



# Game Changer: Accessible Audio and Tactile Guidance for Board and Card Games

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# Motivation

- Board games are common form of social interaction
- Board games improve problem-solving and communication skills<sup>1</sup>



Image Credit: <https://shop.hasbro.com/en-us>

# Accessibility Issues Faced

- Board games are **not** accessible to blind or visually impaired players because information is conveyed visually
- Location of game pieces
- Information on cards



Image Credit: <https://shop.hasbro.com/en-us>

# Current Methods for Adaptation

- Help from a sighted person
- Purchasing accessible games
- DIY solutions

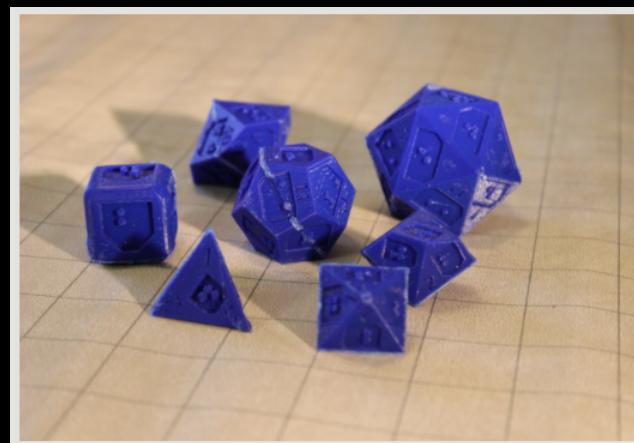
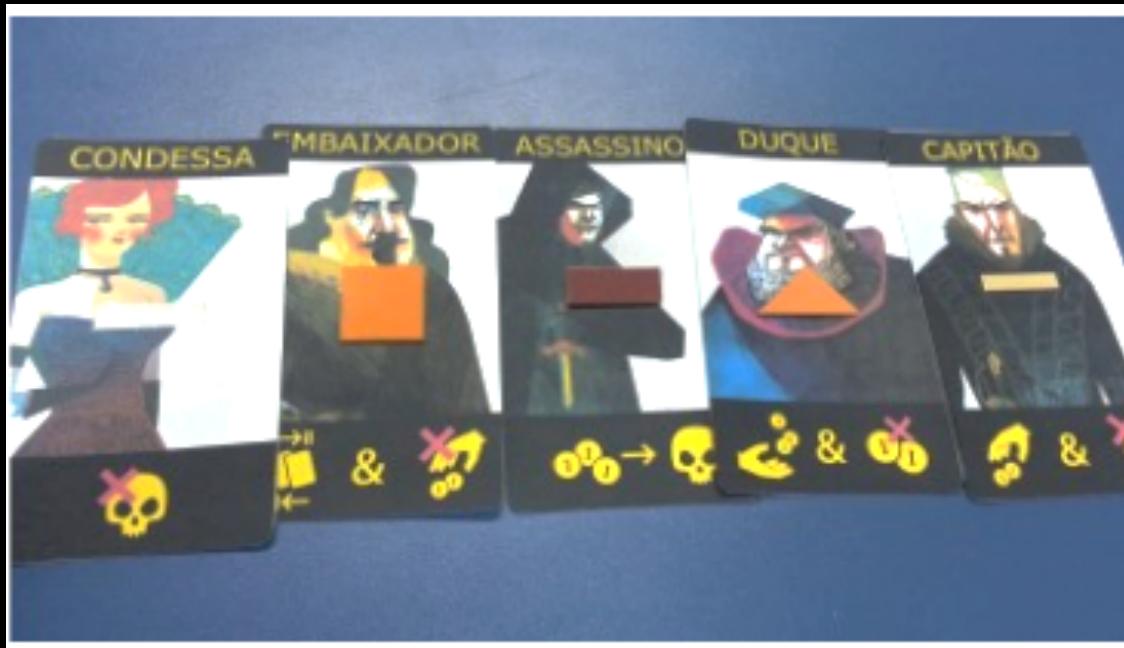


Image Credit: <http://www.64ouncegames.com/>



Image Credit: [escribescrabble.blogspot.com/](http://escribescrabble.blogspot.com/)

# Accessible Games



[Filho et al - CHI 2019]

