I, Suyao Chen, hereby submit this original work as part of the requirements for the degree of Master of Design in Design.

It is entitled:
Inclusive Multiplayer Game Design: Applying Universal Design Principles to the Multiplayer Game Design Process for a Wider Player Range

Student's name: Suyao Chen

This work and its defense approved by:

Committee chair: Ian Bellomy, M.F.A.
Committee member: Benjamin Meyer, M.F.A.
Inclusive Multiplayer Game Design
Applying Universal Design Principles to the Multiplayer Game Design Process for a Wider Player Range

A thesis submitted to the Graduate School of the University of Cincinnati in partial fulfillment of the requirements for the degree of Master of Design in the School of Design of the College of Design, Architecture, Art and Planning

2015 spring
by

Suyao Chen

Bachelor of Art, Jiangnan University, China
June 2011

Thesis Committee:
Ian Bellomy, MFA (Chair)
Benjamin Meyer, MFA
Abstract

Everyone plays games! However, it is often to see some of people have difficulty playing games together. This is an opportunity for game designer to enrich the game market. However, I know of no established game design principles can help game designers to address this need. The goal of universal design is to build a design that is inclusive and can broaden the end user audience, which is similar with to the need for multiplayer game design. This thesis proposes that by applying universal design principles to the multiplayer game design process can make the game playable and enjoyable for a wilder range of players.

This thesis will give an explanation to why some of the players with different skillsets are unable to be fully engaged while competing against each other. I will be analyzing this using Flow theory. A variety of case studies will be conducted to explore the current inclusive games and estimate the significance of universal design principles in these games. Then a multiplayer game design will be developed using universal design principles and other findings to address inclusivity issues for players with differing skillsets.
Acknowledgements

To my family, thank you for your unconditional love and support, for listening to my every little problem and cheering my every little progress.

I would like to express my sincere appreciation to Ian Bellomy, my committee chair and advisor for helping me structure and understand the argument, for pointing out the key problems during the most crucial phase, and for helping me to elevate my thinking to a higher level. Also, I am deeply grateful to Benjamin Meyer, committee member and advisor, who gave me constructive suggestion to my thesis structure, and technical support me about programming. Thank to all of you on the committee, for constantly giving me strength and patient to correct my thesis writing.

To my test participants, thank you for every shared inspiration and challenging me with worth-thinking questions.

Finally, I would like to thank my boyfriend, Davy Chen. He was always there cheering me up and stood by me through the good and bad times.
TABLE OF CONTENT

Abstract................................................................................................................i

Acknowledgements................................................................................................ii

1. Introduction ........................................................................................................1

2. Background .........................................................................................................7
  2.1 The reason for the players can't play games together .......................................7
    2.1.1 What is “Flow”? .......................................................................................7
    2.1.2 What is the connection between “Flow” and game? ....................................7
    2.1.3 How to stay in the “Flow” zone? ..............................................................8
    2.1.4 How to satisfy a player’s “Flow” experience in a multiplayer game? .............9
  2.2 Universal design principle...............................................................................11
    2.2.1 What is universal design? .........................................................................11
    2.2.2 What are universal design principles? .......................................................11

3. Case Studies .......................................................................................................13
  3.1 Carcassonne ..................................................................................................13
    3.1.1 Why choose Carcassonne? .......................................................................13
    3.1.2 How does Carcassonne work? ..................................................................13
    3.1.3 Why is Carcassonne successful? ...............................................................14
  3.2 Virus vs. Virus ..............................................................................................17
    3.2.1 Why choose Virus vs. Virus? ..................................................................17
    3.2.2 How to play Virus vs. Virus? ....................................................................19
    3.2.3 Why is Virus vs. Virus popular? ...............................................................19
  3.3 Summary of Case Studies .............................................................................20

4. Exploring in the iterative game design process ..............................................21
  4.1 Method............................................................................................................21
  4.2 Game concept emergence ............................................................................22
  4.3 First prototype, playability test and result ..................................................23
    4.3.1 Prototyping ..............................................................................................23
    4.3.2 Testing and analyzing .............................................................................24
  4.4 Second prototype test and result ..................................................................25
    4.4.1 Refining and Prototyping .......................................................................25
    4.4.1 Testing and Analyzing ............................................................................26
  4.5 Skill test and result .......................................................................................30
    4.5.1 Visual perception test ..............................................................................30
    4.5.2 Reflex test ...............................................................................................31
    4.5.3 Preferences test ......................................................................................33
    4.5.4 Matching player ....................................................................................34
  4.4 Third prototype test and result ...................................................................36
    4.4.1 Refining and Prototyping .......................................................................36
    4.4.2 Testing and Analyzing ............................................................................38
  4.5 Summary .......................................................................................................39

5. Conclusions .......................................................................................................41

Reference ............................................................................................................iii
1. Introduction

Games as an entertainment activity are becoming more and more popular and accessible. They have become a part of daily life. We can often see people playing games around us, even if for just five minutes while waiting for the bus. Some of players are likely to play games in groups or with friends, but the ways that most current multiplayer games are designed makes this difficult.

