Exploration of Board Game Design and Development

An Honors Thesis (HONRS 499)

by

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Abstract

Games fill an important role in our society. They not only provide entertainment, but they also allow players to practice skills without fear of failure. After taking some time to learn about the game development process I designed my own game. I began by creating a few small prototypes of different game ideas and then chose one to refine further. The process taught me about iterative design, project management, and creative problem solving. The outcome of my project is a working game called Founders, complete with rules and components, that is of high enough quality to be submitted to a games publisher. Founders is a resource management and deck building game for two players. The process of refining Founders had its ups and downs, which I reflect on in a game-industry style commentary of what went wrong and what went well.

Acknowledgements

Thank you to Dr. Paul Gestwicki for advising me in this project. His advice and guidance was invaluable, not only in this project but also in the entirety of my college career.

Thank you to David Rickey for supporting me and helping me throughout the game design process, and in every other part of my life.

Thank you to my mom and my fellow Virginia Ball Center students for playing my games and giving me valuable feedback in order to improve them.
Author’s Statement

Raph Koster, game designer and author of *A Theory of Fun for Game Design*, describes games as “puzzles to solve, just like everything else we encounter in life. [...] The only real difference between games and reality is that the stakes are lower with games” [10]. Games serve a very important role in society. Far from being just modes of entertainment, games provide opportunities to acquire and practice real-world skills without the fear of failure. Koster explains that a relationship exists between fun and learning. As humans we enjoy discovering and learning new patterns, whether that pattern is learning to play an instrument or comprehending a complex math formula. Games allow us to experience the fun of learning a new pattern in a safe environment.

I have always enjoyed playing games. From the hours spent playing *Sonic the Hedgehog* [11] with my mom and brother when I was younger, to the nights spent playing *Dominion* [3] with my friends in college, games have long been an important part of my life. My sophomore year I had the opportunity to participate in an honors colloquium focused on creating a game about General John Hunt Morgan’s raid through southern Indiana [5]. Our goal was to design an experience that would allow elementary students to immerse themselves in the history of Morgan, rather than just read one paragraph about him in their history books.

Board games may seem completely separate from my Computer Science degree, but the two have more in common than it seems. When designing a video game, actually creating a computer version can take extensive amounts of time. Programming a video game requires that it be designed and then implemented, which is like making the game twice-- once in abstract and once in code. Programming just the basic components for a video game takes a lot of time. Most times it is possible to take the idea for a video game and create a board game version. That board game is then used to work out some of the problems with the concept, before any time is spent creating the program code. It is much easier to tweak and change a paper version of a board game than to change code that took hours and hours to write. Many prominent game design books, including *The Art of Game Design* [6] and *Game Design Workshop* [12], strongly advocate physical prototyping.

From the Morgan’s Raid experience, and other projects I have worked on so far, I have found that the process of design and development for board games has a lot in common with design and development of computer games or other software. One popular software and video game design process, the agile methodology, advocates iterative design, upfront planning with room for change, and simplicity [1, 7]. All of these ideas line up with the process of creating a board game. The purpose of my project was to help me better understand the tasks involved in designing and developing software, on a smaller scale. Designing a board game has also helped me develop my creativity as well as problem solving skills. It has also given me experience working against a deadline to create a finished product.

Ian Schreiber, noted game designer and author of “Game Design Concepts: An experiment in game design and teaching”, ends the first lesson of the Game Design Concepts course with an activity [4]. He asks participants to create a race-to-the-end game containing just
a path, a theme, and a set of rules for movement. This activity is meant to last no more than fifteen or twenty minutes. At the end of the activity, Schreiber explains the intent behind the activity:

If you take away nothing else from this little activity, realize that you can have a playable game in minutes. It does not take programming skill. It does not require a great deal of creativity. It does not require lots of money, resources, or special materials. It does not take months or years of time. Making a good game may require some or all of these things, but the process of just starting out with a simple idea is something that can be done in a very short period of time with nothing more than a few slips of paper [4].

