Playing with the Weather

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Abstract. In this paper the contribution of real time weather data to player enjoyment was tested and evaluated. To gauge the contribution of weather to player engagement an adaptronic, multiplayer, location based game, where real time weather data is key to the gameplay, was created. In this game the player assumes the role of a wizard and confronts other players in duels where the current weather plays a decisive role. A survey was conducted and results indicated that the weather contributed positively to the enjoyment of players and to their feeling of a connection between the real world and the game.

Keywords: game, casual game, pervasive game, weather, adaptronic games, multiplayer games, location based.

1 Introduction

According to Bo Walther, adaptronic games "are games consisting of applications and information systems that simulate life processes observed in nature. These games are embedded, flexible, and usually made up of 'tangible bits' that oscillate between virtual and real space". To be adaptronic a game should react to changes in the environment in real time [1]. Sharkrunners is an example of an adaptronic game. In Sharkrunners the game uses the position and movement of real sharks out in the ocean to influence the gameplay [2]. Another example is Boktai, a game where sunlight charges the player's weapon [3].

Other way for a game to be adaptronic is to resort to the real weather. According to Stenros [4] this may be too conceptual and not enough to give players the feeling that the game is merging with real life. Peter Molyneux, who included real weather patterns in a game so that it matched the real weather outside the player's window, goes further on this argument and looking back on the experience considers that is was "a dumb, stupid idea" [5]. So, is this argument final and true? Is using the real weather really a lost bet? We decided give it one more try and address this question in more detail. Perhaps the way the weather is included in the game may make a difference. Just mimicking the weather outside the player's house may not be much fun or contribute to the gameplay. But, if the weather is closely bound to the gameplay, instead of being a mere background feature, then perhaps that may cause a difference. The key contribution of our work is to shed further light on how real time weather data

can contribute to the gameplay as an example of integrating real world elements in games.

Some other researchers have already made interesting work in using weather information in games. This work is addressed in Section 2. In Section 3 we propose a game that revolves entirely around the weather and present the results of the user study. In Section 4 the conclusion and future work are presented.

2 Related work

Several games have already resorted to the weather to influence the gameplay. In the game Free All Monsters, monsters can be freed according to the weather conditions. With this game the authors considered how location based games should be redesigned to accommodate the increase of scale and addressed the participation inequality of players [6]. However, specific results about the influence of the weather in the players' interaction are not presented.

In Weatherlings each player has a deck of cards with weather dependent creatures. The players battle each other in arenas that correspond to real locations. The choice of arenas is limited to U.S. cities. Even though the game makes use of real weather conditions the weather data is not real time, so this game cannot show how the use of real time weather data influences a game [7].

Mythical the Mobile Awakening [8] is another adaptronic game where players perform magic rituals to enhance their magical skills. The authors show an interesting comparison of several types of contexts (environment, spatio-temporal, proximity, and social) in the gameplay. However the weather is not analyzed in detail.

Heroes of Koskenniska is about raising environmental awareness among visitors of a Biosphere Reserve in Finland. The game resorts to temperature, humidity and illumination sensor data, however this is not the focal point of the game but an accessory to the game's storyline [9]. Furthermore, contrary to the game we are proposing (Section 3.1) this game cannot be played everywhere. In Epidemic Menace virus motion is influenced by the wind direction and strength [10]. Similarly to what happens in Heroes of Koskenniska this game can only be played in a specific place.

In Samurai Romanesque, if it rains in Tokyo players cannot use their muskets and their mobility in the game becomes limited. Weather conditions were supplied by the Japanese Weather Bureau [11]. Flightgear [12], Realistic 3-D Golf and the Driving Game [13] are all games that resort to real weather conditions to achieve more realism. In Black & White the weather in the game matches the weather outside the player's house [5]. AgriVillage also resorts to the weather to influence crops, but the weather is simulated by the game [14]. Levee Patroller is another game where the weather is simulated. When it rains the player's sight becomes limited and playing the game is therefore more difficult [15].