Through my research, I found that people have difficulty playing games together. This is because players are different in level of skills, but most games are designed to be exclusive. Exclusive game design refers to games that are designed for players with similar level of skills. These games cater to a specific genre (arcade, strategy, etc), and their genre filters the types of players who play them. A player with a propensity for quick reaction may prefer a racing game, whereas a player who prefers strategy may prefer chess. For a better explanation on what an exclusive multiplayer game design is, I'd like to provide a few examples.

![Figure 1.1: exclusive game examples: Need for Speed and Chess](image)

*Figure 1.1: exclusive game examples: Need for Speed and Chess*
In the *Figure 1.1*, for achieving a high score, the multiplayer racing game *Need for Speed* requires a player to have high skills in reflexes, control and the ability to make faster on-the-fly decisions. However the second multiplayer game *Chess* requires high skill in strategy, which consists of current chess position analysis, setting goals and well-defined plans for future play, regardless of the reaction time. These two games require a different set of skills.

Imagine there are two players that play *Chess* together, player A and player B. Player A is really good at *Chess*, but not really good at *Need for Speed*, another player is the opposite. Their skill sets for playing these two games are speculated as *Figure 1.2*. When they are playing *Chess* together, player A has more opportunities to win. However it is reasonable to assume that player B will lose interest because he/she rarely wins. So after few trials, player A and B will lose fun for playing with each other. “*Play game is all about fun*” (Manrique, V, 2013), without fun, there is no reason in gameplay aspect for players to play together.

*Figure 1.2: skill sets comparison between player A, who is good at Chess, and player B, who is good at Need for Speed (this is speculative / not based on any actual testing)*
The exclusiveness of Games is not only reflects on the disparity of required skills, but it also reflects on the different ability of level of those. Chess and Gomoku (Figure 1.3) require a similar set of skills. The only difference between Chess and Gomoku (five in a row) is the challenge levels. Chess has variety piece types than Gomoku, which is the one example of why it is more difficult. If two players want to play Gomoku together, one player is really good at Chess, another is not, the player that good at Chess must win a lot.

Figure 1.3 Exclusive game examples: Chess and Gomoku(five in a row)

Through these examples we can see that each game requires a specific set of skills in a certain level, which makes the game only playable and enjoyable for a certain group of player. Players with different level of skills will have trouble playing together.

Because players have a wide array of skills, there is a huge game market that game designers have appealed to by creating a wide variety of games. Thus every player can find a kind of game that is appropriate to play. I have heard a lot from my female friends that they can't understand why their boy friends are so addicted to a game, and these female friends even don't want to try the game. It is also often to see, moms playing games with her little child. Since a lot of the children games are designed just for younger child, mothers mostly enjoying bonding with her child, but not the actual gameplay experience.
The Entertainment software association has published a report about the 2014 computer and video game industry sales, demographic and usage data. As showing in the Figure 1.4, just have a small amount of people play games with parents or their spouse or significant other. The most important reasons for parents to play games with their kids is to have fun with the entire family. Less than half of the parents surveyed enjoy playing video games as much as their child does.

![Figure 1.4 2014 computer and video game industry sales, demographic and usage data form Entertainment software association](image)

Just as differences in players’ levels of skills push games to become more exclusive, exclusive games make it difficult for players with varying skillsets to maintain interest. For this
thesis I plan to use Universal Design as game design principle to attempt to address this need.

Universal design was coined by the architect Ronald L. Mace to describe the concept of designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life. This principles seems can be used in the game design field, for helping the multiplayer game become playable and enjoyable by varying players, regardless of their skill level. This leads to my hypothesis, which is that by applying universal design principles to the multiplayer game design process, would develop a game that could become more inclusive and allow for players with a wider range of skill sets to play together.

In order to better explain this thesis, the following content has been divided into sections. First, the background section, which describes the most important reason for people can't play together. This section will also define universal design and how it can be applied.

Second, the case studies section will analyze two popular multiplayer games: Carcassonne and Virus versus Virus. This section will uncover how these games might be inclusive, what might be a problem within the games, and how universal design principles are applied to these games. The first case study, Carcassonne, is the winner of spiel Der Jahres in 2001. This is a multiplayer board game, which allow any combination of player to play together. The second study, Virus versus Virus, is a multiplayer video game that shown a lot when people have gathered together, it is a good icebreaker to play with people you don't know.

