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# ***BloxAR*: Augment Your Social Life!**

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## **Abstract**

Many people who own a smartphone spend a large amount of time playing mobile games. Despite the technological capabilities and social potential of these devices, the majority of mobile games make limited use of available technologies and contain little or no multiplayer elements. *BloxAR* is an augmented reality mobile game that aims to provide a fun and engaging social experience. In this game, players compete in teams to be the first to build a virtual block structure within a set time. Play consists of physically exploring the structure in an augmented reality environment, building the structure by placing blocks and cooperating with teammates to combine blocks together.

## **Author Keywords**

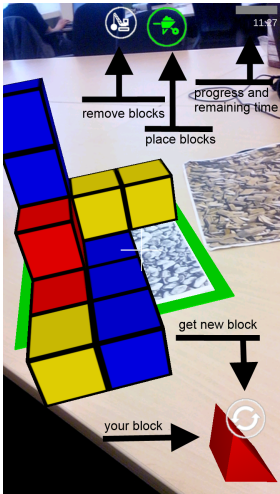
augmented reality; collaborative gaming; social gaming; mobile gaming

## **ACM Classification Keywords**

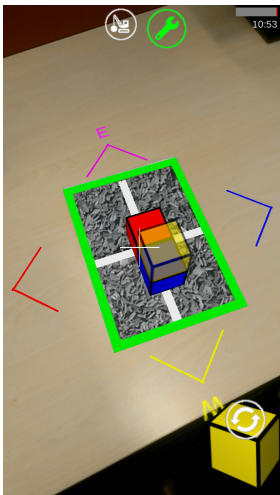
H.5.1 [Information interfaces and presentation (e.g., HCI)]: Multimedia information systems;; K.8.0 [Personal Computing]: Games

## **Introduction**

Despite the large number of sensors modern smartphones are equipped with, most mobile games use few or none of these possibilities. *BloxAR* makes use of the mobility and



**Figure 1:** The interface of BloxAR.

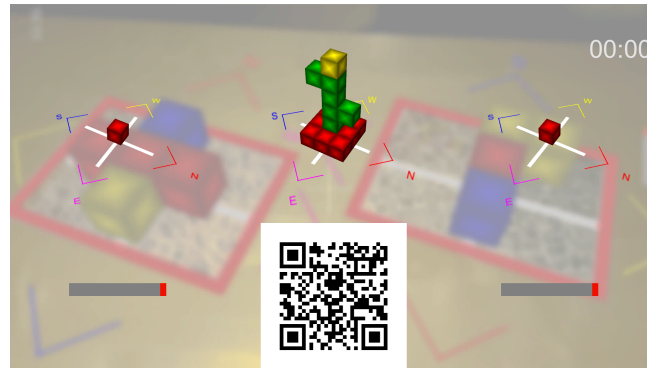


**Figure 2:** An image target with a block structure drawn on top.

sensory capabilities of smartphones to let players interact with their environment and with other players. *Augmented Reality (AR)* is used to display virtual structures as if they exist in the real world, binding all players to a single physical location. Players have to bump their phones together to mix two different color blocks. This way, real-life movement, augmented reality and team play combine into a fun and challenging game experience.

### Game Concept

The objective of *BloxAR* is for each team to replicate a structure of blocks that is shown on a public screen within a set time. [Figure 3](#) shows an example of a public screen, with the target structure in the middle.



**Figure 3:** The public screen, with the target structure shown in the middle. The progress and structure of each team is shown on either side of the target and the QR code to join the game is at the bottom.

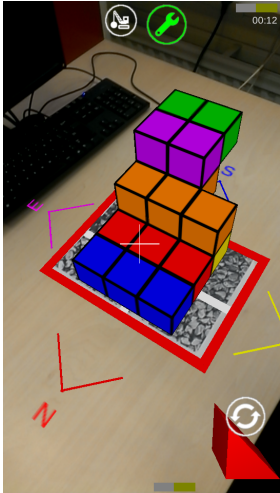
To join a game, a player has to scan a *Quick Response (QR)* code. Most smartphone users are familiar with QR codes, which makes scanning such a code an intuitive means for joining a game.

After joining the game, a player will get a block in one of the three primary colors (yellow, red or blue). A player can tap the refresh button in the lower right corner of the screen to get a new block if they cannot use the block they currently have. [Figure 1](#) shows the user interface as it appears on the smartphone screen.

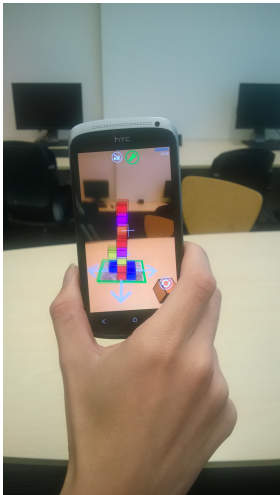
Apart from blocks in the three primary colors, target structures may also contain blocks in the three secondary colors (orange, green and purple). Players have to create blocks in secondary colors by combining their own block with the block of another player. Combining is done by “bumping” the phones of two players back to back, as in [Figure 2](#). After combining, both players receive a new block with a mix of the colors of the combined blocks. An orange block, for example, is formed by combining a red block with a yellow block.