So, even though several games have already somehow resorted to the weather, none of the mentioned previous work provides an analysis specifically focused on the influence of the weather in the gameplay and in player enjoyment. To find out how

the weather contributes to the gameplay we propose a game that is presented in the next Section.

3 Our Proposal

In Weather Wizards the weather is the core of all the gameplay. The initial idea for Weather Wizards was previously presented [16, 17]. Here we present detailed info about the game (Section 3.1), the user tests concerning the influence of the real time weather data in player enjoyment (Section 3.2) and the results and discussion of the user tests (Section 3.3).

3.1 Weather Wizards Game

In our game, the player assumes the role of a wizard and duels other players. During the duels, the player's chances of winning are directly related to the weather at the duel location.

Weather Wizards was implemented as an application for mobile phones (Figure 1 (a)). The game can be downloaded from Google Play [18]. Our game is, as far as we know, the first Android native application that resorts to real time weather data.

Weather Wizards is a multiplayer game. All the players' data is stored on a server. For that reason, a connection to the Internet is required to play the game. The mobile phones send the player's data to the server where the fate of the duels is decided. Real time weather data is retrieved via Weather Underground's API [19] and the name of the place corresponding to the latitude and longitude of the player's current location was obtained with Google's Geocoding API [20]. Weather Underground's API and Google's Geocoding API are contacted by the server.

In Figure 1 (b) the player's profile is presented. Here, the player can check her level, experience, life, coins, location and the weather at her location. In front of the experience points there is a green bar that provides a graphical representation of how many points are left to reach the next level.

(a) Game running in several mobile phones

(b) Player's profile

Fig. 1. (a) Weather Wizards running in several mobile phones and the (b) player's profile

If the user presses the Fight button (Figure 1 (b)) a list of possible rivals is presented (Figure 2 (a)). There are two Fight buttons because some mobile phones' screens are very small. So, if the user scrolls down to see the rest of the options and the first Fight button is no longer visible in the screen it will not be necessary to scroll up again in order to start a duel. All the game revolves around duels that are affected by the weather so we wanted the buttons that allow a duel to start to be as available as possible.

For each wizard in the list (Figure 2 (a)), the name, level, location and weather at the player's location are presented. It is possible to find out more information about a wizard by pressing the Info button. After pressing the Info button the profile of the possible rival appears (Figure 2 (b)). The first wizard in the list is chosen randomly from among all the wizards whose level is inferior or equal to the player's level. The second wizard is chosen randomly from among all the wizards whose level is superior to the player's level. The third wizard in the list is chosen randomly from among the ones who are nearby the player. So, even though the wizards in the list are randomly chosen, diversity was forced. There will always be a wizard who is equal to the player or weaker than the player, a wizard stronger than the player and finally another wizard who is close by. If the player is not happy with the presented possible rivals it is possible to ask the game to search again and other wizards will be presented.
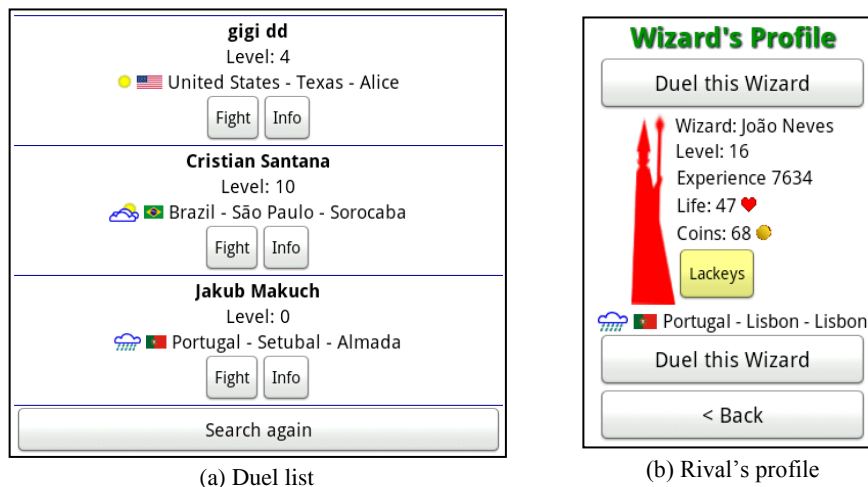
(a) Duel list	(b) Rival's profile

