The Design Process of a Board Game for Exploring the Territories of the United States

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Abstract

The paper reports the design experience of a board game with an educational aspect, which takes place on the location of states and territories of the United States. Based on a territorial acquisition dynamic, the goal was to articulate the design process of a board game that provides information for individuals who are willing to learn the locations of the U.S. states by playing a game. The game was developed using an iterative design process based on focus groups studies and brainstorming sessions. A mechanic-driven design approach was adopted instead of a theme or setting-driven alternative and a relatively abstract game was developed. The initial design idea was formed and refined according to the player feedback. The paper details play-testing sessions conducted and documents the design experience from a qualitative perspective. Our preliminary results suggest that the initial design is moderately balanced and despite the lack of quantitative evidence, our subjective observations indicate that participants' knowledge about the location of states was improved in an entertaining and interactive way.

Keywords

Design process; non-digital game; board game; focus groups

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Introduction

There are three main motivations for this study. First, one needs to mention that, although digital entities or technology bring lots of design possibilities to the game design, they all can be prototyped by paper-and-pencil methods. One of the recommended prototyping methods is actually to represent the video game by physical game bits. This is also important to communicate initial ideas to the team members or investors. Therefore it is also important for digital game designers to pay close attention to non-digital game design. Secondly, studying board game design is also important for its own sake. Although board game industry is not as big as the video game industry (Morris, 2016, Griepp, 2016), there are also considerable amount of people who are investing their resources in terms of time and money to non-digital games (Takahashi, 2014, Duffy, 2015, Gibson, 2014 and Freeman, 2012). Non-digital games also inspire developers to adopt the games into other mediums such as to mobile/smart phones. An example non-digital game would be *Fluxx*, which was later developed for iOS (Fluxx (n.d); Fluxx on the App Store on iTunes (n.d.)). It is also possible where a board game can be inspired by a video game such as *Gears of War: The Board Game*, *Civilization: The Board Game*, *World of Warcraft: The Board Game* or *Doom: The Board Game* among others (Roberts, 2014). Third, to our knowledge, game studies literature is somewhat lacking reports of non-digital game design methodologies which may shed light to junior developers or may help to extend the discourse on non-digital game design in academia. With these motivations in mind, the aim of this paper is to report the design experience of a board game, to articulate how a focus group study is carried out and to detail the analysis and outcome of the study.

The rest of the paper is organized as follows: Firstly, the developed board game prototype is explained and the game's formal elements are stated. In the second section, selected methodology is outlined and design iterations are described step-by-step. Lastly, the results, relation with the literature, limitations of the study and possible future studies are discussed.

Formal Elements of the Game

By following Fullerton, Swain and Hoffman (2004), we see that games can be described with three distinctive elements: (i) formal elements, (ii) dramatic elements and (iii) dynamic elements.

Here, the formal elements of the prototyped game are given which are players, objectives, rules, procedures, conflict, resources, outcome and boundaries.

Players: Player interaction pattern is selected to be one-on-one (2 players) among others.

Objectives: The objective of the game is to acquire as many states as possible (out of three player-specific hidden goal states) when all the cards are used.

Rules: The game consists of three stages which are explained in detail in the Procedures element. There are sixty cards in the main deck that are composed of fifty states of USA and ten "Draw a Blue Star" cards. BlueStar deck is composed of ten cards, which are special power cards that are drawn when a "Draw a Blue Star" is dealt from the main deck. Decks are shuffled at the start of the game and every turn of a player, two options from the state deck are opened for participant to decide.

If a "Draw a Blue Star" card is drawn in the first stage by a player, that card is re-shuffled into the deck and a new goal is given to the player.

If a "Draw a Blue Star" card is drawn in the second/third stage by a player, the player may either decide to use the state card to put a coin on that state or draw a BlueStar card.

If a player cannot choose an option from the two served options at stage three, then those cards are reserved face-up by that player side of the board until the end of the game. When all the cards are depleted, players take the reserved cards and play a last turn by selecting one card among them in their natural turn order.

Procedures: The game consists of three stages as stated previously: 1) Goal Assignment 2) Board Settling 3) Marching

Goal Assignment Stage: In the first stage, three state cards are dealt to both players for their goal states (hidden). These are the states that the players' coins should be residing on at the end of the game.