Since the iterative design process is really important for game design, and the goal of this thesis is focusing on the multiplayer game design process, after reviewing existing games, a multiplayer game design project is needed. The next section of this thesis will involve
designing and testing a multiplayer game design to confirm if the potential game design principles that been found from case studies section, can help the design to be more inclusive.

The last section covers the general conclusions, and the limitations of this thesis.
2. Background

2.1 The reason for the players can’t play games together
For a better understanding on why some players can’t player together, I researched for the Flow theory.

2.1.1 What is “Flow”?
According to positive psychologist Mihaly Csikszentmihalyi, Flow is the optimal experience, which is a state of complete immersion in an activity. In his book, he described the mental state of flow as "being completely involved in an activity for its own sake. The ego falls away. Time flies. Every action, movement, and thought follows inevitably from the previous one, like playing jazz. Your whole being is involved, and you’re using your skills to the utmost." (Csikszentmihalyi, M, 1990)

2.1.2 What is the connection between “Flow” and game?
In an article called “The Positive Side of Video Games”, it states that, “the primary goal of games is to create entertainment through intrinsic motivation, which is related to flow. Through the balance of skill and challenge the player’s brain is aroused, with attention engaged and motivation high.” (Drpamelarutledge, 2012) Thus, Flow theory can be used in the game design process for fostering an enjoyable gaming experience, which can increases motivation for play games and attract player to keep playing. Because Flow has an important influence in the game design field, a lot of game designers are integrating it into their game design process.
2.1.3 How to stay in the “Flow” zone?
“In order to maintain a person’s Flow experience, the activity needs to reach a balance between the challenges of the activity and the abilities of the participant.” (Chen, J. 2007)
Here is the diagram (Figure 2.1) from Mihaly Csikszentmihalyi’s theory, which can represent when the player can get into the “FLOW” channel and what other emotion will be caused if these two factors are unbalanced.

![Figure 2.1: The Flow Zone](image)

The center point in this diagram is the mean level of the challenged skills. As we can see, in order to get into the flow zone, the player’s skill level has to be equal or greater than the average and must be balanced with the challenges of the activity. The emotions can be differentiated from positive to negative as shown in Figure 2.2. The blue means the most positive emotion; the red means the most negative emotion.
2.1.4 How to satisfy a player’s “Flow” experience in a multiplayer game?
As I mentioned in the introduction chapter, in order to win the game Need for Speed, the player needs skills in reflexes, mechanical control and fast decision-making. As such, the center point in Figure 2.2 presents the average levels for reflexes, mechanical control and fast decision-making abilities that needed are play Need for Speed. The chart will be the same for every game, but the skills and challenges are represented differently. So when three players with varying skill levels play Need for Speed together, their emotions will be different as shown in Figure 2.3.
Through Figure 2.3, we can see when these three players are playing in the same challenge level (A, B or C horizontal line), their emotions are totally different. For example, when player 3, a high skills player, is playing challenge A, he runs into the Flow Zone; but the other two players 1 and 2, with lower skills, are in the yellow and red emotion zone. This means that players are not really enjoying this play experience, while player 3 is. In an article called “why people play games”, author Victor Manrique states that “Playing games is all about fun/Happiness.” So, for the multiplayer game, playing games is about having fun together with other players. Combining with the result from Figure 2.3, players with varying skill levels are difficult to play together, because they cannot having fun in the same challenge.
2.2 Universal design principle

2.2.1 What is universal design?
Wikipedia states that: “Universal design (often inclusive design) was coined by the architect Ronald L. Mace to describe the concept of designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life.” It has been used a lot in the interior design and architecture, but it has not been applied in multiplayer game design field for improving varying players gameplay experience. The basic concept of universal design is making the design to be more inclusive and allowing for a wider range of users to experience it. So for the multiplayer game, if the designer wants a wider range of players to play and enjoy in the multiplayer gaming experience, the universal design principles seems a good guideline for address the design to be more inclusive.

2.2.2 What are universal design principles?
Here are the seven universal design principles that published by the Center for universal design, North Carolina State University, 1997. “**Principle one: Equitable Use.** The design is useful and marketable to people with diversity. **Principle two: Flexibility in use.** The design accommodates a wide range of individual preferences and abilities. **Principle three: Simple and Intuitive Use.** Use of the design is easy to understand, regardless of the user’s experience, knowledge, language skills, or current concentration level. **Principle four: Perceptible Information.** The design communicates necessary information effectively to the user, regardless of ambient conditions or the user’s sensory abilities. **Principle five: Tolerance for Error.** The design minimizes hazards and the adverse consequences of accidental or unintended actions. **Principle six: Low Physical Effort.** The design can be used efficiently and comfortably and with a minimum of fatigue. **Principle seven: Size and Space**
for Approach and Use. Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user’s body size, posture, or mobility. In other words, designs should accommodate variety in people’s body sizes and ranges of motion.”

