”Hide and Tweet”: A game to teach schoolchildren about spatial technologies

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Abstract: As part of the Geotechnology research team at NUI Maynooth we were involved in the preparation and running of various activities in the Summer School on Computer Science for school children aged between 12 to 18 years old. Since year 2009 we have been constantly developing, testing, and deploying some geospatial software applications which were used by the children for activities in the summer school programme. The high level goal of this development was to help school children become more familiar GPS devices and computer-based Location-based services (LBS) technologies which are now playing such a crucial role in today’s Internet connected society. The software applications were used as part of games and tasks for the children. In our paper we shall describe how these games have evolve during these years, the educational aspects and benefits of the game and how both the software components and devices were developed. Overall, children participating in the summerschool provided their comments in the form of a survey. They felt that there were now more aware about possibilities in geoinformatics available with “ordinary off the shelf devices”. Different issues related with web-based maps (Google Maps, OpenStreetMap, Bing Maps, etc) were introduced and we explained the differences between them. Most importantly in case of geo-technologies we felt that the activities helped the children become aware that that computing and positioning happens everywhere and is not tied with the desk and the desktop computer. We summarise our experiences gained in these last three years and discuss the educational gains of this type of game-based approach to location-based technologies to schoolchildren. All of our software is developed using free and open-source components meaning that it can be deployed by any school or educational facility with minimum cost. A smartphone-based version of the software has also been developed.

1 Introduction

Any service which takes into account the geographic location of the user via a mobile device and provides the user with information relevant to the user’s spatial location and context is called a “location based service” (LBS). LBS most commonly offer users services such as: navigation, routing, Point-of-interest (POI) querying etc Noh et al. (2012). Recently LBS social networking has become popular. Services such as Foursquare Fleming (2010) have become hugely successful with over 10 million subscribed users who “check-in” at locations and then share this information with family and friends in their social network. A GPS enabled smartphone is required to help the user select the location he/she is at. The “game like” approach of providing the

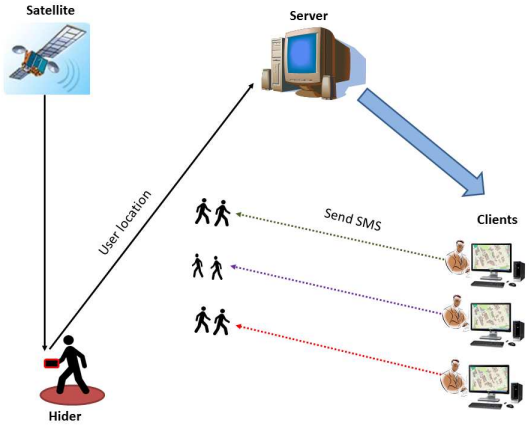

Figure 1: A schematic diagram of how the “hide-and-tweet’ game works

users with points (or “Badges”) for their repeated “check-ins” at locations keeps the user interested to outplay other users who have also ’checked-in’ at these locations. Users with the most “check-ins” are conferred as the virtual “Mayor” of that location. Consequently this game-based approach has interested many other companies such as Gowalla `www.gowalla.com` who have developed their business model around this niche market. Stanley et al Stanley et al. (2010) describe how these technologies can be utilised to tackle other types of issues in today’s by showing examples of how computer games which include spatial awareness may be a catalyst to change human behaviour in regard to playing electronic games. They argue that this could help fight obesity amongst children by simply changing their surroundings into the virtual play-field. PacManhattan Lantz (2007) game where role of traditional board is taken by streets of this district of New York. Successful introduction of these games will require better spatial knowledge and awareness by young children and students about maps, location information, mobile technologies, etc. “Hide and Seek” is a game which every child and adult can relate to. It is a game which each one of us has played at some point in our lives. We decided to bring this concept into the LBS game we developed for students attending the a Summer School in Computer Science at NUI Maynooth, Ireland. Attendees at the were school children aged between 12 to 18 years old. Since 2009 we have been constantly developing, testing, and deploying some geospatial software applications which were used by the children for activities in the summer school programme. The underlying research question for us was as follows: Could we let the students at the Summer School have fun and be their playful selves while we impart knowledge and help improve their information about GPS technologies, spatial maps, effective communication, team work, and competitiveness using location-based games on smart-phone technologies. We developed the game “Hide and Tweet” which is an LBS, smartphone and mapping based variation of the classic game “Hide and Seek”.

