Emerging Tech

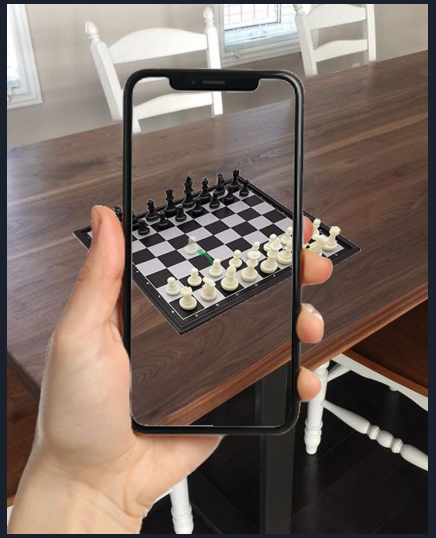
By: Mitchel Bloch, Alan Dong, Noah Glassford

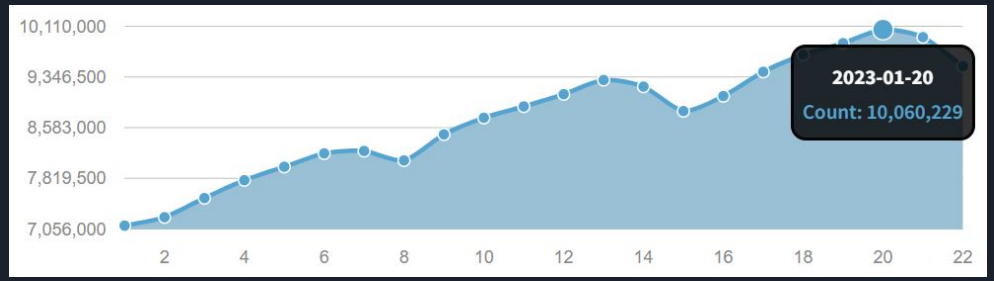
Abstract

While we originally planned on developing a chess application that used computer vision and augmented reality, this was more out of scope than we realized. This presentation will be looking at the paper prototyping techniques we used to get around the technical limitations and the evaluation methods that we used to evaluate our design.

Introduction

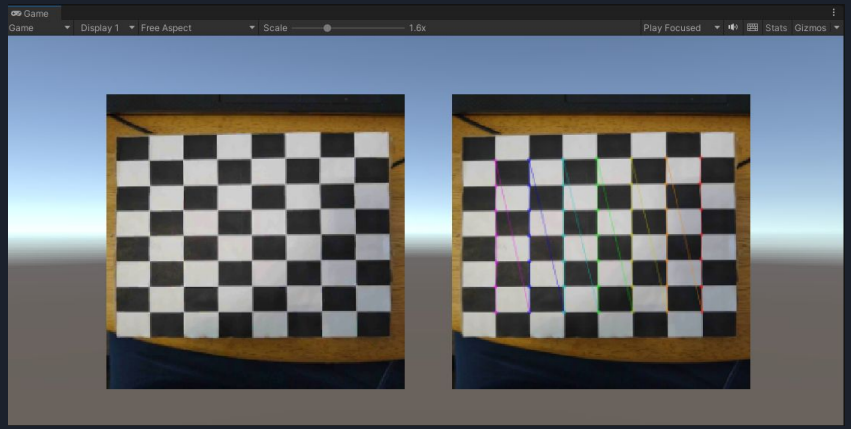
- We chose a chess related project at the start of the semester due to the boom in popularity chess was experiencing, with chess.com growing from 7 million to 10 million users in less than a month and their traffic doubling.
- Our project was planned to use a combination of augmented reality and computer vision in order to provide a more user friendly and more visual interface for chess engines such as stockfish.
- We experienced many problems with both computer vision and augmented reality and had to rely on paper prototyping.
- The main problem we experienced for computer vision was the extreme negative effect it had on performance
- The main problem we experienced from Augmented Reality was inconsistency





Methods: Developing the App

- We used Unity with the Unity AR Foundation package and OpenCVSharp for computer vision
- In order to track the chess board, we first tried to just detect a chessboard pattern using OpenCV
- This only worked on computers and not on mobile, so we then tried to use image recognition instead, but it was very sensitive to camera angles



Methods: Developing the App

- We also tried using a marker specifically made for AR, and while this one worked fairly well for tracking, it was also the size of a full sheet of paper and visually did not match a chess board at all, so that implementation wouldn't really work that well.

- We also weren't able to use computer vision in as large a scope as intended, this was due to major performance issues when running computer vision code on mobile devices.

- In order to try and replace this computer vision solution, we created markers for the pieces for the AR Foundation package to track, however, as mentioned in the introduction, these markers were very inconsistent and very sensitive to lighting conditions and camera angles.