Schreiber's assertion that games can be created with nothing more than paper is the essence of paper prototyping. Paper prototypes are not meant to elaborate or beautiful. The purpose of a paper prototype is to create something, learn from it, and then throw it away and create a new, better prototype. Each iteration, or small change in the game, builds upon the previous prototype. This process is repeated, changing and molding the game idea on each try, until the result is a game that is worth spending the time to produce.

Paper prototyping goes hand in hand with another process known as playtesting. Playtesting involves putting the prototype in front of the target audience and seeing their reactions to playing it. It is a rigorous process meant to find errors in the game concept and mechanics. It is important to have a specific question in mind when iterating on a prototype, such as how a different board layout will affect game play. These questions can be answered through playtesting. In the Morgan’s Raid project our team focused one prototype iteration on refining the size of text shown in the introduction. In the following playtest we specifically looked at how readable the audience found that text, so we would know whether or not to enlarge it. The feedback gained from playtesters is invaluable in refining any game design. Playtesting is repeated for every iteration throughout the entire process of design and development in order to create the best possible product.

My project began with a series of small prototypes and playtests. The first prototype I created, with input from three of my classmates, was called Mall Dash (see appendix B). This game was designed as part of an exercise during my class at the Virginia Ball Center. Our instructor told us to create a game based on the theme of beneficence. My group decided that we would focus on charitable giving as an act of beneficence. The four-player game was set on a grid laid out to resemble a mall, with stores around the edges and small kiosks in the middle (see Fig. 1). Players took turns moving around the board, visiting stores to collect donations for a service project. The whole game was on a time limit of five minutes, so the play proceeded very quickly. It was to the player’s advantage to move and complete their turns as fast as possible.
While the playtesters enjoyed this game, there was not much substance beyond the desire to outrun and outscore your opponents. The decisions involved in game play were minor, and the time limit meant there was no opportunity to carefully plan out a good strategy. Even though the game appeared fun, I knew it was not a game I wanted to pursue more fully. There were too many fundamental design flaws for me to be confident I could turn it into a working game. I only created one iteration of Mall Dash before I decided it was not worth it and moved on.

My second prototype had a paleontology theme (see Appendix C). The two-player game involved players managing resources in order to collect fossils and put them on display in a museum (see Fig. 2, 3). This game appeared to have a lot of potential. The decisions involved in the game were meaningful and fun. There were multiple paths to victory and success required careful thought. I completed three iterations on the game, adjusting the mechanics each time based on the feedback of my playtesters. At the end of those iterations, while there were still things I wished to fix about the game, I was happy with the progress I had made.
Only one thing disappointed me about the paleontology game. It was almost an exact copy of another game I enjoy, Agricola\cite{13}. While my version had a completely different theme, for the most part the mechanics were the same. The concept of reusing ideas but in new situations is nothing new for game design. Koster gives examples of many games that may look different but that all boil down to the same exact mechanics \cite{10}. Daniel Cook, game designer and Chief Creative Officer at Spry Fox, states, \textquote{It is a common practice to include individual mechanics inspired by previous games\cite{2}.} He goes on to say, however, that the industry practice of \textquote{90% familiar, 10% fresh} is plagiarism and the result of lazy designers. He believes that \textquote{the early stages of copying are an essential process that all students of game design should undertake}, but that professional games should be much more original. Despite the fact that I am still a student, I did not want my game to be just a copy of someone else’s hard work. For this reason I decided to leave the paleontology game where it was and continue prototyping more ideas.

My third prototype was a two-player card game called Founders (see Fig. 4) where players managed resources to construct new buildings in a town they controlled (see Appendix A). The goal was to build the most advanced city, achieved by constructing a university. I chose to have the game themed around building a city because I liked the idea of deck building as a means of building some other resource. The idea of a university being the highest achievement stemmed from my belief that learning is essential to any civilization. The resources involved in Founders took the form of workers — bakers, smiths, carpenters and masons. These workers were used to purchase and construct buildings, which each gave the player some benefit. The benefits ranged from increased hand limit to points.
After two iterations, and many times playing through the game, I felt confident that this idea could be turned into something worthwhile. While there were still quite a few defects with the design, it seemed that the mechanics worked well. There were plenty of decisions for the players to make, and those decisions appeared to be meaningful. At this point I was pretty convinced that this game was the idea that I should move forward with. Just to be sure though, I wanted to make one more prototype of an idea that had been slowly forming in my head throughout the project.