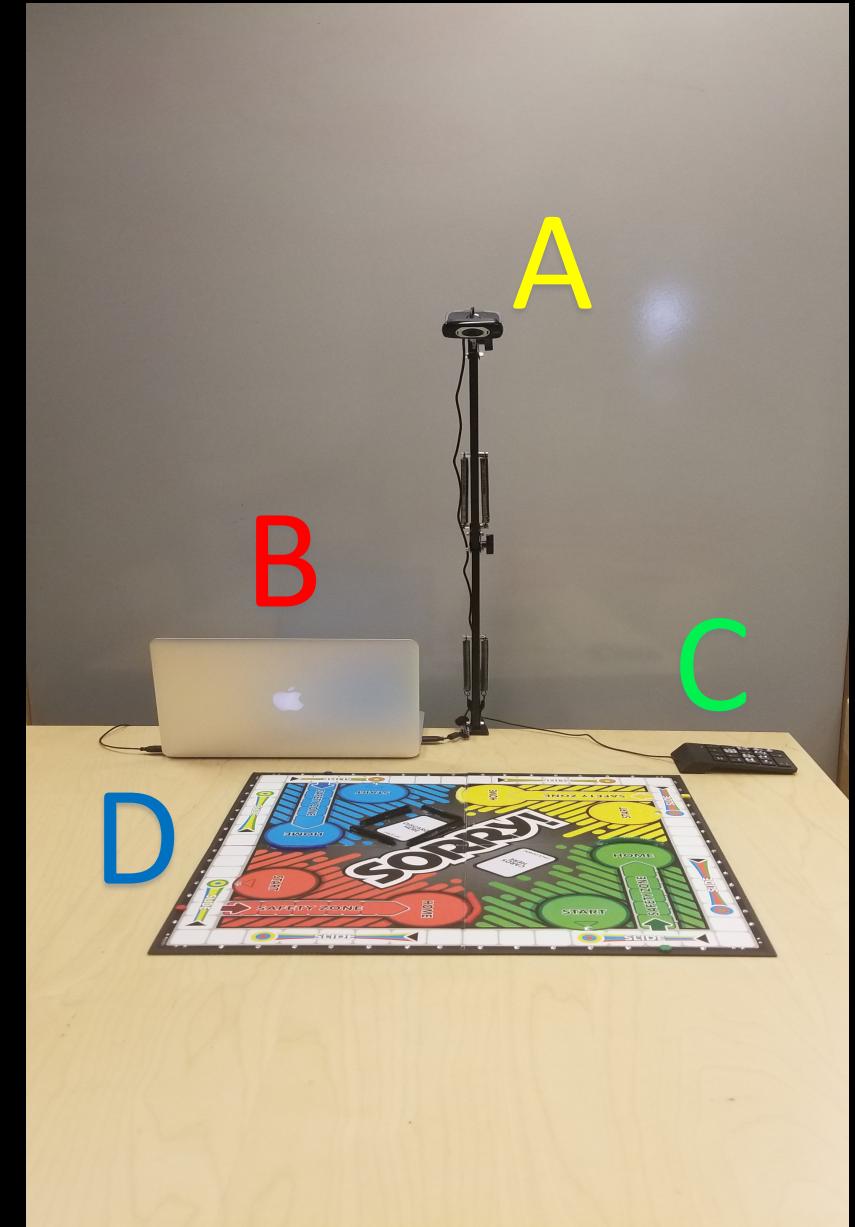


Image Credit: [www.thingiverse.com/thing:514314](http://www.thingiverse.com/thing:514314)

# Game Changer

# Game Changer

- Webcam (\$70)
- Laptop (Varies)
- USB 10 number keypad (\$10)
- Board Game with Tactile Augmentations (\$20)
- Tactilely distinct game pieces (\$3)
- ArUco Markers (\$0)