Methods: testing the app

- In the early prototype stage, Alan and Mitchel tested the prototype app as actors. They each played 2 games on chess.com which uses the same chess engine that we planned to use in our AR chess app.
- During the in class playtest, the AR detection was not working properly, so the users were just told the information that the app would have given to them.
- Later on, we created small paper markers to place on the board to communicate the information in the more visual way the app intended to.
- We intended for these markers to work in AR, however sensitivity to lighting and camera angle made this very impractical.

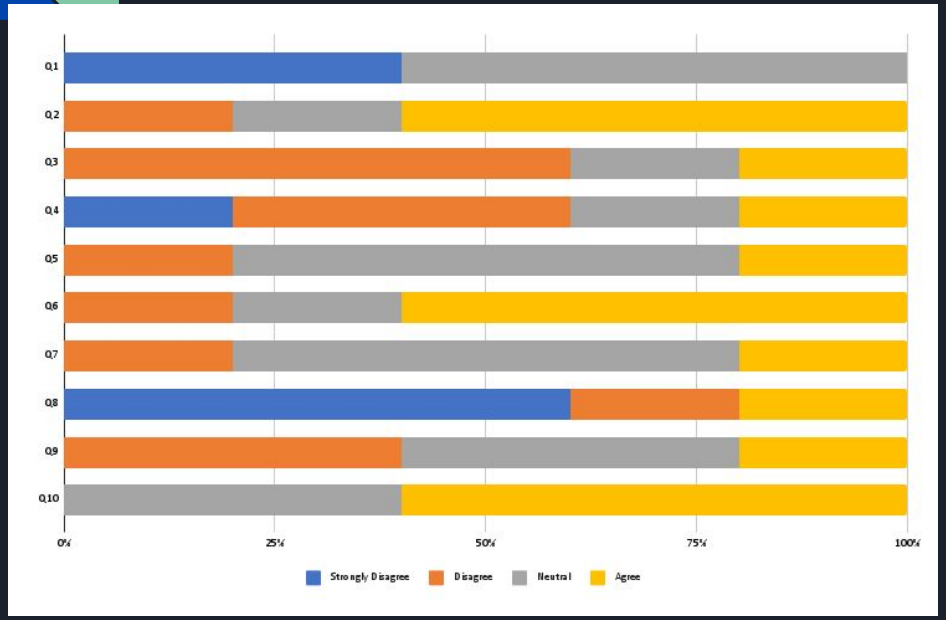
Results: App

- For the app, we were able to get a chessboard to render in AR and track to a marker, however we were not able to track the position of the pieces or do an AR overlay.
- Unfortunately, those two things were the major technological component of our app. However we were able to recreate very similar functionality to our proposed design using a paper prototype.

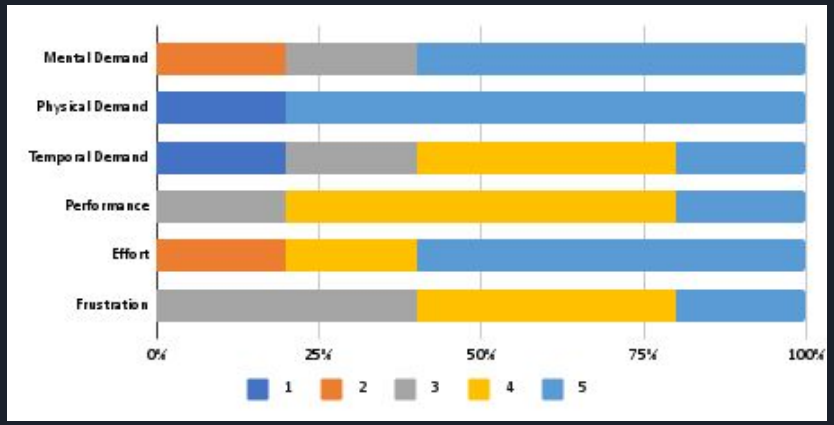
Results: Testing

- The app was tested in class by classmates who were then asked to fill out a survey.
- testing were skewed, due to AR not working and noah having to improvise.
- We had an average overall SUS score of 71.5 which is considered above average
- A PQ score of 401/475
- The highest demand for the TLX was physical demand at 10.5

Results: Testing (graphs)



SUS response graph



TXL graph

Discussion and Conclusion

- We have found that the app was easy to use and get into from our SUS and TLX data, the app has a simple and easy to use interface and new user can get use to it in a short period of time.
- During our literature review we also found that AR improves learning capabilities in various other education applications, including chess.
- In the literature review we also found that due to the way that AR visualizes all the information while also being interesting enough to keep the user entertained and motivated enough to keep using the application.
- During the testing process we also found that the AR recognitions relies deeply on the camera aligning with the chess board, as well as having good lighting in the room.
- This led us to using markers, which allows a more accurate tracking for the app, however it is still not enough to make the AR reliable enough to be used for the app.