My fourth prototype was a two-player dice game with a space theme (see Appendix D). Players each controlled a spaceship and used dice to upgrade the various parts of the ship (see Fig. 5). The goal was to fight and destroy the opponent’s ship. Players took turns rolling dice to enhance an attribute of their choice -- attack, defense, health and technology. These attributes determined the results of each combat.

While simple, the game was quite fun. It was entertaining to race your opponent to level up the attributes, and satisfyingly frustrating with the dice rolls did not land in your favor. However, playtesting quickly uncovered a large flaw in the design. Once both players had fully upgraded their ships, if no winner had been determined by that point then the game basically came to a draw. Even after iterating multiple times on the design, I could find no good way to stop this from occurring. After realizing that the spaceship game was not going to work, I felt ready to return to Founders and focus on refining it to production quality.
My refinements of Founders came mostly in the form of balancing costs. The initial values were an educated guess on my part based on how important each worker or building was to winning the game. A few playtests in it became apparent that the costs needed reworked. Each iteration included small changes to the costs of various cards, which were then playtested to determine effectiveness. Other refinements included removing certain workers and buildings that were either too powerful or not worthwhile. I also spent a good amount of time redesigning the building cards to be both clear and compact.

I spent around a month at this stage of my project. Each change I made was playtested and each playtest revealed more changes that should be made. As with many other types of projects, the concept of being done with a game design is very subjective. Eventually the game has to be finished or it can never be released. The process of improving and balancing can go on forever, but there are diminishing returns. Often games are released and then updated later when further refinement has occurred. Video games can be updated for as long as someone is willing to continue improving them. Even board games, though harder to update once they’ve been printed, sometimes include rule changes and improvements in newer versions of the given game. Similarly, at some point in my project I just had to decide that I was happy with how my game had turned out, even if there were still improvements that could be made.

After many iterations of Founders I decided that it was done. From then on I focused on reflecting back over the process. UBM TechWeb publishes postmortems for many major games through their outlets Gamasutra and Game Developer Magazine. Postmortems are descriptions
written by someone involved in the game design and development process about what went right and what went wrong during the project [14]. I decided to write a postmortem for Founders as a way to expound upon the challenges I faced while creating the game.

What Went Wrong

1. The mechanics not producing the desired effect.
   In my experience, it is easy to create a game that is playable, but much harder to create a game that is fun. When designing Founders, I started out with two mechanics that I enjoy from other games -- deck building and resource management. When done correctly both of these mechanics create fun games, as *Dominion* [3] and *Settlers of Catan* [9] can attest. It seemed to me that if I could combine those mechanics, the resulting game would also be fun. While I do think that is still possible, Founders does not achieve this result. All of the mechanics work, but the game just is not fun. The game play is repetitive and uninteresting and leaves something to be desired. I spent the last few iterations on the game trying to find the right balance, but nothing I came up with worked. At some point I was forced to acknowledge that Founders just wasn’t going to be fun. Even though that is disappointing, I do not consider it a failure. Every attempt at game design better prepares me for the next, no matter the outcome.

2. Having too large of a scope.
   The original design for Founders included a few more specialty workers, a couple more kinds of buildings, and four other large university-type building projects. With five large buildings to choose from, the end condition of the game was someone building three of them. I had plans for each type of building to offer some different benefit to the player. The ability to go down multiple paths towards victory appealed to me, and I used variety of buildings as a means to that end. On the very first play-through it was quickly apparent that the game would drag on too long. Aside from costs being unbalanced at that point, the end condition was too lengthy and the intermediate game play not interesting enough to counteract that length. There just was no good reason to have so many different kinds of buildings. Not only did they add redundancy to the game play, but also it was just that much more work for me to come up with unique abilities for each type of building. If I had stuck to the original plan I would not have had time to refine the mechanics as much as I did.