Board Settling Stage: In the second stage, players settle on the board in five turns by selecting one of the two options s/he was offered from the top of the state deck. The card that is not selected are put to the bottom of the deck.

Marching Stage: In the third stage, a player again offered two cards from the state deck. This might turn out to be two state cards, one state card and a "Draw a Blue Star" card or two "Draw a Blue Star" cards. Either way, the card that is not selected is discarded never to return back into the game. In the first scenario, the player selects one of the states and marches her avatar to another her already acquired state by crossing over the selected state and by at most using five action points. An action point is spent by moving the avatar from its position to an adjacent position (moving from Texas to New Mexico in Figure 1). Therefore, in general, every player can march to at most five adjacent

states (from Texas to Oregon in Figure 1). If a territory is occupied by the opponent, one spends two action points to claim that area and march on. If the player has already claimed bunch of territories adjacent to each other, s/he uses only one action point to go through her own territories. In the second scenario, the player may decide to select the state to march on or select the "Draw a Blue Star" card to draw from the BlueStar deck. In the last scenario, the player has to select a "Draw a Blue Star" card instead of marching and draws a card from the BlueStar deck.

Figure 1. Basic Mechanic – Move of a Player from Texas to Oregon with 5 Action Points (Adapted from MissMJ (2011)).

Resources: Both players have twenty-five coins to place on the game board.

Boundaries: The boundary of the game is the United States of America map divided into states.

Conflict: Emerges in the game by the rules, procedures and objectives.

Outcome: After all the cards are depleted, the players check how many of their goal states they have managed to acquire. A player wins if she has acquired more of her goal states than her opponent at the end game state (e.g. 3-2). A player also wins if the players acquired same amount of goal states (0-0, 1-1, 2-2, 3-3) but she has acquired more states in total. The game ends in draw if both players acquired same amount of their goal states and total states.

The Game Prototype

The prototype was developed in an evolutionary prototyping manner (Floyd, 1984) that is the prototype developed was not completely discarded in each iteration. Instead, it was used for the next iteration of design and evolved.

The game bits are: 70 cards in total where 60 of them for main deck and 10 for BlueStar deck, 50 placeable bits where half of them for one

player and the other half for the other player including the avatars for both players and the game board which essentially a slightly modified version of the United States of America state map.

For the design of the game, the first batch of decisions was given for the layout of the game board. This is actually an architectural design decision for a game that adopts the territorial acquisition as the core game dynamic where a territorial acquisition game is defined as a game that is based on controlling a piece of territory like in the games Carcassonne and Risk (Brathwaite and Schreiber, 2009).

The number of territories, the inter-distance between the territories, the adjacency of the territories (the number of adjacent territories to a certain territory) or the symmetry of the game board are all prominently crucial for the subsequent side (architectural) design decisions since a change in those configuration may end the game up in a dreadful condition making the game imbalanced or creating a dominant strategy. Therefore the initial architectural design decisions are important before going into specifics.

Study and Procedure

After the initial prototype was developed, test run of the focus group was conducted.

In total, the focus group studies were conducted with 12 participants from Turkey where 7 were males and 5 were females, ages ranging from 20 to 32. Focus groups were conducted with 2-4 participants at a time in home or school settings. If the group was more than 2 people, participants that are not active players watched the playtest session and gave feedback according to the conversation they carried out with the players and by watching how the game emerges.

Afterwards, a semi-structured interview and a measure list were established according to this specific case.

In the interview, the participants were asked subjectively if they enjoyed the game in overall, if they felt bored or disoriented at times, if they were comfortable with the presented information complexity and relevancy and be able to guess intuitively what to do next. Some other questions were involving if they liked the layout, if they thought that the navigation was easy to understand, if it was easy to remember the possible actions and apply them. The overall procedure (play-testing, brainstorming and the interview) for an iteration often took around one hour.

Measures that does not need feedback from users are also recorded such as the score of the game, the length of each game, newly added features that contribute to the length of the game, the quantity of the total acquired states, the quantity of the acquired states by individual

players, the number of obsolete (and obvious) moves encountered or the number of BlueStar cards that could not be used in a game session and so on.

