# Chapter 2 – Context

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## 2.1 Multiplayer Social Games

In March 2020 the UK government announced its first full lockdown to help prevent the spread of COVID-19 (Gov.uk, 2020). Millions of people had to work from home and the only way they could spend time with friends and family was online. This created a boom in social video calling applications like Zoom as they became replacements for in-person social gathering (Yuan, 2020).  
At the same time, video game companies saw record breaking increases in demand for video game consoles as people looked for new ways to spend their free time indoors (gamesindustry.biz, 2020). This increase in gaming was not limited to dedicated consoles; smart phone and web browser games also rose in popularity(Knezovic, 2022). COVID-19 increased the national consumption of video games, but it also welcomed a new type of video game user that did not exist before. These users were people who do not normally play multiplayer games but were in a situation where video games were one of the only forms of group social activity.

This change in the marketplace can be observed in the rise in popularity of Among Us (Stuart, 2022). Among Us is an online multiplayer social deduction game (IGN.com, 2021)inspired by the horror movie The Thing (The Thing, 1982). In Among Us players control a 2D character that has to undertake tasks along with their crewmates while trying to avoid being killed by the secret imposter crewmate who is trying to sabotage the team. Released in 2018 Among Us saw little mainstream popular attention and maintained a small audience for the first 18 months. In mid 2020 the games popularity skyrocketed and in the years since, it has become a multimillion dollar franchise. The game’s creators have attributed the game’s popularity to its simple design and broad availability on multiple devices (Noclip, 2022).

As well as playing online video games, it was common for people to try to translate in person games to a remote friendly format. This could be using websites to play digital versions of board games, or using video calls to organise quizzes. In many of these situations, the video calls was started separately to the game, and is continued while participants play through a rotation of board games that are available online (Law, 2020).

Another company that took advantage of the change in the market was Houseparty. This social network application was available on PC, Mac, Android and iOS and let users play built in games like Heads Up, Trivia and Uno while on a video call. When playing games, the video call feeds from other players would be resized on screen to make space for a gameplay window. Similiarly to Among Us was started in 2016 but saw a large increase in useage during the pandemic. Houseparty was later discontinued by its parent company Epic Games in 2021 due to low player numbers (Griffin, 2021).

## 2.2 Card Playing Games

Playing Cards have been represented in video game since the earliest graphical user interfaces were available. In 1990 with the release of Windows 3.0, Microsoft included Windows Solitaire as a free pre-installed game (Warren, 2020). It was designed partially as way to "to soothe people intimidated by the operating system," (Garreau, 1994). The game has remained a part of the Windows Operating System since its initial release over 30 years ago and in 2019 The Strong National Museum of Play inducted Microsoft Solitaire to its World Video Game Hall of Fame (The Strong Museum of Play, 2019)

The increase of home internet usage in the 1990s and early 2000s also saw an increase in online poker playing, growing to a $2.4 billion industry in 2005 (Newsweek, 2005). The online gambling industry also saw an increase in users during the COVID-19 pandemic (Gambling Commission, 2021). Online poker interfaces are often browser-based and are designed around flat 2D representations of cards and poker chips.  
  
A significant influence for the design of CardsAR is Tabletop Simulator (Tabletop Simulator, 2022). This is a PC and Mac game that allows players to play and create tabletop games in a multiplayer physics sandbox. The game is designed to allow any tabletop game to be played from within it. When installed it comes with royalty-free games like chess, blackjack and mah-jong, but it has an open design that allows for players to easily develop their own games with imported 3d models and custom scripting. Tabletop simulator also comes with a standard interface for playing cards. Compared to browser-based online poker, Tabletop simulator has a high barrier to entry. At the time of writing, it costs £14.99 at full price. In order to handle the physics simulations necessary for gameplay features like realistic dice rolls, the game also has non-trivial hardware requirements (System Requirtements Lab, 2022).   
  
During development, a new game called All On Board was successfully crowdfunded on Kickstarter. All On Board is a VR game similar to Tabletop Simulator, that is designed as be platform for users to create their own board games in virtual world (The Game Kitchen, 2022).   
  
The market for playing cards games skews either to simple web browser interfaces or high end realistically simulated tabletop games. There is currently no successful 3D environment for playing cards that can be played on smartphones. That is what CardsARs aims to be, an interactive 3D environment for playing cards that can run on as broad range of smartphones.

## 2.3 Augmented Reality

Augmented reality can be defined as an interactive experience that incorporates real word and digital content. Since the term was coined in 1990, (Interactive Design Foundation, 2020) companies have experimented with different use cases with various hardware input devices. In 2006 the Wearable Computer Lab at the University of South Australia created AR Quake. The game used a custom built backpack and headset to allow players to play a version of popular first-person shooter Quake, projected into the real world through a head-mounted display (Wearable Computer Lab., 2006).   
  