3. Not having enough cards.
   After cutting back my scope I realize that the game no longer contained enough cards. It was possible to win the game using only three of each type of basic worker. That means that a player’s deck could include as few as twelve cards. When the hand limit got increased to five cards this meant it was necessary to shuffle every two to three turns. Working with such a small number of cards was not very satisfying. Cutting back the
scope of the game was definitely the best decision I could make for the project, but it did not come without consequences. Removing a number of cards from the game left only the bare minimum workers and buildings. My original designs for other buildings could have added more decisions to the game, removing the simple strategy I mentioned before. Adding benefits to each type of building might have added more weight to the choices made by players. The final version of Founders feels too small and limited, which I think lowers the entertainment value.

4. Having a simple strategy.
   
   My goal for Founders was to include enough different types of workers and buildings that players could choose what strategy to employ on their path to victory. After playing through a number of times, though, a very simple strategy emerged. It always seemed that the quickest way to win was to focus on buying only the number of buildings and workers needed to begin building the university. This allowed the construction of buildings along the way, such as one of each victory point building in order to increase the hand limit, but for the most part the focus was entirely on the university. In this strategy there was almost no reason to buy specialty workers. This failure seems to stem from the end condition necessitating that the university be built, but also from a lack of benefits provided by other actions.

5. Not completing enough iterations.
   
   I have so many ideas for improvements to Founders. Each time that I play it I think of something that should be changed or added in order to enhance the play experience. Due to the nature of my project, however, there just was not time to complete as many iterations as I would have liked. As I mentioned before, at some point I just had to decide I was done enough. Although I am happy with how the game turned out, I know that it could be better. While I have no aspirations to become a game designer, I do think it would be fun to continue refining Founders at some point in the future. Perhaps then I would find the right changes to turn a good game into a great game.

What Went Right

1. Cutting back the scope.
   
   My solution to having too large of a scope was to cut out four of the large buildings. The end condition changed from constructing three large buildings to constructing the last piece of the one remaining large building. This simple act of removing some variety made all of the difference. The game went from being too large to handle to being a reasonable size to complete in one semester. While I was sad to see some of the variety go I know it was for the best. The reduced length of the game was a huge improvement, and I had more time to focus on refining what variety was left.
2. Creating a new type of game play.

At the start of this project I took a lot of time trying to decide what kind of game I wanted to make. My first few ideas were all over the place. After working on a few prototypes I realized that I wanted to do more than just put a new face on an old game. My paleontology game did just that, and while it was fun the result was unsatisfying. I wanted to create a new kind of game. To that end, I decided to focus on two specific mechanics that some of my favorite games employ when designing Founders—deck building and resource management. I combined these mechanics hoping that the result would be something different from either of them. The result of this combination was Founders. I can definitely say I have never played a game quite like Founders. For better or for worse, the feeling of creating a new game is priceless and very worthwhile.

3. Iterating on the costs of workers and buildings.

The costs for workers and buildings in the original game design were the product of educated guesses. I chose values that seemed reasonable, with more valuable buildings requiring more workers to build than ones that were not worth points, and the workers associated with those buildings costing more than the starting workers. After just one play through it was apparent the costs did not work. At one point in the play through it became impossible to progress further because of how many workers required to construct certain buildings. Throughout the prototyping process I was constantly adjusting the costs. I tried to find a balance between always being able to move forward and being challenged to spend resources well. Revising the costs helped determine the flow of the game. The original design’s costs would have stretched the game out, if it could be finished at all. The revised costs allow the game to be played in around 20 minutes, which seems to be a good length for the mechanics.

4. Iterating on the physical pieces of the game.

All of game design is an iterative process. The physical pieces are no exception. My first iteration of Founders included individual cards for each level of building (see Fig. 6). When upgrading the player would take the new card and lay it on top of the old building. This setup meant there were a lot of cards. Also, the buildings were labeled by level to indicate how many workers they could hold. It was confusing to see a level one building and remember that it could hold two workers. The next iteration of the cards exchanged the level number for a number indicating how many workers the building could hold. This eliminated the confusion but did not reduce the number of cards in any way. For the final iteration I wanted to somehow combine all levels of a building into one card. My inspiration for the design came from Rivals for Catan [8], where the resource cards are turned to indicate how many of the corresponding resource a player has (see Fig. 7). This card design perfectly addresses the issues the previous design had. The building cards now have all levels on a single card, which is turned to indicate what level
the building currently is (see Fig. 8). The process of changing the card design based on
playtesting was very helpful and I ended up with the perfect design for the mechanics. I
never could have reached that point if I had just kept the original card design. This
experience just shows how important it is to iterate on all parts of a game design.

