Research Paper

People, Places, Memories and Mobile Apps

Understanding the Potential of Augmented Reality in Public Participation and Community Development

Ming-Chun Lee, Ph.D., School of Architecture, University of North Carolina at Charlotte; USA

Abstract

Augmented Reality (AR) goes beyond the dichotomy of passive methods of engagement with the public. It offers an interactive method to expand visualization techniques in participatory planning processes. This paper discusses three mobile apps developed by a partnership. These apps support a series of community events aimed at increasing overall public participation and civic engagement with a goal of increasing awareness of community history through data visualization and story-telling.

Keywords

Augmented Reality (AR), Public Participation, Community Development, Civic Engagement, Data Visualization

1. Introduction

Samuel Mockbee once argued that the practice of community planning and design not only requires individual participation in the profession, but also requires active civic engagement (Mockbee et al., 2003). He stressed the importance of a deeper democratic purpose of inclusion in energizing one's community. Many methods for public participation have been introduced in urban planning and its allied fields such as architecture and urban design. This type of community-based practices has its root in the field of participatory design, which is a response to the demand to have voices heard and ideas taken from those who are involved in the design process. It sees community members as citizen designers who play an active role in shaping the formulation of both the design process and its ultimate results (Arnstein, 1969).

One of the issues facing this type of participatory design has to do with the challenge of making the process comprehensible, relevant, and interesting to the potential participants in order for them to willingly participate in the process (Baykurt, 2011). Augmented Reality apps on personal mobile devices, such as smart phones or tablets, may offer some clues. Immersive visualization technologies, such as Virtual Reality and Augmented Reality (AR), are powerful tools to facilitate participatory approaches in community design. As a visualization apparatus, AR goes beyond the dichotomy of passive methods of engagement and their one-way communications with the public. AR offers an interactive method to expand both non-computerized and computerized visualization techniques in community design. Moreover,

AR increases public engagement by providing comprehensible information to citizens and assisting them to express their preferences in an intuitive way.

One important aspect of AR is this fun factor in the form of mobile games (Sicart, 2016). No other AR game has drawn more players and created this world-wide phenomenon than Niantic's Pokémon-Go has in the past years. One unique fact about this Pokémon-Go fever is its ability to bring people together into public spaces. Many organizations have used Pokémon-Go in community events (Kooragayala and Srini, 2016). In collaboration with Knight Foundation and Niantic in May 2017, OpenStreets704, a non-profit organization in Charlotte, North Carolina, organized one event temporarily closing streets to automobile traffic to allow residents to use them for walking, bicycling and meeting their neighbors. Niantic arranged special in-game elements for Pokémon-Go and helped draw people to interesting places along the route of the event (Polygon, 2017). Similar events have taken places in other cities around the world (Humphreys, 2017; Knight Foundation, 2017; Niantic, 2017).

This paper discusses three projects conducted by a partnership among four organizations in Charlotte to design three AR mobile apps. These apps along with Pokémon-Go support a series of community events developed and organized by this partnership. These projects are as the following:

1. Neighborhood History Walk App utilizes AR to guide users to visit selected locations in Charlotte's streets. Users see historical photographs of street scenes through this AR app at these locations.
2. Neighborhood Pop-up Story-telling Exhibit, imagined as an urban autobiography, uses AR to peel back the layers of time to show the city in new ways through different perspectives. The collection of stories as images serves as the cornerstone of this exhibit.
3. Charlotte #HomeCLT Exhibition provides a collage of stories from local residents in five selected neighborhoods in the city. Visitors can use AR to interact with physical display panels to view data related to social, economic, environmental and safety conditions in these Charlotte neighborhoods.

The underlying principle behind these apps and community events is that innovative digital tools for information-sharing and broad-based pubic engagement can help build inclusive, healthy, and livable communities.

2. Augmented Reality in Public Participation and Civic Engagement

One of the key factors to successful community planning and design is for urban planners and designers to work together with community members and empower them to play a key role in this community building and transformation process. Together urban planners and community members work to envision the future of their communities (Fung, 2006). However, it is inevitable that people hold different views of their communities and often have different scenarios about the future. To bring together these diverse viewpoints and further come to a unified vision of the future in this community planning and design process, neutral information is needed to build a solid foundation for "informed" decision-making. To meet this need, we must employ proper tools to acquire and analyze data, help people gain

insights into the conditions of their environments, and in turn develop common understandings of issues facing their communities (Al-Kodmany, 2002; OECD, 2013).

