The Good, the Bad and the Neutral: An Analysis of Team-Gaming Activity

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Abstract. This paper describes a preliminary study where a multiplayer location-based game's logfiles were used for the assessment of the overall practice of teams. We explore the use of activity metrics previously introduced and applied to CSCL settings. We argue that these metrics, if adapted in a meaningful way, will provide insight of the progress of a location-based gaming activity and its quality regarding the score. Moreover, we assert that this can be achieved in an automated way. A small set of activity metrics, related to game characteristics and player activity, is applied to a set of gaming activities. The results are analyzed regarding team performance and score. The paper proposes a way to analyze group activity in the context of location-based games while taking into account the characteristics of successful collaborative activities. Future work is proposed towards the development of automated metrics for the analysis of location-based gaming activities with emphasis on collaboration and group dynamics.

Keywords: location-based games, activity analysis, collaboration, evaluation

1   Introduction

During the past few years, the widespread use of mobile devices affected not only the way we communicate, but also the way we learn and interact with others. A common scenario involves players of location-based mobile multiplayer games in places such as museums, archaeological sites or historical city centers. The notion of location-based playful learning activities has been introduced and various games are designed to support it [1, 2]. However the analysis and evaluation of gaming practices is mainly carried through qualitative methods, using audio/video recordings, interviews and observation notes [3, 4]. In this paper the gaming activity of teams in a location-based playful setting is analyzed using simple metrics previously introduced for the assessment of collaborative, learning activities. Metrics of activity or interaction have been widely used in CSCL methodological frameworks for the assessment of collaboration. Simple metrics such as the volume and rate of activity [5], the temporal locality [6] or the distribution of activity in time [7] have been proposed and used in CSCL studies.

In this paper, we explore whether the application of activity metrics to location-based gaming practices can offer an insight regarding the fulfillment of the game's objective in relation to the effectiveness of team collaboration. We argue that due to the characteristics of mobile, collaborative learning, the activity metrics proposed will capture the performance and reflect the quality of their practice. Learners in a mobile scenario, especially like the one analyzed here, are expected to be on the move and to continuously interact with the location. The players have limited time to plan future actions or reflect on the activity. They are not expected to spend much time standing in order to discuss and argue, as opposed to the collaborative practice in a non-mobile setting. Instead in a mobile setting the key to a successful practice is for learners to be able to coordinate their actions effectively across time and space. We claim that this can be mapped in the logfiles of the activity.

The study presented here does not directly relate to workplace learning or workplace collaborative practices. However due to the special nature of mobile learning requiring users to be on the move and associating action and/or learning with motion in space, we believe that the proposed setting could be successfully adapted into a workplace mobile learning context as well.

2   Case Study: The MuseumScrabble Game, the Aftermath

In the case study we present here, we analyze the recorded activity of the Museum-Scrabble game, a location-based multiplayer game which was designed to facilitate children visiting a museum, and which was previously evaluated in the field [8]. It is a real-time multiplayer game where the players form competing teams and use handheld devices to scan the RFID tags of museum exhibits and to "link" topics –as imposed by the game- to relevant exhibits. Successful linking is rewarded with points and the team with the highest score is the winner of the activity. Seventeen pupils participated in the field evaluation, which lasted approx. 25 minutes, forming seven teams of 3-4 players. All teams were formed randomly before the beginning of the activity. Each team shared one handheld device. The teams either assigned the operation of the handheld device to one team member for the whole duration of the game, or the team members took turns. Observation on the field showed that decisions regarding the use of the PDA were taken mainly at the group level and not at the level of the operator. In that sense, the logfiles portray the activity of the team. The purpose of the analysis presented is to explore whether the use of descriptive statistics and activity metrics can provide insights on the efficiency of team strategies towards the game objective. To that end, we classified the teams into three categories regarding their scores, as computed after the end of the activity:

— the Good Teams (gt): Good teams (2 teams, referred here as gt00 and gt01) are characterized by the highest game score (more than 17 points) and therefore good performance
— the Bad Teams (bt): Bad teams (3 teams, referred here as bt00, bt01 and bt02) are those with the lowest gaming score (zero points)

─ the Neutral Teams (nt). The teams that achieved a medium score of four to eight points are categorized as neutral (2 teams, referred here as nt00 and nt01).