Players can see the structure they are building by aiming the camera of their phone at a specific AR image target, as shown in [Figure 2](#). The structure will be drawn on top of the image target on the phone’s screen. By moving the phone around, a player can aim at the location where they wish to place their block. Tapping the screen places the block at the location highlighted in the structure. Removing blocks is also possible by switching to a ‘destroy mode’ at the top of the interface. In this mode, players first target a block to destroy and then tap the screen to remove that block from the structure. At the top right of the interface, the player may see the remaining time and the progress of the current structure.

Players of *BloxAR* are divided into two teams. The team that finishes the target structure first or has most progress when a set time has elapsed wins the game.



**Figure 4:** A structure nearing completion.



**Figure 5:** The structure as seen through a phone

The public screen, seen in [Figure 3](#), shows the progress of both teams, the structure each team has built so far, as well as a progress bar showing how complete each structure is. This allows sby to enjoy watching the game. Furthermore, it allows both teams to see the progress of their opposing team, increasing the competitive element of the game.

A gameplay video showing the basics of *BloxAR* can be found at <http://youtu.be/p8bu2bqPSKQ>

### Target Audience

Although most building block toys target younger players, *BloxAR* was designed to appeal to a wide age group. Ideally, people who have never met before can play the game together regardless of age and background. User tests with a group of people of mixed ages, from early teens to early twenties, have shown that this is a realistic scenario.

*BloxAR* is a fairly simple game that forces its players to communicate and cooperate and it can even be used at events where people have to get to know each other or learn to work together. The main difficulty is that the game requires some setup, requiring both a server, public screen and one image target for each team. Once people start playing, however, the public screen will make others want to join or watch. In testing, we found people who had not spoken a word to each other before playing the game having elaborate conversations afterwards.

### User Experience

The most important aspect of a social game is of course the people playing. *BloxAR* draws attention with its prominent appearance including a public screen, players bumping their phones together and people aiming their

phones at image targets. The fun environment created by the game makes people want to join. The QR code on the public screen provides an easy way to do so.

Bumping phones back to back is not an intuitive action for most people and therefore the game provides a short tutorial explaining the concept of mixing blocks. In testing, some players initially had difficulty mixing, either because they bumped the phones too rapidly or because they were not aware of the possible color combinations. After a few minutes of practice, however, there were no further confusions.

The fun and social experience delivered by the game keeps players hooked. So far, every user test resulted in people playing until either their phones ran out of energy or the server was shut down.

### Innovations

Although the technologies used in *BloxAR* are not new by themselves, the innovation comes from combining those technologies into a social game. Collaborative and competitive gaming, augmented reality and real-world movement provide a unique gaming experience.

*BloxAR* is also unique with regard to the amount of interaction players have with their surroundings. In a time where many people focus more on the screen of their smartphone than on the world around them, *BloxAR* uses that very same screen to make people who might have never met before interact with one another.

The basic concept described above allowed us to provide the following three innovative gameplay features:

- Augmented reality, which leads to an immersive gaming experience. Players see the world around

them with the game state drawn on top, making them feel more connected to their environment. Being able to modify the structure in the augmented reality environment enhances this experience.

- Players are bound to a specific location by the public screen and the image targets. Because players of the game are physically together, they will be more inclined to interact verbally. Likewise the public screen allows passersby to watch and possibly be drawn into playing the game for themselves.
- All team members share the same augmented reality state. Any member of a team can modify the shared structure of their team. Changes to the structure will be visible for every player, through their phones or on the public screen. The collaborative element is increased by being able to see the actions of other team members in real time.

### Technical Aspects

*BloxAR* relies on various existing technologies. The game is built using the *Unity* [2] game engine. For recognizing image targets and extended tracking, *Qualcomm® Vuforia™* [3] is used. The *ZXing* library [1] is used for generating and reading QR codes.

Near Field Communication (NFC), a technique to communicate between devices in close proximity, is currently not supported on many smartphones. Therefore, *BloxAR* uses a custom bump detection algorithm. The algorithm uses the phone's accelerometer input to detect peaks in acceleration, as would occur when bumping phones together. Furthermore, raw compass data is used to detect changes in the magnetic field possibly caused by another phone. The sensor data is combined with timing information to detect phones being bumped together.



Figure 6: Testers combining blocks.

### Related Games

*Paintrix* [4] is a social game in which teams have to color figures in a matrix by scanning QR codes with their smartphone. Like *BloxAR*, players have to mix colors. The mixing mechanic used by *Paintrix* is to first color a cell with one primary color, followed by another primary color.

### References

- [1] Official ZXing ("Zebra Crossing") project home. <https://github.com/zxing/zxing>.
- [2] Unity - Game engine, tools and multiplatform. <https://unity3d.com/unity>.
- [3] Vuforia - enable your apps to see. <https://www.vuforia.com>.
- [4] Slappendel, D., Lie, F., de Vos, M., Kopla, A., and Bidarra, R. Paintrix: Color up your life! In *Advances in Computer Entertainment*, D. Reidsma, H. Katayose, and A. Nijholt, Eds., vol. 8253 of *Lecture Notes in Computer Science*. Springer International Publishing, 2013, 576–579.