Feedbacks and Iterations

Main feedback at the first iteration: "*There are too many options to deal at one turn.*"

In the first play session, six cards were being opened for a player per turn where s/he could choose one of the three to march on (at the stage three of the game) after the opponent discards three of them. The first idea was to make the game as strategic as possible by also including the opponent in the turn even if that turn is not the her turn. However, after inspecting the game play and feedbacks, it has been determined that too much information is being presented to players at a turn therefore, that design decision was changed to opening of two cards without the intervention of the opponent.

Figure 2: Focus Group #4 – First Session

Figure 3: Focus Group #4 – Second Session

Main feedback at the second iteration: "*My opponent got too much ahead in the first few turns and I got bored since I felt like I will not be able to catch her.*"

After the second iteration, the action points were decreased from 6 to 5. Being able to play six action points per turn made a player much stronger at certain occasions resulting in a player to take advantage too early in the game. Also, in this phase, there was no "first stage" that was mentioned before as the goal assignment stage. Instead the main goal was to acquire as many states as possible and the player who has the most state would win when there is no cards left. However, it has been decided that there should be some hidden information to both players, therefore three hidden goals for each player has been introduced where these hidden goals must be acquired by each player instead of trying to acquire all states.

Main feedback at the third iteration: "*Same game should be applied to the map of Turkey.*"

Since the game inherently has an educational side where -to be able to assess if they can or will use that State for their turns- the players should be able to find the States written in the cards on the game board. That feedback was not implemented for this project however, it has been noted for future studies and as a different mode of the game. The board of the game stands as the back-bone where all the mechanics lean on therefore it has been decided not to change the initial architectural design decision.

Main feedback at the forth iteration: "*The actions taken in the game are a little too routine.*"

After the forth iteration, to be able to break the monotonous routine actions of the game, "BlueStar" mechanism has been added where the main deck included some "Draw a Blue Star" cards that if a player draws a blue card and decides to select that option, s/he draws a card from the BlueStar deck. BlueStar cards are all convenient/positive cards that can be used instantly and any time during the game. They can also be used together to create synergies. Some feedbacks were mainly on cosmetics of the game in this iteration. Players wanted to see some relevant information on the cards related to that states. They also wanted to see a little USA map on the cards where the state is highlighted on the map to make the finding of the state on the board easier. However, this would undermine the logic behind "look at the card, find that state on the map to play", where the situation actually brings a tradeoff issue between the educational style and the player desires. This focus group study was conducted in two sessions where the participants' play tested the game twice (see Figures 2 and 3).

Main feedback at the fifth iteration: "*When I ended up at the corners of the map, I couldn't find a way to get back and stuck there.*"

After the fifth play session, there were more feedbacks from the participants than other iterations (Figure 4). If a player draws two "Draw a Blue Star" cards from the main deck, s/he was allowed to get two BlueStar cards, however this created imbalance and inconsistency since throughout the play, players choose one of the two options. Therefore, agreeing with the feedback rule has changed to: "Player can get one BlueStar card even if a participant draws two BlueStar cards in a turn". Another feedback was that, when players' avatar ends up standing at the very north-west (Washington), north-east (Maine), south-west (Alaska) or south-east (Florida) of the map at some point of the game, the avatars tends to stuck there instead of going back into the game. To prevent this, those states are connected to each other, which brought the game a new face. Players avoiding to march through those territories has been observed to be marching more and more to those lands to control the game in the later iterations. The game dynamic created with that change was satisfactory therefore the rule was set. Another feedback was to increase the number of BlueStar cards and add some other powers. This was addressed and the BlueStar card number has been increased by two (It was eight up to this point and raised to ten). After getting this feedback, we realize that the starting player also plays the last turn resulting in playing more turns then the other player which was a serious flaw of the game in terms of balance. Adding two more cards (adding one more turn into the game) also fixed this issue. Since two more BlueStar cards were added, the main deck was more saturated with these power cards. Therefore, we decide to add the discarded cards at the second stage to the bottom of the deck to create more availability to players and to enhance opportunities to the attentive players who pay attention to what states will possibly be coming as options at the late parts of the game.

