?" and "Do you own a car?", we are able to know and make decisions based on the players' context. We can establish that a player drives from home (e.g. cell 55 (green)) to work (cell 56 (blue)) everyday, what cells they travel through and how long it takes. This will appear on the visualization as a set of coloured lines that form a pattern and therefore establish a pattern of behaviour. The wider a coloured bar the longer a player has stayed in the location (cell-id) that the bar relates to. In examining the data an author can directly tailor the Prof Tanda game sessions (sessions sent to a player) for a specified player.

4 Visualization

The Prof Tanda visualization was implemented as a Java applet which can be accessed by authors via a web page (Figure 2). The goal of these visualizations was to provide information on a player’s game experience to support the authors in allocating new game sessions. Furthermore, these visualizations were used in the post-game analysis of the data with a view to exploring the patterns of play of players.

The data is presented on a time line which was divided into three sections (Figure 2). The top section displays information about game sessions, facts and questions asked of the player by Prof Tanda. The middle section displays cell-id data i.e. a unique cell-id that the players phone was connected to at a particular time presented as a coloured box with each cell-id being assigned a random colour. Finally,

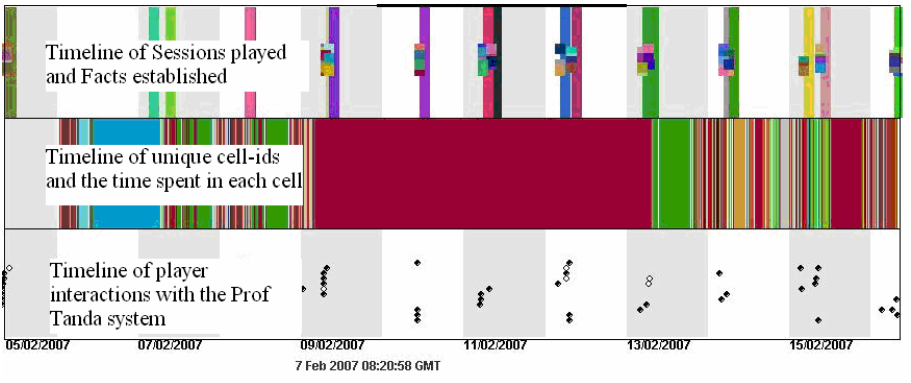

Fig. 2. Timeline visualization of data gathered as part of the Prof Tanda pervasive game

the bottom section displays information on interactions between the player and the game for example, when a session was triggered or when the player has answered a question from Prof Tanda.

As we can see from Figure 2, the timeline displays all the information gathered about that player. To aid in the daily exploration of the data we broke down each day into a separate timeline which we display under this overview timeline (Figure 3). The advantage to this is that we can view a much more finely grained picture of the data.

Furthermore, users are able to brush, or hover, over elements in the time-line to view further details. For example, if the user brushes one of the coloured cell-id boxes

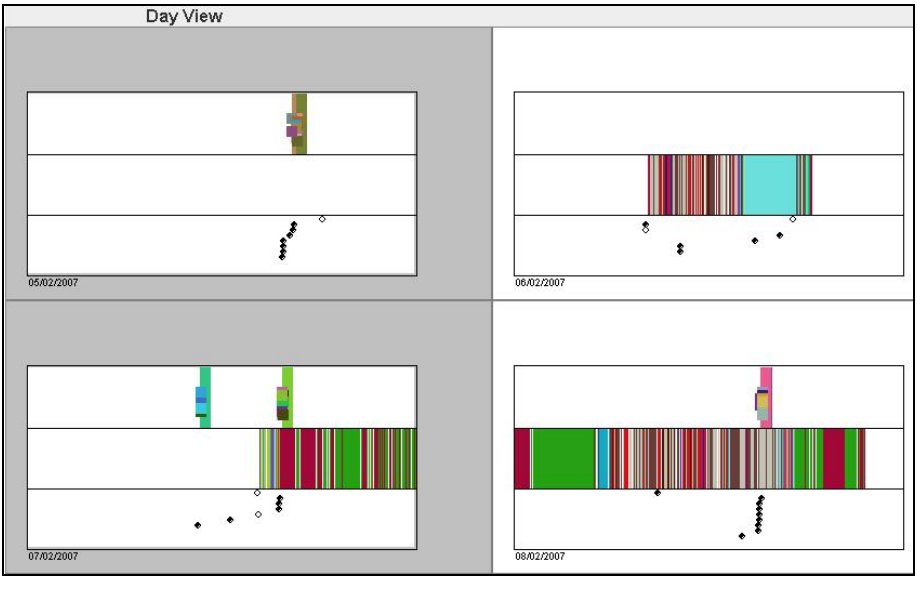

Fig. 3. For each day we display the collected information so that a more fine grained view of the data can be viewed by the users

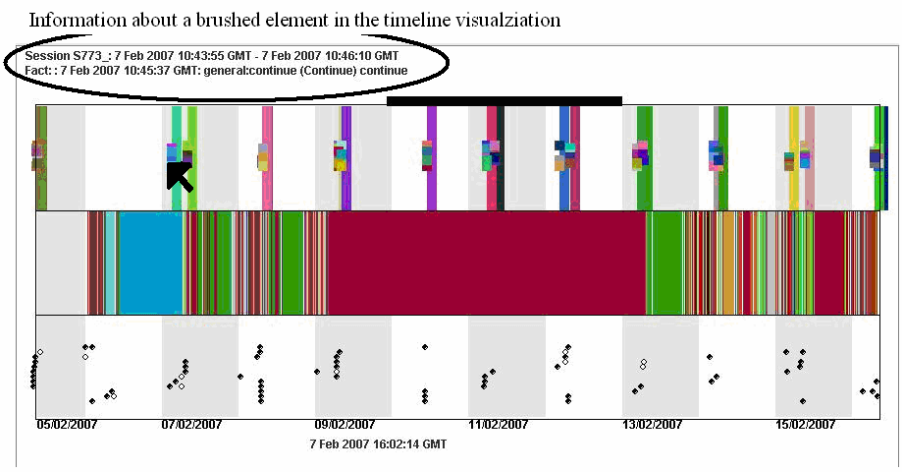

Fig. 4. By brushing elements in the timeline we are able to get more detailed textual information about that element. The example above shows the information. displayed when brushing in the top section of the timeline to discover information about Sessions and Facts.