It is worth mentioning that after the end of the activity, users were asked whether they had used a PDA device before. The majority of players in the teams characterized as good were experienced with PDA devices while this was not the case with the other teams [8]. For each team the descriptive statistics of the activity and its projection in time were computed and compared. The objective was to track any indication of metrics that could be further used for the automatic evaluation of a gaming activity.

The descriptive statistics of the activity were computed for all the teams participating in the game. Various metrics that have been previously used for the assessment of CSCL activities, were originally considered but the ones that appeared to differ among teams of different quality regarding the game score, are: total sum of events[1] (#events), difference of (#link actions - #unlink actions) (#dlu), average time between consecutive actions (#avg_time_gap). In Fig. 1 the activity statistics per team are pictured. It is evident that the good teams (gt) portray intense activity, temporally dense (high number of events within short time) which fades out and scatters in time for the neutral teams (nt) and bad teams (bt). This is a rather trivial finding that justifies nonetheless the original notion: Teams that appear to have a high activity, temporally dense and without delays also score higher in the game. However one could claim that an intense activity could also portray a team that acts spontaneously/hastily/without planning. To investigate this point, the activity metrics were analyzed in time. In order to portray the unfolding of the activity, each team's practice was split in time periods of 60 seconds.

The events which took place within these time periods were summed and visualized per category (Fig. 2). The good teams (gt) exhibit intense, continuous activity throughout the game. Periods of zero activity are extremely rare while the teams appear to be more productive in the middle of the activity. On the other hand, the neutral (nt) and bad (bt) teams have low activity in comparison to the good teams. Periods of zero activity are more frequent and last longer, throughout the whole duration of the game. The difference between good and neutral/bad team practices is even more distinctive in the case of linking/unlinking actions. The linking/unlinking actions are directly connected to the overall score (a correct link is rewarded with points). Therefore good teams are expected to have a higher number of linking/unlinking actions than the rest. However the interesting point is the distribution of linking/unlinking actions in time. For the case of neutral/bad teams, the linking/unlinking actions take place mostly during the first minutes of the activity, gradually fading out and coming to a halt almost after the first half of the activity duration. For the good teams the links are evenly distributed throughout the duration of the activity.

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[1] An event can be a) a successful scan, b) an unsuccessful scan, c) a link action, d) an unlink action, e) enter a topic, f) exit a topic
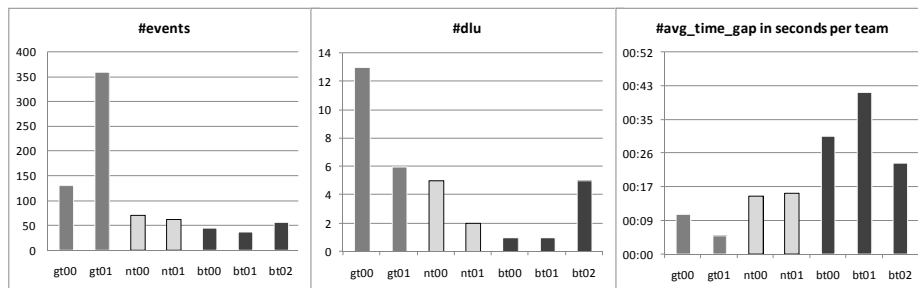
Fig. 1. Total sum of events (#events), difference of (#link actions - #unlink actions) (#dlu) and average time between consecutive actions (#avg_time_gap) for good, neutral, bad teams (gt, nt, bt) as calculated from the logfiles of the application
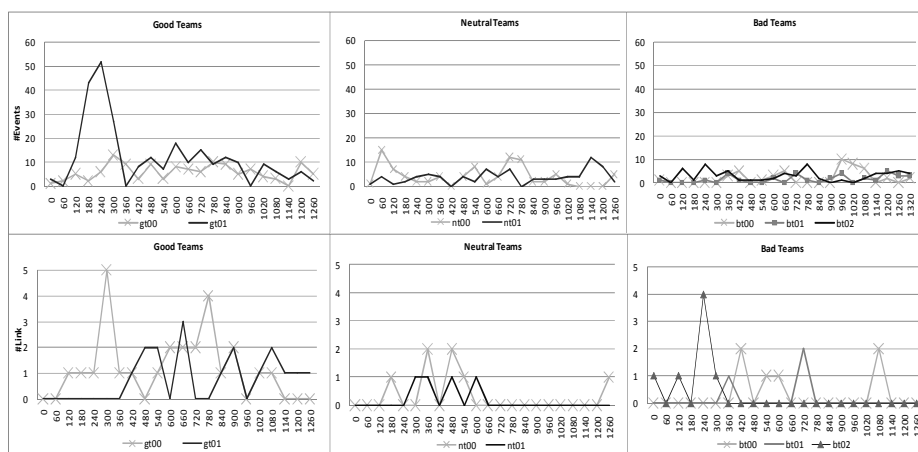