Fig. 2. (a) Duel list and (b) rival's profile

To start a duel the player presses the Fight button, in the duel list, corresponding to the wizard she wants to fight with (Figure 2 (a)). Optionally it is also possible to press the Duel this Wizard button in the rival's profile (Figure 2 (b)). After pressing the Fight button the player's wizard teleports to the rival's real location. The duel's background shows the weather at the rival's location. In Figure 3 several different weather conditions, during a duel, are presented. The sun may be shinning (Figure 3 (a)), it may be a cloudy day (Figure 3 (b)), it may be raining (Figure 3 (c)), it may be a foggy day (Figure 3 (d)), it may be snowing (Figure 3 (e)) or there may be a thunderstorm

(Figure 3 (f)) or a thunderstorm with rain (Figure 3 (g)) at the rival's location. The player is the black colored figure on the left and the rival is the red colored figure on the right. During the duel each wizard will take turns to attack the opponent casting spells. The health bar of each wizard, represented at the top of the screen, will gradually decrease for each successful attack. Eventually, the health of one of the opponents will decrease to zero and the duel ends. The victorious wizard is the player whose health is above zero. The wizard whose health is equal to zero loses.
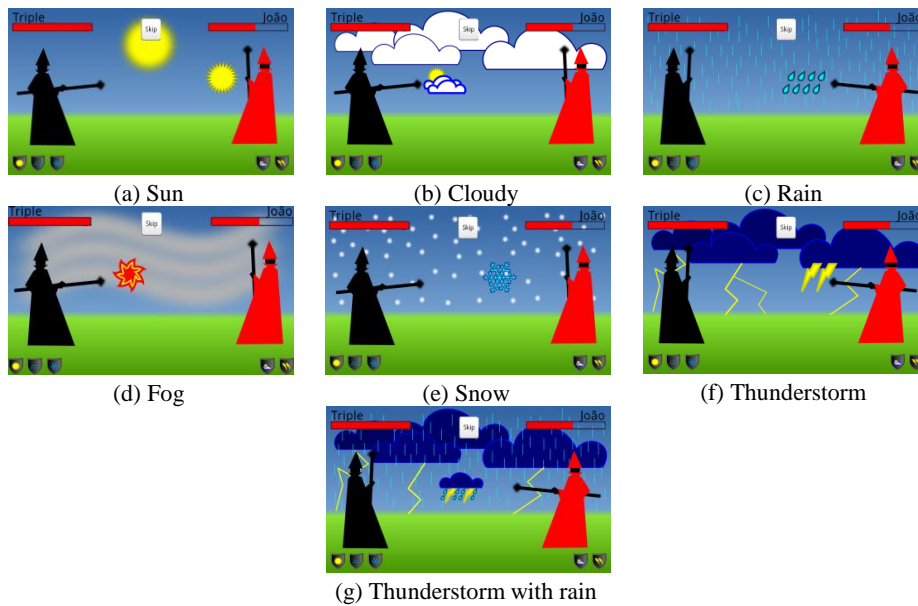

(a) Sun	(b) Cloudy	(c) Rain

(d) Fog	(e) Snow	(f) Thunderstorm

(g) Thunderstorm with rain

Fig. 3. Wizards dueling in different types of weather

Each wizard can cast different types of spells. There is one basic attack spell that is available to all wizards but which is not very powerful. The really powerful spells are the weather spells. The available weather spells are: clear sky, cloud, rain, fog, snow, thunderstorms and thunderstorms and rain. Each of those spells becomes stronger if the weather element it corresponds to is present during the duel. So, if it is raining at the rival's location and the player casts a rain spell, that spell will become stronger.

The spell to cast, in each turn, is chosen randomly from among all active spells in the wizard's grimoire. Spells are stored in the wizard's grimoire (Figure 4 (a)). In the Grimoire a wizard can buy, upgrade and activate or deactivate spells. If a spell is deactivated that spell will not be cast during a duel. So, if the wizard has a strong rain spell and the rival to duel is at a rainy location it will be convenient to deactivate all the spells, except for the rain one, in order to maximize the chances of success.

