
Mute Robot - Cooperative Gameplay through Body Language Communication

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Abstract

Body language is an expressive form of communication that transcends language barriers, and can range from subtle to outrageous. We have designed Mute Robot, a game in which 2 players must cooperate to solve a series of puzzle challenges by communicating through body language only. Kinect devices are used to capture players' posture and movement, which are then shared between two partners who are playing at two different physical locations. Mute Robot is designed to connect people across the globe who otherwise would not be able to communicate via a common language. Our 16-person user study showed that body language is practical and entertaining, with 2/3 of the players reported that they could understand the other player's body language well.

Author Keywords

Game; Video games; Game design; Body language; Kinect

ACM Classification Keywords

K.8.0 [Personal Computing]: General *Games*.

Introduction

Body language is proven by previous studies[12, 7] that it carries much of the emotive content. It may provide clues as to the attitude or state of mind of a person. For example, it may indicate aggression, attentiveness,

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boredom, a relaxed state, pleasure, amusement, and intoxication[6]. Body language is also the fundamental form of communication. It is how we communicate with babies who have not developed language skills, and how we communicate with people whom we do not share a common language with.

With the recent advancement in motion capture devices, such as the Microsoft Kinect[2], players are now able to play games with body motion and gestures. However, most games have focused on using body motion as a more natural input to replace controllers. Also, multiplayer games have focused on party settings with co-located players, rather than connecting people across the globe. In our work, we aim to develop a cross-language game by leveraging subtlety and fun in body languages. Even when players do not share a common language, they can still connect with each other through cooperative gameplay.

Mute Robot shows a novel integration between current cooperative gameplay and body language. Our 16-person user study results indicate that body language based cooperative gameplay is practical and entertaining. Compared to previous game designs that used keyboards and mice as input devices to move the avatars (e.g. Way[5]), Mute Robot makes use of body language which is significantly more expressive and captures the nuances in communication. We hope Mute Robot inspires future exploration of this relatively unexplored area of game design.

Cooperative Game Design Patterns

There were some related works done by past researchers. Such as Zagal et al, analyzing cooperative game design patterns through board games[11]; Bjork and Holopainen[8], supporting plenty of Game Design

Patterns, inclusive of cooperative and social interaction patterns. In addition, Rocha et al[10] provided several game design frameworks, and Magy et al[9] integrated all and proposed methods to evaluate quality about Game Design Patterns. From experience mentioned above, the design of Mute Robot adopts the following design patterns: *Complementarity*, *Abilities that can only be used on another player*, *Shared Goals*, *Shared Puzzles*.

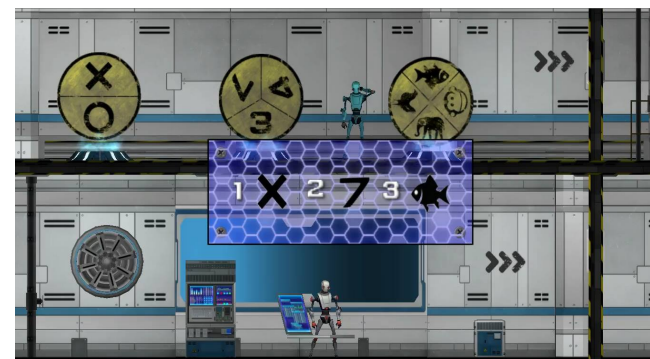


Figure 1: The asymmetric puzzle game design in one of Mute Robot's stages.

Design and Development

Mute Robot is a cooperative puzzle platformer game built using Unity3D[4] engine. The game involves two players at two distinct locations connected over the Internet. The players cannot talk to each other directly and the only way to communicate is using their body language. Each player uses a Wii[3] controller to move the avatar (e.g. left, right, jump) and a Kinect to capture their body language.

Using Body Language

To encourage players to use body language, we have designed an asymmetric puzzle system, with only one



Figure 2: A participant performing pictogram (letter "N") with body language.

player receiving puzzle hints. The player will use body language to guide the other player to solve the puzzle. Taking one of our game stage as an example (Figure 1), there is a locked door on the right side which obstructs both players' route to the next stage. The top player can't see the puzzle-solving hints but can turn the wheel to match the puzzle answer, which consequently opens the locked door. The only way to pass the stage is for the bottom player to convey the puzzle-solving messages to the other player with body language.