It wasn’t until the release of the first iPhone 2007 that the public would have access to an internet enabled device with a camera that could be used in AR tools and games. For the first few years, AR was used in novelty applications that weren’t integrated into the daily lives of users (Sung, 2012). That changed with the release of Pokémon GO in 2016, one of the most popular and profitable augmented reality app of all time (Perez, 2016). Pokémon GO’s core gameplay loop consists of players travelling to real world locations to catch virtual pocket monsters that appear in the real world as seen through the phone camera (Chamary, 2018).

### 2.3.1 AR Survey

When researching the viability of CardsAR, a survey was taken of every popular augmented reality app on iPhone and Android. Apps were identified by searching both the Google Play and Apple App store. Articles were also collected from the past 5 years that showcase AR apps.  
  
The methods used to collect AR apps in the survey have limitations. Only apps that were currently available to download on either the Play store or App store were considered. This means that any app released in the last decade, that has been discontinued, was not reviewed. Reviewing the features of a discontinued app would be too unreliable to include in the survey. This leaves the possibility that an app with similar functionality to CardsAR may have already existed but has been removed from sale. In addition, limiting the survey to published apps, research projects and unreleased prototypes from environments like game jams, have not been covered.   
  
In total 149 smartphone AR apps were collected in the survey. Each app was grouped by app category and movement style.   
  
The AR app categories created for this survey are Game, Art-Tool, Educational, Model Viewer, Utility and Fitness. These size categories were based on the results of the survey and were a to meaningful way to differentiate the results.

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| Category | Description |
| Game | Designed primarily as a game |
| Art-Tool | Designed to be a self-expression tool. Examples include drawing apps and face filter apps. |
| Educational | These apps are designed to tell a story or convey information through 3D models. |
| Model-Viewer | These apps let users place 3D models in their environment. This can be with a list of predefined novelty models like dinosaurs or vintage cars. Or it can be a community app that lets you look at models other users have created. |
| Utility | These apps achieve a task that AR is uniquely suited to. For example taking the measurements of a room. |
| Fitness | Fitness apps are primary for the tracking or fitness activities or for guidance on how to perform certain exercises. |

Each game was also grouped according to their movement style. The categories for movement style are seated, standing, and walking. Seated apps can be used while seated and do not require the user to stand or move significantly while using. Standing apps require or at least encourage players to move around a space to either look at multiple focal points on the space or look at a focal point from different perspective. Finally walking apps require that the user move from location to location. Walking apps normally incorporate GPS into their systems.

### 2.3.2 AR Survey Results

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From these results it can be seen that “standing” is the most common movement style for AR games. Standing games try to take advantage of the 3D space which a person is currently placed. A typical example of such a game is Euclidean Lands (kunabi brother, 2017) or ARise (Climax Studios, 2017), both puzzle games that have the player walk around a 3D model that they project into the middle of a space. To solve puzzles players must look at the model from the different positions and angles to enable gameplay features.   
  
CardsAR can be considered a sitting game. A common gameplay feature of sitting games is the projection of a 3D game board onto a flat surface in front of the player. Similar to CardsAR, games like Jenga AR (Free Range, 2022) and Lego Hidden Side (LEGO Systems, 2022) attempt to create a digital simulation of a real like tabletop game. Many of the planned features for CardsAR were not identified in the survey. No game used playing cards as its focus, and none of the games focussed on socialising as a primary feature. Every game also displayed the 3D models overlaid onto the real world, none of the games took place in a virtual world like the one planned for CardsAR.

## 2.4 Hand Tracking

Hand tracking from the world facing camera has been considered as an interaction method. Some models of smartphone contain LIDAR scanners which could be used to accurately tracks hands and fingers (Apple, 2020). This feature is only available on new high-end iPhone Pro and iPad Pro models, which would negatively impact the availability of users to test this feature. Moreover, as CardsAR has been designed as a low-cost more broadly available alternative to high end VR devices, it should be designed with features available to most devices.  
  
Third party tools do exist for hand tracking from a single source RGB image. Manomotion was selected as the platform upon which to build this feature upon. This choice was made as the company has a Unity toolset for hand skeleton from the front facing camera (Rutegard, 2021).

## 2.5 Face Tracking

Face tracking is the most common AR use for the front facing camera of a smartphone. Across the AR survey, this was the only use for the front facing camera. Glasses retailer Warby Parker has an app that lets users try on glasses in real time with a projected 3d model (Warby Parker, 2022). Social media apps Snapchat, Instagram and TikTok all allow users to take pictures and record videos of themselves with 3d models and effects projected onto their tracked faces (Facebook, 2017) (Snapchat, 2022) (TikTok, 2022).