Main feedback at sixth iteration: "*I couldn't determine where the adjacent territories of Alaska and Hawaii.*"

After the sixth iteration, minor changes were made (Figure 5). The adjacent states of Alaska and Hawaii (which do not have direct borders to other states) were not clearly defined and were conveyed orally to the players however after the iteration, the adjacent states of these states were decided to be clearly identified on the board to prevent any confusion during the game.

Some feedback that is not addressed

"Divide also the states into cities, let the game time elongate and incorporate more rules into the game."

This feedback was not addressed since the game was planned to be playable between 10 minutes to 30 minutes max which was an architectural design decision. Dividing the states into cities would drastically increase the game time which was not the scope of the project.

"Main and BlueStar decks should be doubled in number to create more variety in the game."

The same reason applies here like the previous one, since doubling the card number would "at least" double the game time.

"Let there be three options instead of two."

Increasing the options to three would imbalance the game since the mechanics were mainly placed on duality mentality. Increasing the options to four is also not feasible since the cards would have been exhausted too fast and most of the options would be trash without being played (three cards discarded per turn).

"Each player should be able to play maximum numbers of two BlueStar cards per turn."

Although playing BlueStar cards seems overpowered, it should be noted that to be able to have a BlueStar card, players sacrifices to playing that turn. Therefore they should have the right to play them whenever and in what order they liked to. Also, playing BlueStar cards one after another creates different opportunities and strategy options for the players that provides variety to the game.

"A BlueStar card should give the player the prerogative to secure one of her state."

The reason for not addressing this feedback is that, one of the fun lying underneath is to prevent your opponent from reaching her goals besides trying to reach for own goal. Giving immunity on some states would damage that dynamic and would limit mobility.

"There should be RedStar cards as well, that are designed to affect the players in a negative way. They can be directly stuck to the player and resolved immediately. One BlueStar card can be to force the other player to draw a RedStar card."

While developing the game and naming the special power cards as "BlueStar", the initial idea was also to add RedStar cards as mentioned in the feedback. However, because of the time limitations of the project, RedStar cards could not be implemented and tested in the game.

Figure 4: Focus Group #5

Figure 5: Focus Group #6

Results

This game study set out with the aim of assessing the importance of the systematic game design process. Furthermore, it is needless to mention the prominence of the playtesting sessions while developing board games.

The main crucial implication of these studies is to be able to gather relevant information and refine the game elements and the mechanics accordingly. A formal approach or framework has not been yet developed for playtesting or utilizing focus groups in the process of board game development. This paper considers a case study, which seeks insights of how the game can be improved iteratively by using the experience gained from the game session (i.e. tacit knowledge) that should improve the game quality explicitly.

The main worthy of notice is that some of the feedbacks gathered can be biased. However, feedbacks are taking shape from the specific occasions that are encountered during the game, which is totally

acceptable and expected. However, since the participants are in the players' shoes that are trying to win (even if it is told that the game is not finished yet and it is important to evaluate the game instead of beating the opponent), some feedbacks can become biased in favor of one player only for that specific situation.

As a designer, instead of blindly incorporating the desired changes into the game, one needs to filter the incoming information in an impartial manner and make the required changes using a structural process.

The players (i.e. evaluators) who are participating in the study neither do know the project/study requirements and design specifications nor the time, budget necessities. Also the designer generally intends for a target population and the audience in the focus group may not be the exact sample. Therefore, making serious changes depending on one feedback deserves a second thought on that matter.

Another important implication of the study was that the feedbacks gathered from the players may not necessarily be doable however, those insights should not be ignored and trashed instantly, since it has been seen that an arbitrary feedback can initiate to fix another flaw or imbalance in the game. Therefore deliberating on the ideas around a feedback is also useful to be closer to a more balanced game.