Alongside with the rapid development in the field of Geographic Information System (GIS), immersive visualization technologies present a tremendous opportunity for data analytics and information sharing. Over the past year, much attention has been turned to AR with the belief that it offers an interactive method to expand both non-computerized and computerized visualization techniques in community planning and design (Reinwald et al., 2014). Moreover, AR increases public engagement by providing comprehensible information to lay citizens and assisting them to express their preferences in a very intuitive way.

AR is a new way of seeing. A viewer's own visual perception can be enhanced through computer-generated digital contents. This can be achieved in a variety of ways by see-through devices, head-mounted displays, or mobile devices amongst others, (Reinwald et al., 2014). The common features of all these systems are that virtual contents generated by these digital devices and the real-world physical reality are combined and overlaid. These systems operate interactively in real time and three-dimensional (3-D) information is provided (Azuma, 1997; Azuma et al., 2001).

Initial research on AR and its related technologies, such as Virtual Reality, can date back to the 1950s (Carmignani et al., 2011). However, the first definition of AR was provided in 1997 by Azuma: An AR environment has the following three characteristics: "1) combines real and virtual environments; 2) is interactive in real-time; 3) is registered in 3-D" (Azuma, 1997). While AR has been in use since the 1990s, this has mainly been in research projects, and only a few specific projects have been developed. Only in recent years have mobile AR applications enjoyed an increased presence due to the development and use of AR-enabled game engines or browsers. Because of the current distribution of suitable mobile devices equipped with high-resolution cameras, data connection and improved computing power, AR applications have become of interest to general end users.

At present, this new technology is mainly used for marketing, navigation, in the game sector, in medicine, as well as for service technicians and in tourism. The field of urban planning is increasingly interested in AR. The assumption is that the use of AR can support quality assurance in planning processes (Nash, 2010). In particular, architecture and urban and landscape planning could benefit from the use of AR applications. AR has the potential to expand the range of instruments which are offered to support public participation and community engagement. It is expected that computerized tools like AR will change but also increase the quality of public participation (Al-Komandy, 2002).

Reinwald argues that visualizations in planning, especially the digital technologies developed over recent years, can function as a mediator of empowerment in public participation (Reinwald et al., 2014). AR in urban planning and participation processes has the potential to improve civic engagement processes and make them more efficient (Nash 2010). To increase the standards and quality of public participation procedures, AR instruments should satisfy requirements such as framework conditions and virtual contents should be clearly and comprehensively communicated or equal chances for different groups to participate and influence the decision-making processes should be guaranteed (Broschart et al., 2013).

3. The Partnership

With the funding support from The Knight Foundation-Niantic Augmented Reality Fellows Program (Niantic, 2018), a partnership was formed among four organizations in Charlotte to carry out the development of three experimental AR applications, which were used in a series of community events taking place between September 2018 and February 2019 in Charlotte.

In March 2018, City Building Lab at the University of North Carolina at Charlotte created an AR exhibit in conjunction of the Urban Complexities Symbolism. This event drew more than 200 participants from the area, including planning practitioners, community activists, local developers, etc. This AR exhibit was aimed to explore the new junction between the conventional mapping methods and many new emerging digital techniques for data processing and visualization, including 3-D GIS, integration with AR, and integration with remote sensing Imagery (City Building Lab, 2019).