To better protect herself, a player can also buy defense spells. Similarly to what happens in the attack spells there are also clear sky, cloud, rain, fog, snow, thunderstorms and thunderstorms and rain defense spells. A defense spell will decrease the

health damage received by the wizard when attacked with the corresponding attack spell. Defense spells are represented bellow each wizard during the duel (Figure 3).

When the player presses a spell in the grimoire more information about that spell can be visualized (Figure 4 (b)). Initially, some of the spells are locked (Figure 4 (c)). However, as the player gains more experience those locked spells will progressively become available.
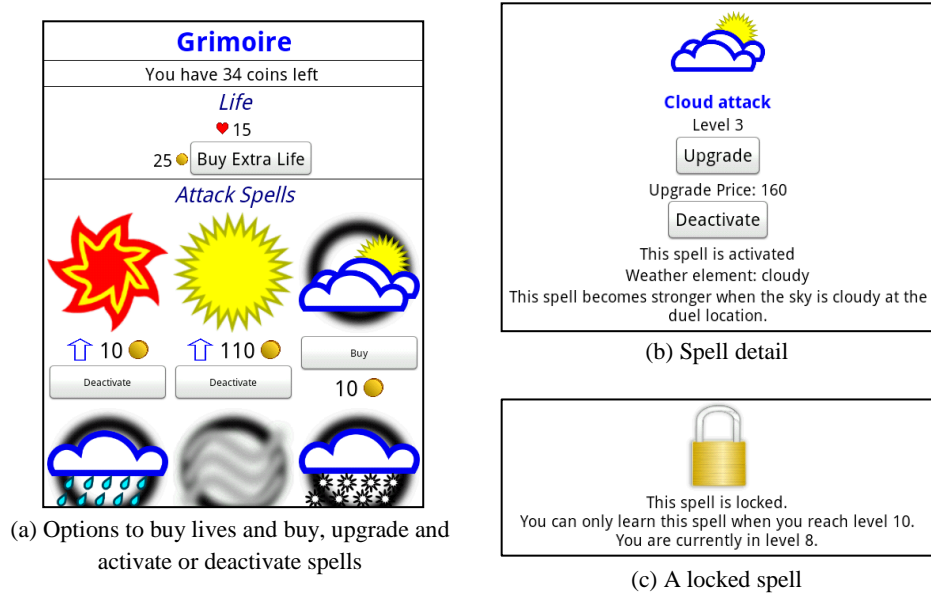

Grimoire
You have 34 coins left
Life
❤ 15
25 ● Buy Extra Life
Attack Spells

⇧ 10 ●   ⇧ 110 ●   Buy
Deactivate   Deactivate   10 ●

(a) Options to buy lives and buy, upgrade and activate or deactivate spells

Cloud attack
Level 3
Upgrade

Upgrade Price: 160
Deactivate

This spell is activated
Weather element: cloudy
This spell becomes stronger when the sky is cloudy at the duel location.

(b) Spell detail

This spell is locked.
You can only learn this spell when you reach level 10.
You are currently in level 8.

(c) A locked spell

Fig. 4. Grimoire

After a player acquired enough experience that player can become master of the wizards defeated during the duels, who turn into lackeys. Having a master is not entirely devoid of advantages as the master concedes a daily scholarship to the lackeys (Figure 5). The higher the level of the master the higher is the value of the scholarship. With the scholarship's coins the wizard can buy more spells for the grimoire or upgrade spells that are already in the grimoire. Another way of wining coins is trough duels. When a duel ends the player always receives coins, whether she wins or loses. However, more coins are awarded when defeating higher level wizards.

Your Master granted you 4 coins for all your hard work.

Fig. 5. Master functionality

A wizard can find out who is her master by pressing the Master button and check on her lackeys by pressing the Lackeys button in the Profile (Figure 1 (b)). Some wizards may not have a master. For example, the player whose profile is presented in Figure 2 (b) was, at the time of writing, the most experienced wizard in the game and had no master. That is why there is no Master button is his profile. Similarly, in a wizard without lackeys, the Lackeys button will not appear.