The paper is organised as follows. In Section 2.1 we describe the software components of the “Hide and Tweet” game and the specific rules of the game. In Section 3 we discuss the literature related to the educational aspects of the “Hide and Tweet” game . The results and general observations from the game as part of a Computer Science Summer Camp are discussed in Section 4. The final section of the paper is Section 5 where we draw some conclusions and include some ideas for future work.

2 Software Components and Game Play Rules

“Hide and Tweet” is based on the original hide and seek game. We have a person who hides (one of the game organisers) and also one who seeks (one of the summer school particpants). The change from the original concept is that unlike the actual

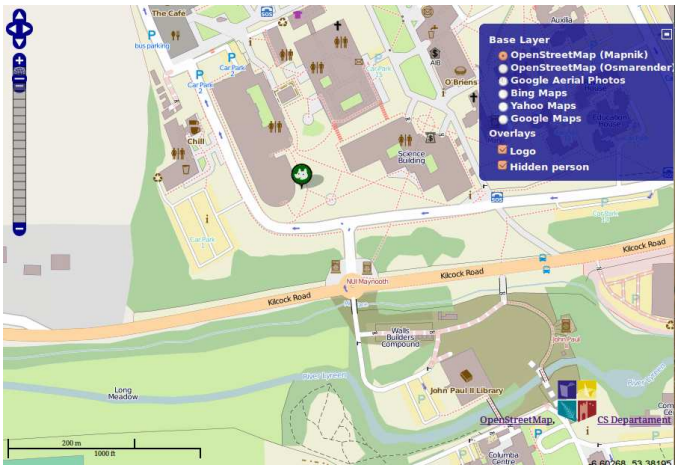

Figure 2: The web-based map interface presented at the Command Centre computer

game where all participants hide and one seeks we have reversed the concept to one person hiding and all the participants seek. We divide the participants into groups (groups of maximum four people) seeking this one person ("hider"). At any given time we have 2 team members ("seekers") from each group who are outside physically seeking for the person who is hiding and the other 2 team members are in the lab, sitting in front of a computer with a map interface (called the "Command Centre"). The person who is hiding is carrying a GPS enabled mobile phone with the "Hide and Tweet" mobile application running on it. As shown in Figure 1 the application sends the current geographic location of the person hiding to the server. A special map interface will display the location of the person hiding on a web-based map at the computer in the Command Centre. The team members at this computer can choose between the various map views that are available: OpenStreetMap (OSM), Google Maps, Google Satellite Imagery, etc. The OSM interface provides the building names and a very wide range of physical features mapped in the area where the game is taking place. The Google Satellite Imagery view helps the users sitting at the Command Centre to understand the physical environment - for example tree coverage, building types, open ground, etc. Figure 2 shows a screenshot of the map interface provided to the Command Centre. The seekers are equipped with a paper map of the region with building names, a GPS device, and a normal mobile phone. The team-members at Command Center in the lab have to send text SMS messages to the seekers about the current location of the hider. Communication is only allowed one-way. The seekers cannot communicate back to the Command Center. Consequently Command Center must be very clear and precise with their explanation and description of the location of the hider. The person hiding is always on the move and thus it is not a fixed location as he/she moves continuously. However the hider is constrained to a closed area - the University campus in our case.

The hider location is updated on the map as the hider moves. The Command Center in the lab must continuously send SMS messages as they see the user move on the map. There is no communication back from the seekers until they return to the lab with the password they obtain when they find the hider. Once the first team returns back to the lab with the password the other 2 members go out with the GPS device, mobile phone, and the paper map and the roles are thus reversed between the team-mates. The winning team is the one who provide both the passwords first to one of the team organisers in the lab.