In this thesis, the term “use” in the universal design principles will refer to “play”, “useful” will refer to “playable and enjoyable”, and “design” will refer to “game”.

The principles are really broad and not specific, it can’t be applied directly into multiplayer game design process. However, it is still possible that these principles can be used as a guideline to develop games that are more inclusive. The principles can also help evaluate if the game is a universal game.

The next section of this thesis includes two case studies. These two multiplayer games are successful examples of inclusiveness but in different ways. In the analysis section of these two studies, I will note if the reasons for them to be inclusive reflect on universal design principles.

“The Principles of Universal Design were conceived and developed by The Center for Universal Design at North Carolina State University. Use or application of the Principles in any form by an individual or organization is separate and distinct from the Principles and does not constitute or imply acceptance or endorsement by The Center for Universal Design of the use or application.”-The Center for Universal Design
3. Case Studies

3.1 Carcassonne

3.1.1 Why choose Carcassonne?
Carcassonne is a tile laying German-style family board game for any combination of two to five players. The original version of it has been released in 2000, designed by Klaus-Jürgen Wrede. It is highly appreciated by the players. Many game players consider it as an excellent gateway game, which can be a great game to introduce to new player. Tom Vasel, a well known podcaster and reviewer of board games, said: “Carcassonne is not only bringing new gamers into the fold but offers fun, tactical depth with a mix of luck”. And Carcassonne is also the spiel Der Jahres winner in 2001, which has to be an easy to learn and has solid gameplay game. Because of its huge achievements in the board game design and the immense popularity, there were over seven official expansions published in the following years (2002-2014) after the first version has been released. All of these are fully illustrated that, the game of Carcassonne succeeds in multiplayer game design field.

3.1.2 How does Carcassonne works?
Carcassonne comes with seventy-two land tiles that are detailed by the actual southern French city, which is famed by its heavily fortified walls and countryside feature. As the start of the game, each player has eight small wooden people in same color, known as meeples; one tile will be placed in the middle of the table as the start point. The youngest player decides who goes first, and then player proceeds clockwise around the table. On each players turn, they will blindly draw a tile; place it directly on the table; and it has to match with the edges of the tile(s) that already on the table; if no legal placement is available, player can discard the tile. Then the player can choose whether or not to place one of their meeples on the tile that has just been placed by themselves, to occupy a feature of road, field, city or cloister. When the tiles complete a city, a field, a road or a cloister, player who owns it will have the score for this area. After all the tiles have been placed on the table, players who have meeple(s) on the table with uncompleted feature, will have the half score for each occupied tile.

3.1.3 Why is Carcassonne successful?
Due to its success in the game design field, a lot of game reviewers already did bunch of incisive and insightful reviews for it. Here is my summary of their efforts. Most of the viewpoints are from Tom Vasel, a well know game reviewer who I have mentioned before.

I’d like to explain it from two aspects: Aesthetic and Gameplay.

The first aspect: Aesthetic

1) **Watching the board grow in the game progress brings huge fun to player.**
During the gaming, players draw and place the tiles together for building of the Carcassonne land. The fun is not only from the satisfaction of each time when they finish the game, looking at the cool map that had been built differently, but also from the significance of each occupied tile that will be counted as the score for each players.
2) The well-designed tiles are of good quality.

The artwork on each tile is varied, and printed in the very high quality cardboard, so when placed on the table they look very nice. The starting tile has a different colored back to allow it to be pulled from the rest.

The second aspect: Gameplay

3) The game is very easy to learn.

The rules in the Carcassonne game are short and simple with full colored illustration. It is not just a very straightforward tile placement game, but the decision in this game are also very basic that will only need a short/simple explanation, then players can pick up on it right away.

4) The game is easy but has deep strategy.

Although the game isn’t have ton of strategy for player, the game do allow for difficult decision-making. The player need to decide if they should finish the city for gain the points, or place it next to another city to attempt to steal some points from other player. The cities are absolutely a keystone of the game. Because player can gain more point by completed a city than other feature. However roads allow player to get some quick point that city can’t.

5) The game has a fair amount of luck.

“There is a fair amount of luck in what players draw, to be sure.”(Vasel,T, 2001) All the tile pieces are different and there is no guarantee that you will get the piece that fits into what you want, so the game can be a bit frustrating by the randomness of luck. However, the luck seems a really important factor for this game becomes playable by any combination of two to five players. For people who are less strategic than others, they can play with others with no barrier by through this random luck. It is a good way to balance the ability of players.