Testing and Evaluation

We recruited 16 participants, and randomly divided them into 8 groups. In each group, participants did not know each other. We captured the players' movement through a video camera and the gameplay was also screen-recorded by Fraps[1]. On average, the total game duration was about 10 to 20 minutes. At the end of the game, we provided a five-point Likert scale questionnaire to collect players' feedback to improve the gameplay experience.



Figure 3: A sequence puzzle from Mute Robot. The top player knows the correct sequence and is showing the bottom player to step on the center yellow button among the three buttons.

Communication Patterns

Our recorded video reveals some patterns on how the players communicate. We summarize these patterns below:

- (1) **Repeat after me:** player who received puzzle-solving hints would perform all the puzzle-solving actions in one go for the other player to observe and emulate. For example, in one of our game stages (Figure. 3), the 3 buttons on the floor had to be stepped on one after another in a specific order. The top player would perform the answer all at once for the underside player to repeat.
- (2) **Step-by-Step:** player who received puzzle-solving hints would command the other player to do one action at a time. The next command would not be given until the previous command was executed correctly. For instance, a player jumped in place several times in order to imply that the other player should stand on the object at the corresponding position.
- (3) **Pictogram:** players would use their own body to express and mimic the hints. As shown in Figure 2, one participant wanted to express the letter "N" to the other player. Her solution was using her body to perform pictogram to show the character.

We observed that the Step-by-step style is most used across player groups and game stages. In spite of large diversity of body language communication, the players can still find way to communicate effectively.

Results from Questionnaires

The results from the questionnaires show that our Mute Robot game design is practical and interesting. Figure 4 shows that all participants thought it was interesting to use body language to communicate. Figure 5 shows that

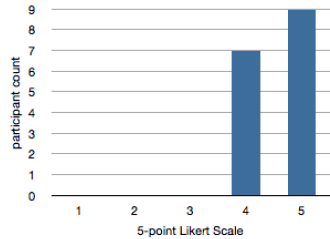


Figure 4: Participant rating of "Using body language is interesting".

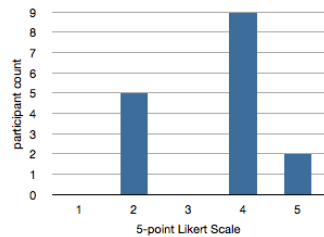


Figure 5: Participant rating of "Understood the partner's body language well".

about two-thirds of the players reported they could understand the other player's body language well.

Future Work

Currently, our system using Kinect (v1) only tracks significant body movement, which leaves behind important cues in facial expression and finger movement. For example, players can express their emotion through facial expression such as frowning and smiles, which may help players sense their teammate's feelings and connect them more deeply. On the other hand, players may use their fingers to express numbers and letters too easily, making their body language less entertaining.

Futhermore, Mute Robot applies asymmetric puzzle system in which only one-way message passing is required to pass all the stages. We plan to explore stages that supports two-way message passing between players, like letting both players receive part of puzzle-solving hints and exchange messages with body language. We believe that it will promote even more interaction between players and make the stages more challenging.

Conclusion

We have designed Mute Robot to transcend language barriers and connect people via cooperative gameplay and communication through body language. Our user study results indicate that body language-based cooperative gameplay is practical and entertaining. We hope to inspire more exploration of using body language in game designs.

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References

- [1] Fraps. www.fraps.com.
- [2] Microsoft. Microsoft Kinect. <http://www.xbox.com/en-US/KINECT>.
- [3] Nintendo. Wii. <http://www.nintendo.com/wii>.
- [4] Unity. Unity3D. <http://unity3d.com/>.
- [5] Way. <http://www.makeourway.com>.
- [6] Wikipedia, Body Language. http://en.wikipedia.org/wiki/Body_language.
- [7] Beck, A. Emotional body language displayed by artificial agents. In *Proc. ACM Transactions on Interactive Intelligent Systems (TiiS)* (2012).
- [8] Bjork, S., and Holopainen, J. *Patterns in Game Design*. Charles River Media, California, USA, 2004.
- [9] El-Nasr, M. S. Understanding and evaluating cooperative games. In *Proc. ACM CHI'10 (2010)*,
- [10] J. B. Rocha, S. M., and Prada, R. *Game Mechanics for Cooperative Games*. in ZDN Digital Game, 2008.
- [11] J. P. Zagal, J. R., and Hsi, I. Collaborative games: Lessons learned from board games. *Simulation and Gaming vol. 37* (2006), 24–40.
- [12] Kita, S. *How representational gestures help speaking*. Cambridge University Press, In D. McNeill (Ed.), *Language and gesture*, 162185, Cambridge, UK:, 2000.