To motivate and provide visibility to the most successful players, Weather Wizards has two types of ranks: the Power Rank (Figure 6 (a)) and the Lackeys Ranks (Figure 6 (b)). In the Power Rank wizards are ordered by experience and in the Lackeys Ranks they are ordered by the number of lackeys. The ranks are accessible through the menu button of the Android phone.
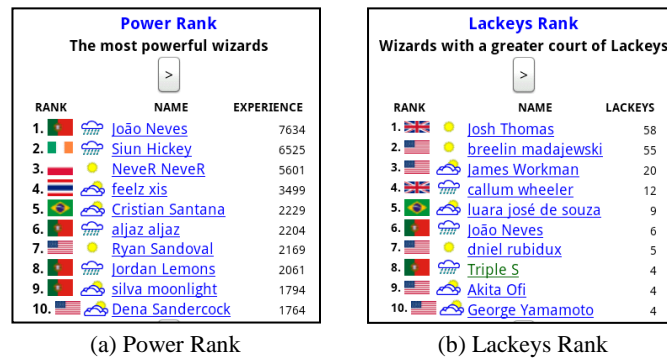

(a) Power Rank   (b) Lackeys Rank

Fig. 6. (a) Power Rank and (b) Lackeys Rank

To test how the use of the weather affects player enjoyment, a user study was conducted. The user study is addressed in the next section.

3.2 User Study

To test Weather Wizards we deployed the application on Google Play. We could have sent the application's APK file to a few selected users and ask them to install it in their phones. However, we thought that deploying the game on Google Play would provide us with the more realistic scenario possible, rather than merely having the players sitting at the lab to experiment the game [21]. In order to create a realistic scenario, and so that our game would be subjected to all the same constraints that other games are subjected to when they are deployed in the wild, no rewards were offered to players for installing and playing the game. The game was advertised on the research group's web page, on social networks and on mailing lists.

The application was deployed on Google Play in 27 December 2011. Until the moment of writing there were 306 user installs. The evolution of the active device installs is presented in Figure 7.

When the game is installed players are asked what their gender is. 70% of our users are male, 20% are female and 10% preferred not to answer that question.

Fig. 7. Evolution of active device installs

To evaluate the game and influence of the weather in player enjoyment we resorted to both the logs of the player data stored in the server and to a survey that the players filled via the web. We sent an email to players asking them to fill the survey. 21 players responded to our survey. 81% of those players are male and 19% are female. Their average age is 28.6 years old. 86% of the players use their phone to play games. The remaining 14% do not use their phones to play games (so probably, ours was the first they installed). 9 of the players were students, 6 worked in areas related to informatics and finance, 5 were researchers and 1 did part time jobs.

3.3   Results and Discussion

57.2% of the players agree or strongly agree that the weather made them feel that the game was dependent from the real world (Figure 8 (a)). Perhaps this percentage could be higher. During the duels, the weather that was displayed in the mobile phone was the weather at the rival's location. Eventually, that rival could be far away from the user so the sense that the weather was real could not be so evident.

71.5% of the players agree or strongly agree that using real weather data was fun (Figure 8 (b)). None of the players thought that using real weather data was not fun. 28.6% of the players neither agree nor disagree. So, there were players who even though didn't feel that the game was dependent from the real world, nevertheless found the user of weather data fun.

We asked players if they would prefer randomly generated weather data instead of real weather data. 86% of the users prefer real weather data. 14% would rather have randomly generated weather data (Figure 9).
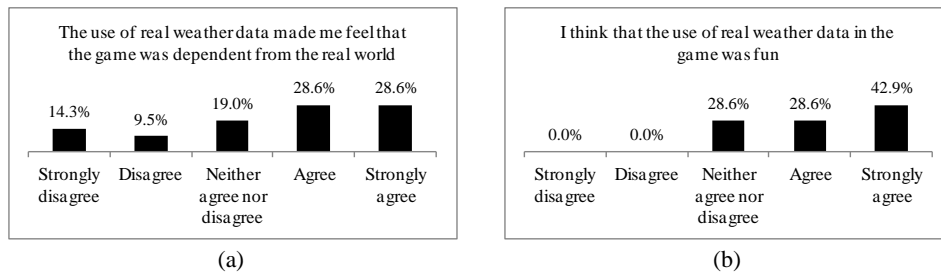