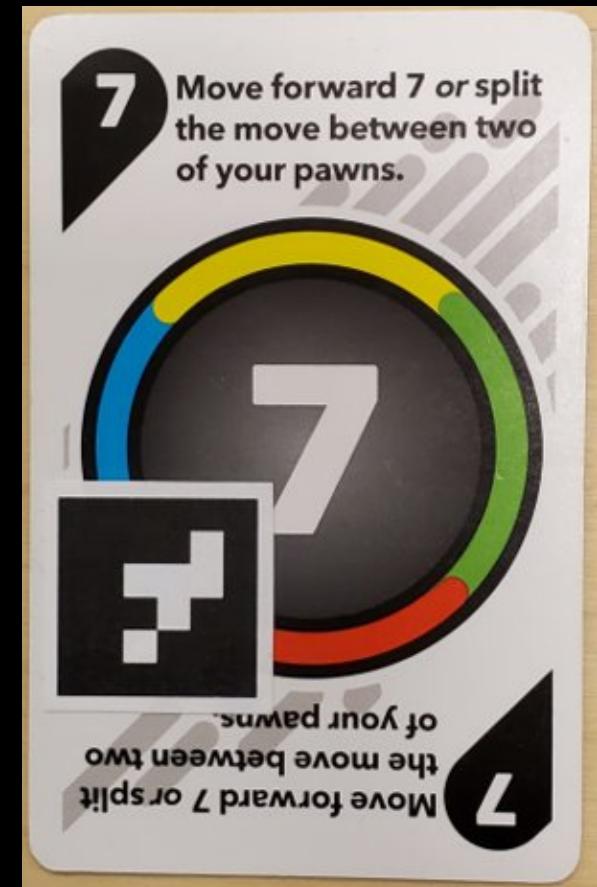
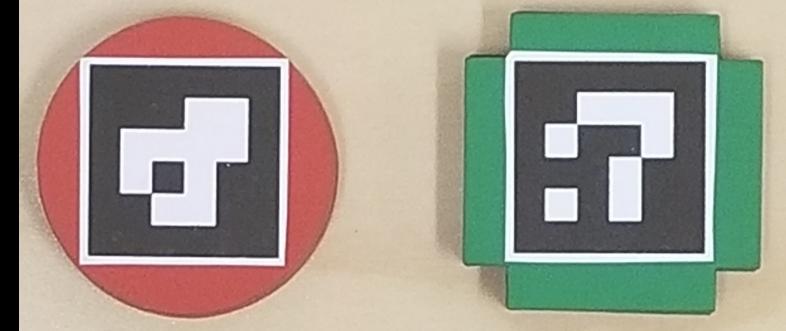


# Software

- OpenCV
- ArUco Markers
- Metadata game file

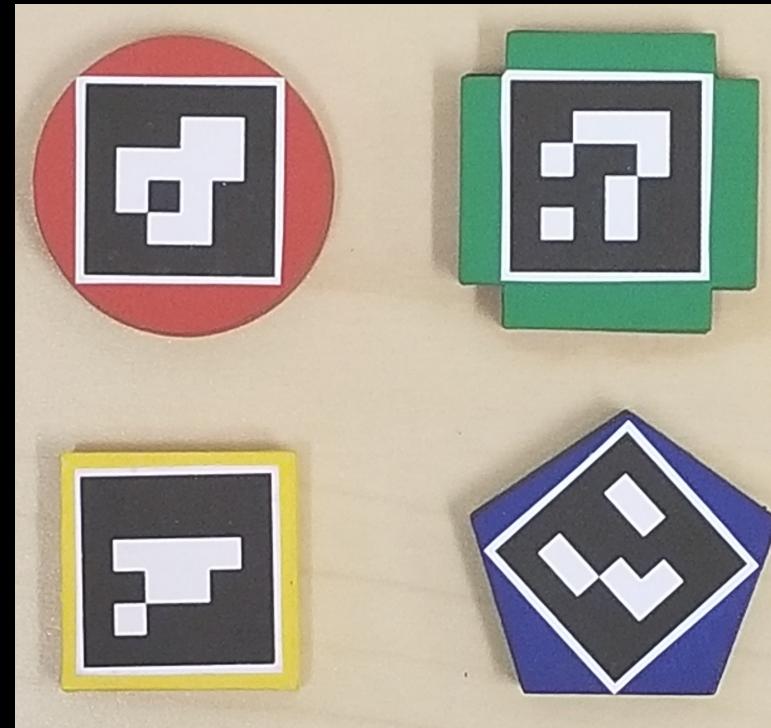
ArUco ID, Description

39,1. Move forward 1  
40,2. Move forward 2  
41,3. Move forward 3  
42,4. Move backward 4  
43,5. Move forward 5  
44,7. Move forward 7 or split the move between two of your pawns  
45,8. Move forward 8  
46,10. Move forward 10 or move backward 1  
47,11. Move forward 11 or change places with an opponent  
48,12. Move forward 12



