The Worker Bee's Dilemma: A Game to Encourage Collaboration

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Abstract

This game is intended to create a condition of forced collaboration between two players. If the players follow the rules, the game cannot be completed unless the opponent, or teammate, successfully completes his or her side of the puzzle. To achieve a win-win outcome, it is necessary for the players to find a way to communicate and describe the difficulties they are encountering throughout the game. The possible outcomes of the game are lose-lose, win-lose, and win-win.

Keywords
Collaboration; negotiation; sensory problem solving; 3D puzzle; teamwork; Prisoner's Dilemma; control; communication; descriptive language; win-win; win-lose.

Introduction

The goal of this game was to create a physical toy that demands participation of two players. In order to achieve a win-win outcome, both players must complete their task successfully. Control is lost periodically to the other player, and it is necessary for the players to verbally communicate.

The name of the game is derived from the honeycomb appearance of the frame, and borrowed from the classic Prisoner's Dilemma, although the game is certainly not a direct example or representation of it. In this case the players must decide, at the beginning or during the course of the game, if they want to aim for a win-lose or a win-win outcome. In a win-lose scenario, there is one continuous path built on the board, and the marble lands on one of the player's trays. In a win-win scenario, the players work together to build two continuous paths that result in both players receiving a marble.

In the 10 user tests, sometimes the players did not achieve their goal. The failures would be a path that did not reach either tray, with the marble getting stuck somewhere along the way, or the players would build one successful path but fail to build a second path to create two winners.

The pieces are opaque and the paths inside them are hidden, requiring the players to pick up and analyze the pieces with their hands. The game could theoretically be played without sight at all. Additionally, as the game progresses the board becomes more opaque. This forces the players to communicate verbally rather than with hand gestures, facial expressions and other physical cues.

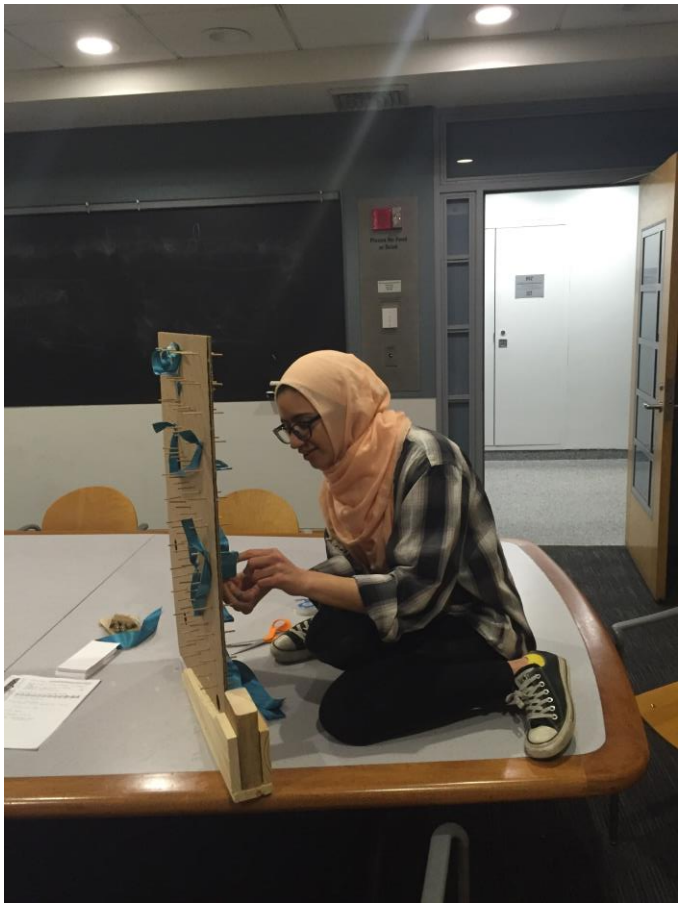

Fig 1. The first prototype

The Object

The first iteration of the game was an upright cardboard "wall" lasercut to accept short pegs spaced at two inch intervals. This created a grid that was interrupted periodically with larger holes. The goal of the game was to construct a path for the marble using miscellaneous materials, and the players were instructed to feed the marble through the board as many times as possible. This initial object was unsuccessful and was never developed highly enough, with suitable materials, to enable the marble to follow the path. I decided to create a high-fidelity 3D model, and used consultations with my peers as a replacement for user testing prior to fabricating the object. There should have been a middle ground of testing with a lower-fidelity object. The result was that the user-tests were all performed using the very carefully crafted final object. Fortunately, the game is in pieces that could be re-used and re-purposed to many possible future iterations, as long as the dimensions of the hexagon are preserved.

Fig 2. The final prototype's frame

The object consists of a frame, base, and pieces. The frame is CNC milled hardwood, a grid of hexagonal throughcuts. This is resting in a base which serves to stabilize the frame and collect the marbles once they fall. The pieces are ZCorp 3D prints, which allowed for the intricacy of the interior tubes. The pieces could theoretically be made out of wood, but this would require a massive amount of labor.

The hexagon was chosen for the shape of the pieces because it offers a maximum amount of organizational possibilities arising from the orientation of the faces. The pieces look identical, and the players must pick them up and examine them to determine what happens to the marble when dropped in to that piece.