(a)

(b)

Fig. 8. Players' opinion about (a) how much the use of real weather data made them feel that the game was dependent from the real world and (b) how much the use of real weather data in the game was fun
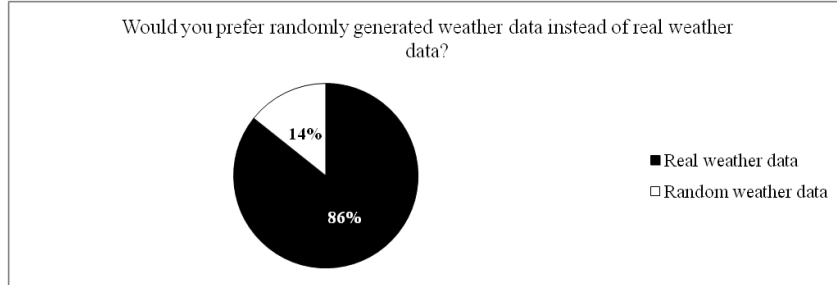
Fig. 9. Players' opinion about using real weather data or randomly generated weather data

As Weather Wizards depends of the user's location, we asked users if they thought it was fun to know the real location of the other players (Figure 10 (a)). It is possible to know the real location of another player through that player's profile (Figure 2 (b)). In the ranks (Figure 6) there is also a flag that indicates the country where the player is. 85.7% of the players agree or strongly agree that it is fun to know the real location of the other players. This percentage was higher than the one that refers to the use of the weather (Figure 8 (b)).

Since the game was made available on Google Play, until the time of writing, players have fought 10335 duels. These duels were initiated by 125 distinct users. In 66.9% of those duels the spell that corresponded to the weather at the rival's location was activated.

We also asked players if the game responds quickly to their actions. To obtain the real time weather data the phone needs to contact the server and the server needs, in turn, to contact Weather Underground's API. Those two steps could cause some delay. Surprisingly, 71.4% of the players agree or strongly agree that the game responds quickly to their actions (Figure 10 (b)).
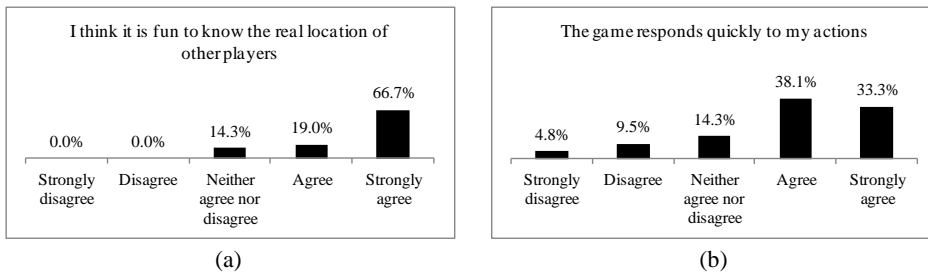

(a)

(b)

Fig. 10. Players' opinion about (a) how fun it is to know the real location of other players and (b) about how quickly the game responds to their actions

In the survey, players were asked a series of questions based on the Game Flow. People experience flow when they do an activity for the sole sake of the activity, for enjoying themselves and not to receive material rewards [22, 23]. In one of the questions we asked players to what extent did they have a sense that the game kept them concentrated while they were playing. This question was related to the concentration