Figure 6 - First Iteration of Founders Buildings

Figure 7 - Rivals for Catan Card

Figure 8 - Final Building Design

5. Including specialty workers.

I am very glad that narrowing the scope of my game did not require me to cut
specialty workers from the design. From the start I liked the idea of incorporating some
way for the players to perform special actions. Specialty workers provided an outlet for
all of the game ideas that I liked but could not implement more substantially. Some
abilities associated with the specialty workers were changed or reduced over time, to
conform to other changes made, but the basic idea stayed the same throughout the design
process. I iterated on and tested many ideas for how players would gain specialty
workers, including being able to buy specific workers, but in the end I settled on drawing
two workers and choosing one. Eventually I added the rule that specialty workers were
worth one victory point, to encourage their use. I think that the specialty workers added
necessary flair to the Founders design, and I am happy that the idea survived all of the
changes I made.
This project taught me some very important lessons, and reinforced a few that I already knew. From my experience on the Morgan’s Raid project I knew that game design was hard. Coming up with a game idea is easy, but putting that idea into action takes effort, creativity, and perseverance. This project was no different. Finding solutions to the problems revealed by playtesting required creative thinking. At times I succeeded in fixing the issue, but at times I failed. While my failure was disappointing, it only reinforced the idea that failing provides an opportunity to learn. Without failing there is nothing to base change, and therefore learning, on in the future. The more I worked at improving the games the better I got at it, even if my changes weren’t always for the best.

I learned how hard it can be, and how necessary it is, so stick to a schedule. I could have worked on refining Founders for months and still found things to improve, but being on a schedule helped me determine at some point that I was done enough. This concept is hard to grasp but seems to have far reaching consequences. Everything in life could always be better, but the important thing is to find a point where you’re happy and let the rest of the problems go.

Finally, I learned that I am capable of creating a game. The other game design projects I was a part of involved a number of other people. While I was deeply involved in the decisions of those projects I was not the sole designer of the games. It is one thing to help design a game as a group, and quite another to design a game with the help of only one other person. David was extremely helpful whenever I got stuck trying to fix parts of the games, but even he was only there as a support. The majority of the game design work was my responsibility, and I am proud of how well my first solo game design attempt went.
Appendix A: Founders Rules

**Founders** is a two-player card game where players race to create the most advanced town by constructing buildings, hiring skilled workers, and establishing a university.

- **Players:** 2
- **Time:** 20-30 minutes
- **Age:** 10 and up
- **The goal of the game is to build a town worth more victory points than your opponent’s town. Each player’s town consists of buildings that either house workers, produce victory points, or both. During the game players take turns hiring workers and constructing new buildings in their towns.**