6) The game has a great amount of tension.

When player are searching for a position to place the tile, there is a great amount of tension for every player. Every time when a player draws a tile, every player has to pay attention to
what each person is doing, because every tile placed affects everyone else and no one is playing on his or her own game on side. That is a high level of player interaction.

7) Using expansions meet players’ different needs.

The expansions of Carcassonne brought new ways to play the game, which can keep the game fresh and varied. The new ways are all add to the tile mix and add in some more strategic options. For players who don’t like randomness that much, the expansions will be a better choice. However the basic Carcassonne still has the biggest repercussion.

Figure 3.2 is the comparison chart for Universal design principles and successful factors of Carcassonne. From the chart we can see every individual universal design principle is connected with several factors that make the game successful. And there is one factor even can’t be reflected on the principles. This means the universal design principles can offer goals for game designer to find a way to go but it doesn’t tell what specific rules we can apply for directly achieving the goals.

Figure 3.2 Comparison chart for Universal design principles and Carcassonne
3.2 Virus vs. Virus

3.2.1 Why chose Virus vs. Virus?

Virus vs. Virus is published in 2012 by FlipScript Co., Ltd. It is a multiplayer versus game collection, which has a variety of amusing and frantic creative multiplayer games. The game also has a really high rating in the app store (4.6 out of 5). The app discovery engine, Appcrawlr, did a review summary for this game, which is shown in Figure 3.4.
In the Figure 3.4, we find that the 92% of the reviews for this game are positive reviews. Most of the reviews refer to the good gaming experience of play with others. Such as “best multiplayer game ever”, “fun playing with family/friends” and “nice game for all ages”. However, in the minor pain section, it still has few bad reviews. These reviews can’t completely deny the success part of the game, but it remaining me even through most of the player think the game is good, it still has some problems that made the game not
completely universal. A completely universal experience is difficult to obtain. Despite our best efforts problems will always exist. However, we can use those problems as a cue to improve the next game we design and be closer to a more universal experience. Now let's take a look at Virus vs. Virus.

3.2.2 How to play Virus vs. Virus?
Virus vs. Virus is a combination of mini multiplayer games, and been developed basic on virus character.

Figure 3.5 examples of mini games in Virus vs. Virus
In the game, you can either select play random game(s), or choose to play a certain game. Under the random game mode, the computer will randomly choose game(s) for player to play, so every player won’t know what they are going to play. However, the other option, choose to a game to play, will give players opportunity to talk with others and choose a game that all of them would like to play.

3.2.3 Why is Virus vs. Virus popular?
I think the most important reason for Virus vs. Virus became popular is because it is a collection of games. It means it is a game, but also contains various mini games, which are all easy to learn. Because people like different games, the game collection not only make more players can find and have fun in this game, but also gives player opportunity to find an appropriate game to play with others. This is similar with the reason for Carcassonne’s successful, which is easy to learn, but they are in different ways to achieve this goal.
Since the game pool is limited, the fun the game can offer is also limited. Most of games in this pool require a low level of strategy skills, so for players who enjoy strategy games, this game probably won’t fit their taste. This limitation can also be seen from some of it’s reviews, which we can see from Figure 3.4, such as “little silly”, “wish there are more strategy based mini games”. The game Carcassonne has a success factor of easy but has deep strategy, which is the desire for this game.

Video games have an advantage that board game can’t compete with, it is the effects, both visually and auditory. It gives player instant response of their actions, I think it can let player more concentrate on the gameplay, and have quick sense of how much efforts they will need to put into it, in order to win or complete the game.

### 3.3 Summary of Case Studies
In summary, universal design principles provide goals that can make the game become more universal. But it seems unclear about how it can be used as a guide in the game design process. From what I have learned from these two case studies, the successful factors of easy to learn and play but has deep strategy seems necessary for multiplayer game to be inclusive. In the next section I will attempt to apply these findings to a new game design. In the develop process, I will develop and test a series of game prototypes to determine if varying players experience can be improved.
4. Exploring in the iterative game design process

4.1 Method

Iterative design is a design methodology based on a cyclic process of prototyping, testing, analyzing, and refining a work in progress. It is offering game designer opportunities to going back and fixing things in earlier steps, and created what is sometimes known as the iterative approach.

“In the case of games, iterative design means play testing.” (Zimmerman, E, 2003) “In general, the more times you iterate, the better your final game will be.” (Schreiber, I, 2009) Since the propose of my thesis is helping designers in their game design process, thus, a iterative game design project is needed for taking me closer to the problems.