2.1 Software Components

The software components of "Hide and Tweet" are separated into the classic Client and Server components. The client component is based at the hider interface. A Java Android based phone is used by the hider. They do not need to interact with

this device in any way. They are required to keep moving (not necessarily running) until they are found. The Android-based phone is GPS enabled and the “Hide-and-Tweet” application is programmed to transmit the location (in Latitude Longitude coordinates) back to a special software application on the Computer Science web-server in our department. This is shown in Figure 1. The spatial position of the hider is automatically sent to the server every 6 seconds. The position is stored in a spatial database (PostgreSQL 8.3 with spatial supported provided by Postgis). The server component of “Hide and Tweet” involves management of the spatial database of locations of the various hiders currently involved in the game. PHP software is developed for the server which manages reading the spatial database of locations and then automatically updating the position of the hider on the map at the Command Center computer (marked as clients in Figure 1). The command center application is a simple HTML web-page interface with an embedded web-based maps. All components are free and open source software so there is no cost of software purchase for the deployment of the game. The underlying web-based mapping provided by OpenStreetMap is also free with an open license. OpenLayers is the technology used to display the web-based maps inside the web-browser. It is free and open source and easy to integrate into web-pages. OpenLayers is particularly well developed for the real-time update and display of the map based on spatial data extracted from sources such as a dynamically updating spatial database.

3 Educational motivation for this game

According to Encyclopedia of Pedagogy Pomykało (1997); Clare and Newstead (2009); Mason (2010) a didactic game states the kind of educational methods which are problematic. They organise the content of learning into the models of real effects, situations or processes. The aim of this is to approach the educational level of the learners. During classes in the Summer School in Computer Science we made didactic games with the usage of information technology and interactive map technologies which form a core part of the postgraduate and postdoctoral research carried out by our research group. Our research focus is on delivering of quality, freely available, spatial data to users on mobile devices while developing valued-added services on these data streams. How can we make this research “fun”? Game play and educational games are strictly related to each another (Kebritchi and “2c” Hirumi, 2008). Such a game is “fun” only if it lives up some basic conditions: that it gives the participants pleasure, there are chances to win, and there are some agreed upon rules of play (Çankaya and Karamete, 2009). They are a lot of different theories of “fun”. According to Lazarus (1885) the authors state that fun is a resting time after other activities for children which are not fun. Others such as Spencer (1855) believe that play is a “use of surplus vital energy”. Famously, Karl Gross in his two well-known books Groos (2010*b*) and Groos (2010*a*) makes the connection between animals and humans and states that play is a training for exercise and prepares children for survival in unfriendly environments and for existing in those environments. Educational fun and games stimulate natural activity of a child’s activity (Barendregt et al., 2006). Fun is so important in childhood that it fulfils almost half of their life. The character form and function of games change along with the development of a child. Firstly these games are rather individual and then slowly develop more into teamwork. Children begin to learn the concepts of cooperation, the formation of moral attitudes, and understanding of a system of rules. Games arouse curiosity in children’s creative abilities and development of motivational and educational causes while also stimulating cognitive processes. Younger children prefer rather didactic games because they do not absorb their processes but focus on the result which they are trying to achieve. Such games are especially useful in working with students who have learning difficulties. They are therapeutic and they help the child to increase their feeling of self-consciousness, safety, success, and to deal with stress. It is worth mentioning that these games have to be pleasurable for children and all of them should take part in these games. There must be a pleasant mood in the classroom before the game starts. Game can inspire a emotional tension

which improve motivation and effectiveness of the whole learning process. Ideally during such activities pupils do not even find that this is a learning activity. In Okoń (1987) the author divides games into: *Didactical games* - those games according to formula made by adults: puzzles , crosswords etc. *Constructional games:* relying on building various objects with blocks and other strands. *Movement games:* demanding frequent changes of place by the children and finally *theme games* where play is connected with role playing. (Hurlock, 1965) outlines the functions of a game in the educational process. The game should have the following functions: *Education:* a child enriches its potential about itself and the world. It improves its senses. *Upbringing:* the game teaches the norms of dealing with another peoples. *Therapeutic:* the child solves problems and discharges its emotions. *Projection:* the child shows its personality traits and problems.