The game was initially intended to be designed considering the "easy to learn, hard to master" heuristic by Bushnell (as mentioned in Federoff's study (2002) and criticized by Bogost (2009) that familiarity makes something easy to learn). Here, it is posited that this heuristic was satisfied by offering the player a familiar method of navigation (moving from territories to territories obeying the adjacency rule) with easily comprehensible goals (acquire a state) and also challenge their minds by requiring them to remember what territory has already been played and what yet has to come. Genuineness here is that the players are not being forced to remember and this emerges as a game dynamic during the play if the player wants to. One can easily reject to follow the information that has been revealed and what has to come and just play casually and enjoy. Another offering of the game is that avid players may decide to store the information verbally (as it is written on a card) or spatially (where it is located on the board).

While carrying out informal discussions with the participants about the game mechanics, we have realized that they were recalling the name of the states, finding them on the map, talking about their geographical locations which imply that the game may have an educational side which obviously needs further testing.

One last inference of this study is that the designers should not hold on to the initial ideas strictly. The ideas developed should be bendable, twistable or even breakable.

Discussion

To date, there are a number of academic studies carried out in the video gaming domain in relation with the human-computer interaction studies, especially in recent years (BPausch, Gold, Skelly and Thiel, 1994 and Pinelle, Wong and Stach, 2008). However when we boil down to board games more specifically, we are left with less number of studies (Huynh, Raveendran, Xu et al. 2009 and Schlieder, Kiefer and Matyas, 2006). There are also studies that are trying to learn lessons from already designed board games by observations, determining pitfalls to bring light for game designers for future games (Zagal, Rick and His, 2006). A study aims to create a system that automatically balances a turn-based board game by not changing the parameters of the game but the rules of the game by using genetic algorithm to search the space of game rules (Hom and Marks, 2007). Advancements in that sense may greatly help the game designers to achieve balancing of their game. Another study looks for ways to enhance board game AI (bot) to play complex board games such as Risk (Johansson, 2006). Completely different line of studies also may use old board games to culturally investigate a society (Van Binsbergen, 1997). This study however, explicitly develops a game and reports the design process, describes how the focus group study was conducted in the development pipeline and gives insight on design considerations while designing a board game.

Other than mere entertainment, board and card games are examined for other purposes such as education. A card game development procedure is articulated for instance to teach chemistry (Bochennek, Wittekindt, Zimmermann and Klingebiel, 2007). The enhancing of numerical knowledge of young children through playing linear number board games has been investigated in a highly cited study and found out that they actually became more proficient (Ramani and Siegler, 2008). Another study also found out that playing number-based board games both improves children's knowledge and also keeps them engaged (Ramani, Siegler and Hitti, 2012). Medical education is another aspect that the utilization of board/card games was examined (Bochennek, Wittekindt, Zimmermann et al., 2007). There are many more studies about using board and card games in different domains (e.g. the use of board games in psychotherapy with children (Matorin and McNamara, 1996)) but the game study articulated here is different from the aforementioned studies in the sense that the game here is not ambitiously targeting to teach a specific subject. Instead, it presents a way to gather general knowledge on geography while having fun.

From a more technological point of view, board games that are being utilized is the genre of augmented reality games that are often pronounced under "pervasive games" category (Magerkurth, Cheok, Mandryk et al. 2005 and Broll, Ohlenburg, Lindt et al. 2006) where pervasive games are defined as blending of real world with the so-called

game world spatially, temporally and/or socially (Montola, Strenos and Waern, 2009). Novel approaches are being developed to integrate digital information seemingly with the real world objects (i.e. board game bits) that distinctively creates new game design possibilities for board games and provides richer experiences (Huynh, Raveendran, Xu et al., 2009, Magerkurth, Memisoglu, Engelke et al. 2004 and Magerkurth, Cheok, Mandryk et al. 2005). In recent years, there has been an increasing amount of studies for creating location-based games from classical board games (Schlieder, Kiefer and Matyas, 2006). There are also leading attempts to design games that make use of a wide range of sensors and utilizing wide local area network, using the world as a game board (Björk, Falk, Hansson et al. 2001). The game at hand in this study does not contain any digital counterparts which differentiates this study from the mentioned game studies.

Limitations and Future Studies

The main limitation of the study is the time requirements and number of participants. More iteration would probably highlight many more important aspects of the game. Also, there were no quantitative comparisons that were made between designs that are given according to the feedbacks. Comparing one version of a game with another prevailing design quantitatively (using certain measures such as Ijsselsteijn, De Kort and Poels', metric (2013) and/or Brockmyer et al.'s metric (2009)) with sufficient participants as a future study may give more insights about how to make the game more fun for players.