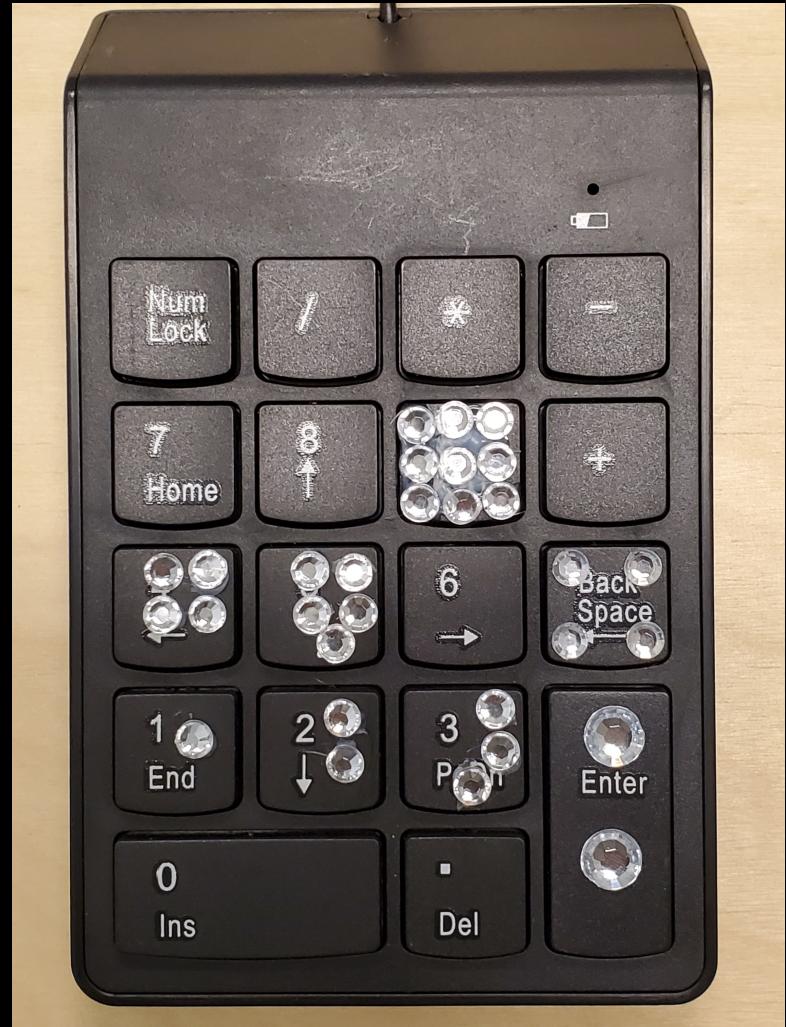
# Tactile Features

- Game Pieces
- Tactile Features



# User Input

- Commands Available
  - Game piece locations
  - Information on cards
  - Information about special spaces
  - Roll dice, if applicable



# Adding New Games

- Metadata file specific to each game
  - Contains all necessary information about the board layout and cards
  - Supported Games: SORRY!, Monopoly, Chutes and Ladders

```
Game Space Number,startX,endX,startY,endY;
42,25,65,25,67
43,71,112,25,67
44,118,160,25,67
45,165,206,25,67
46,212,255,25,67
47,260,302,25,67
48,307,349,25,67
49,355,397,25,67
50,404,445,25,67
51,450,493,25,67
52,497,540,25,67
53,545,588,25,67
54,593,636,25,67
55,640,682,25,67
56,688,729,25,67
57,733,777,25,67
58,733,777,73,117
59,733,777,121,165
60,733,777,169,214
1,733,777,218,260
2,733,777,264,307
3,733,777,311,354
4,733,777,358,402
5,733,777,406,450
```

# Playing the Game



The yellow circle is at space number 51. The red circle is at space number 51. The blue circle is at space number 51. The green circle is at space number 530.