**Contents:**

<table>
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<tr>
<th>#</th>
<th>Card</th>
<th>Ability</th>
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<tbody>
<tr>
<td>12</td>
<td>Baker</td>
<td></td>
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<tr>
<td>10</td>
<td>Carpenter</td>
<td></td>
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<tr>
<td>10</td>
<td>Smith</td>
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<tr>
<td>10</td>
<td>Mason</td>
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<tr>
<td>2</td>
<td>Arsonist</td>
<td>Burn down one unprotected building.</td>
</tr>
<tr>
<td>2</td>
<td>Alchemist</td>
<td>Put one worker from discard into its building.</td>
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<tr>
<td>2</td>
<td>Deserter</td>
<td>Count one of opponent’s workers towards building.</td>
</tr>
<tr>
<td>2</td>
<td>Mercenary</td>
<td>Discard a random card from opponent’s hand.</td>
</tr>
<tr>
<td>2</td>
<td>Chef</td>
<td>Double production of workers in a single building.</td>
</tr>
<tr>
<td>2</td>
<td>Architect</td>
<td>Count as any two builders.</td>
</tr>
<tr>
<td>4</td>
<td>Bakery</td>
<td>Home of Baker</td>
</tr>
<tr>
<td>4</td>
<td>Sawmill</td>
<td>Home of Carpenter</td>
</tr>
<tr>
<td>4</td>
<td>Forge</td>
<td>Home of Smith</td>
</tr>
<tr>
<td>4</td>
<td>Workshop</td>
<td>Home of Mason</td>
</tr>
<tr>
<td>2</td>
<td>Tavern</td>
<td>Home of Specialty Workers</td>
</tr>
<tr>
<td>10</td>
<td>Cabin</td>
<td>1 VP, increases hand limit by 1</td>
</tr>
<tr>
<td>8</td>
<td>Store</td>
<td>3 VP, increases hand limit by 1</td>
</tr>
<tr>
<td>6</td>
<td>Monument</td>
<td>5 VP, increases hand limit by 1</td>
</tr>
<tr>
<td>2 each</td>
<td>University 1 -3</td>
<td>3 VP</td>
</tr>
<tr>
<td>1</td>
<td>University 4</td>
<td>5 VP. Game ends when built.</td>
</tr>
</tbody>
</table>

**Set up:**

- Each player gets their own stockpile of basic workers - bakers, carpenters, smiths, and masons. These cards are placed face up to the side of the player, sorted into piles based on their type (see Fig. 1).
- All building cards go face up in the center, shared stockpile. Specialty workers are all shuffled together into one pile, which is placed face down in the shared area (see Fig. 2).
- Each player starts with a town consisting of one “Bakery 2” and one “Sawmill 2”.

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- Each player begins the game with a few workers in their deck - three bakers, one carpenter, and one smith. These are shuffled together and placed face down near the player.
- Leave space for a discard pile near each player (see Fig. 1). When workers are used or left in a player's hand at the end of a turn they are placed face up in the discard pile.
- The starting hand limit is two cards. Various buildings will increase the hand limit throughout the game.
Play

- On your turn you can:
  - Place worker in corresponding building to be used later.
    - Each kind of basic worker can be placed into a specific building to be saved for later use.
    - Specialty workers may all be placed in the Tavern to be saved for later use.
  - Use workers to hire a new worker, build a new building or upgrade an existing building.
    - To hire a basic worker, pay the cost listed on that worker's card. The worker is then placed in the player's discard pile.
    - To buy a specialty worker, use four bakers, draw top two cards from specialty worker pile. Pick one of these workers to place in your discard pile, and then return other to bottom of specialty worker pile. Each specialty worker in your deck is worth one point at the end of the game.
    - To build a building, pay the cost listed on that building's card. Place building in player's town, with the lowest numbered heading at the top. The number indicates how many workers may be housed in the building at a time. The layout of your town does not affect game play.
    - To upgrade an existing building, if that building is not already at its highest level, pay the cost listed by the arrow on the building. Turn the building in the direction of the arrow so that the next higher number is shown at the top of the card.
  - These actions may be taken in any order, and any number of times, as the player's hand of cards allows.
  - At the end of your turn:
    - Discard any workers left in your hand face up into your discard pile.
    - Draw back up to your hand limit. If there are not enough cards in your deck to draw the correct number of workers, draw as many workers as possible then shuffle your discard pile and continue drawing until you have the correct number of workers or your deck is empty.
  - The game ends when one player builds the level 4 University building. Players then count the victory points gained from all of their buildings and specialty workers. The player with the most points wins.

Specialty Worker details

- Alchemist - Put a worker from your discard into its corresponding building. This can be used on a worker previously played in the same turn.
- Deserter - Count one of opponent's workers towards your building costs this turn. That worker does not leave its building.
- Mercenary - Randomly discard one card from your opponent's hand.
- Chef - Doubles production of workers in a single building.
- Architect - Counts as any two builders.
• Arsonist - Burn down one of your opponent’s buildings. The burned building is turned over. All workers inside are left under the turned card and cannot be used until the repair cost of the building is paid.
  o If a player’s last cabin, store, or monument is burned, that player must place cards from her hand on top of her deck, in any order, until she has reached the lowered hand limit.
  o If part of a player’s university is burned, that player cannot continue building onto it until that part is repaired.
Appendix B: Mall Dash Prototype

Mall Dash

- 2 - 4 players
- Players race against the clock, taking turns visiting stores in the mall to collect donations for a charity.