This humble study explains a case study based on the core dynamic: territorial acquisition (as it was mentioned in Brathwaite and Schreiber, 2009). As a future study, different board games that have different core dynamics can be discussed, playtesting and focus group study procedures specific to their dynamic can be compared and the novelties specific to the dynamic may be studied to be revealed.

The audience of the game was selected to be +18 because of the not-so-simple game mechanics and an average requirement for cognitive load. The testers are also selected accordingly. To better determine if the game is convenient for younger people pedagogically, future studies are needed by incorporating instructive experts in the process.

Other than these, a next step can be to work with an instructional designer to better understand the possible pitfalls of the game in terms of learning and to improve the game accordingly.

Conclusions

This empirical study highlights an optimal process for designing a board game. It details the user experience gained during the progression of the work. Results have shown ways towards enhancing our understanding of a board game design process. Further studies need to

be carried out in order to improve the non-functional requirements of the game such as usability, quality, and playability. To this end, it would be crucial to compare the experiences of more individuals within the same game setting. Such findings may help us to understand the difficulties of game design, which can potentially help designers to learn from the shared experience. Also, our preliminary results suggest that the proposed game might be useful for learning or refreshing the knowledge of individuals who are willing to benefit from an interactive approach for exploring states of the U.S. However, there is still need for a quantitative empirical study to validate the effectiveness of this game and the methods to build it in terms of its proposed educational aspect, which is planned as a future study.

References

Björk, S., Falk, J., Hansson, R., & Ljungstrand, P. (2001). Pirates!–using the physical world as a game board. In *Proceedings of interact* (pp. 423-430).

Bochennek, K., Wittekindt, B., Zimmermann, S. Y., & Klingebiel, T. (2007). More than mere games: a review of card and board games for medical education. *Medical teacher*, *29*(9-10), 941-948.

Bogost, I. (2009, April 2). Gamasutra - Persuasive Games: Familiarity, Habituation, and Catchiness. Retrieved from http://www.gamasutra.com/view/feature/3977/persuasive_games_familiarity_.php

BPausch, R., Gold, R., Skelly, T., & Thiel, D. (1994, April). What HCI designers can learn from video game designers. In *Conference companion on human factors in computing systems* (pp. 177-178). ACM.

Brathwaite, B., & Schreiber, I. (2009). *Challenges for game designers*.

Brockmyer, J. H., Fox, C. M., Curtiss, K. A., McBroom, E., Burkhart, K. M., & Pidruzny, J. N. (2009). The development of the Game Engagement Questionnaire: A measure of engagement in video game-playing. *Journal of Experimental Social Psychology*, *45*(4), 624-634.

Broll, W., Ohlenburg, J., Lindt, I., Herbst, I., & Braun, A. K. (2006, October). Meeting technology challenges of pervasive augmented reality games. In *Proceedings of 5th ACM SIGCOMM workshop on Network and system support for games* (p. 28). ACM.

Duffy, O. (2015, November 25). Board games' golden age: sociable, brilliant and driven by the internet | Technology | The Guardian. Retrieved from http://www.theguardian.com/technology/2014/nov/25/board-games-internet-playstation-xbox.

Federoff, M. A. (2002). Heuristics and usability guidelines for the creation and evaluation of fun in video games (Doctoral dissertation, Indiana University).

Floyd, C. (1984). A systematic look at prototyping. In *Approaches to prototyping* (pp. 1-18). Springer Berlin Heidelberg.

Fluxx | Looney Labs. (n.d.). Retrieved from http://www.looneylabs.com/games/fluxx

Fluxx on the App Store on iTunes. (n.d.). Retrieved from https://itunes.apple.com/us/app/fluxx/id561319376?mt=8

Freeman, W. (2012, December 9). Why board games are making a comeback | Life and style | The Guardian. Retrieved from http://www.theguardian.com/lifeandstyle/2012/dec/09/board-games-comeback-freeman

Fullerton, T., Swain, C., & Hoffman, S. (2004). Game design workshop: Designing, prototyping, & playtesting games. CRC Press.