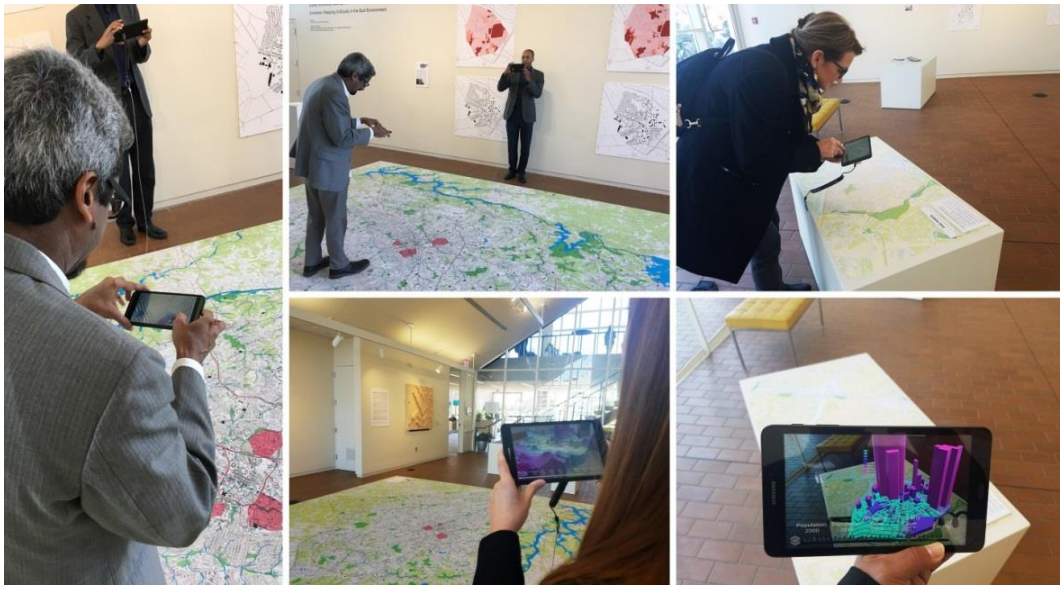

Figure 1 Mapping (In)equity exhibition associated with Urban Complexities Symposium on March 23, 2018

Charlotte-Mecklenburg Library, as a public institute, has long being serving the greater Charlotte Metropolitan as not only a knowledge activator but also a third place for the public to meet and learn. Many educational events are scheduled year-round, such as Learn, Connect, Play events that encourage cooperation, problem solving, letter and word recognition, and critical thinking skills. The Robinson-Spangler Carolina Room in the Main Library, which houses historical collections of photographs, publications, maps, and artifacts about Charlotte, has been an invaluable resource for Charlotte residents to learn about local history and genealogy.

OpenStreets704 of Charlotte organizes events that temporarily close streets to automobile traffic to allow residents to use them for walking, bicycling, dancing, playing, and meeting their neighbors. These events have proven to be successful at achieving goals related to recreation, public health, active transportation, and community building. In collaboration

with Knight Foundation and Niantic in May of 2017, OpenStreets704 organized one special event where Niantic arranged special in-game elements for Pokémon-Go and helped draw people to interesting places along the route of the event (Polygon, 2017).

Levine Museum of the New South has curated many exhibits with community members around Charlotte. One recent example is K(NO)W Justice K(NO)W Peace, which was co-created with the community. This exhibit includes first-person testimonials from police officers and activists, journalists, clergy leaders, the Mayor, the Chief of Police, and Charlotte residents. Students from Johnson C. Smith University provided a portion of the exhibit devoted to the victims of police-involved violence throughout the country (Exhibits, 2019).

4. The Three Projects

The Goals of these three projects that were carried out by the partnership and funded by The Knight Foundation-Niantic Augmented Reality Fellows Program are as the following:

1. To explore the potential of AR as a tool for education (data) and interaction (social gaming) in advancing community development and civic engagement.
2. To introduce AR to the general public through the use of both Pokémon-Go and the experimental AR apps developed by UNC Charlotte in different community events.
3. To establish a partnership with local organizations, including Charlotte-Mecklenburg Library, Levine Museum of the New South, and OpenStreets704 to develop and conduct community events as a platform to achieve the first two goals.

The underlying assumption behind all these apps and community events is that innovative digital tools for information-sharing and broad-based public engagement can help build inclusive, healthy, and livable communities.

The Knight Foundation-Niantic Augmented Reality Fellows Program helped initiate three pilot studies, each of which was aimed to develop one AR mobile app using Niantic's AR platform and/or open-source software assets. A series of community events were then organized by the partnership as test cases for these AR prototype mobile apps. Niantic's Pokémon-Go was also used in all these community events as an activity to inject some needed fun factor into the events. The partnership also explored the possibility to customize Pokémon-Go with additional features and/or functionality to meet the needs of these planned community events.