"Hide and Tweet" as proposed is a didactic, thematic, movement-based game. This has involved the introduction of some new technologies (computer interactive map and GPS technologies) (Çankaya and Karamete, 2009; Kebritchi and "2c" Hirumi, 2008) to classical game processes. There are no real prizes for the winners of the game except the declaration of their team as "winners" to all participants of the Summer Camp. So this allowed the game to involve healthy competition. There is a spatial learning aspect required in order to read the map properly (both the paper and web-based map). As Filippakopoulou and Nakos (2009) argues children are exposed to maps from an early age but overall map understanding progresses slowly and gradually from easy to more difficult concepts such as navigation. As shown in Figure 2 the Command Centre map web-based map incorporates all functionality of real-world web-based mapping: there are user interface functions to zoom the map, pan and scroll the map, and a layer switcher allowing the user to switch the base-layer map view to one best suiting their visual preference or query type. Ability to use mobile phones and smartphone technologies was assumed of all children in the Summer School (Aydin et al., 2011). Under Hurlock (1965)'s functions of the game "Hide and Tweet" allows the children to: experience the need for team work, show their personality in being a team-leader, and solving problems such as map reading or concise communication via SMS messaging. Children are taught about conformings to the rules of the game, self-discipline, honesty and also how to lose "with honour".

4 Results: Assessment of the game

Since year 2009 we have been constantly developing, testing, and deploying some geospatial software applications which were used by the children for activities in the summer school programme. The high level goal of this development was to help school children become more familiar GPS devices and computer-based Location-based services (LBS) technologies which are now playing such a crucial role in today's Internet connected society. In Summer 2011 we prepared a survey assessment which allowed us to more clearly understand what the participants thought about the value of the game and their experiences of it. Upon receiving parental consent a total of 29 children answered the survey. We worked under the constraint that the survey would only ask very general questions. We attempted to capture the essence of the discussions outlined in Section 3. The survey was handed out in paper format and we asked a number of questions including:

1. Did you find this game interesting?
2. Have you been taught like this before in IT classes or other classes in school before?
3. Did they prefer being the individual (hider) or being part of the team (Command Centre or Seekers)?
4. Would you like to play these types of games in school?

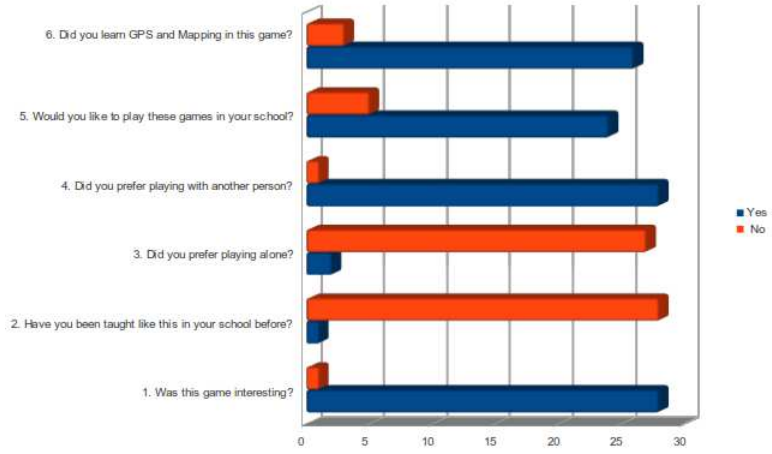

Figure 3: Survey questions where there was only a yes or no answer. The horizontal axis represents the number of children.

5. What did you like about this game the most?

6. Have you learned any new skills?

In Figure 3 we show the response to the questions from the survey where there were only a yes or no answer. The horizontal axis represents the number of children. Almost all children found the game interesting (question 1) and all agreed that they had not been taught about spatial techonologies in school in a game play method. Encouragingly the children almost all agreed that they preferred to play the games as part of a team (question 3 and 4). One of the highest responses of 'no' was to question 5 where 4 of the children said that they would not like to play these types of games in school. We feel that the success of the game-based approach is shown in Question 6 where almost all of the children said that they had learned the usage of web-based mapping, paper maps, and GPS in the game. Overall we feel that the very positive responses to the survey was related to the high level of satisfaction that the children took from the game. As discussed in Section 3 the game was designed to ensure that the elements of "fun" and "healthy competition" were a core part of the game play. Certainly as outlined from (Hurlock, 1965) in Section 3 the "Hide-and-Tweet" game allowed the children to project their personality onto the game (some were more inclined to be Command Center than Seekers and vice-versa).