Setup

- Place the number of dice indicated in each store. Place three kiosk tokens on outer kiosks and four kiosk tokens on inner kiosks. Player tokens go in indicated spaces. Play begins by starting the five-minute timer.

- The person with the most money in their pocket goes first. If that fails, just roll a die to determine first player.
- Each player can take two actions during their turn.
- Actions include:
  - Move one square orthogonally.
  - Roll dice to collect money in a store.
    - To collect money in a store, roll the dice that are currently in the store. Add the total shown on the dice and add that many dollars to your scorecard. Return all but one die to the store. Place your color piece in the store to signify you have visited the store. You may not collect donation there again.
  - Collect money from a kiosk, located in the center of the board.
    - To collect money from a kiosk, take all of the money tokens present and place them on your scorecard. Each token is worth $2.
- Game ends when the timer goes off, after five minutes. Play continues until everyone has had the same number of turns. The player who collected the most donations wins.
Appendix C: Paleontology Prototype

Paleontology

- 2 players
- Players take the role of a paleontologist, collecting fossils for museum displays and writing research papers.

- Each person starts with two assistants, who will be assigned tasks to complete. As play progresses there will be opportunities to hire new assistants in order to take more actions.
- Players take turns selecting an action for the assistant to complete and receiving the results of that action.
- To assign an assistant to an action, place the assistant’s token on the action card.
- Players cannot take actions that already have assistant tokens on them.

![Figure C1 - Paleontology Play Area](image)

- The game has five rounds, each with a different number of phases. A phase is the process of each player placing all of his or her assistants. At the end of each phase, assistant tokens are returned to their player.
  - Phases are as follows:
    - Round 1 - 3 phases
    - Round 2 - 3 phases
    - Round 3 - 2 phases
    - Round 4 - 2 phases
    - Round 5 - 1 phase

- At the end of every round you will be paid for any fossil exhibits you have created. You also must pay two tokens for each assistant you have.

- At the start of the game only a few basic actions are available. Each new round brings more possible actions to the table.
- Actions include:
  - Writing research papers
  - Digging for fossils
  - Requesting grant money
  - Presenting findings
- Creating fossil exhibits
- Upgrading tools
- Hiring new assistants
- Gaining the first player advantage.

- Game ends after the fifth round is complete. The player with the most money wins.
Appendix D: Spaceship Prototype

Spaceship

- 2 Players
- Each player controls a spaceship. The goal of the game is to destroy your opponent’s spaceship.

- Spaceship Stats:
  - Health: Max number of dice that the player may roll. Takes effect at beginning of turn. I.e., if you started your turn with 4 health but you repaired your ship, if you were later attacked you would still only be able to roll 4 dice in defense.
  - Technology: Max number of dice you may roll to repair or upgrade other stats.
  - Attack: Max number of dice you may roll to attack your opponent.
  - Block: Max number of dice you may roll to block opponent’s attack.

- Game Turn:
  - Play phase card face down. When both players have selected, simultaneously reveal selected phase.
  - Carry out actions in order listed on Spaceship mat. You only take the action you chose. If both players choose attack, the oldest player attacks first. Even if a player is knocked to zero health during a turn, you still complete the action selected for that turn.

- Phase actions:
  - Attacking and blocking: Players roll the number of dice showing on corresponding stat. Each 5 and 6 is an attack/block. Any attacks that are not blocked deal damage to ship, lowering health by 1 each.
  - Repairing: Roll number of dice shown on Technology stat. Each 5 or 6 repairs ship health by 1.
  - Upgrading: Roll number of dice shown on Technology stat. If any rolled dice are higher than your current stat then you upgrade that stat by 1.

- Game ends when one or both players have 0 health at the beginning of a turn. Last player standing wins. In the event that both players die in the same turn, it is a draw.
Works Cited