4.1. Project-1: Neighborhood History Walk App

The Robinson-Spangler Carolina Room in the Main Library was seeking new ways of making its vast collections of historical materials more accessible to the public. This partnership believes that the emerging immersive visualization technologies, such as AR, can help accomplish this goal. UNC Charlotte developed a Neighborhood History Walk App that utilizes AR to guide users to visit a number of identified locations in city's streets. Users were able to see historical photographs of street scenes through this AR app at these locations. Viewing angles, orientation, distances, and heights were carefully adjusted in order to precisely overlay these photographs onto the present-day street views as seen through the camera of users' mobile device. This app allowed users to compare what was in the past to

what is now at these selected locations in Charlotte. Additional historical images associated with these locations may also be displayed along with the street scenes.

This app was deployed in one of the OpenStreets704 events in September 2018 (OpenStreets704, 2018). Based on the success of the first Pokémon-Go/OpenStreets704 event in May 2017, the partnership once again incorporated Pokémon-Go in this event as an activity. While hunting for Pokémon characters, event goers were drawn to a number of "Pokéstops" and located one of the kiosks or signs with QR codes and instructions to download and use our Neighborhood History Walk App. Historical graphic contents were provided by the Robinson-Spangler Carolina Room of Charlotte-Mecklenburg Library.

Figure 2 OpenStreets704 event in City of Charlotte

4.2. Project-2: Neighborhood Pop-up Story-telling AR Exhibit

The Levine Museum of the New South is currently developing a new project, called #HomeCLT. This project is positioned to offer direct response to community needs, build bridges of communication and learning across the differences etched in the landscape of city's diverse neighborhoods, and help Charlotte find its way through the continuing civic identity crisis. It is imagined as an urban autobiography, peeling back the layers of time to show the city in new ways through a wide variety of voices and perspectives. The collection of stories, past and present, will be the cornerstone of this exhibit. The Levine Museum planned to build a proof-of-concept prototype model as a pilot version that could be installed temporarily at various locations around the city in a "pop-up" style. This prototype model was comprised of origin stories, first person narratives, artifacts, and images, as well as illustrative figures, maps, and charts revealing the development of the city over time by the numbers.

To enrich visitors' experience with this planned project, UNC Charlotte developed an AR app for two pop-up exhibits in two different selected indoor spaces at two local libraries in Charlotte. This AR app worked with the physical displays or installations to offer visitors more visual contents associated with the theme of the planned exhibits. The AR app detects the maps installed on the panels as a part of the pop-up installations. Users could see

"virtual" 3D data models shown on top of the maps. They then could tap on one of these virtual data models on the screen to call out the visual contents for that specific neighborhood. These contents can be any combination of historical photographs, video clips, and/or illustrative figures of quantitative information. The Robinson-Spangler Carolina Room provided historical materials relevant to this collaborative project. A Pokémon-Go event was organized to take place around these locations to accompany these pop-up exhibits to draw in more participants.

Figure 3 Neighborhood Pop-up Story-telling events

4.3. Project-3: #HomeCLT

#HomeCLT is an exhibit series rooted in the stories of Charlotte's neighborhoods. #HomeCLT aims to show the city in the words of its diverse residents, to reveal the unexpected, to prompt reflection and dialogue, and to inspire civic participation as Charlotte strives to build a more equitable future (HomeCLT, 2019).

The first iteration of #HomeCLT includes the stories of the Eastland Mall, Enderly Park, Hidden Valley, Dilworth and Sedgefield neighborhoods. Through an Augmented Reality app developed by UNC Charlotte, visitors can "see" the demographic changes in these neighborhoods occur over time as visuals and graphics are projected on their phones and other devices. The AR app detects the large map installed on the floor of the space as a part of the installation. Users can see "virtual" pins shown on top of the map as well as a series of 3-D models revealing some of the socio-economic conditions across Charlotte.

The exhibit includes a video recording booth where visitors can tell their own stories of the neighborhoods they have shaped and that have shaped them. It also features work by Charlotte photographer, Alvin C. Jacobs, Jr., and videographer, David Butler. The AR app also interacts with some of the display panels to allow visitors to view selected video recordings on their own mobile devices.