There are four larger hexagonal holes in the frame which accept "passage" pieces that bring the marble to the opposite side of the board. The organization of the frame demands use of at least two of these pieces which ensure that the players will lose control of the marble at some point.

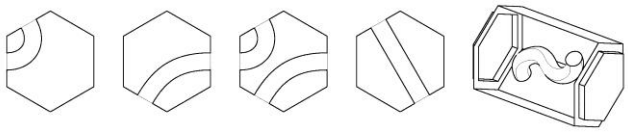

Fig. 3 the paths created by the 3D printed pieces

User Testing

10 rounds of user testing were completed using the high-fidelity model. Of these, 6 games had a win-lose outcome, 3 games had a win-win outcome, and 1 had a lose-lose outcome.

The players were presented with the empty frame and the pieces in an accompanying box. They were instructed that the marble must begin at any one of the eight starting positions at the top of the frame, and it must end at one of the eight ending positions at the bottom of the frame.

Players were offered the choice of playing to win for one player or for both. Most players understood that it would be more difficult to build two different paths, and if they wanted to finish quickly they chose to pursue the win-lose scenario. In other cases, this decision was not made at the beginning, and one player took control to construct a path that would result in a win for themselves. This was the case with the second user test. Player 2 took stock of the pieces and quickly assembled a path for himself, leaving player 1 circling the board confused. Player 2 reached around to his opponent's side of the board and inserted pieces where he wished- this was then expressly forbidden in the rules after this test. Without that rule, Player 2 was able to play his own game, to his great satisfaction, with zero collaboration or input from Player 1. Player 1 suggested that the game should be played in turns.

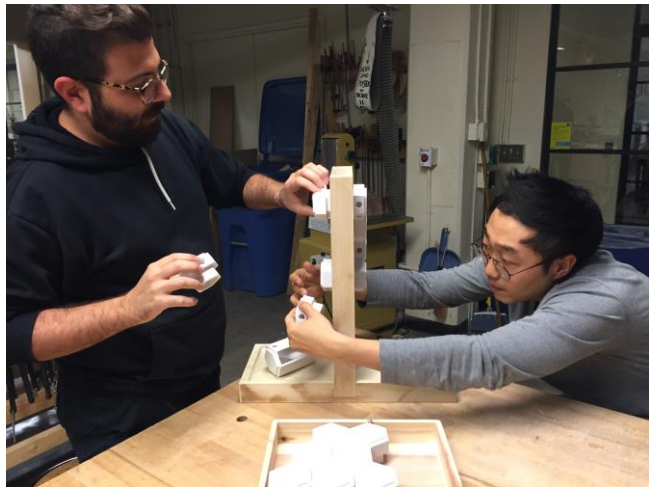

Fig. 4 In user test 2, Player 2 creates his own path.

In the first user test, the players decided midway through the game that they were aiming for a win-lose scenario, but that they considered it a win for both of them. They felt that they were supporting each other to achieve a successful outcome.

Some players resisted any type of collaboration. Upon realizing that he would eventually lose control of the marble with the passage pieces, Player 2 in the third user test said, "But I don't want to give it to (Player 1)!" Eventually they accepted that they would have to collaborate, and the marble ended up in Player 1's tray. These players "lost" the marbles several times and had to contend with the opacity of the game, pulling the pieces out and shaking them to figure out where the marble had been blocked.

In user tests 4 and 9, the players set out to create two paths for a win-win outcome, but they ultimately failed to build it. There was no time limit given, but they decided not to redo their work to create two paths.

The first team to achieve a win-win outcome (user test 5) took 45 minutes to do so. They started by quietly examining the pieces, and then communicated extremely well. Solving the game was a conversation between them, and they created terms for the different pieces as a part of the descriptive language they developed for themselves. They called the passage pieces "switches" and the curves pieces "wiggles", and they both fell into this method of communicating, to their success. They communicated each step to each other, and when one had an idea, he described it very clearly to the other player. These two players are close friends, which certainly helped them communicate well.

The relationship between the players was also clear in the tenth user test. These players were acquaintances but not good friends. They did not communicate well, and they kept deferring to the other in decision making. The phrase "you can win if you want" was said by both players. They ended up building a path that didn't work, the marble got stuck partway through the board. This was the only user test with a lose-lose outcome.

Findings

The most successful teams were those who were willing to share control of the game, communicated effectively, and enjoyed a shared determination to complete the game to the outcome they originally aimed for. If one player lost interest in the game, the other player seemed to follow suit.

All of the players knew each other, but closeness of relationship did not correlate in every case with success. It would be interesting to test the game on total strangers to find out if they are able to communicate well, or if they can sense each other's willingness to complete the game.

Several users suggested that there should be a greater variety of pieces, including some "trick" pieces that blocked the marble's passage or sent it in some unexpected direction. There are also opportunities to make the game more complex in the way the rules are presented. The game could be timed to make it more difficult, and players would have to quickly develop their language of the game. This could introduce an element of stress to the game as well as frustration with the other player.

Conclusion

The game successfully induced collaboration and communication between players. In its next iteration, it would be great to create a wall so large that the players can only communicate verbally, and cannot see each other at all. It could be a good tool to observe communication and problem-solving between strangers. Because sight is not necessary to play the game, it would be interesting to test on vision-impaired players who are accustomed to using other senses to solve problems. The game was also originally conceived as a game for children, but no children were found for testing.

Acknowledgements

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