Gibson, E. (2014, November 24). Board games don't just bring us together – they remind us how to play | Technology | The Guardian. Retrieved from http://www.theguardian.com/technology/2014/nov/24/board-games-families-risk-children-play.

Griepp, M. (2016, August 1). ICv2: Hobby Games Market Nearly $1.2 Billion. Retrieved from http://icv2.com/articles/news/view/35150/hobby-games-market-nearly-1-2-billion.

Hom, V., & Marks, J. (2007). Automatic design of balanced board games. In Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE) (pp. 25-30).

Huynh, D. N. T., Raveendran, K., Xu, Y., Spreen, K., & MacIntyre, B. (2009, August). Art of defense: a collaborative handheld augmented reality board game. In *Proceedings of the 2009 ACM SIGGRAPH symposium on video games* (pp. 135-142). ACM.

IJsselsteijn, W. A., De Kort, Y. A. W., & Poels, K. (2013). {The Game Experience Questionnaire: Development of a self-report measure to assess the psychological impact of digital games. Manuscript in Preparation}.

Johansson, S. J. (2006, May). On using multi-agent systems in playing board games. In *Proceedings of the fifth international joint conference on Autonomous agents and multiagent systems* (pp. 569-576). ACM.

Magerkurth, C., Memisoglu, M., Engelke, T., & Streitz, N. (2004, May). Towards the next generation of tabletop gaming experiences. In *Proceedings of the 2004 Graphics Interface Conference* (pp. 73-80). Canadian Human-Computer Communications Society.

Magerkurth, C., Cheok, A. D., Mandryk, R. L., & Nilsen, T. (2005). Pervasive games: bringing computer entertainment back to the real world. *Computers in Entertainment (CIE)*, *3*(3), 4-4.

Matorin, A. I., & McNamara, J. R. (1996). Using board games in therapy with children. *International Journal of Play Therapy*, *5*(2), 3.

MissMJ. (2011, August 31). *A map of the United States with all 50 states and the District of Columbia* [Map]. Retrieved from http://en.wikipedia.org/wiki/List_of_states_and_territories_of_the_United_States#/media/File:Map_of_USA_with_state_names.sv

Montola, M., Stenros, J., & Waern, A. (2009). *Pervasive games: theory and design*. Morgan Kaufmann Publishers Inc..

Morris, C. (2016, February 16). Level up! Video game industry revenues soar in 2015 | Fortune.com. Retrieved from http://fortune.com/2016/02/16/video-game-industry-revenues-2015/

Pinelle, D., Wong, N., & Stach, T. (2008, April). Heuristic evaluation for games: usability principles for video game design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1453-1462). ACM.

Ramani, G. B., Siegler, R. S., & Hitti, A. (2012). Taking it to the classroom: Number board games as a small group learning activity. *Journal of educational psychology*, *104*(3), 661.

Ramani, G. B., & Siegler, R. S. (2008). Promoting broad and stable improvements in low-income children's numerical knowledge through playing number board games. *Child development*, *79*(2), 375-394.

Roberts, D. (2014, August 6). 10 amazing video game-themed board games. Retrieved from www.gamesradar.com/10-amazing-video-game-themed-board-games/

Russel, J. V. (1999). Using Games To Teach Chemistry. 2. CHeMoVEr Board Game. *Journal of Chemical Education* 76, no. 4: 487.

Schlieder, C., Kiefer, P., & Matyas, S. (2006). Geogames: Designing location-based games from classic board games. *Intelligent Systems, IEEE*, *21*(5), 40-46.

Takahashi, D. (2014, August 18). North American hobby game market hits an estimated $700M | GamesBeat | Games | by Dean Takahashi.

Retrieved from http://venturebeat.com/2014/08/18/north-american-hobby-game-market-hits-an-estimated-700m/

Van Binsbergen, W. M. (1997). Rethinking Africa's contribution to global cultural history: lessons from a comparative historical analysis of mankala board-games and geomantic divination.

Zagal, J. P., Rick, J., & Hsi, I. (2006). Collaborative games: Lessons learned from board games. Simulation & Gaming, 37(1), 24-40.