I have total three times iterative game tests. For the first iterative prototype test, I selected five people for testing if the game works at all. If the game doesn’t work for someone, then it won’t be work for anyone. Based on the result, I refined the game as my second prototype. For the second test, since I played a lot and I am the designer of the game, I supposed I am the highest-level player for play my game, and played with nineteen people. After I got their
feedbacks, I implemented my game for the next prototype. In order to find players that are truly different in their levels of skill for playing my game. I did a series skill tests. Then marched five groups of players for testing my final prototype.

4.2 Game concept creation
In order to iterate, I need to define what the goal is. More specifically I need to identify the game’s Play value: the abstract principles that the game design would embody, which is the parameter for the ideation session. (Zimmerman, E, 2003) As I have mentioned in the second case study of Virus vs. Virus, the video game has the advantage of effects that board game can’t compete with. I decide to design a video game base on the ipad format. Then the first play value for this project is defined as designing a playable and enjoyable multiplayer video game for players with wider level of skills range.

In order to be successful and popular, both of the two case studies are using different ways to make the game easy to learn. And the factor of “easy to learn” is also be corresponded in the universal design principles of equitable play, flexibility in play, simple and intuitive play and perceptible information. I can’t make tons of games in a collection that are easy to learn, I can only make one, then I decided just to design a game. Eventually, a game concept created: using simplest elements, colors, to build a split screen multiplayer video game.
4.3 First prototype, playability test and result

In order to map out the basic game mechanic, I come up with fifteen ideas basic on the play values. After discussing with my committee, I chose one to keep exploring, and programming it for the initial test.

4.3.1 prototyping

*Figure 4.3* is the first prototype. The A area has 42 randomly changing squares. The B area has three different color rectangles. When the game begins, the player in the B area needs to press on a colored rectangle. The player in the A area needs to remember what color the other player has pressed, then find and press it down in his/her area. Player B also can press two or three rectangles at the same time, so the correct color for player A will be the mixed color of what player B pressed. When player in the A area is click on the right color, he/she earn one score. Otherwise, the player in the B area get one score. The player who earned more scores in 60 seconds wins the game. There is no order restriction for this game.
4.3.2 testing and analyzing
The game has to at least woks for someone, In order to work for different people. I randomly chose five people for this fundamental test. For testing if the game works at all. The feedbacks about the gameplay are all negative. The top complaint I heard is about the huge challenge level difference between the two play areas. In this prototype, A area has the higher challenge level. The challenges include: pay attention to the other player’s action, figure out what is the correct color, find the correct color in a large pool which involve a lot of tiny buttons. B area has the lower challenge level. The task for this area is only to press the button(s) to decide what is the correct color for another player. This difference is a big barrier for making the game playable for two people. It is also against with universal design principle one: equitable play, principle six: low physical effort, and principle seven: size and space for approach and play (the buttons were too small to press). As such, the next prototype will balance the difficult levels for two play areas and adjust the button to an appropriate size for improving the playability.
4.4 Second prototype test and result

4.4.1 Refining and Prototyping
For solving the problems from the first prototype, I added shapes as another element to improve the game playability, which is as simple as colors. The second prototype is been built as shown in Figure 4.4.

In this version, both areas have three different shapes (circle, triangle, square) on three different colors (red, yellow, blue). The total 9 shapes are randomly changing in 12 positions. When the game begin, who is the first person pressed on the button will decided what color/shape the other player should press. In order to have score, the player in the A area needs to find and press the color that the other player pressed. No matter this player pressed the wrong or right color. The player in the B area needs to find and press on the shape that player in the A area has pressed. For both of players, when they are pressed on a
right color/shape, the add one score, otherwise, minus one. Who is the person reached the score of ten first, will win the game.

4.4.1 Testing and Analyzing
I played this prototype with nineteen people. Each people played three times after they understand how to play the game. After play, I let them fill out the sheet (Figure 4.5) for evaluate their play experience, and record their performance (win or lose).

![Evaluate your skill level for playing this game](image)

![Evaluate the difficulty level of this game](image)

Please list three words that can describe your gaming experience

_________________  ___________________  ___________________

*Figure 4.5 Game design: Second test questionnaire*

After I finished all the tests, I give score for each level of skill and difficulty, shown at Figure 4.7. Basic on the scores I put all the participants in one Flow chart, which shown in Figure 4.8. Then put the words that they wrote down near their photos, which shown in Figure 4.9. In this chart the players are all over the place, which means they feel differently while they are playing, and the differences are covered both negative and positive emotions. This illustrated that this prototype is not allowing any combination of these participants to play together.
Evaluate your skill level for playing this game

Evaluate the difficulty level of this game

Figure 4.7 Game design: Scoring the data

Figure 4.8 Game design: Second prototype self evaluate data
Figure 4.9 Game design: Second prototype self evaluate and emotion data

Based on the words (Figure 4.9) that participants wrote down, I don’t know how to make a clear match between what they said and the categories of the Flow model. I don’t know how that related. The Flow model predicts what these people experienced. As the chart shown,
almost half of them are located in the left side of the chart. My aim is to move all the participants together to the right side of the chart, which is closer to the Flow zone.