Figure 4 #HomeCLT exhibit at the Levine Museum of the New South

5. Discussions

This section discusses some of the lessons learned from the pilot projects with these experimental AR applications as well as the inclusion of Pokémon-Go as an activity in the community events:

Some of the most significant or impactful outcomes of these events can be summarized as the following:

For the Pokémon-Go players

- Knowing Niantic cares about them and wants to connect with them through a variety of community events.
- Getting involved in other communal and educational activities in these events.

For the other event participants

- Learning about Augmented Reality and gaining first-hand experience about its potential to promote civic engagement and public education.
- Getting involved in community affairs and learning more about their own places and people.

For the event organizers

- Getting hands-on experience about how the mobile gaming can be a fun way to engage community members.
- Getting to know about Augmented Reality and its potential as an educational and story-telling tool.

Things or factors that most contributed to the success in achieving the outcomes of these events include the following:

- Need local partners, as many as you can possibly find.
- Maintain a smooth channel for communications among local collaborators.

- Setup routine check-up meetings frequently.
- Make sure each event has a clear focus with a set of goals that are reasonably achievable.
- Pokémon-Go is fun, but so are the locally-driven activities.
- Planning and getting started with logistics ahead of time.
- Talking to the right people who can really make decisions.

In terms of event planning, preparation, logistics, and execution, some of the lessons learned from these events include the following:

- Getting people out to participate has been proven much difficult than originally expected.
- More activities that are tailored to the needs or interests of the local community are needed.
- Pokémon-Go players really expect and want something unique to the local place and people.
- Making sure it's a win-win-win situation for all partners/collaborators.
- Communications/promotion efforts require close coordination.

6. Preliminary Conclusions

Through these community events, the partnership was able to further explore the potential of AR in community planning and design with mobile gaming, image processing, 3-D data visualization, and community engagement. Specially, the AR Team at UNC Charlotte was able to develop a series of experimental AR apps to allow community members to learn more about the history of their communities. Another highlight would be the connections that UNC Charlotte was able to build with several local organizations, together working to bring Pokémon-Go to Charlotte as well as increase people's awareness of the possible applications of AR in community development and civic engagement.

Pokémon-Go creates a unique "third-place" for people to meet both physically in the real world and virtually in the digital world. This idea of social gaming is both evolutionary and revolutionary, as it can be seen as a continuation of all sorts of efforts we humans have made to connect to one another, while social gaming has generated a whole new platform for different forms of communications and human interactions to take place.

7. Future Outlook

AR is still evolving. Its potential is endless. However any possible use-case has to have a clear goal that is specific and geared towards its target users.

The issue of scale appears to still be a big challenge. Choices between scale-up with profitability and market dominance, and scale-down with public good and community-focused benefits will have to be carefully balanced to ensure its lasting success.

Allow for more user-driven voluntary contents to be built into Niantic games, such as Pokéstop selections, descriptions, more images associated with the uniqueness of these locations.

Connecting Pokémon-Go to public health measures, both physical and mental, through plug-ins, apps, smart devices, or sensors built into physical environments, such as public squares, parks, or streets.

8. References

Al-Kodmany, K. (2002). "Visualization Tools and Methods in Community Planning: From Freehand Sketches to Virtual Reality." *Journal of Planning Literature* 17, 189-211.

Arnstein, Sherry R. (1969). "A Ladder of Citizen Participation." *Journal of the American Institute of Planners*, 35, no. 4 (1969): 216. https://doi.org/10.1080/01944366908977225.

Azuma, R. (1997). "A Survey of Augmented Reality." *Presence: Teleoperators and Virtual Environments*, 6 (4), 355 - 385.

Azuma, R.; Baillot, Y.; Behringer, R.; Feiner, S.; Julier, S. & MacIntyre, B. (2001). "Recent advances in augmented reality." *IEEE Computer Graphics and Applications*, 21(6), 34 - 47.

Baykurt, Burcu. (2011). "Redefining Citizenship and Civic Engagement: Political Values Embodied in FixMyStreet.Com." In AoIR Selected Papers of Internet Research. Seattle, 2011.