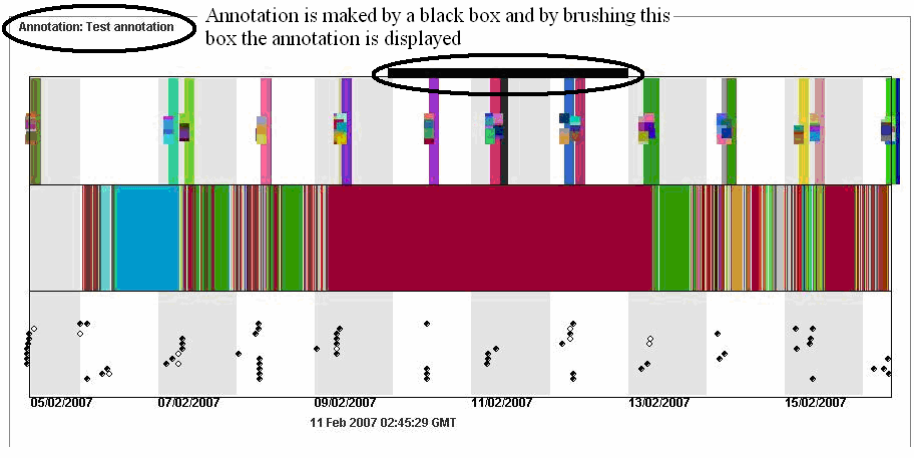

Fig. 5. Users are able to annotate the timeline by drawing a bounding box along the time they with to annotate. This annotation is then displayed as a black box along the top of the timeline which can be brushed to display the annotation to the user.

information about that cell-id and the time spent in this 'cell' is displayed. Similarly, if the user brushes in the top section of the timeline information about the sessions and facts established during that session are displayed (Figure 4).

The timeline visualization aims to aid the exploration of the data gathered during the course of the Prof Tanda pervasive game. This data is collected to aid the authors in the creation of the next day's content as well as for post game analysis where patterns can be explored to identify types of game play and user experience. We

further support these activities by allowing the author to annotate the timeline. This is achieved by drawing a bounding box along the length of the time they wish to annotate. This then opens a new annotation window in which the author can add comments and observations about the data. This annotation is then displayed as a black box along the top of the timeline and can be brushed to display the annotation to the user (Figure 5).

5 Discussion and Future Work

As we have stated before, the main aim of the Prof Tanda visualizations are to allow authors to gain an insight into the data gathered and to allocate as well as tailor content to that player. The advantage that these visualizations give is that authors are able to quickly parse large amounts of context-based data into an understandable format that relates to the users' behaviour.

In the Prof Tanda game we rely on the authors allocating content on a daily basis and these visualizations combined with statistical views of the data allow authors to make these kinds of decisions. However, the future development of Prof Tanda means that this allocation of content will potentially become more automated. Therefore, these visualizations become less of a method by which to establish appropriate daily content for a player and more a way of allowing authors to explore ways in which to tailor the content.

For this iteration of the Prof Tanda visualizations we visualize the data gathered on a timeline (we also display certain statistical data in tables). Timelines were decided on as they are able to display the information we needed to show in relation to time (our focal metric). Furthermore, the main author had had previous experience using timeline visualizations as part of Day of the Figurines.

However, we could display this data in a number of different ways that can be combined to provide the authors with a richer set of visualizations. For example, we could display the cell-id data in a similar way to the Hitcher visualization system i.e. as a graph, to give the authors a more spatial representation of the data. We could also use animation to allow the authors to view how the data builds up over.

Moreover, currently in the MRL we employ a number of visualization systems that have the ability to visualize sensor based data; such as sound, carbon monoxide levels and light levels in a geographical manner using Google Earth [3]. We are also able to include annotations and photographs that are taken by the user. It is envisaged that the two systems will be combined in the near future, as well as adding the ability to visualize sensor data about the user; such as heart rate and pulse, creating a system that can provide a more 'holistic visualization' approach, that can take into account the social, psychological and physicality of the user.

We envisage that these systems may be used as an orchestration tool for prototyping and real time performance, for aiding in the design of personalised data serving systems and for ethnographic research/evaluation. By using such systems we are able to evaluate and establish the patterns in everyday life.

6 Conclusion

In this paper we have explored how the context data gathered about players playing the Prof Tanda mobile pervasive game can be visualized and used to allocate and tailor the games content.

The visualizations that we have implemented visualize this context data primarily as timelines. The advantage to these visualizations is that the authors are able to parse large amounts of context data which can be explored and annotated.

In the future we wish to expand upon these timeline visualizations to include a richer set of visualizations that provide different perspectives on the data, e.g. spatial or emotional. Furthermore, we wish to, as part of a pervasive game like Prof Tanda, to collect and visualize sensor data so that we can build up a richer picture about the player and their environment. Overall we wish to explore this data as it could lead to more adaptive interfaces or games that adapt to the context of the player.

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