In Figure 4 we show the results of the survey question "What did you like in this game?". This provided a very interesting set of respones. Sixteen children (55%) responded that they enjoyed being Seekers and using the paper-based maps, GPS, and mobile-phone communication to be instructed on how to find the Hider. Rivarly between the teams was also a very popular aspect to the game with 12 of the children placing this as their most favourite aspect. Opposite to this 11 students listed cooperation as part of a group or team as something they really enjoyed. Twelve students also responded that they enjoyed learning about new devices (the GPS) and using the web-based mapping interface. As a general open question at the end of the survey the majority of children (over 90%) felt that had learned new things about GPS devices and how to read both paper-based maps and web-based maps. Some of these responses included comments that they would try to used web-based maps much more as part of their school and leisure activities.

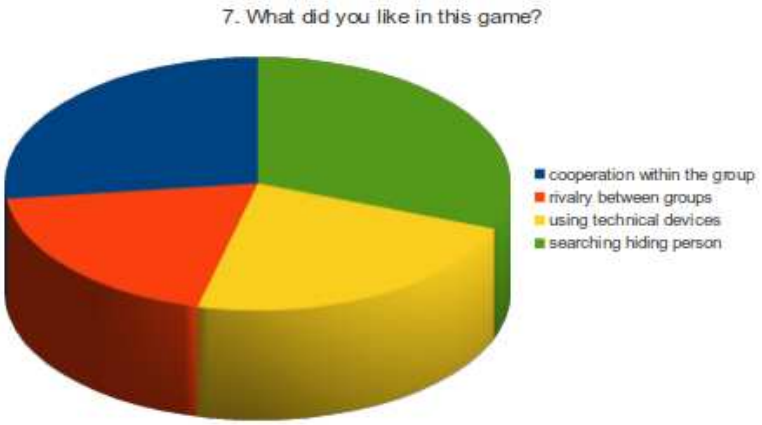

Figure 4: A pie-chart showing the results of the survey question “What did you like about this game?”

5 Conclusions

We have described the software development, educational philosphy, and summer-school implementation of a game called “Hide-and-Tweet”. The game has been designed to teach schoolchildren about spatial technologies and location-based services (LBS). The game takes the shape of the classical Hide-and-Seek game. In “Hide-and-Tweet” the schoolchildren used web-based mapping, hand-held GPS, and paper maps as part of a team to find a “Hider” somewhere within the University campus. Overall, we felt that the game helped engage the summer school participants in the use of web-based mapping and GPS technologies. The results in Section 4 are particularly encouraging. Survey results are illustrated in Figure 3 and Figure 4. Overall we feel that we have seen a meaningful relationship between students’ attitudes towards the LBS tasks and the use of technology (in agreement with (Kebritchi and “2c” Hirumi, 2008)). “Hide-and-Tweet” is not restricted to NUI Maynooth. With some very minor changes to the web-server application code (section 2.1) the game could be used in any other location. It is not fixed to Ireland. Anywhere there is OpenStreetMap mapping the “Hide-and-Tweet” software can be used. All components are free and open source software meaning there are no costs of software purchase for the deployment of the game. The underlying web-based mapping provided by OpenStreetMap is also free with an open license. The only cost is the mobile devices and the cost of network coverage. In the end of Summer School survey conducted by the Department of Computer Science “Hide-and-Tweet” has been voted the “Top Activity” every year by the participants. We are very proud of this. Peter Mooney created the initial concept for the game. Blazej Ciepluch and Ricky Jacob developed the software and web applications. Justyna Ciepluch provided the research underpinning the educational evaluation of the game in the context of benefit to school children participating in the Summer School. The game will be integrated as part of future Summer Schools. More extensive surveys are planned. We intend to analyse the GPS traces created by the “seekers”. These could help us undertand better how children “way find” using paper maps and the SMS instructions. We will also investigate if children use mapping and directional terminology correctly in the game or resort to improvised terminology they deem suitable for communicating with each other via SMS.