Broschart, D., Zeile, P. & Streich, B. (2013). "Augmented Reality as a Communication Tool in Urban Design Processes." In M. Schrenk, V. V. Popovich, P. Zeile, & P. Elisei (Eds.), Proceedings REAL CORP 2013 (pp. 119-126). Schwechat-Rannersdorf: Selbstverlag des Vereins CORP - Competence Center of Urban and Regional Planning.

Carmignani, J. & Furht, B. (2011). "Augmented Reality: An Overview." In B. Furht (Ed.), Handbook of Augmented Reality (pp. 3-46).

City Building Lab (2019). https://www.facebook.com/CityBuildingLab-158386934209297/?ref=hl.

Exhibits (2019). "The Levine Museum presents a variety of interactive and immersive exhibits." The Levine Museum of the New South. https://www.museumofthenewsouth.org/exhibits.

Fung, A. (2006). "Varieties of participation in complex governance." *Public Administration Review*, 66,166-75.

HomeCLT (2019). "#HomeCLT: PEOPLE. PLACES. PROMISES." The Levine Museum of the New South. https://www.museumofthenewsouth.org/homeclt.

Humphreys, Lee. (2017). "Involvement Shield or Social Catalyst: Thoughts on Sociospatial Practice of Pokémon GO." Mobile Media & Communication 5, no. 1: 15–19. https://doi.org/10.1177/2050157916677864.

Knight Foundation (2017). "Augmented Reality Games Ingress And Pokémon Go Focus Of New Community Engagement Initiative Launched By Niantic And Knight Foundation." https://knightfoundation.org/press/releases/augmented-reality-games-ingress-and-pok-mon-go-focus-of-new-community-engagement-initiative-launched-by-niantic-and-knight-foundation.

Kooragayala, Shiva, and Tanaya Srini. (2016). "Pokémon GO Is Changing How Cities Use Public Space, but Could It Be More Inclusive?" Urban Wire: Neighborhoods, Cities, and Metros (Urban Institute) (blog), https://www.urban.org/ urban-wire/pokemon-go-changing-how-cities-use-public-space-could-it-be-more-inclusive.

Mockbee, S., Moos, D. & Trechsel, G. (2003). *Samuel Mockbee and the Rural Studio: Community Architecture*, 2003-11-01, Birmingham Museum of Art.

Nash, A. (2010). "Web 2.0 Applications for Collaborative Transport Planning." In M. Schrenk, V. Popovich & P. Zeile (Eds.), Proceedings REAL CORP 2010 (pp. 917-928). Schwechat-Rannersdorf: Selbstverlag des Vereins CORP - Competence Center of Urban and Regional Planning.

Niantic (2017). "Niantic forming a multi-year partnership with the John S. and James L. Knight Foundation." Niantic, Inc. https://nianticlabs.com/blog/knight050417/.

Niantic (2018). "Empowering local communities through games: Introducing the Niantic/Knight Fellows Program." Niantic, Inc. https://nianticlabs.com/blog/knightfellowsaug2018/.

OECD (2013). Government at a Glance 2013, OECD Publishing. Retrieved from http://dx.doi.org/10.1787/gov_glance-2013-en.

OpenStreets704 (2018). "Open Streets 704 teams up again with Niantic and Knight Foundation." OpenStreets704, City of Charlotte. https://openstreets704.com/open-streets-704-teams-up-again-with-niantic-and-pokemon-go/2018/.

Polygon (2017). "Pokémon Go's first community event is a hint of the game's future." https://www.polygon.com/2017/5/4/15546436/pokemon-go-community-events-2017-outdoors.

Reinwald, F., Berger, M., Stoik, C., Platzer, M., & Damyanovic, D. (2014). "Augmented Reality at the Service of Participatory Urban Planning and Community Informatics – a case study from Vienna." *The Journal of Community Informatics*, 10(3). Retrieved from http://www.ci-journal.net/index.php/ciej/article/view/1087.

Sicart, Miguel. (2016). "Play and the City." Edited by Judith Ackermann, Andreas Rauscher, and Daniel Stein. Navigationen, Playin' the city – artistic and scientific approaches to playful urban arts, 16, no. 1 (2016): 25–40.