# User Study

# User Study

- Participants
  - 7 Participants
  - 4 male, 3 female
  - Aged from 29 – 49
  - “No vision” (n=4)
  - “Light perception” (n=3)
- Participants played SORRY! independently using Game Changer against a sighted opponent

## Round One: Play SORRY! with Sighted Assistance

- Play 5 to 10 turns of SORRY! with sighted assistance

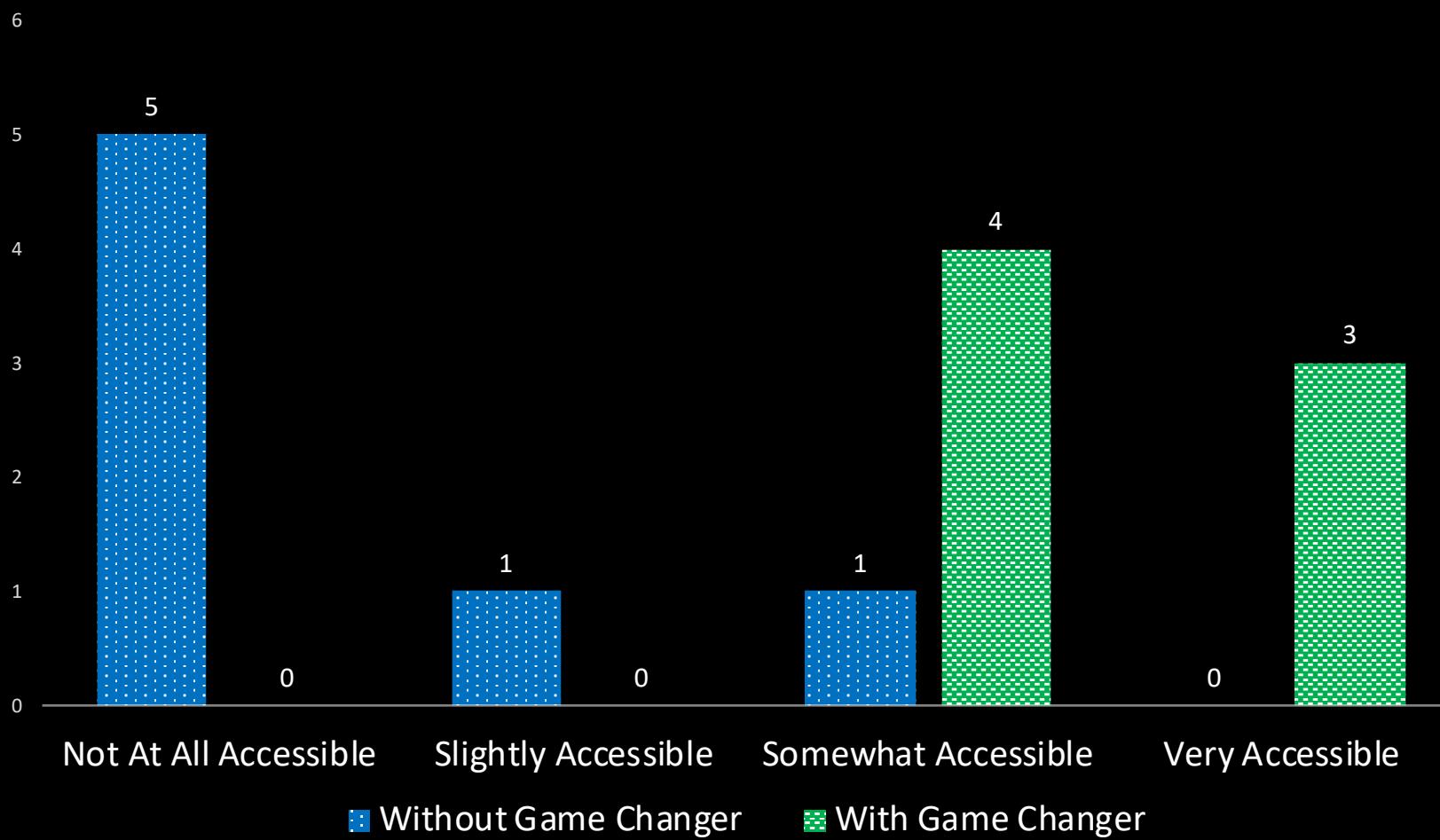


## Round Two: Play SORRY! with Game Changer

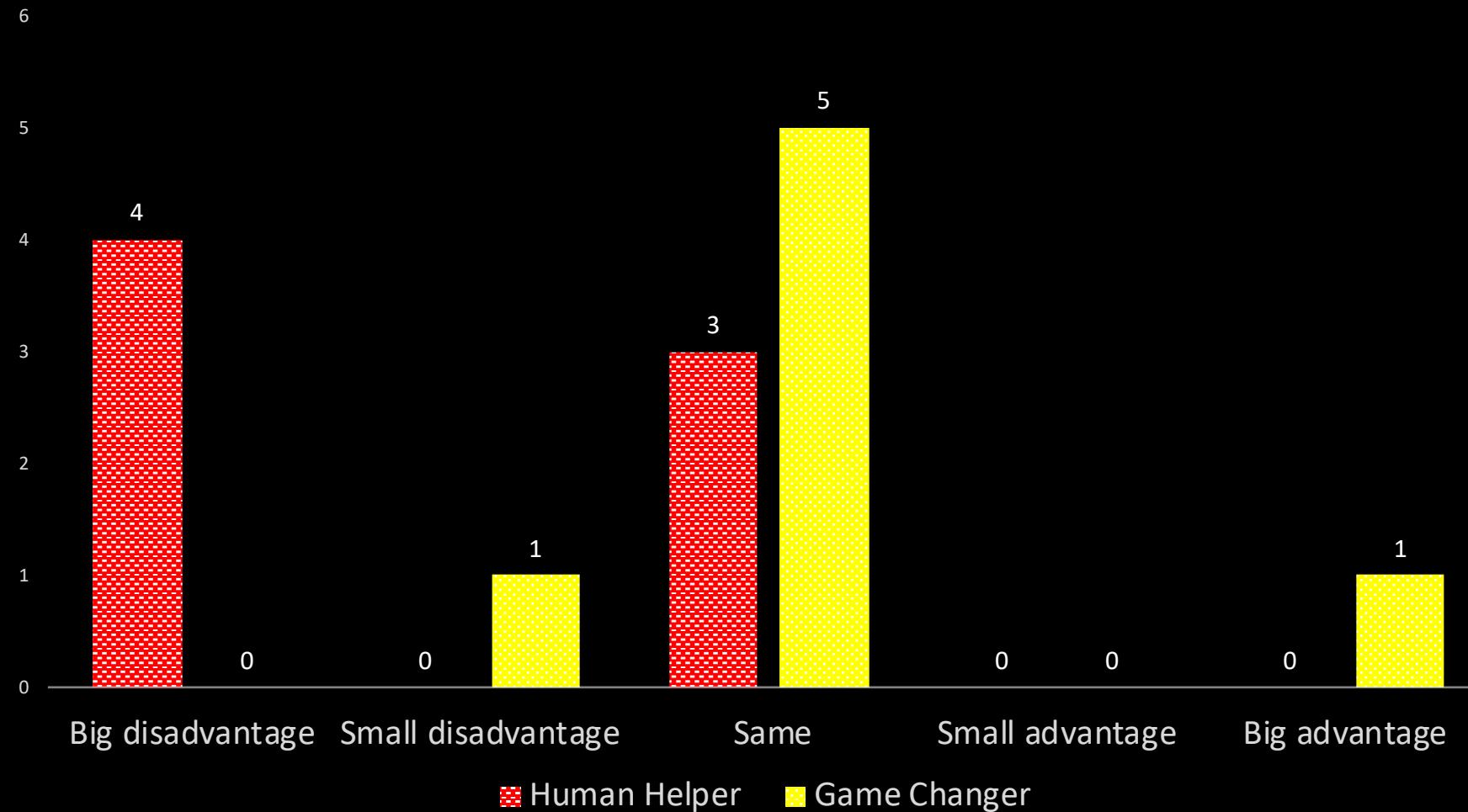
- Complete an exploratory task
- Play 10 to 15 turns of SORRY! with Game Changer as only assistance
- Gather feedback on system