*Figure 4.10* is the words cloud that summarized from the question of “please list three words that can express your gaming experience”. Form it, we can see the word of nervous is really large, this is because this prototype needs high skills in visual perception and reflex, which made the players with low level skills in these areas feel uncomfortable to play.

![Words Cloud](image)

*Figure 4.10 Game design: Words cloud*

For a better understanding of what they are thinking about while they are playing, I asked few questions after the test, such as what make you feel the words that you wrote down and what you want to change for improving your gaming experience. The feedback contains both praise and problems. Form the chart *Figure 4.9*, we can found part of the participants feel the game is really engaging and fun. However, there is still a significant amount of participants have trouble to have fun in the game. The top reason for causing this trouble is the game has not enough strategy for players to slow down and think about why they should take action. This is similar with the fault of Virus vs. Virus, that is offering fun, but not for a wide group of player. And this is conflict with universal design principle one: equitable play.
This means every player should have an equitable experience and all engaged in the gameplay. But the game Carcassonne avoided this problem by adding strategy as well as keeps the game still easy to play. In the next prototype, the strategy will be added to balance the players’ levels. The other complaints are including need time to react for the indirect information, information are spread everywhere, low re-playability, colors are in a high saturation and sounds are too annoying. Most of these reasons are not meet with universal design principle two: flexibility in play, three: simple and intuitive play, four: perceptible information and six: Low physical effort. These problems will be implemented in my next prototype.

4.5 Skill test and result
In order to make sure the variability of my test group and select match people for my next test, I did a series of tests for evaluate participants’ levels of skills for playing my game.

4.5.1 Visual perception test
The first test is a mini game for evaluates participants’ visual perception, which is shown in Figure 4.10. The participants need to repeat the random order under the timer. The faster they can finish the task, the higher visual perception ability they have for my game. Each participant needs to repeat the test three times, the average time will count as their final result.
Figure 4.10 Game design: visual perception test

The Figure 4.11 is the data info graphic for all the participants’ visual perception ability for my game. The participants’ are spread on the 4 seconds timeline, which means their visual perception skills for my game are diverse.

Figure 4.11 Game design: visual perception test data info graphic

4.5.2 Reflex test

Figure 4.12 is the second test. This test is for checking players’ reflex skill for my game. The participants need to click on the blue squares as fast as they can. The more right clicks they have, the better reflex ability they have for my game. The result of this test will be the average click number from three times test.
Figure 4.12 Game design: reflex skill test

Figure 4.13 is the data info graphic for the reflex test. The difference of participants’ reflex levels are also can be seen from it. And from the chart we can see, the participants will higher right click number usually have a higher wrong click number than others.

Figure 4.13 Game design: reflex skill test data info graphic
4.5.3 Preferences test

The next test is a survey that designed for understand participants’ game preferences. (Figure 4.14). In the survey, I ask people to choose one or two game genre(s) they like and one or two they don’t like. After this, they will need to evaluate their skill level for playing these marked games.

Select 1 or 2 your FAVORITE game genre(s) mark by ✓
Select 1 or 2 your UNLIKE game genre(s) mark by ✗
Evaluate your skill level for all the MARKED genres

Can you talk a little bit about why you like or dislike these games?

Figure 4.14 Game design: Preferences test
Figure 4.15 Game design: Preferences test data info graphic

From the research section, we know people likely to play games that provide appropriate challenge for them. It has been supported by test. As we can see from Figure 4.15, the games that each participants like have appropriate challenge for them to play, which means the games they like is not too easy or too hard for them to play. I suppose people will spend more time to play the game if they like, and their skills for playing these games will be improved. So players seems have higher skills for the games they like. Through the chart we also can see the green and red triangles are almost covered all the genres. It proves my test group has various levels of skills.

4.5.4 Matching players
Figure 4.16 Marching participants
Basic on the skill tests of visual perception, reflex and preference, I matched two players in a group. Every group’s two players have relatively large levels difference in at least two of my skill tests. I have totally five groups. In the Figure 4.16, I am comparing each group’s players together for showing their difference.

4.4 Third prototype test and result

4.4.1 Refining and Prototyping

Figure 4.19 is the third prototype I developed for this thesis. By applying the principle of “easy to learn but has deep strategy” that learned from the case study of Carcassonne, the third prototype was designed to allow players use strategy in the game. In this prototype players still can have score of one by click on the right shape or color, but if they click on the right shape or color plus the bonus color or shape will have extra two scores.