Fig. 2. The timeline activity for the event metrics of #Events and #Link action events for all teams (good -gt, neutral -nt, bad –bt)

3   Discussion

In this paper we study the use of simple activity metrics deriving from CSCL frameworks to gain insights on group collaborative activity during location based games. Since the game is played by teams, we argued that automated metrics for the analysis and evaluation of CSCL activities will also apply to a location-based gaming context. Yet, the special characteristics of mobile collaboration and learning require the analysis and evaluation of practices on a whole different basis than traditional CSCL frameworks suggest. Mobile learners are always on the move and therefore argumentation, response and action has to be immediate and continuous. Unlike what happens in a classroom, mobile learners do not usually gather around a table to discuss on a plan or to reflect on the outcome so-far. Therefore careful planning, good coordination and effective communication within a team in a mobile learning scenario are expected to result in a continuous activity, which is well balanced and equally distri-

buted in time. On the other hand, an unsuccessful collaboration within a team, may lead to loss of interest towards the common goal and failure to fulfill the goal.

In order to fully support this assumption and propose an automated analysis framework, extensive, large-scale studies must be designed and carried out on collaborative location-based gaming activities where each and every player will be supported by a mobile device to analyze not only the team's activity as a whole but also the interaction of team members. Additional parameters such as the type of mobile device, the learning context, the age of players, team size, etc., should be further examined not only regarding the gaming experience but from a collaborative perspective as well.

4 References

1. Schroyen, J., Gabriëls, K., Luyten, K., Teunkens, D., Robert, K., Coninx, K., Flerackers, E., Manshoven, E.: Training social learning skills by collaborative mobile gaming in museums. Proceedings of the 2008 International Conference on Advances in Computer Entertainment Technology. pp. 46–49 (2008).
2. Huizenga, J., Admiraal, W., Akkerman, S., Dam, G.T.: Mobile game-based learning in secondary education: engagement, motivation and learning in a mobile city game. Journal of Computer Assisted Learning. 25, 332–344 (2009).
3. Stenros, J., Waern, A., Montola, M.: Studying the Elusive Experience in Pervasive Games. Simulation & Gaming. (2011).
4. Reid, J., Hull, R., Clayton, B., Melamed, T., Stenton, P.: A research methodology for evaluating location aware experiences. Personal Ubiquitous Comput. 15, 53–60 (2011).
5. Kahrimanis, G., Chounta, I.-A., Avouris, N.: Study of correlations between logfile-based metrics of interaction and the quality of synchronous collaboration. Guest Editors. 24 (2010).
6. Schümmer, T., Strijbos, J.-W., Berkel, T.: A new direction for log file analysis in CSCL: Experiences with a spatio-temporal metric. Proceedings of th 2005 conference on Computer support for collaborative learning: learning 2005: the next 10 years! pp. 567–576 (2005).
7. Chounta, I.-A., Avouris, N.: Time series analysis of collaborative activities. Collaboration and Technology. pp. 145–152. Springer (2012).
8. Sintoris, C., Stoica, A., Papadimitriou, I., Yiannoutsou, N., Komis, V., Avouris, N.: MuseumScrabble: Design of a mobile game for children's interaction with a digitally augmented cultural space. International Journal of Mobile Human Computer Interaction (IJMHCI). 2, 53–71 (2010).