element of the Game Flow. Providing a lot of stimuli from different sources is a criteria that contributes to the concentration element and that in turn contributes to the flow. As the weather is another stimuli we wondered if this element might favor concentration. Another of the elements of the Game Flow is immersion. In what refers to this element players were asked if they felt involved by the game, less aware of what was surrounding them and less worried about everyday life. As the weather surrounds the player, constantly immersing her, eventually this might favor immersion. However, our results regarding concentration (Figure 11 (a)) and immersion (Figure 11 (b)) were quite neutral. The average value for concentration is 3.2 and the average value for immersion is again 3.2. This may be due to the fact that Weather Wizards is a casual game designed to be played during short bursts of time and meant to be easily interrupted in case the player has something else to do [24]. So perhaps Weather Wizards' casual nature didn't inherently favor concentration or immersion.
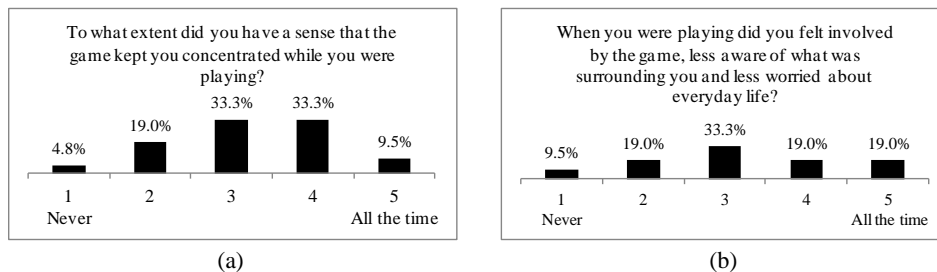

Fig. 11. Players' opinion about the (a) concentration and (b) immersion elements of Game Flow

In the survey players were asked how the game could be better, what they liked and what they didn't like. 28.6% of the players wanted better graphics. Conversely, 14.3% of the players liked the game's graphics and praised its simplicity. 23.8% of the players wanted more interactive combats and demanded features such as friends' lists, so that they could track their progress and challenge them, exchange of messages between wizards or different privileges based on the player's real location. 42.9% of the players praised the innovation, originality or idea behind the game. 9.5% of the players mentioned the masters and lackeys functionality (Figure 5) as good way for new players to more easily attain visibility and rise in the game's hierarchy (Figure 6 (b)). Experience is cumulative over time, so it is more difficult for a new player to surpass players that have been in the game for longer. Lackeys, in contrast, are relatively easier to steal.

Our results indicate that real time weather data has potential to contribute positively to player enjoyment in a game, but there are risks associated with it [25]. Weather data providers may crash or may not scale appropriately if the number of players increases. Furthermore, if one opts for a paid solution weather data will become an extra cost. Inaccuracy problems may also surface as the weather data supplied by the provider may be wrong. However, there may be one way to avoid this external dependency. The application Weddar [26] may have found the solution. Weddar is a

weather report service powered by its own users. It is not a game, but the strategy that they used may be the way out for games not to become dependent from an external, possibly paid, solution. Of course, there can be some inaccuracy in this sort of approach, but weather data providers may also suffer from some form of inaccuracy. So this may well be a possibility worth considering.

4 Conclusions and Future Work

In this work, the contribution of real time weather data to the player enjoyment was analyzed. To this effect we created a game, Weather Wizards, where the weather is central to the gameplay and conducted a survey to the players. 71.5% of the players considered that using real weather data was fun and 57.2% of them felt that the use of real weather made them feel that the game was dependent from the real world. When asked if they would prefer using real weather data or randomly generated weather data 86% of the users preferred real weather data and only 14% would opt for randomly generated weather data. Our results therefore indicate that real time weather data can contribute positively to player enjoyment.

In what refers to the concentration and immersion elements of the Game Flow, our results were only slightly positive, possibly because Weather Wizards is a casual game, built to be played for short amounts of time. In a short amount of time it is difficult for a player to feel completely immersed and detached from the real world.

Our survey was conducted in a limited population, and the respondent rate might eventually have affected the outcome, but the user results about the use of real weather data are encouraging so we believe there are still many opportunities to explore in what refers to the combination of weather and games.

As future work we plan to port this application to other devices in order to augment the number of potential players and run more user tests. We also plan to offer the choice of different skins for the game because even though several users complimented the aesthetics and simplicity of the game, others would prefer a more elaborate design.

5 Acknowledgements

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