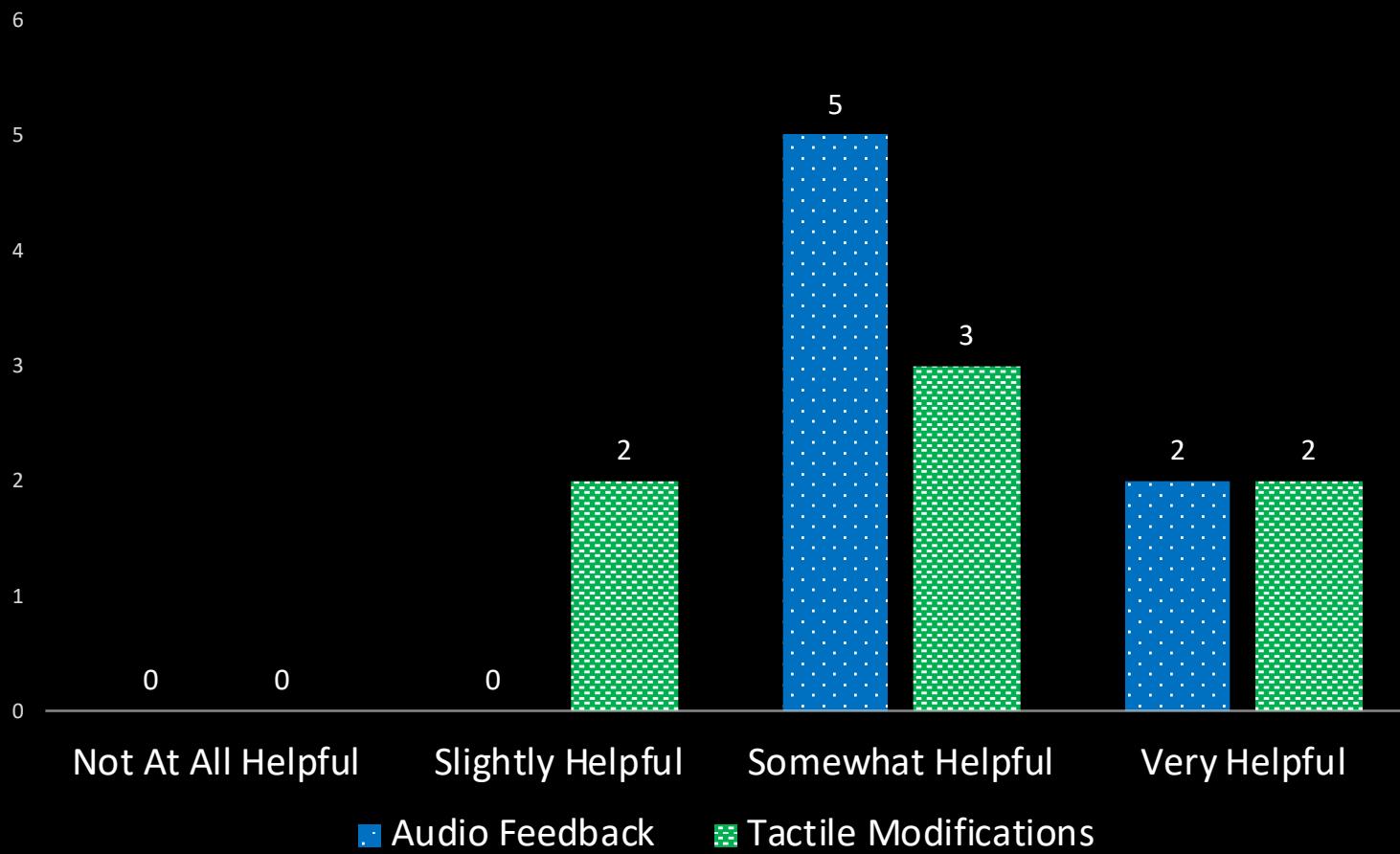
# Accessibility of Rounds



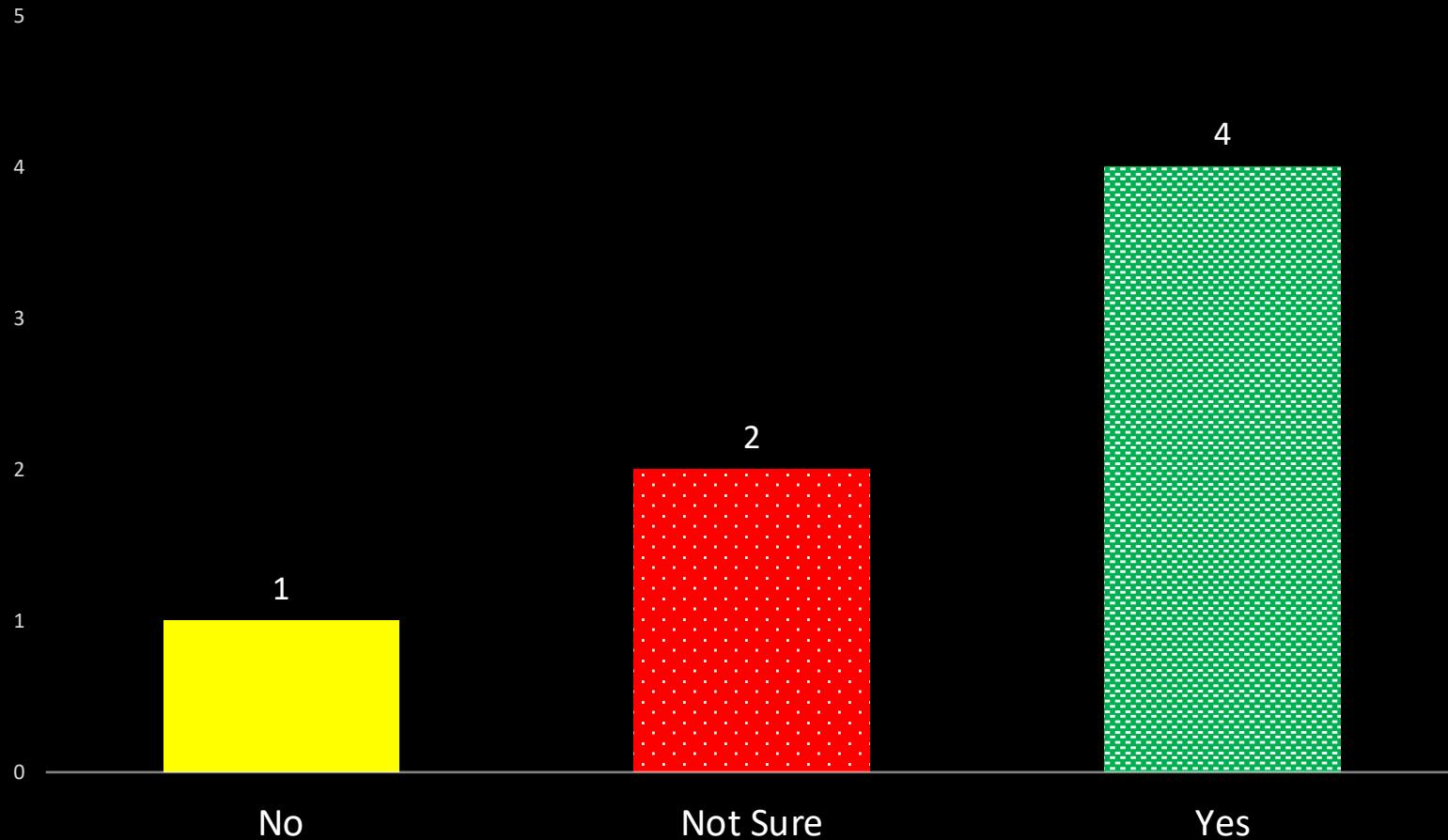
# Advantage or Disadvantage



# Helpfulness of Feedback Modes



# Independence



# Interesting Quotes

*“I would give it zero out of ten in terms of accessibility for the first one (without Game Changer). The first one had nothing in terms of accessibility. There isn’t anything basically not even from a usability perspective in terms of how to use the game.” –P4*

*“I felt I was at a big disadvantage. I felt like I didn’t know what was going on, I know I had a helper but that just makes it feel automatically not fun, so it’s just like a chore versus me actually playing a game. It is the basic thing that I had no idea what was on the board and no idea what the cards said unless I relied totally on someone else, just feels like a huge disadvantage” –P3*

*“I like that the system reads the card. That is one of the most annoying [things] about playing with other people is that they don’t always remember to read the cards.”* –P1

# Future Work

- Information needs
- System Setup
- Repository of Metadata Game Files
- Application for Game Designers

# Conclusion

- Many board games are **not** accessible to BVI people because information is presented visually
- Game Changer: **tactile** features and **audio** descriptions of board games can be used to make existing games **accessible**
- Participants valued the ability to play games **independently**



# Thank you! Questions?

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