From Figure 4.17 and Figure 4.18, players with relatively higher reflex and visual perception skills win more easily during the second prototype test. From the reflex skill test, I found that players have higher right click number than others will also have a higher wrong click number. For balance the varying players reflex and visual perception skill levels, the life limitation added in this prototype. In the last version, when player click on the wrong button, their score will be minus one. The wrong click won’t directly make them lose the game. However, this version won’t allow too many mistakes. When player click on a wrong button they will lose one life from the totally five lives that each of player has.
Figure 4.17 Reflex and Performance

Figure 4.18 Visual perception and Performance

The visual and audio are all implemented based on the opinions from the last test, for closer to the requirement of universal design principle one: Equitable play, principle two: flexibility
in play, principle four: perceptible information and principle seven: size and space for approach and play.

![Game design: Third prototype](image)

**Figure 4.19 Game design: Third prototype**

4.4.2 Testing and Analyzing
This prototype tested with the five groups of participants that been matched after skill test section (*Figure 4.16*). By applying the same analyzing method that deal with the second test, I figured out a new Flow chart. *Figure 4.20* are the two Flow charts from the last test and this one.
As I mentioned in the second prototype test, my aim is to move all the participants together to the right side of the chart, which is closer to the Flow zone. The charts shown that after the changes, the game pushed the players closer in the center of the chart. Even through they are not perfectly in a zone, the trend is illustrated the changes I did for this version have the ability to balance the players’ levels of skills (pushed participants closer in the chart), and then offer more possibilities for various players to play together. Problems still exist in this prototype. As shown in the Figure 4.20, players are mostly not in the Flow zone, which I need to test for more times to balance the need from varying players.

4.5 Summary
The game is unfinished, but the prototyping, testing, analyzing and refining cycle of iterative design process was successful, because at each stage I clarified exactly what I wanted to
test and how. And letting participants written questionnaires and video records their behavior.

Through the iterative design process, I found the problems from each prototype are all related to not satisfy with universal design principle. And universal design principles truly didn’t tell me how to build an inclusive game, but it gives goals for me to use my own knowledge to pursue. These goals are needed and necessary for leading game to be more playable and enjoyable for a wider range of players to play together.

Easy to learn and play but has deep strategy is the principle found from the case studies. The importance of this principle for improving the game’s inclusiveness also had been supported by my tests. It can be seen from the comparison of tests’ result, which clearly shows the participants are getting closer in the Flow chart after refining. So I believe “easy to learn and play but has deep strategy” is an important factor for a game become more inclusive.
5. Conclusions

The multiplayer games that can allow a wider range of players to play together are in demand. Games like Carcassonne and Virus vs. Virus are on their way to meet the need of inclusive games. Because there are various problems game designers are facing in their game design process, it is really hard to summarize a method for teaching them how to solve all the problems. However, we still can find something for guiding the multiplayer game design to be more inclusive.

Through my studies and tests, I found universal design principles could be criteria for evaluate if the game is going to be an inclusive game. It can be used when game designers are working on an inclusive multiplayer game design project, especially when they facing problems after each iterative test. The universal design principles could ensure all the problems are being solved in the direction of making the game more inclusive. Because universal design was first used in architect and product design, its scope is limited. So more finding are needed for built a better inclusive multiplayer game. The principle of “easy to learn and play, but has deep strategy” is found from my case studies and been supported by my test. I think it can help game designer to narrow down the game concept, and then make wider range of players equal to play (push players closer in the Flow chart). I also believe this finding has the penitential ability to not only push players to play together, but also going to the optimal Flow zone, which I don’t have time to prove.

My hypothesis, by applying universal design principles to the multiplayer game design process, would develop a game that could become more inclusive and allow for players with
a wider range of skill sets to play together, is partly been approved by my process. Because through my process I find universal design principles are benefit to my design process, but it can't work alone by itself to help me develop a game that inclusive.

This thesis has some limitations. First, the number of participants is far away from the requirement of the usability test. Second, my programming skill is limited, which made me can't test with the most ideal concept. Finally, the Flow theory is the parameter of this thesis, but it is not the only thing can make game successful. As such, my findings are not very inclusive.

Through my test process, I feel there are more penitential rules or principles that we can find for helping the inclusive multiplayer game design process. Those are fair amount of luck, dynamic difficulty adjustment and negative feedback loop. Since I have difficulty to connect these factors to my test, I just mentioned it here. For someone who wants to keep exploring how to build an inclusive multiplayer game, I think these probably will be a good start. It is worth to have a more research in the future for giving a clearly guide for game designer to make more inclusive games.
Reference