References

Aydin, D., Feychting, M., Schüz, J., Andersen, T. V., Poulsen, A. H., Prochazka, M., Klæboe, L., Kuehni, C. E., Tynes, T. and Röösli, M. (2011), “Predictors and overestimation of recalled mobile phone use among children and adolescents”, *Progress in Biophysics and Molecular Biology* , Vol. 5, pp. 29–40.

Barendregt, W., Bekker, M., Bouwhuis, D. and Baauw, E. (2006), “Identifying usability and fun problems in a computer game during first use and after some practice”, *International Journal of Human-Computer Studies* , Vol. 64, pp. 830 – 846.

Clare and Newstead (2009), “Pedagogy, post-coloniality and care-full encounters in the classroom”, *Geoforum* , Vol. 40, pp. 80 – 90.

Filippakopoulou, V. and Nakos, B. (2009), Children and mapping, *in* E. in Chief: Rob Kitchin and N. Thrift, eds, ‘International Encyclopedia of Human Geography’, Elsevier, Oxford, pp. 50 – 57.

Fleming, N. (2010), “Foursquare founder: Privacy fears are exaggerated”, *The New Scientist* , Vol. 207, pp. 29 –.

Groos, K. (2010*a*), *The Play of Animals*, reprint translated from german edn, General Books LLC. ISBN: 978-0217104111.
URL: *http://books.google.com/books?id=z9oHAQAAIAAJ*

Groos, K. (2010*b*), *The Play of Man*, reprint translated from german edn, General Books LLC. Library of Congress BF717 G76 ISBN:978-1458929440.

Hurlock, E. (1965), *Rozwój dziecka (Developing of Child)*, Państwowe Wydawnictwa Naukowe PWN (State Science Publishing House), Warszawa.

Kebritchi, M. and “2c” Hirumi, A. (2008), “Examining the pedagogical foundations of modern educational computer games”, *Computers and Education* , Vol. 51, pp. 1729 – 1743.

Lantz, F. (2007), Pacmanhattan, *in* F. Borries, S. P. Walz and M. Böttger, eds, ‘Space Time Play’, Birkhäuser Basel, pp. 262–263.

Lazarus, M. (1885), *Über die reize des spiels*, F. Dümmler.
URL: *http://books.google.com/books?id=mERWAAAAMAAJ*

Mason, M. (2010), Critical theory and pedagogy, *in* E. in Chief: Penelope Peterson, E. Baker and B. McGaw, eds, ‘International Encyclopedia of Education (Third Edition)’, third edition edn, Elsevier, Oxford, pp. 133–140.

Noh, H.-Y., Lee, J.-H., Oh, S.-W., Hwang, K.-S. and Cho, S.-B. (2012), “Exploiting indoor location and mobile information for context-awareness service”, *Information Processing and Management* , Vol. 48, pp. 1 – 12.

Okoń, W. (1987), *Zabawa a rzeczywistość*, Wydawnictwo Szkolne i Pedagogiczne.

Pomykało, W., ed. (1997), *ENCYKLOPEDIA pedagogiczna (Pedagogy Encyclopedia)*, Vol. 1, Fundacja „Innowacja”, Warszawa.

Spencer, H. (1855), *The principles of psychology*, Longman, Brown, Green, and Longmans.
URL: *http://books.google.com/books?id=9rs6AAAAcAAJ*

Stanley, K., Livingston, I., Bandurka, A., Kapiszka, R. and Mandryk, R. (2010), Pinizoro: A gps-based exercise game for families, *in* ‘Proceedings of Future Play 2010’, Vancouver, Canada, pp. 276–279.
URL: *http://hci.usask.ca/uploads/183-p243-stanley.pdf*

Çankaya, S. and Karamete, A. (2009), “The effects of educational computer games on students’ attitudes towards mathematics course and educational computer games”, *Procedia - Social and Behavioral Sciences* , Vol. 1, pp. 145 – 149.